

# Presentation Abstracts

## 55<sup>th</sup> Annual Meeting

### Missouri Academy of Science

#### April 12-13, 2019

#### Northwest Missouri State University

#### Maryville, MO

#### AGRICULTURE SECTION

##### *Oral Presentations*

**E. Ernat, T. Zell, and O. Perez-Hernandez, School of Agricultural Sciences, Northwest Missouri State University. OVERWINTERING BEHAVIOR AND END-OF-SEASON MORTALITY OF THE SOYBEAN LEAF BEETLE (*Cerotoma Trifucata Forster*) IN NORTHWEST MISSOURI.** The soybean leaf beetle (SLB, *Cerotoma Trifucata Forster*) is the most economically important insect pest of soybeans in Missouri. Soybean leaf beetle adults are suggested to overwinter in soybean crop residue. However, little is known about the overwintering behavior and end-of-season mortality of SLB adults. The objective of this study was to characterize the overwintering habits and mortality of SLB in northwest Missouri. Adult SLBs were collected on September 26, 2018 from a soybean field near the Northwest Missouri State University campus in Maryville. Next, 25 beetles were carefully placed in each of four 12 × 12 × 12 inch collapsible mesh cages. To provide natural overwintering sites for the beetles, two 10 inch<sup>2</sup>, 1.5 to 2-inch deep, undisturbed soil portions were carefully excised, placed into plastic trays, and put inside each cage. Two cages were placed inside the laboratory and kept at room temperature while the other two were placed outside under normal end-of-season weather conditions. The activity and mortality of adult beetles was monitored every other day beginning September 26 and ending November 16. In the indoor cages, beetles were active for a few days, but most of them died or became lethargic within the first 17 days. In the outdoor cages, beetles became inactive or

searched for refuges in plant debris as temperatures decreased. However, they remained alive longer than the ones kept indoor. Our study suggests that in northwest Missouri, SLB adult activity slows down by late October and beetles became inactive by middle November.

**O. Pérez-Hernández, C. Olewunne, and N. Hoilett, School of Agricultural Sciences, Northwest Missouri State University, Maryville, Missouri. PREDICTING INTENSITY LEVELS OF FROGEYE LEAF SPOT (*Cercospora sojina*) IN NORTHWEST MISSOURI.** Frogeye leaf spot (FLS; *Cercospora sojina*) is a late-season fungal disease that has become prevalent in northern U.S. states in recent years. Under favorable weather conditions, the disease can reduce yield up to 60% in susceptible soybean cultivars. Effective chemical control of FLS requires sound knowledge of its epidemiology, especially timing when the disease attains certain intensity levels. This information is not clearly defined. The objective of this study was to determine intensity levels of FLS in northwest Missouri. Ten soybean rows in a soybean field were selected in Nodaway County, Missouri in the fall of 2017. In each row, four plants were identified and one trifoliolate leaf in the upper canopy was marked to monitor the progress of the disease, which was assessed as the number of lesions appearing on the leaf over time. The disease was monitored at four-day intervals starting on September 1 and ending on October 28. Varying intensity levels of the disease were determined using survival analysis. The results indicate that towards the end of the season, from initial lesion foci FLS can reach up to 50% severity in about 8 days. After that period, the epidemic rate decreases in a linear fashion.

## AGRICULTURE SECTION

### Poster Presentations

**S.E. Svenson. Charles Nemanick Alternative Agriculture Garden, Department of Agriculture, Southeast Missouri State University. NATIVE PERENNIALS FOR BUTTERFLY AND POLLINATOR GARDENS: FOURTH YEAR PERFORMANCE IN SOUTHEAST MISSOURI.** Perennials native to Missouri were evaluated for survival, growth, and flowering from forty to fifty-two months after planting into a compost-amended urban soil in Cape Girardeau, MO. Twenty-eight container-grown plants of each species were planted in late August 2014 in a butterfly-shaped garden under full sun growing conditions. Two plots per species were planted in each wing of the garden, providing four replicated plots of seven plants of each species for analysis. During the fourth full year after establishment, the following species had 100% survival, excellent growth, and 100% flowering: *Penstemon digitalis*, *Rudbeckia fulgida* var. *umbrosa*, and *Rudbeckia missouriensis*. Species having 75% to 86% survival, good growth, and 100% flowering during the fourth growing season included: *Eryngium yuccifolium*, *Eutrochium purpureum*, *Symphotrichum oblongifolium*, and *Veronicastrum virginicum*. *Asclepias tuberosa*, *Echinacea pallida*, *Echinacea paradoxa*, *Echinacea purpurea*, *Glandularia canadensis* and *Zizia aurea* had less than 50% survival, poor growth, and 100% flowering of surviving plants. *Amorpha canescens* had less than 50% survival, but living plants had good growth and flowering. *Rudbeckia fulgida* var. *umbrosa*, *Rudbeckia missouriensis*, and *Eryngium yuccifolium* have seed propagated at the location, populating additional area in and around the experimental plots. Less than 75% of the original *Coreopsis lanceolata* specimens remained alive in the fourth growing season, but the species has aggressively populated near-by growing beds and gravel pathways. Two species planted in nearby secondary plots had 75% to 86% survival, excellent growth, 100% flowering, including: *Asclepias incarnata* and *Liatris spicata*. The data will help guide the selection of plant species used for urban or suburban butterfly and pollinator gardens in southeast Missouri.

**S. Williams, A. Coy, N. Hoilett, and O. Perez-Hernandez. School of Agricultural Sciences, Northwest Missouri State University. DO AGRICULTURAL BIOLOGICALS AFFECT CARBON DYNAMICS?** Increasing global populations dictate an increased efficiency in food, fiber, and fuel production techniques. The use of agricultural biologicals is a recent trend in production techniques to enhance crop productivity. The effect of agricultural biologicals on soluble

soil carbon is little understood. Soluble soil carbon fractions have been associated with nutrient cycling and availability. Potassium permanganate oxidation provides a measure of labile carbon. The focus of this research is investigating the influence of soil biologicals on labile carbon as an indication soil response to management changes, specifically the introduction of agricultural biologicals. Labile soil organic carbon tends to respond very quickly to alterations in soil properties. For this study the potassium permanganate oxidation, cold-water extraction, and hot water extraction methods were used to measure soluble soil carbon. The information gathered from this project will provide valuable information on the influence of agricultural biologicals on soil carbon dynamics that could potentially influence soil microbial activity and nutrient cycling.

**V. Singamreddy, C. Kipping, N. Hoilett, and O. Perez-Hernandez. CHARACTERIZATION AND IDENTIFICATION OF MOLD FUNGI IN HARVESTED SOYBEAN SEED IN NORTHWEST MISSOURI.** Continuous rainfall at the end of the 2018 growing season in northwest Missouri favored the occurrence of field mold fungi on soybean grain in the region. Mold severity was exacerbated in fields infested by the soybean leaf beetle. Several species of fungi causing grain mold diseases are reported in the literature. However, the species that caused epidemics in harvested grain in northwest Missouri have not been characterized and their identity is unconfirmed. The objective of this survey was to characterize and identify the fungi associated to grain mold in the region in 2018. Twenty-two soybean grain samples were provided by two elevators in northwest Missouri for use in the study. The seeds were surface sterilized with 0.1% sodium hypochlorite and rinsed in sterile water for 1-2 minutes. Seven to ten seeds were plated in potato dextrose agar medium and incubated at 27 to 30°C for five to seven days. The fungal colonies that developed were transferred to new plates to isolate and purify the fungi and again they were kept in an incubator at 27 to 30°C for five to seven days. Based on colony morphology of microscopic observation of fungal sporulation, at least three genera have been identified to date: *Aspergillus*, *Penicillium* and *Fusarium*. These genera are believed to be associated with soybean seed mold in the collected samples. Pathogenicity seed tests and further morphological and molecular identification will substantiate the identity of the fungal species associated with mold diseases in this region.

**V. Cloughley, K. Tharp, and O. Perez-Hernandez, School of Agricultural Sciences, Northwest Missouri State University. EFFICACY OF A NUTRITIONAL SEED TREATMENT ON EARLY DEVELOPMENT OF SOYBEAN (*Glycine max*) IN CONTROLLED CONDITIONS.** Nutritional seed

treatments constitute a new option in soybean production. Their benefits include strong and rapid crop establishment, improved response to seedling diseases, and prevention of early-season crop nutrient deficiencies. However, their use is still limited and their benefits poorly recognized. This is mainly due to unavailability of nutrient-based products apt to be seed applied and to the lack of data on this treatment types. The objective of this study was to determine the efficacy of a nutritional seed treatment on early soybean development. Soybean seeds cv. Pioneer P37T09L were treated with a complex containing major elements, micronutrients and amino acids, or left untreated. The treatment was applied at a low, medium, and high commercial rates (4.0, 5.5, and 7 fl.oz. per 100 lbs of seeds, respectively) while the control was treated with sterile deionized water. The experimental units consisted of glass jars containing 50 grams of seed. All treatments were disposed in a completely randomized design with four replications. Four days after treatment, 20 seeds from each experimental unit were germinated in paper rolls and incubated for seven days at 25°C. Primary root length was measured in 12 seedlings selected systematically in two rolls from each of the four treatment replications. First run of the experiment indicated that treatment did not negatively affect germination and, compared with the control, it increased the length of the primary radicle of seedlings. No apparent treatment effect differences for dosages was observed. Repeat of the experiment is underway.

**A. Coy, A. Kelly, S. Williams, N. Hoilett, and O. Perez-Hernandez.** School of Agricultural Sciences, Northwest Missouri State University. **EVALUATING THE INFLUENCE OF AGRICULTURAL BIOLOGICALS ON RHIZOSPHERE ENZYME ACTIVITY.** Global demands for food, fiber, and fuel necessitate the use of innovative technology to increase agricultural productivity in an environmentally sound manner. A growing trend in crop production is the use of agricultural biologicals derived from microorganisms or plant extracts. The market for agricultural biological products is estimate to surpass US\$13 billion by 2022. The key concept behind the use of biologicals is their influence on crop productivity and soil health. However, the role of these biologicals in soil processes is not well understood. Questions arising from the use of biologicals include, how do biologicals influence soil microbial dynamics and function? One area of study that provides meaningful information on soil function is soil enzymology, due to the sensitivity of enzymes to management changes. This research hypothesizes the application of soil biologicals will stimulate soil microbial population within the rhizosphere zone, potentially increasing soil enzymatic activity. Four groups of soil enzymes, dehydrogenase (general microbial activity); carbon cycle enzymes ( $\beta$ -glucosidase); nitrogen cycle enzymes (urease) and phosphorus

cycle enzymes (phosphomonoesterases) were assessed in this study. The information gathered from this project will valuable information on the effect of agricultural biologicals on soil microbial function and nutrient cycling.

**H. Dudusola, P. Oruganti, S. Soman, S. Anuoluwa, N. Hoilett, O. Perez-Hernandez, and K. Royal.** School of Agricultural Sciences, Northwest Missouri State University. **SPATIAL ANALYSIS OF COVER CROP INFLUENCE ON SOIL HEALTH USING KRIGING GEOSTATISTICAL PROCEDURES.** Cover crops are an effective conservation management practice with the potential to improve soil health and crop yields. This study, conducted in Northwest Missouri uses kriging spatial interpolation technique to estimate field values based on observations collected from known sampling points. The objective of this study is assessing and analyze the effect of cover crops on soil health over a four-year period. Measured soil properties include characterizing soil biological community using phospholipid fatty acids (PLFA), soil enzyme activities (dehydrogenase, urease, phosphomonoesterase, and  $\beta$ -glucosidase), bulk density, water infiltration rates, and soil carbon dynamics. Field maps created from these discrete points will be presented.

**P. Oruganti, H. Dudusola, S. Soman, S. Anuoluwa, N. Hoilett, and O. Perez-Hernandez.** School of Agricultural Sciences, Northwest Missouri State University. **IMPACT OF INTRODUCING COVER CROPS IN A CORN – SOYBEAN ROTATION SYSTEM ON SOIL HEALTH AND SOIL ENZYME ACTIVITIES.** Cover crops have been proposed as a strategy to reduce soil erosion, prevent nutrient leaching, decrease nitrogen loss from fields, and improving soil physical, chemical, and biological conditions. Cover crops influences soil microbiology community via increased carbon (C) supply. The intent of this project is to track changes in soil enzyme activities over four years of including cover crops as part of the agronomic management practices. It is well established that soil enzymes are more agile in their response to management changes than other soil health indicators. In addition, enzyme activities are well-established indices of microbial biomass (dehydrogenase), carbon turnover ( $\beta$ -glucosidase), and nitrogen dynamics (urease). For this study, we measured the above-named enzymes for 20 fields in Northwestern Missouri. The results from this study will provide insight to farmers, soil conservationist, and other interested groups on the potential of soil enzymes as an indicator of soil health.

**S. Anuoluwa, N. Hoilett, P. Oruganti, H. Dudusola, S. Soman, and K. Royal.** School of Agricultural Sciences, Northwest Missouri State University. **ASSESSING THE INFLUENCE OF COVER CROPS ON SOIL COMMU-**

#### **NITY CHARACTERISTICS USING PHOSPHOLIPID FATTY ACID PROFILES.**

The benefits of adding cover crops in agronomic systems include reducing soil erosion, relieving soil compaction, improving soil fertility, increasing water infiltration and storage, and promoting carbon sequestration. In addition, cover crops are reputed to influence soil biology. The intent of this project is to determine changes in soil biological profile of agronomic systems within the first four years of introducing cover crops. Soil biological assessment will include measuring active carbon using the potassium permanganate method; and characterizing soil biological community using phospholipids fatty acids (PLFA) profiles. The amount of active carbon in the soil is a good indicator of soil health, based on its association with soil organic matter readily available as food and energy sources for the soil microbial community. In addition, active carbon positively correlates with organic matter content, aggregate stability, and soil biological activities. PLFAs are key components of the microbial cell membrane and has consistently been using to assess soil microbial response to management changes. Therefore, information from this project will provide insight to stakeholders on the response of soil health indicators to the introduction of cover crops in a crop management system.

#### **S. Bugh and M. McGee, Department of Agricultural Science, Northwest Missouri State University. SIGNIFICANCE OF ASSISTED REPRODUCTIVE TECHNOLOGY IN MODERN ANIMAL PRODUCTION SYSTEMS.**

Assisted Reproductive Technology, also known as 'ART', is various techniques used to obtain genetics from superior animals and produce offspring from reproductively challenged candidates. ART has been a growing technique partner within the livestock industry to combat infertility issues among various species. As technology develops, techniques and instruments used within ART are developed further and instruments previously used are redesigned. Due to the strong relationship with technology, the ART industry is fast evolving and becoming more efficient. Techniques include multiple ovulations and embryo transfer (MOET), artificial insemination (AI) or even in-vitro fertilization. Similarly, technicians are able to select specific semen based off sex, or collect multiple embryos from one superior female to produce multiple offspring using surrogates or storing them for future use. Beyond combating infertility issues, ART also allow producers to swiftly increase genetic superiority as well as production levels in livestock systems compared to conventional methods. In this paper, ART's history and evolution will be explored demonstrating its importance in reproductive efforts.

#### **E. Greeley and N. Holett, Department of Agricultural Sciences, Northwest Missouri State University. UNDERSTANDING THE EFFECT OF FEEDING AND RUMINATION TIME ON PARTURITION TIME IN CATTLE TO DECREASE RISK OF DYSTOCIA.**

Feeding and rumination time play key roles in determining the expected calving time in cattle. The purpose of this study is to examine the influence of feeding times on parturition process in cattle. The ability to observe pre-calving symptoms can help producers decrease calving loss. Studies have shown that there can be multiple causes for dystocia including environmental conditions, parity and age of the female, birth weight of calf and abnormal fetal positions. Other research observed relationships between feeding time, rumination time and calving time. This paper will review the body of research related to the impact of rumination times on parturition time and calving loss. Indications suggest strong correlations between rumination and feeding time with calving time. Understanding this idea and other factors related to dystocia can help producers monitor and more accurately predict the calving times of their cattle. This in return will decrease the economic impact that calf loss has on cattle productions and help producers become more efficient.

### **BIOCHEMISTRY, BIOMEDICINE, & BIOTECHNOLOGY SECTION**

#### *Oral Presentations*

#### **C. Espinoza Patharkar<sup>1</sup> and O.R. Patharkar<sup>2</sup>, <sup>1</sup>Department of Science, Technology and Mathematics, Lincoln University, <sup>2</sup>Department of Biological Sciences, University of Missouri-Columbia. USING FLUORESCENCE IMAGING IN UNDERGRADUATE RESEARCH- BASED COURSES TO STUDY PLANT-MICROBE SIGNALING PATHWAYS.**

Inquiry-based and research-based laboratory pedagogies in undergraduate science are effective to increase student learning. We developed a semester-long research-based laboratory course of Cell Molecular Biology with the goal to provide a "real" research experience to motivate student learning. The research topic was the subcellular localization of Arabidopsis proteins involved in chitin signaling. Chitin, a main component of the fungal cell wall, is released when plants are attacked by fungal pathogens. Chitin is recognized by receptor proteins in plant cells leading to activation of the innate immune response in the whole plant. Students filled an exit survey and results showed that they found learning more interesting, encourage them to use scientific reasoning, and gave them a broader sense of purpose. More engaged students

spent extra hours fixing problems encountered in the laboratory classes. Interestingly, a couple of students decided to go to graduate school and do research in Cell Biology or Genetics, instead of their initial idea of going to Medical School. Students presented their results at different local and regional conferences. More recently, we have developed a website (<https://rahulpatharkar.000webhostapp.com/>) that provides well tested reliable life science protocols in print and video form to be used as supplement in laboratory classes or for training of young researchers. We are currently working to develop laboratory courses syllabi using these video protocols to be readily available for higher education and high school teachers.

**K.A. Yusuf and K. Kim, Department of Biology, Missouri State University. THE USE OF PALLADIUM (Pd) AND PLATINUM (Pt) CYANOXIMATES IN THE TREATMENT OF CANCER CELLS, INITIATING A NEW APPROACH TO CANCER CHEMOTHERAPY.** The use of chemotherapy is the one of the most common treatments of cancer and the most effective and widely used are metal-containing anticancer drugs such as cisplatin, carboplatin, and all Platinum(II)-containing complexes. This research experiment is aimed at testing the effects of palladium (Pd) and platinum (Pt) cyanoximates in treatment of cancer cells (HeLa cervical cancer epithelial cells). The experiment is being conducted *in vitro* using novel Pd and Pt complexes from Dr. Nikolay Gerasimchuk of Chemistry department, Missouri State University. With Cisplatin as positive control, the study examined the effect of Pd(Deco) and Pt(Deco) on cell proliferation and cytotoxicity, using cell proliferation kit ii (XTT). The results obtained indicated that both Pd(Deco) and Pt(Deco) effectively inhibit cell proliferation at 0.25mM concentration with significant difference ( $p < 0.05$ ) when compared with non-treated control. Research is still ongoing in order to determine the effect of the chemicals on rate of cell apoptosis as well as taking measurements for reactive oxygen species. The ideal of this study is to decipher the more potent of the two cyanoximes providing evidence for why either or both can be used as a close substitute or replacement to the currently used cisplatin.

## BIOCHEMISTRY, BIOMEDICINE, & BIOTECHNOLOGY SECTION

### *Poster Presentations*

**Z. McAdams, Department of Physical & Biological Sciences, Columbia College. DEVELOPMENT OF COMPETITIVE ENZYME-LINKED IMMUNOSORBENT ASSAY (ELISA)**

**TO QUANTIFY LEVELS OF BENZOYLECGONINE IN NATURAL WATER SYSTEMS.** Cocaine is an illicit drug which functions as a dopamine reuptake inhibitor stimulating a pleasure sensation in the brain upon ingestion. The drug is spontaneously or enzymatically hydrolyzed into many metabolites, the prominent form being benzoylecgonine (BZE) - a biologically active molecule that serves as the most common target of cocaine drug testing. BZE has been detected in natural water, thus a method to monitor metabolite levels in these systems is needed. One fast and specific method to quantify concentrations of a target compound is an enzyme-linked immunosorbent assay (ELISA). A competitive ELISA to quantify BZE levels in an efficient manner is under development in the present study.

**W. Redler, Department of Chemistry, Northwest Missouri State University. THE LINK BETWEEN HIGH DOSE B VITAMINS AND CANCER.** In 1998, The University of Tromso sponsored The Norwegian Vitamin Trial or NORVIT, a study that involved 3750 men and women between the ages of 30-85 suffering from severe heart disease. The purpose was to see if administering the patients' treatments of vitamins B9, B12, B6, C, and D would lower blood homocysteine levels and treat cardiovascular disease. The results showed no promise in treating the disease but it did result in showing that the vitamin group had an increased mortality rate due to cancers particularly lung. These unfortunate results grabbed the attention of two researchers conducting a study at the Fred Hutchinson Cancer Research Center in Seattle that tracked the supplement intake of 77,000 people living in the state of Washington, Emily white and Theodore Brasky. The results showed that over years men who were taking daily 20mg doses of vitamin B6 showed an increased lung cancer risk 2x more than those who were not taking any, and showed increased lung cancer risk by 3x in male smokers. Smokers who daily took upwards of 55 micrograms of vitamin B12 showed a lung cancer risk increased 4x. Risk in the women were not apparent. It is recommended that individuals do not consume more than the recommended daily amount of B vitamins. Sources: <https://clinicaltrials.gov/ct2/show/NCT00266487>, <https://www.medicalnewstoday.com/articles/319083.php>.

## BIOLOGY SECTION

### *Oral Presentations*

**T. Roy, Department of Biology, Missouri Western State University. REVISITING THE NORTH AMERICAN AGALINIS (FAMILY: OROBANCHACEAE).** The genus *Agalinis* (the "false foxgloves"), belonging to the family

Orobanchaceae, is native to the Western Hemisphere, with around 40 species distributed across temperate North America, and a large group native to Missouri and the Midwestern United States. About 21 species of this genus warrant conservation measures. We utilized chloroplast and nuclear ribosomal ITS DNA sequence data, and bioinformatics tools, to further understand the phylogenetic relationships among the different species, taxonomical sections, and subsections within this group. Our study corroborates to previous studies and indicates the North American *Agalinis* to be a strongly supported, monophyletic group. Our study is also the first to investigate the biogeography of this genus in temperate North America. We utilized the computer programs BEAST and SDIVA and through secondary calibrations from previous studies, tried to understand the diversification timings and ancestral areas of this group. Our study points to south eastern United States as the center of diversity and place of origin of the *Agalinis* in temperate North America, from which they spread to the rest of the United States and even migrated to Canada, around the mid- Miocene period.

**G. Dieringer and L. Cabrera R. Department of Natural Sciences, Northwest Missouri State University. PHENOTYPIC SELECTION ON STAMINAL TRICHOMES OF *AGALINIS AURICULATA* (OROBANCHACEAE).** Sexual selection theory predicts plant male reproductive success to be limited by its dispersion of pollen to other plants. Pollen presentation theory predicts that the best pollen dispensing strategy should evolve to match the abundance of pollinators and transfer of pollen to stigmas. When visitation is abundant, selection is expected to favor floral traits that cause pollen to be dispensed progressively over multiple visits to enhance the probability of siring seeds. The sonicating of anthers by bees represents a specialized behavior to dispense pollen as a floral reward. *Agalinis auriculata* is pollinated by *Bombus impatiens* and *B. pensylvanicus* and possesses long trichomes along the filament of the longer stamens. *Bombus impatiens* sonicates stamens while foraging sternotribically and *B. pensylvanicus* collects pollen while foraging nototribically. We conducted a field study to test whether trichome number influenced pollen removal. Experiments using single bee visits to virgin flowers were used estimate pollen removal from flowers and trichome number was quantified with the aid of scanning electron microscopy. Selection differentials were calculated for relative pollen removal versus standardized values of trichome number. We found statistically significant differentials for both types of foraging. Contrary to expectations, the number of trichomes along the filament had a significant positive effect on pollen removal for sternotribic, sonicating visits by *B. impatiens* but had a significant negative effect for nototribic visits by *B. pensylvanicus*. We conclude the contrasting influence tri-

chomes had on pollen removal is most likely explained by the predominance of sternotribic visits to the short-lived flowers.

**K. Mellor, G. Hanrahan and G. Thornsberry. Department of Natural Sciences, Northwest Missouri State University. THE EFFECT OF PEPPERMINT OIL ON BIOFILM PRODUCTION IN *STAPHYLOCOCCUS EPIDERMIDIS* ISOLATES.** As part of the human epidermal microbiota, *Staphylococcus epidermidis* can cause nosocomial infections, particularly if capable of producing a biofilm. This project investigates the ability of peppermint oil to decrease biofilm formation in *S. epidermidis*. Following an initial trial with five essential oils, peppermint oil was shown to decrease biofilm production and was selected for further study. Fourteen isolates previously characterized as moderate or high biofilm producers were chosen. Strains were grown overnight on tryptic soy agar, transferred to tubes of phosphate buffered saline (PBS), and standardized. Aliquots of *S. epidermidis* were transferred to 96-well plates containing tryptic soy broth supplemented with 1% glucose and then topped with aliquots of peppermint oil of varying concentrations. Four replicates of 12 wells were conducted for each strain at each oil concentration. Growth was determined using spectrophotometry. Wells were then emptied, washed with PBS, and dried. The biofilm was stained with crystal violet which was then solubilized with acetic acid before quantifying by spectrophotometry. The total growth and biofilm development for each concentration of oil was compared to the control. Biofilm production was also compared between moderate and high biofilm producing isolates at various oil concentrations. A significant difference in biofilm formation is observed at all concentrations of peppermint oil. A decrease in biofilm production is observed with 1% peppermint oil; however, both low (0.25% and 0.5%) and high concentrations (2%) show a significant increase in biofilm production when compared to the mineral oil control.

## BIOLOGY SECTION

### *Poster Presentations*

**S. Templeton and P. Adam. Department of Natural Sciences, Northwest Missouri State University. DIVERSITY OF SKULL MORPHOLOGY IN SEA TURTLES WITH CORRELATIONS TO DIET.** The seven living species of sea turtles are a small remnant of a lineage that was once, during the Cretaceous (80 million years ago), the most diverse group of marine reptiles ever to have existed. Although few in number, modern species still capture some of this past diversity, with species ranging in size from 30 kg

(Ridley's sea turtle, *Lepidochelys kempii*) to 900 kg (leatherback sea turtle, *Dermochelys coriacea*) and with diets that vary and include species that specialize on sponges (hawksbill sea turtle, *Eretmochelys imbricata*), sea grasses (green sea turtle, *Chelonia mydas*), and jellyfish (leatherback sea turtle, *Dermochelys coriacea*), in addition to other, more generalized diets. Data used in my analyses include measurements taken directly from skulls combined with landmark data established from standardized photographs. Data were subjected to discriminant function analyses to ascertain validity of dietary groupings and to identify characteristics of skull morphology most indicative of each feeding type. The overarching objective of my study was to reveal functional differences in feeding structures of different sea turtles and to create tools that can be used to predict diet in extinct sea turtle species.

**P. Keyser. Department of Natural Sciences, Northwest Missouri State University. BENTHIC MACROINVERTEBRATE DIVERSITY IN THREE WATER BODIES.** Benthic macroinvertebrates are an important and often basal part of aquatic communities. Treatment of ponds with a variety of chemicals to discourage plant and algae growth could disrupt these communities. I compared the diversity of benthic macroinvertebrate populations of a stream, an untreated pond, and a pond treated with Dibrox® (herbicide), Mizzen® (algicide), SparKlear® (beneficial bacteria designed to lower dissolved nutrients), and a dye (inhibit UV penetration to limit algal growth) annually. The stream was sampled with three Hester-Dendy artificial substrates and the ponds were sampled with three Modified Hester-Dendy artificial substrates because of their muddy or silty substrates. Artificial substrates were left for one month (July 15<sup>th</sup> to August 15<sup>th</sup>), then benthic macroinvertebrates were collected and preserved with iodine tincture. Samples were identified to genus and a total count was taken. Diversity for each water body was assessed with a Shannon-Wiener diversity index. The Shannon-Wiener values were compared with a Hutcheson's t-test. Benthic macroinvertebrate diversity was significantly higher in the stream than in either pond and the diversity in treated and untreated ponds was not significantly different. This suggests that while ponds have lower benthic macroinvertebrate diversity than streams treatment of ponds to discourage plant and algae growth does not significantly alter benthic macroinvertebrate diversity.

**M. Haskins<sup>1</sup>, L. Bates<sup>2</sup>, L. Carter<sup>2</sup>, P. Clevenger<sup>2</sup>, R. Coffman<sup>2</sup>, L. Duncan<sup>2</sup>, T. Dunks<sup>2</sup>, S. Eckert<sup>2</sup>, D. Eddington<sup>2</sup>, S. Fossell<sup>2</sup>, B. Grant<sup>2</sup>, J. Grom<sup>2</sup>, C. Hargraves<sup>2</sup>, N. Hickman<sup>2</sup>, M. Ireland<sup>2</sup>, C. John<sup>2</sup>, S. Jones<sup>2</sup>, C. Jones<sup>2</sup>, J. Major<sup>2</sup>, A. Monteer<sup>2</sup>, E. Oldro<sup>2</sup>, B. Richards<sup>2</sup>, V. Roberts<sup>2</sup>, J. Sanders<sup>2</sup>, T. Schweder<sup>2</sup>, W. Selectman<sup>2</sup>, R. Siliven<sup>2</sup>, S. Simpson<sup>2</sup>, J. Smith<sup>2</sup>, L. Smith<sup>2</sup>, L. Suter<sup>2</sup>, J. Tate<sup>2</sup>, K.**

**Troxel<sup>2</sup>, M. Via-Lockhart<sup>2</sup> and N. Yuille<sup>2</sup>. <sup>1</sup>Biology Department, Rockhurst University. <sup>2</sup>Chillicothe Correctional Center. A COMPARISON OF BENTHIC ORGANISMS IN WINTER LEAF PACKS.** Abiotic and biotic tests were conducted on an unnamed perennial first-order tributary of Sn-A-Bar Creek in unincorporated eastern Jackson County, Missouri. Like many waterways in the area, the tributary exhibited both steep and severely undercut banks due to periodic localized flooding from the runoff of adjacent pastures and row crops. Despite the predominantly silt substrate the turbidity was a consistent 0 NTU, likely due to the normally sluggish current's inability to carry suspended particles. Benthic collection was accomplished by submerging six leaf pack LaMotte® mesh bags containing air-dried senescent leaves previously collected from trees on the tributary's banks. Individual bags of a single leaf type (Burr Oak, Paw Paw and Sycamore) were tied to cinder blocks and placed in 0.4 m of water on both east and west banks. Approximately seven weeks later, in January, bags were retrieved for analysis and yielded a total of 108 organisms representing 1b taxa. Burr Oak contained the highest taxon number (11), followed by Sycamore (8) and Paw Paw (7). In order of abundance, taxa present in all leaf types included: stoneflies, snails, midges, alderflies, mayflies, sowbugs and scuds. Multiple indices indicated an overall rating of good, and nearly excellent, water quality.

**E. Manoj, M. Burton, S. McElveen and B. Mirza. Department of Biology, Missouri State University. THE DIVERSITY OF BRADYRHIZOBIUM AND NON-RHIZOBIAL ENDOPHYTES WITHIN THE ROOT NODULES OF SOYBEAN.** Soybean serves as a food and feed crop, as well as an intercrop that may enhance soil fertility by establishing symbiotic associations with nitrogen-fixing bacteria of the genus *Bradyrhizobium*, which reside in the root nodules of the host plant. Culture-based methods have suggested that members of the genus *Bradyrhizobium* are the dominant occupants of soybean root nodules, while other studies have identified the presence of non-rhizobial endophytes. The extent and selection of non-rhizobial endophytic diversity within root nodules are unknown. The objective of this study is to assess the root nodule microbiome using NextGen DNA sequencing on root nodules from plants of differing genotypes, purple and white flowering cultivars. The 16S rRNA genes of the microbial community from all root nodules of each plant's root system were sequenced to assess the diversity of *Bradyrhizobium* and non-rhizobial endophytes of the total plant. Sequence analysis reveals that *Bradyrhizobium*-related sequences were the most abundant taxa in both soybean genotypes analyzed, followed in abundance by *Nitrobacter* and *Tradiphaga*. Relative abundances of these genera

did not significantly differ between purple and white flowering soybean plants. Other non-rhizobial endophytes were found only inconsistently, and at far lower abundances in all nodules sampled. These results may suggest that soybean does not select growth-promoting bacteria for nodule occupancy. These results may inform strategies for the use of non-rhizobial bioinoculants in legumes.

**C. Barta, B. Jenkins, D. Lindstrom, J. Reynolds, N. Karns, W. Constable, J. Phelan, M. Hesel, R. Prawitz, J. Brown, K. Moore, M. Moore, and C. Thammarat. Department of Biology, Missouri Western State University. PHYTOHORMONE TREATMENT ALLEVIATES THE NEGATIVE ALLELOPATHIC EFFECTS OF AMUR HONEYSUCKLE (*LONICERA MAACKII*) LEAF EXTRACTS ON SEED GERMINATION AND GROWTH.** Invasive species are a threat to biodiversity and a relevant concern for species conservation and restoration. These species may employ a large array of strategies, through which they negatively impact the germination, growth, survival or reproduction of native species. One such strategy is the synthesis and release of a variety of allelopathic chemicals into the environment, which directly or indirectly affect native species. Decomposing leaves of Amur honeysuckle (*Lonicera maackii*), a shrub rapidly invading the Midwestern US have been shown to leach a variety of phenolic molecules into the soil, with devastating inhibitory effects on native species in the region. Nevertheless, the action mechanism of inhibition has not been studied to date. In this work we explored the mechanism of inhibition by honeysuckle leaf extracts in germinating field mustard in a bioassay. The extracts significantly decreased the germination of mustard seeds. While the inhibitory effect was dose-dependent, stronger with increasing extract concentrations, we found that high endogenous or exogenous gibberellic acid (GA) phytohormone treatment can relieve the inhibition. We hypothesize, that the allelochemicals in the honeysuckle leaf extract alter the hormonal balance in germinating seeds, effect which however, can be alleviated by elevated GA concentrations. Ultimately, a better understanding of the inhibition mechanism by allelopathic chemicals is expected to contribute to developing effective invasive species management approaches in the future. Supported by MWSU-PORTAL and the MWSU-Department of Biology.

**P. Mayhood, Department of Biology, Missouri State University. 16S RDNA SEQUENCING OF RHIZOBIAL AND NON-RHIZOBIAL ENDOPHYTES WITHIN INDIVIDUAL ROOT NODULES OF SOYBEAN.** Soybean is a valuable crop that establishes a symbiotic association with nitrogen-fixing microorganisms. For a long time, culture-based methods suggested that members of the genus *Bradyrhizobium*

are the only nitrogen-fixing inhabitants of soybean root nodules. However, results from recent studies identified the presence of many other bacteria within soybean root nodules. Much of previous research is derived from culture-dependent methods, only estimated to account for 0.1% of microbes in agricultural soils, potentially misrepresenting community dynamics. This study investigated the presence and relative abundance of rhizobial and non-rhizobial endophytes (NREs), within different nodules on the same soybean plant. Three sites were selected on Kendrick Farm in Springfield, MO, where three plants and rhizosphere soil were collected at each (nine total plants). The microbiome of approximately 24 individual soybean root nodules from each plant were analyzed using next-generation 16s rDNA gene sequencing. Preliminary results suggest high abundance of *Bradyrhizobium* genera within root nodules. Two non-rhizobial endophytes that were consistently present in all root nodules, *Nitrobacter* and *Tardiphaga*. Other NREs were inconsistently present at low abundance, suggesting a lesser role in plant growth as endophytes. Investigation of *Tardiphaga* and *Nitrobacter* within root nodules are of high importance, as few studies have isolated *Tardiphaga* and none have isolated *Nitrobacter*.

## CHEMISTRY SECTION

### Oral Presentations

**M. McCarthy and V. Merker. Department of Natural Sciences, Northwest Missouri State University. SYNTHESIS AND EVALUATION OF TYLENOL DERIVATIVES.** Tylenol is an over-the-counter analgesic with several side effects. The purpose of this research work is to find the best form of Tylenol's active ingredient (acetaminophen) that may reduce the negative health impact concerning toxicity and liver health. The acid-catalyzed reaction of acetaminophen at 60°C, 80°C, and 100°C with acetone, betulin, and vanillin in variable molar ratios affords products in high yield. These products were characterized using NMR, and melting point data. Modified acetaminophen compounds are interesting since they increase the design potential of analgesics and hence represent an unexplored strategy for therapeutic compound discovery. A series of modified acetaminophen derivatives was synthesized and assessed for physical, chemical, and medicinal properties.

**C.R. Scholtz, J.D. Steinkruger, C. Zhou. School of Natural Sciences, University of Central Missouri. ZWITTERIONIC THIOLATED GOLD NANOPARTICLES AS SENSORS FOR METAL IONS IN AQUEOUS SOLUTION USING FLUORESCENT SPECTROSCOPY.** Metal ions play vital roles in biological environments. Detection of metal ions in



aqueous environments is traditionally completed using fluorescence spectroscopy due to assay simplicity and low cost. Fluorescent gold nanoparticles (AuNPs) have emerged as effective tools for the probing of metal ions with high selectivity and sensitivity. Significantly, AuNPs can be customized by changing the thiolated ligand(s) chosen to synthesize the luminescent AuNPs. We have completed a gram-scale synthesis of a thiolated dipeptide (tDP) containing a Lysine residue. Molecule tDP was combined with 11-mercaptouanoic acid (11-MUA) in a 1:1 ligand ratio to prepare luminescent gold nanoparticles under mildly reducing conditions. Transmission Electronic Microscopy (TEM) of the resulting AuNPs revealed a gold core size of  $1.6 \pm 0.3$  nm. Fluorescent spectroscopy of AuNPs in water displayed a 25 nm red-shifted emission maximum compared to single-ligand 11-MUA AuNPs. The observed red-shifted fluorescence emission provides indirect evidence of dual-ligand AuNPs. Preliminary studies using the synthesized luminescent AuNPs as sensors for toxic metal ions using fluorescence spectroscopy will be discussed.

## CHEMISTRY SECTION

### *Poster Presentations*

**L. Hedges and C. Babayco, Department of Physical and Biological Sciences, Columbia College. QUANTIFICATION OF WIDESPREAD COCAINE CONTAMINATION ACROSS ONE- DOLLAR BILLS IN THE SOUTHERN MIDWEST.** Previous research has identified cocaine contamination on banknotes around the world, including more locally in Chicago, IL and Kansas City, KS. This study examines the contamination of cocaine on bills from Kansas City, MO along Interstate 70 to Saint Louis, MO and then along Interstate 64 to Evansville, IN. Three one- dollar bills were collected at each of 30 locations at 20 to 40-mile intervals along the interstates and more frequently within urban areas. Cocaine was extracted from each bill by acid extraction followed by concentration using solid-phase extraction and analysis by gas chromatography- mass spectrometry. Quantifiable amounts of cocaine were detected on all 90 bills with concentrations ranging from 0.02  $\mu\text{g}/\text{bill}$  to 40.5  $\mu\text{g}/\text{bill}$ . When bills were grouped into urban and rural regions, higher concentrations were observed in the more urban areas and also exhibited greater variability in the measured concentrations. Compared to previous studies, these results show greater cocaine contamination on paper currency both in the relative number of bills contaminated and the total concentrations found on bills.

**A. Malkawi, C. True, and A. Bailey, Department of Chemistry, Northwest Missouri State University. EFFECT**

**OF SELENIUM NUTRITION ON GIBBERELIC ACID ACCUMULATION IN SPINACH PLANTS GROWN UNDER VARIABLE ENVIRONMENTAL CONDITIONS.** Selenium is an essential micronutrient for humans. Agricultural crops fortified with selenium provide a practical approach to increase the amount of selenium in the human diet. The three-fold objectives of the present study were, first, to isolate and identify gibberellic acid present in spinach tissues grown in the presence of selenium, second, to quantify levels of this compound during the ontogeny of flower induction, and third, to study the effect of selenium on the levels of endogenous gibberellic acid. Plants were initially grown under non-inducing conditions and then half of the plants were transferred to inducing conditions. Harvest of plants began 48 hours later and over a period of 12 days with 2-day intervals. Gibberellic acid was isolated and quantified using preparatory solvent partitioning, reversed-phase high-performance liquid chromatography and combined gas chromatography- mass spectrometry. When plants were transferred from floral non-inducing to inducing conditions, the gibberellic acid content increased with increasing levels of selenium treatment. Two additional experiments were performed in which the above photoperiodic regime was employed and the temperature was kept constant at 30°C and 20°C. These experiments showed similar trends of decreasing gibberellic acid content under non-inducing conditions and, conversely, increasing under flower inducing conditions. Our study establishes a correlation between increased gibberellic acid levels with the flowering of spinach grown in soil supplied with selenium.

## COMPUTER SCIENCE AND MATH SECTION

### *Oral Presentations*

**A. Hasanbasri and Y. Liu, College of Arts and Science, Maryville University. PREDICTING AND TESTING THE CHICAGO TAXI FARE.** Using the data of the Chicago taxi trips from January to December of 2016, we predict taxi fare using several models: linear regression, tree, and random forest. In addition, we also tested the data on the k-mean clustering method to find the best number of clusters by looking at the cost and silhouette values. We then choose the best model to predict the Chicago fare based on the root-mean-squared error (RMSE). Due to the largeness of the dataset, we used Spark Apache in our big data analysis.

**I. Shields, M. Tsai, R. Patel, and Y. Liu Department of Actuarial Science, Data Science and Mathematics, Maryville University of St. Louis. OPINION MINING USING**

**DEEP LEARNING WITH PRE-TRAINED MODELS.** Due to the rise of digitalization in business, vast amounts of text data are generated every day. The text data have significant potential economic value. Utilizing text mining techniques such as opinion mining can help business understand customers' experience which is important for businesses to better their services and products. In this study, an Opinion Mining Model for Yelp reviews was built using Deep Learning with pre-trained models GloVe, Word2Vec, FastText, and Universal Sentence Encoder. We also summarize, compare and contrast the various models.

## COMPUTER SCIENCE AND MATH SECTION

### *Poster Presentation*

**N. Kempf, K. Slater, D. Urban, and J. Mutua, Department of Computer Science, Mathematics, and Physics, Missouri Western State University. A MATHEMATICAL MODEL TO EVALUATE THE EFFECTS OF VARYING ANTIBODY CONCENTRATIONS ON HIV DYNAMICS.** HIV (Human Immunodeficiency Virus) remains a major public health challenge and one of the leading causes of death worldwide with over 36 million people living with the virus. HIV attacks the body's CD4 T cells in the immune system, thus making the body more susceptible to disease and other HIV related infections. The major challenge about HIV is that no effective cure for the virus currently exists. This fact has prompted the emergence of studies which look at ways to control the virus. As such, it is important to study the effects that antibodies have on the spread of HIV. In this study, we develop a mathematical model that incorporates the effects of antibody concentrations on the HIV dynamics. Using our model, we quantitatively describe how varying antibody concentrations affect virus infection rates, infected cell deaths, virus clearance, CD4 T cell count, and the basic reproduction number. We found that high levels of antibody concentration result to decreased virus infectivity, increased virus clearance, and death of infected cells. Our results also show that high levels of antibody concentration result in a low basic reproduction number suggesting that HIV may be controlled if effective measures such as development of vaccines which boost antibody levels are explored.

## CONSERVATION SECTION

### *Oral Presentations*

**J. McGhee, Department of Natural Sciences, Northwest Missouri State University. ASSESSING SUMMER POND**

**AND LAKE INLET USE BY COPE'S GRAY TREE FROGS USING PVC PIPE TRAPS.** The need to develop rigorous conservation strategies for amphibians means reliable monitoring methods are required. I investigated the use of PVC pipe traps as a monitoring method for a Cope's Gray Tree frog (*Hyla chrysoscelis*) population in Nodaway County, Missouri. PVC pipes were placed as four arrays of four pipes at each of three ponds and two inlets of Mozingo Lake. Arrays were centered on a randomly selected tree within 50 m of a pond. Tree frogs were monitored during the summers of 2016–18, to determine if ponds and pipes within ponds were used differentially, using contingency table analysis. We also assessed and compared sex ratios at each pond or inlet using an ANOVA. We found that tree frogs were detected in pipes more commonly at inlets rather than breeding ponds, but found no significant difference between ponds or between inlets, respectively. Pipe location relative to trees within a pond also showed no significant difference in use by tree frogs. Mean sex ratios tended to favor males, ranging from 0.6 to 6.3 males per female. These sex ratios did not differ significantly between ponds. Despite inherent variability, monitoring using PVC pipes seems suitable for our study site. There is no indication of a need to focus on or drop particular ponds or inlets in the study or modify pipe placement.

## CONSERVATION SECTION

### *Poster Presentations*

**K. B. Nowack and J. D. McGhee, Department of Natural Sciences, Northwest Missouri State University. WADING POOL USAGE BY TERRESTRIAL VERTEBRATES AS AN ADDITIONAL WATER SOURCE DURING DROUGHT CONDITIONS AT MOZINGO LAKE IN NORTHWEST MISSOURI.** Supplemental water sources may be important to vertebrate wildlife during periods of drought, and may in turn provide opportunities for monitoring. We examined the use of small wading pools by terrestrial vertebrates during a season of drought in conjunction with a population study on Cope's Gray tree frogs, at Mozingo Lake, Nodaway County, Missouri. Pools were in 10 different locations near 5 different ponds and lake inlets. Usage of pools was examined from May through August of 2018 using trail cameras, which were checked weekly. Pictures were examined for the three most commonly caught species: Gray Catbird (*Dumetella carolinensis*), Raccoon (*Procyon lotor*), and White-tailed Deer (*Odocoileus virginianus*). We found that pool activity was highest in July for all three species.

Pictures suggest high re-use of pools by deer and raccoons. We conclude that supplemental water sources, even near large lakes, are beneficial to wildlife during drought and may be used heavily by certain species. This in turn may provide useful opportunities for monitoring and assessing vertebrate diversity at a given site.

**J. Porter, Department of Natural Sciences, Northwest Missouri State University. COMPARISON OF WATERFOWL DIVERSITY BETWEEN NATURAL WETLANDS AND FLOODED AGRICULTURE FIELDS IN NORTHWEST MISSOURI.** Studies have shown that waterfowl show a preference between natural wetlands and flooded agriculture fields during the fall migration. This hypothesis was tested in this study done across Northwest Missouri by randomly selecting five sites within four different wetland habitats and conducting point-count surveys at each site. It was determined there was a higher species richness within flooded agriculture wetland habitats than within natural wetlands. Natural wetlands did produce a higher number of species but lacked in species diversity as compared to flooded agriculture fields. In conclusion, flooded agriculture fields which likely provide a higher density of food attract a higher diversity of species of waterfowl than do natural wetlands.

**A. Reuter, M. Andres, R. J. Arndt and J. D. McGhee, Department of Natural Sciences, Northwest Missouri State University. COMPARISON OF *Anchoa mitchilli* DIET COMPOSITION AT BACK BAY, EAST PASCAGOULA AND CENTRAL MISSISSIPPI SOUND.** Bay Anchovy (*Anchoa mitchilli*) is the most abundant fish in the estuaries of the Gulf of Mexico. As an important species in the diets of larger commercial and recreational fish, they are a key link in the food web for the local biotic community, and the local diet of this species is therefore of interest. We collected samples of *A. mitchilli* from random locations in Back Bay, East Pascagoula, and Central Mississippi Sound. The samples were taken back to the lab where their stomach contents were sorted and counted. We used a One-way ANOVA to assess if zooplankton distribution differed by location for 3 taxa: Calanoidea, Cyclodoidea, and Diatom. We found a significant difference in the amount of all zooplankton by location. We conclude zooplankton amounts likely vary by regional habitat, possibly affecting the distribution of *A. mitchilli*.

**T. R. Sutton and J. D. McGhee, Department of Natural Sciences, Northwest Missouri State University. NAIVE METAMORPHOSIS RATES FOR A COPE'S GRAY TREE FROG POPULATION AT MOZINGO LAKE, NODAWAY COUNTY, MISSOURI.** To better understand Cope's Gray tree frog (*Hyla chrysoscelis*) reproduction, we assessed tadpole metamorphosis rates at Mozingo Lake,

Nodaway County, Missouri. We placed plastic wading pools at random locations at ponds and lake inlets to act as sites for tree frogs to deposit eggs. We collected a subset of tadpoles at pools where eggs were laid to observe in the lab to estimate metamorphosis rates. Only 3 out of 10 pools were used by frogs. For the cohort, metamorphosis occurred over a short period of time, with high survival. This information can help monitor the reproductive vital rates of Gray tree frog populations within the Mozingo Lake ecosystem.

**E. Grimes<sup>1</sup>, J. McGhee<sup>1</sup> and D. Welchert<sup>2</sup>. <sup>1</sup>Department of Natural Sciences, Northwest Missouri State University. <sup>2</sup>Loess Bluffs National Wildlife Refuge. ROAD MORTALITY OF SNAKES AT LOESS BLUFFS NATIONAL WILDLIFE REFUGE.** A common detriment to local wildlife populations is the anthropogenic effect of automobile traffic. Despite the strong protective measures of National Wildlife Refuges, sites with auto-tour roads subject the same pressures of collisions on refuge inhabitants. The primary objective of this survey was to quantify the number of snakes hit by automobiles on the Loess Bluffs National Wildlife Refuge auto tour route. Secondly, the study attempts to correlate the relative rate of mortality (RRM) with multiple characteristics including species, age class, and location. I drove 220.3 km of the auto-tour loop on days with favorable weather conditions for snake activity. I measured snout to vent length (SVL), identified the species, and took a geotagged picture at each encounter. After seven survey days from April to October 2018, I recorded 96 resident snakes from 10 native species. The three most prevalent species were *Storeria dekayi*, *Thamnophis sirtalis*, and *Nerodia sipedon*. Sixty snakes were immature and 36 were mature. Of the 96 total snakes, 62 were found dead on road (DOR) and 34 were found alive. Immatures were found DOR more often than matures. *Nerodia rhombifer* had the highest RRM at 0.88, and 6 out of 10 species had an RRM value greater than 0.50. I was able to determine three primary crossing points where snake movement and collisions were highest. These areas of high snake-traffic would be good starting points for refuge management measures, especially for common native species that are more active during this time of the year.

## PHYSICS AND ENGINEERING SECTION

### Oral Presentations

**C. Sailor, Department of Mathematical Science and Physics, Westminster College. THE BIG BANG THEORY — GEOMETRY OF THE EXPANDING UNIVERSE.** The expansion of the spatially homogeneous and isotropic universe is

described by Friedmann models in which Einstein's equations take the form of one single ordinary differential equation. Differential geometry is used to study the curvature of spacetime equipped with the Robertson-Walker metric:  $ds^2 = -dt^2 + a^2(t)dL^2$ . Here,  $a^2(t)dL^2$  denotes the metric of the homogeneous and isotropic spatial slice with  $a(t)$  being the scale factor. The shape of the evolving universe is determined by the solutions of Einstein's equations for the scale factor. These include constant positive, zero, and constant negative spatial curvature respectively. In the case with negative or zero curvature, the universe expands forever. In the case with positive curvature, the universe collapses back to a singularity after a maximum radius is reached.

**J. Shaw<sup>a</sup>, D. Monismith<sup>b</sup>, Y. Zhang<sup>a</sup>, D. Doerr<sup>a</sup> and H. S. Chakraborty<sup>a</sup>,** <sup>a</sup>Department of Natural Sciences, Northwest Missouri State University, <sup>b</sup>Software Maintenance Group, Tinker AFB, Oklahoma. **WAVEPACKET DYNAMICS IN THE SCATTERING OF HYDROGEN ANIONS OFF VICINALLY NANO-STEPPED METAL SURFACES.** We study the electron dynamics in monocrystalline Cu, Au and Pd surfaces with stepped vicinal structures modeled in a Kronig-Penney scheme. The unoccupied bands of the surface are resonantly excited *via* the charge transfer interaction of the surface with a moving hydrogen anion. The interaction dynamics are simulated in a quantum mechanical wavepacket propagation approach [1,2] that used parallel computations. The survival probability of the interacting ion is calculated as well as the electron probability density at all times during the interaction. Animated videos are produced of the electron probability density which show that, when the electron is transferred to the metal, the first image state and surface state are the most likely locations of the electron as it evolves through the superlattice. The survival probability shows peaks at those energies that produce standing waves between the steps on the surface when the electron is in the image state subbands. The relative survival probabilities between the metals are shown to be related to relative positions of the band gaps, first image state energy and surface state energy. The work is supported by the XSEDE allocation grant for high performance computation and partly by NSF Grant No. PHY-1806206. References:

- [1]Schmitz et al, *Phys. Rev. A* **81**, 042901 (2010);  
 [2]Shaw J et al, *Phys. Rev. A* **98** 052705 (2018)

## PHYSICS AND ENGINEERING SECTION

### Poster Presentations

**J. Sundararajan, M. Cruzan, T. Pederson, M. Yang, C. Ames, G. Cornwell, and S. Beebe, Chemical and Physical**

**Sciences, Missouri Southern State University. STRATEGIC APPROACH TO ACTIVE LEARNING TECHNIQUES AND EFFECTIVE PARTICIPATION IN INTERMEDIATE PHYSICS LABS.** The main aim of intermediate physics lab course is to expose students to experiments in modern physics, optics, photoelectric effect, wave phenomena and circuits. Every experiment in this course demonstrate specific concepts and deliberate approach in performing the lab. The structure of the course was framed as follows. Every student was assigned two labs for the semester, expected to approach them in a scientific way, develop hypothesis, present the concept behind the experiment, history and background to the class. The student clearly explained the importance of the experiment and the actual experiment performed initially, planned the course of experiment and framed the data sheet. The students took primary role in conducting the lab and guiding fellow classmates towards successful completion of the lab. Implications of the results of the newly adopted strategy of intermediate physics lab activities will be presented in the poster. Supported by the department of chemical and physical sciences.

**A. Sithole, J. Mutua, and G. Lack, Department of Computer Science, Mathematics, and Physics. NON-PARAMETRIC TREND TESTS AND CHANGE-POINT DETECTION FOR RADIOACTIVE IODINE LEVELS IN DRINKING WATER IN THE U.S. MIDWEST.** Radioiodine (I-131) is one of the most feared and hazardous byproducts from the nuclear fission of Uranium-235 or the neutron capture by Tellurium-130. Iodine-131 is radioactive, and its nuclear decay to Xenon produces ionizing beta ( $\beta^-$ ) particles and gamma ( $\gamma$ ) radiation. Human exposure to ionizing radiation can have short and long-term health effects. The purpose of this study was to perform trend tests and change-point detection of Iodine-131 times series data. In this study, the longitudinal data (1979 -2017) from the [EPA database](#), comprising Iodine-131 concentrations in drinking water measured in the Midwestern part of the United States (EPA Region 7) were analyzed. The Gaussian kernel (G-k) smoothing was performed to separate long-trends from the random noise in the data. The Mann-Kendall (M-K) rank correlation and Theil-Sen's (T-S) tests indicated the existence of positive trends on the data. The Pettitt's Homogeneity (P-H) tests indicated statistically significant increases ( $\alpha = 0.05$ ,  $p < 0.0001$ ) in Iodine-131 radiation levels for the periods 1978-1995 and 1995-2017. Jefferson (MO) and Lincoln (NE) had higher average concentrations of Iodine-131 than Cedar Rapids (IA) and Topeka (KS). The implications of this study will be discussed in detail in this paper. The determination of the existence of seasonal variations in the I-131 data require future investigation.

**E. Bereyso, N. Thorsen, and S. Tewari, Cooperative Engineering Program, Missouri State University in association with Missouri University of Science and Technology. EXPLORING VARIATION IN WATER CLARITY AND FLOW RATE OF LAB-SCALE SAND FILTERS.** The purpose of this preliminary study is to explore variation in water clarity and flow rates of lab-scale sand filters. These filters are composed of up to two layers varying thicknesses consisting of sand particles separated by physical sieving. The particle sizes are 1.18mm for the large particles and 0.3mm for the small particles. The study consists of five filters having various layers of these particles - 100% large particles, 75% large particles with 25% small particles, 50% of each, 25% large and 75% small, and 100% small particles. Titration tubes were used as containers for the filtering medium. The volume of the sample water used for each filter was 30 ml. The height of the total filtering medium was about 25.4 cm. The initial average turbidity of the dirty water samples was 713 NTU. The percent removal of turbidity ranged from 77% to 97%. The flow rate varied from 0.05 to 0.46 ml/s/cm<sup>2</sup>. There is a definite trend in filtering efficiency and the volumetric flow rate per unit area of these filters. This kind of study could be used to determine particle sizes and the ratio of depths of filtering media composed of these particles to have a certain water quality and optimized flow rate.

## **SOCIAL AND BEHAVIORAL SCIENCES SECTION**

### ***Oral Presentations***

**B. C. Gerhard. Department of Social and Behavioral Sciences, Lincoln University. THE RELATIONSHIP BETWEEN DEPRESSION, SLEEP, AND DREAM CONTENT AMONG COLLEGE STUDENTS.** This study

examined any correlation linking depression with the sleep and dream content of college students. A survey was given to Social and Behavioral Science college students at Lincoln University. The survey contained self-report questions on their level of depression, sleep habits, dream content, exercise habits, and basic demographic information. Based on prior research, we expect students who report high levels of depression to have poor sleep quality. We also expect depressed students to report a higher frequency of dreaming, and “bad” dream content than non-depressed students. Results indicating there is a relationship between depression and sleep will serve as a basis to conduct future research to narrow down the potential link.

## **SOCIAL AND BEHAVIORAL SCIENCES SECTION**

### ***Poster Presentations***

**J. Kibirige, Department of Economics, Political Science and Sociology; and Elec Sithole, Department of Computer Science Mathematics and Physics, Missouri Western State University. THE SOCIAL DEMOGRAPHY OF OPIOID ADDICTION IN THE US: IMPLICATIONS FOR PUBLIC POLICY.** The “Opioid Epidemic” in the US is currently a widely discussed topic. Yet it remains a relatively abstract concept whose definition is, at best, vague. Because of that, accurate analysis of the problem remains problematic and, consequently, the solutions presented are too broad to properly address the underlying issues. Is the “opioid crisis” really a new problem or is it a synonym for a problem that has long existed? This paper, therefore, examines the social demographic distribution of what has been defined as the opioid epidemic and, in essence, examines the suitability of existing and proposed solutions.