

ABSTRACTS
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Agriculture Oral Presentations

*Navarrete-Tindall, Nadia, Weber, P., Bartelette, S., Alvarez, I. Lincoln University of Missouri. PROTECTING AND GROWING NATIVE WILD LEEKS IN MISSOURI. Wild leeks (*Allium tricoccum*) are shade tolerant edible plants native to deciduous forests in the United States and Canada. Conservation measures are underway in states like West Virginia, North Carolina, Virginia and New York because of the threat of overharvest. In Missouri, wild leeks are documented in 19 counties. To avoid this imminent risk in Missouri and protect natural populations, the main goal of this study is to offer training through outreach and education based on research conducted in these states. We are also evaluating them as specialty crops in Missouri to discourage digging in the wild. Plant growth and seed germination will be measured for 3 or more years at LU campus in raised beds, pots and field plots. Preliminary results on numbers of bulbs per plant and bulb size showed no differences for wild leeks grown in pots with three different soil media. Survival was close to 98% and animal disturbance and diseases were not observed. Five small farmers in Boone, Callaway, Cole and Scott Counties are collaborating with this study. Wild leeks' acceptability as an edible was tested in 2015 during food tasting sessions, in which volunteers rated flavor, aroma, texture, appearance and acceptability of recipes with wild leeks. Average rates for flavor, texture, aroma, presentation and overall acceptability of five recipes containing wild leeks was 4.2 to 4.5, with 5.0 being excellent. Evaluations will continue in 2016. This study receives funding from the Missouri Department of Agriculture and the USDA.

*Timpe, Tricia, Wetzel, J., Dudenhoeffer, G., Edwards, J., Zhang, Y., Omara-Alwala, T. -Department of Agriculture and Environmental Science, Lincoln University of Missouri, Jefferson City. EFFECTS OF VITAMIN PRE-MIX, ASCORBIC ACID, AND CHOLINE CHLORIDE SUPPLEMENTATION ON GROWTH AND SURVIVAL OF NORTHERN BLUEGILL. Cultured Northern Bluegill *Lepomis macrochirus macrochirus* increase in value with size. Fish feed formulations needed to further growth are usually supplemented with what are referred to as vitamin premixes (A and B vitamins, E, and K) as well as ascorbic acid and choline chloride with the assumption all are some are required. Herein, we explore inclusion of dietary vitamin premix, ascorbic acid, and choline chloride in the diets of Bluegill. Age-0 Bluegill were quarantined for >60 days in an indoor RAS. Five diets, three replicates of each, were formulated as follows: no supplementation (-control); supplementation with all (control); control -choline chloride (-CC); -control +0.5 vitamin premix (+0.5); and control -ascorbic acid (-AA). Fish (n=16) were stocked for a 10-week growth trial with five days of feedings per week. Weight determinations were made weekly following two days of food withdrawal. At trial end, surviving fish were euthanized with MS-222 and stored frozen for later examination. Dissected fish were examined for gross appearance of the liver, as well as liver weight and total visceral weight. The -control diet was dropped in week six due to high mortality rates. Results varied in terms of weight increase, feed conversion ratio, specific growth ratio, and survival rates. From the results, we conclude a +0.5 vitamin premix is sufficient while choline chloride and ascorbic acid need further scrutiny. From project provides baseline from which more detailed study of Northern Bluegill vitamin requirements can start.

*Panday, Dinesh and Nkongolo, N. Lincoln University of Missouri. EFFECT OF SOIL AND CROP MANAGEMENT PRACTICES ON SOIL PORE SPACE TORTUOSITY AND GAS DIFFUSION COEFFICIENT. Soil and crop management practices affect soil properties, but the assessment of the effects of these practices on soil is mostly restricted to properties such as soil moisture or bulk density. Soil pore space indices can better detect changes due crop and soil management, but they are not often investigated. We studied the effect of tillage (no-till vs conventional tillage), cover crop (no-rye vs rye) and crop rotation (continuous corn, continuous soybean, corn-soybean and soybean-corn) treatments on soil pore space indices: the relative gas diffusion coefficient (D_s/D_o) and the pore tortuosity factor (τ). The study was conducted on a silt loam soil planted to corn and soybean at Freeman farm of Lincoln University in 2011-2015 growing seasons. The experimental design was a randomized complete block with 16 treatments and 3 replications. Soil samples were collected at two depths: 0-10 and 10-20 cm, and their fresh weights recorded. Samples were later oven dried at 105°C for 72 h. After drying, air-filled porosity (AFP) and total pore space (TPS) were calculated and later used in Marshall, Buckingham, Sallam et al, Millington, and Jin and Jury models for predicting D_s/D_o and τ . Results showed that there were significant ($p < 0.05$) tillage*cover crop and tillage*crop rotation interactions for both pore space indices for all models and years (except in 2011). D_s/D_o increased in tilled plots with cover crop, however, τ decreased in tilled plot planted to rye. D_s/D_o also increased in tilled corn-soybean rotation and continuous corn plots and τ followed an opposite trend to that of D_s/D_o . D_s/D_o and τ can be used to assess the impact of soil management practices on soil physical properties.

*Zelalem, Mersha and OConnor, M. Lincoln University Cooperative Extension. EVALUATION OF THE SPRAY ADVISORY PROGRAM MELCAST, FUNGICIDE ALTERNATIONS AND MULCHING TO MANAGE WATERMELON DISEASES IN MISSOURI. Melons are economically important crops in the state of Missouri. Each year, three diseases namely Alternaria Leaf Blight, Anthracnose and Gummy Stem Blight cause yield losses on these crops. Use of calendar based fungicide sprays is frequent on many commercial farms. MELCAST (MElon disease foreCASTer), is an advisory program that guides melon growers in scheduling fungicide sprays based on weather favorability index (EFI). The MELCAST sites in 2015 were Jefferson city, Fortuna, Truxton, Sikeston, Clarkton and Hornersville. From 2013 – 2015, research plots were established at George Washington Carver Farm to study the effect of using MELCAST and mulch as well as alternating fungicides in reducing watermelon diseases using variety 'Crimson Sweet'. Fungicide spray significantly ($P < 0.05$) reduced diseases when compared to non-sprayed plots. In 2013 and 2014, alternating Bravo WeatherStik® and Inspire Super® or Quadris Opti® and Luna Experience® significantly reduced watermelon diseases when compared to non-treated control. But no significant difference was detected between these two alternation plans. In 2014, total foliar biomass showed a significant ($P < 0.05$) increase (73.8%) when plastic mulched plots with (34.7 lb/plot) and without (9.1 lb/plot) spray were compared. Whereas no significant difference between disease severities of MELCAST and Weekly spray plans was observed, use of MELCAST saved 1-2 fungicide sprays per season in all years. This resulted in decreased cost of production. Watermelons need bedding material and if sprayed, alternations of fungicides for a profitable production. Rye-vetch and black plastic mulch significantly reduced watermelon diseases compared to plantings on bare ground. Disease suppression was not significantly different between the rye-vetch and black plastic mulch.

*Zoellner, Joe, Wetzel, J., Dudenhoeffer, G., Omara-Alwala, T., Zhang, Y., Edwards, T. Lincoln University. EFFECTS OF CO-CULTURING BLUEGILL ON PRODUCTION OF BLACK CRAPPIE FINGERLINGS IN A RECIRCULATING AQUACULTURE SYSTEM. Black Crappie *Pomoxis nigromaculatus*, is one of the most desired game fish species as table fare, yet little has been invested in its production as food fish. Pellet-fed Black Crappie in a small aquaria tend to grow slowly due to low feed intake rates and do not respond to feeds with higher nutrient value or increased palatability. Therefore, environmental factors may be inhibiting growth. Polyculture studies have inferred that sunfishes related to Black Crappie are subject to social learning which may influence feed intake and weight gain. This experiment set out to determine if co-culturing Bluegill *Lepomis macrochirus* effects production of Black Crappie. Sixteen 115- L tanks were stocked with 25 Black Crappie. Treatments consisted of randomly stocking four replicates with 0, 1, 2, and 4 Bluegill. Fish were hand-fed daily at 0800, 1200, and 1600 for 12 weeks. There was significant increase in percent weight gain in tanks co-cultured with 4 Bluegill compared to control tanks containing 0 Bluegill. Feed intake increased significantly in all treatments containing Bluegill. Feed consumption rate improved in treatments 2 and 4 compared to 0. Positive increasing growth trends existed in final weights, weight gain, and specific growth rate. Evidence in this trial showed increased growth rate of

Black crappie co-cultured with Bluegill, however further studies are needed to see if this would carry through in larger aquaria and pond settings.

*Panday, Dinesh and Nkongolo, N. Lincoln University of Missouri. EFFECT OF SOIL AND CROP MANAGEMENT PRACTICES ON SOIL PORE SPACE TORTUOSITY AND RELATIVE GAS DIFFUSION COEFFICIENT. Soil and crop management practices affect soil properties, but the assessment of the effects of these practices on soil is mostly restricted to properties such as soil moisture or bulk density. Soil pore space indices can better detect changes due crop and soil management, but they are not often investigated. We studied the effect of tillage (no-till vs conventional tillage), cover crop (no-rye vs rye) and crop rotation (continuous corn, continuous soybean, corn-soybean and soybean-corn) treatments on soil pore space indices: the relative gas diffusion coefficient (D_s/D_o) and the pore tortuosity factor (τ). The study was conducted on a silt loam soil planted to corn and soybean at Freeman farm of Lincoln University in 2011-2015 growing seasons. The experimental design was a randomized complete block with 16 treatments and 3 replications. Soil samples were collected at two depths: 0-10 and 10-20 cm, and their fresh weights recorded. Samples were later oven dried at 105°C for 72 h. After drying, air-filled porosity (AFP) and total pore space (TPS) were calculated and later used in Marshall, Buckingham, Sallam et al, Millington, and Jin and Jury models for predicting D_s/D_o and τ . Results showed that there were significant ($p < 0.05$) tillage*cover crop and tillage*crop rotation interactions for both pore space indices for all models and years (except in 2011). D_s/D_o increased in tilled plots with cover crop, however, τ decreased in tilled plot planted to rye. D_s/D_o also increased in tilled corn-soybean rotation and continuous corn plots and τ followed an opposite trend to that of D_s/D_o . D_s/D_o and τ can be used to assess the impact of soil management practices on soil physical properties.

*Rai, Dipti and Nkongolo, N. Lincoln University. MEASUREMENT OF CARBON DIOXIDE EMISSIONS FROM CORN/SOYBEAN FIELD USING PHOTOACOUSTIC INFARED SPECTROSCOPY AND GAS CHROMATOGRAPHY. Greenhouse gas emissions have gained a special interest mainly due to their relation with global warming. Accurate measurements of these emissions are necessary to devise climate change's mitigation strategies. Photoacoustic Infrared Spectroscopy (PAS) and Gas Chromatography (GC) methods were evaluated for measuring CO₂ emissions in a silt loam soil at Freeman Farm of Lincoln University. Sixteen PVC static and closed chambers measuring 30 cm in height and 20 cm in diameter were permanently inserted into the soil to a depth of approximately 5 cm. Soil air samples for gas analysis were collected from each chamber with 60 ml syringes and put into storage bags. Air samples analyses for determination of CO₂ concentrations was conducted at Dickinson Research Lab using a GC. CO₂ was also directly measured at these 16 locations using PAS. The accuracy of PAS and GC measurements were found comparable in different years 2012, 2013 and 2015. PAS measurements for CO₂ showed a strong correlation ($r = 0.84$; $p < 0.05$) with GC in 2012. Similar significant results between PAS and GC measurements were also found in the year 2013 ($r = 0.98$; $p < 0.05$) and 2015 ($r = 0.99$; $p < 0.05$), respectively. Apart from the good agreement between methods, portability and ease of operation makes PAS an alternative option for conventional gas chromatography.

*Higgins, Todd R. Lincoln University. CANOLA FOR MISSOURI: HOW TO FIT INTO OUR CROPPING SYSTEMS. Canola is one of the major oilseed crops globally. Typically, North American canola growing locations have been in western Canada, and the northern tier of US states. Recent developments in canola breeding have provided an opportunity for canola to become a potential third crop for Midwestern and upper Mid South states. Research in Missouri is focusing on both winter and spring canola production. For Missouri, the challenge for growing winter canola is largely related to the timing of the removal of the preceding crop (typically corn) to allow for winter canola to be sown in a timely manner. An alternative method of sowing canola is to frost seed spring canola in February and harvest it in late June or early July to allow a short season soybean crop to be produced in the same year. The paper presented here focuses on the challenges of canola production and how innovative strategies may open up the Midwest as a significant canola producing region.

*Sharma, A. Lincoln University. ALTERNATIVE MANAGEMENT OPTIONS FOR MISSOURI FORESTS: AN EVALUATION USING USDA-FVS MODEL. The state of Missouri has rich forest resources with one-third of its geographical area under forests- primarily privately owned- providing diverse ecological and economic benefits. In 2013, Missouri forest products industry contributed approximately 8 billion dollars to Missouri's economy, supported 42,500 jobs, and generated 78.5

million dollars in state sales tax revenue. Ecologically, estimated 18% of native vascular plants, 14% of nonvascular plants, and 28% of the vertebrate animals in Missouri are the species of conservation concern. However, most of the private forest landowners of Missouri have limited knowledge or experience regarding forest management. Only about 10% of Missouri's family forest owners utilize assistance from a professional forester, leaving 90% of Missouri's family forest land being managed without any professional guidance. To ensure long-term sustainability and to realize full ecological and economic benefits, it is imperative that we evaluate and develop alternative forest management options for Missouri forests. In this study, we used USDA Forest Vegetation Simulator (FVS) model to evaluate individual tree selection (q-factor based), clearcut (even-aged) method, and no management options for managing Missouri's major forest type (Oak-Hickory) for structural diversity, and production benefits. Over a period of 100 years, we found that uneven-aged management led to higher annual merchantable timber production (69.91ft³/ac/yr) and stand structural diversity (Shannon Index: 2.27) than either clearcut-regenerate method or no action option, given the assumptions of the simulation modeling. Uneven-aged management also led to sustained yield of sawtimber (1159 to 1280ft³) every 20-year cutting cycle.

*Baldwin, Katie, Weathers, J., Lowman, S., Mauk, W. Southeast Missouri State University. AGRICULTURE IN THE EU. The Southeast Missouri State University Department of Agriculture went on a 2 week long study abroad trip to Ireland, London, and France. The objective of this research study was to compare before and after knowledge of the many agriculture sectors, after studying abroad. This expedition took place during January 2016. The goal of the trip was to provide learning opportunities, develop a knowledgebase of agriculture sectors, and learn through "hands on" experiences. My hypothesis was that students' would have an increase in their understanding of agriculture as a whole. A pre-survey and post-survey were conducted in order to measure the students' (n=19) knowledge and preparedness. The results showed an increase in knowledge of 8 different agriculture sectors, overall.

*Bailey, Charles, Brock, A., Giri, A. University of Central Missouri. PURINA MILLS. Missouri consistently ranks among the top ten states in the nation in animal production. Majority of the animal producers use products of Purina Mills, a subsidiary of Land O' Lakes, in their livestock operation. This study focuses on company analysis of Purina Mills. More specifically- types of products, product differentiation, market structure, SWOT analysis and advertisement strategies. Poster presentation of this company will be very beneficial to university students of Missouri as many intend to return to their family livestock operations and/or start one of their own after school. Preliminary findings based on product research suggests that the products offered by the company are both horizontally (at same price all products enjoy positive market share) and vertically (at same price level only few products enjoy positive market share) product differentiated. Moreover, after analyzing regional and national markets we identified that the company has any limited market power (mostly oligopoly) based on licensing, patent, geographic location and some other unique attributes. In addition to analyzing advertisement methods, we also talked with company personnel, carefully studied the mission and vision statement of the company to do an extensive Strength, Weakness, Opportunity and Threat (SWOT) analysis. From SWOT analysis we found that the strength (S) of the company was high quality products, extensive research, reputation, variety of products offered; Weakness (W) were high price products, domestic market; Opportunities (O) were technology leader, producer specific product to reach new markets and the potential threats (T) were- declining market share, and competition from other firms.

Agriculture Poster Presentations

*Takhache, Parameshwor, Nkongolo, N. Department of Agriculture and Environmental Sciences, Lincoln University. STATISTICAL AND GEOSTATISTICAL ANALYSIS OF SOIL THERMAL PROPERTIES AT GRIFFITH FARM. Thermal properties of soil, in addition to crop vegetation, influence directly or indirectly, the processes of mass and energy flow in the boundary layer of the atmosphere. Assessment of the distribution of these properties is therefore important in understanding their changing nature at field scale. Thus, this study was conducted to explore the status and spatial variability of soil thermal conductivity (K), thermal resistivity (R), thermal diffusivity (D), volumetric heat capacity (C) and soil temperature (T) across the Griffith farm. Soil samples were collected in 2014 in a farmer field and sent to a commercial laboratory for analysis. Soil thermal properties were directly measured using a KD2 Thermal Properties meter. Results showed that the average values for K, R, D, C and T were 0.34 ± 0.01 , 302.42 ± 54.72 , 0.29 ± 0.04 , $0.04 \pm$

0.17 and 33.43 ± 1.83 , respectively. The variogram analysis showed that the measured properties correlated spatially, however the coefficients of determination (R^2) were low. Interpolated maps showed that soil thermal conductivity (K) was evenly distributed with range between 0.31 and 0.37. Since, the R^2 value were not highly supportive the geostatistical map for the soil thermal properties could be done only using inverse distance weighing method instead of kriging.

*Nelson, Lancelot, Nkongolo, N. Department of Agriculture and Environmental Sciences, Lincoln University. STATISICAL AND GEOSTATISTICAL ANALYSIS OF SOIL PROPERTIES BUSBY FARM IN MISSOURI. In recent years the, the study of agriculture has revolutionized dramatically. Information about weather, climate, and climate change are now used in calculating and estimating crop viability and efficiency. Soil properties are also studied as an important crop evaluation technique. Thus, Geographic Information System is being use to pin point and log these soil properties data spatially so that farmers are more aware, and changes, overtime are analyzed. In 2014 Lincoln University conducted a soil sampling at Busby farm to assess and map the status of micronutrients Fe, Cu, Mn, Zn, B, and Al .Based on the data, Iron (Fe) was fitted to a linear variogram model $R^2 = 0.29$. This data was plotted into a map which showed two zones. The area of higher intensity was northerly and lower concentration was southerly. Copper (Cu) varied with no area of high or low intensity. (Mn) showed that a southeastern zone having a lower value than the northwesterly zone. Zinc (Zn) recorded lower area of intensity in the northern zone followed by area of highest intensity then a diminishing in intensity towards the southern zone. There was also a high area of intensity in the middle of the field for Al micronutrient.

*Al-awwal, Nasruddeen, Nkongolo, N. Department of Agriculture and Environmental Sciences, Lincoln University. MAPPING SOIL NUTRIENT CONTENT USING STATISTICAL AND GEOSTATISTICAL TECHNIQUE IN OSAGE COUNTY MISSOURI. Understanding of the status and distribution of soil properties is vital in any farming operation. Statistical and Geostatistical analysis can help in improving our understanding such status and distribution. The objective of this study was to determine and map soil nutrients content using statistical and geostatistical technique. The study was conducted in a farmer field in Osage County in Missouri. Soil samples are collected in the farm and sent to a commercial laboratory of soil chemical properties and nutrients. Soil nutrients of interests were nitrate (NO_3), ammonium (NH_3), potassium (K), phosphorus (P), calcium (Ca), magnesium (Mg) and sulfur (S). Results showed that the coefficients of variability (CV) for NH_4 , NO_3 , K, Mg, PII, P, S, and Ca were 17.46%, 36.96, 12.65, 16.75, 5.31, 10.52, 21.57 and 14.84%, respectively. The mean and median values for these properties were close enough to assume normal distribution of the data. Geostatistical analysis showed that NH_4 , NO_3 , , Mg, PII and P were fitted to a Gaussian variogram model with the R^2 values of 0.49, 0.66, 0.90, 0.81 and 0.11 respectively. However, S and K had isotropic variogram that fitted a spherical model with R^2 values equal to 0.29 and 0.50. This study revealed the potential and ability of geostatistical in determining and mapping soil nutrients.

*Mzeru, Christopher, Nkongolo, N. Department of Agriculture and Environmental Sciences, Lincoln University. GEOSTATISTICAL ANALYSIS OF MICRONUTRIENTS AT FREEMAN FARM. Information on soil nutrients status is of great importance in agricultural production and management of the environment. We studied the spatial distribution of soil micronutrients: Iron (Fe), Manganese (Mn), Copper (Cu), Zinc (Zn) and Aluminum (Al) in a silt loam soil at Freeman farm of Lincoln University. Forty eight samples were collected in 2015 at 0-10 cm depth and sent to commercial for analysis. The spatial distribution of micronutrients was studied using both classical statistics and geostatistics. Results showed that average values of micronutrients were 194.80, 191.42, 477.80, 2.45 and 3.45 mg/kg for Fe, Mn, Cu, Zn and Al, respectively. Their coefficient of variation ranged from 7.70 for Al and 15.80% for Mn. Geostatistical analysis showed that Fe responded to an exponential variogram model with $R^2= 0.12$. The corresponding map showed the highest concentrations of Fe in the eastern part of the field, near the Missouri river bank. Cu and Mn, on the other hand, responded to a Gaussian model with $R^2= 0.45$ and $R^2 = 0.45$, respectively, with high concentrations in the middle of the field. Al and Zn fitted to a spherical model with $R^2 = 0.12$ and $R^2=0.77$ respectively. Geostatistical analysis was useful in portraying the distribution of micronutrients across the farm.

*Prater, Brandi, Nkongolo, N. Department of Agriculture and Environmental Sciences, Lincoln University. STATISTICAL AND GEOSTATISTICAL ANALYSIS OF SOIL PROPERTIES IN A FARMER FIELD OSAGE COUNTY. Mapping soil properties is important in determining the overall quality and health status of a soil. We studied the distribution of soil bulk density

(BD), volumetric water content (VWC), temperature (T), thermal conductivity (K), and thermal resistivity (R) in a farmer field in Osage County, Missouri. The farm is located at 38.701052 latitude and 91.709377 longitude. Data on soil thermal properties (T, K and R) was collected in 2013 using a KD-2 Thermal Properties meter. Soil samples were also collected at a depth of 0-30 cm for the determination of soil volumetric water content (VWC), bulk density (BD) as well as other soil physical properties. Statistix 10 statistical software and GS+ 7.0 Geostatistical software were used for data analysis. Results for statistical analysis showed that BD ranged from 0.92 to 1.63 g/cm³ with an average value of 1.29 g/cm³. Soil thermal resistivity (R) showed the highest variability with a minimum value of 74.00 and maximum of 389.00, therefore a range of 315.00 W/mK. Interpolation map of BD showed a much higher BD on the left side of the field than on the right. The interpolated map R however, showed values higher on the right than the left side of the field though there was only slightly significant correlation between the two thermal properties. Interpolated maps of other properties showed a more even distribution across the field.

*Morgan, Anthony, Nkongolo, N. Department of Agriculture and Environmental Sciences, Lincoln University. MAPPING SOIL MICRONUTRIENTS AT GRIFFITH FARMS MILLER COUNTY, MISSOURI. Management of soil properties is crucial in maintaining plant nutrition and crop production. Geospatial technologies can help to identify farm areas where nutrients are deficient for their subsequent correction. We mapped the distribution of soil micronutrients at Griffith farm. The farm is located in Miller County (Missouri) and its coordinates are Latitude 38.355079 and Longitude - 92.533460. Soil samples were collected at 30 cm depth and sent to a commercial laboratory for analysis. The micronutrients of interest were B, Al, Mn, Fe, Cu, and Zn. Results showed that the mean values for B, Cu and Al were closer to their medians, implying that data for these micronutrients approached normality. The coefficients of variation (CV) ranged from 15.29 for Al to 58.90% for Mn. In fact, Mn concentration varied from 22.00 to 284 mg/kg, therefore a range of 262 mg/kg. Interpolated maps showed that the concentration of micronutrients were higher in the southern portion of the field. With this information, we can make better manage the fertility of our field.

*Almuhanna, Abdulhadi, Nkongolo, N. Department of Environmental Sciences, Lincoln University. STATISTICAL AND GEOSTATISTICAL ANALYSIS OF SOIL PROPERTIES AT CARVER FARM. Knowledge of the distribution soil properties is important in farm management and productivity. We conducted a statistical and geostatistical analysis of soil chemical properties and nutrients at Carver farm of Lincoln University. The chemical properties studied were soil pH, cation exchange capacity (CEC), total carbon (TC), total nitrogen (TN) and organic matter (OM). Macronutrients investigated were soil phosphorus (P) and calcium (Ca). Soil samples were taken in 2014 and were sent to commercial laboratory for the analyses of these properties and nutrients. The results of statistical analysis showed that the average pH was 5.98 and ranged from 5.60 to 6.60, suggesting that the soil of the study site was acidic. The coefficient of variation (CV) ranged from 5.03 for pH to 45.52 for TC, suggesting that TC had the highest variability. All mean values for soil chemical properties were closer to their median, suggesting that these properties were normally distributed. Geostatistical analysis showed that soil chemical properties fitted to a range of variogram models with R² ranging from 0.49 to 0.99. Interpolated maps also showed that soil chemical properties were evenly distributed along E-W zones with pockets of high and low concentrations across the field. These maps showing the distribution of chemical properties can be crucial for farm management and productivity.

*Zhang, Yongfang, Dudenhoeffer, G., Giri, N., Wetzell, J., Omara-Alwala, T. Department of Environmental Sciences, Lincoln University of Missouri, Jefferson City. COMPARISON OF THE AMINO ACID PROFILES IN THE TISSUES OF JUVENILE BLUEGILL (*LEPOMIS MACROCHIRUS*) FROM THE WILD AND COMMERCIALY FED FISH. Amino acid profiles of fish tissues and fish eggs have been extensively investigated in some fish species. Amino acid profiles are helpful in the quantification of the indispensable amino acids requirements for these fish. Bluegill is a major forage fish for the largemouth bass (*Micropterus salmoides*) and an important recreational fish throughout the US. Recently, the demand for it as food fish is increasing. However, the information on the amino acid profiles of the bluegill eggs and tissues is lacking. The objective of this study was to determine the amino acid profiles of muscle and whole body from 1-2 g wild or commercially fed bluegill. Wild fish was obtained from ponds that rely on natural food source. Commercially fed fish were grown indoors. Skinless muscles were obtained by dissecting both sides of 1-2 g bluegill. The results showed that lysine was the most abundant indispensable amino acids in muscle and whole body for both wild and farm raised fish. The proportion of an individual indispensable amino acid amount to the sum of all detectable amino acids amount was

similar for whole body and muscle in wild or raised fish. For whole body or muscle tissue, wild fish contained significantly higher crude protein but lower crude lipid than raised bluegill ($p < 0.05$). This study suggested that nutritional history affect tissue proximate compositions but not amino acid profile of bluegill.

*Giri, Namrata, Zhang, Y., Dudenhoeffer, G., Omara-Alwala, T. Department of Environmental Sciences, Lincoln University of Missouri, Jefferson City. ALPHA-AMYLASE ACTIVITY IN JUVENILE BLUEGILL (*LEPOMIS MACROCHIRUS*) COMPARED WITH SELECTED FISH SPECIES. Carbohydrates are the least expensive form of dietary energy for animals. Although fish don't have specific requirements for dietary carbohydrates, they must have appropriate levels of the nutrients in their diets for proper growth. Moderate levels of carbohydrate may also decrease the use of more expensive protein and lipid in the diet. Different fish have different ability to utilize digestible carbohydrates. This difference may relate to the relative amount of amylase activity present in the digestive system of various fish species. Alpha-amylase is the key carbohydrate- digesting enzyme in animal. Bluegill, an important forage and recreational as well as a newly emerged food fish, is the most commonly produced sunfish in the North Central Region. The information on the digestive alpha-amylase activity and the dietary carbohydrates utilization of bluegill is lacking. The objective of this study was to determine the distribution of α -amylase activity along the digestive tract of juvenile bluegill and compare its activity with that in selected fish species. The alpha-amylase analysis followed the procedure by Worthington (1993) with slightly modification. In the bluegill, alpha-amylase was detected in stomach, pyloric cecum, proximal intestine, mid intestine and distal intestine. The lowest alpha-amylase activity was found in stomach with no difference in alpha-amylase activity among three parts of intestine. Alpha-amylase activity in bluegill along the digestive tract was higher than that in crappie, but significantly lower than that in grass carp ($p < 0.05$). This information could be used for estimating the carbohydrates level in juvenile bluegill diets.

*Johnson, Hwei-Yiing. Lincoln University. ORGANIC LETTUCE PRODUCTION USING A DIY VERTICAL HYDROPONIC SYSTEM. A forty-foot long four-tiered vertical hydroponic system was assembled to grow lettuce in front of a farm building. The system was made of PVC pipes (4 inches in diameter) and plumbing fittings to form a closed circulation system. Two hundred lettuces were planted with two red cultivars of Ruby Sky and Skyphos and two green cultivars of Adriana and Tropicana. Compost tea was made by brewing worm castings and food waste compost mixed at a ratio of 2 to 1 (v/v) under an actively aerated condition with dissolved oxygen above 8 ppm. The compost tea was used as primary sources of nutrients and beneficial microbes to support plant growth. Fish hydrolysate and liquid kelp, were added at below recommended doses to supplement nutrients. The nutrient solution was maintained in the ranges of pH 5-6. EC (1-1.5 mmho/cm), NO_3^- (60-100 ppm), Ca_2^+ (90-130), and K^+ (50-100 ppm). Lettuce plants developed large size and healthy appearance with bright pigmentation during the 8-week growing period. This trial proved that organic lettuce can be produced using an economic DIY system with the support of compost tea and reduced doses of organic fertilizers to minimize operational cost. This system demonstrates the feasibility of maximizing organic food production at urban homes and small producers' farms in a limited space without soil. The operator's knowledge and experience on composting, compost tea brewing, monitoring nutrients and investment of test kits are crucial to sustain the success of growing hydroponic crops.

*Braden, Indi, Bollinger, D., Craft, C., Klueppel, M., Vonder Haar, J., Galeski, M. Southeast Missouri State University. LEARNING THROUGH APPLICATION: SPATIAL ANALYSIS. For many years, producers have based management decisions on final yield averages for row crop acres. Precision agriculture technology allows producers an opportunity to evaluate inputs and outputs on a site-specific scale. Yield data was collected for corn and soybean harvest at the David M. Barton Agricultural Research Center, Gordonville, MO. Students enrolled in AG444 Spatial Analysis were challenged with evaluating yield data. By using real-world data, students are able to ask questions and consider relationships between yield and other variables, such as soil test results. Students applying course material to real-world data are able to gain hands-on experience and critical thinking skills that can be applied in future geographic information system (GIS) applications.

*Takhachhe, Parameshwor, Liu, F., Yang, J., Marianne, D. Department of Environmental Sciences and Cooperative Research Programs, Lincoln University, Jefferson City. VARIABILITY OF WATER QUALITY ACROSS HEADWATER CATCHMENTS WITH DISTINCT SOILS AND HYDROLOGIC SYSTEMS IN MID-MISSOURI. Surface water and groundwater

contamination by non-point pollutants such as soil applied herbicides and fertilizers continue to be a major water quality problem in Mid-Missouri. Variation in watershed characteristics due to the presence of distinct soils and hydrologic systems has added the complexity in understanding the controls of contaminants. The purpose of this study is to examine spatial variability of water quality among three different headwater catchments-Goodwater Creek Experimental Watershed (GCEW) with claypan soil, Sulphur Creek Watershed (SCW) with deep loess soil, and Wet Glaize Creek Watershed (WGCW) with karst system. Samples were collected from February 2015 to February 2016 from streams, springs and groundwater and analyzed for major nutrients and herbicides. Mean $\text{NO}_3\text{-N}$ concentrations in the stream water were 0.78 (± 0.76) ppm, 0.35 (± 0.32) ppm and 0.77 (± 0.04) ppm in GCEW, SCW and WGCW, respectively. Nitrate-N concentrations in groundwater were higher than those in stream water, with 16.32(± 3.7) ppm, 8.02(± 15.5) ppm and 3.20(± 1.30) ppm on average at GCEW, SCW and WGCW, respectively. Atrazine concentrations in stream water were higher than in groundwater at both GCEW and SCW. The mean atrazine concentrations were 3.16(± 6.52) ppb and 0.063 (± 0.14) ppb in stream water and groundwater at GCEW, respectively, while the values were 1.47(± 2.04) ppb and 0.0067(± 0.012) ppb in stream water and ground water at SCW. This study provides a holistic overview of the spatial variability in water quality among headwater catchments in Mid-Missouri.

*Seabaugh, Lindsey, Weathers, J., Schabbing, C., Lowman, S. Southeast Missouri State University. CONCEPTION RATES: ARTIFICIAL INSEMINATION BARN VS. CATTLE CHUTE. The purpose of this experiment is to determine if these claims are true. The question trying to be answered is there a great difference between conception rates of beef cows and heifers artificially inseminated in the breeding barn versus that of beef cows and heifers artificially inseminated in the squeeze chute? The ongoing research took place December 12, 2014 and December 16 and 18, 2015. The experimental test animals included beef heifers and cows that were produced at the Barton Agricultural Research Center. The cattle were distributed equally and randomly into groups to either be inseminated in the AI barn or the squeeze chute. There were two AI technicians that would rotate between inseminating in the AI barn and the squeeze chute equally. In the December 2014 insemination, $n=16$ it was found after calculations that more cattle were successfully inseminated in the AI barn (100.0%) as compared to the squeeze chute (62.5%). In the December 2015 insemination, there was an increase in the number of test subjects to make the test more effective in representing the results. For this insemination $n=50$, and it was found after the calculations that more cattle were successfully inseminated in the AI Barn (64.0%) as compared to the squeeze chute (56.0%), but only by a slight margin. This study does not account for technician fatigue or cattle stress levels. More variables such as technician fatigue or cattle stress levels may need to be accounted for to get the best results on Artificial Insemination.

*Edwards, Winston, Wetzel, J., Omara-Alwala, T., Dudenhoeffer, G. Lincoln University. EFFECTS OF INITIAL WEIGHT AND FEEDING METHOD ON FEED CONSUMPTION OF AGE-0 NORTHERN BLUEGILL. Northern Bluegill *Lepomis macrochirus macrochirus* is an important sunfish to aquaculture in the Midwestern U.S. A premium is placed on large size and often involves formulated feeds. Estimates of feed intake and growth rate as a function of fish size are needed for realistic predictions of feed needs, production and sizing culture systems. Feed intake maybe related to initial weight when formulated diet use commences and by feed application method. Herein, we explore initial size and feeding method on feed consumption of fingerling Northern Bluegill. Full-sibling age-0 fish ($n=50$) were sorted by weight and stocked into twelve 35-gal tanks with mean initial weight of $\sim 1 \pm 0.5$ g ($n=8$) and $\sim 4 \pm 0.5$ g ($n=4$). Feeding was to apparent satiation 3X daily for the two-week acclimation period. At trial start four tanks of small fish and all tanks of large fish where fed with a 12-h belt-feeder while the remaining tanks of small fish were continued to be fed by hand. Trial duration was 16 weeks with total within tank weight determinations weekly with feed consumption done on similar basis. This allowed calculations of feed consumed per gram of fish (FC), specific growth rate (SGR) and feed conversion ratio (FCR) for each week. As fish increased in size FC and SGR decreased while FCR increased. Larger averaging fish at trial start exhibited faster growth. The results give a more accurate picture of Northern Bluegill performance a function of size. Future work can then look at impacts of temperature and photoperiod that complicate estimates associated with pond production.

*Grellner, Troy, Wetzel, J., Edwards, T. Lincoln University. CRISPY CRITTERS! SO GOOD YOU'LL CRY WHEN THEIR GONE! Of the 35+ plus crayfish species native to Missouri, only four are legal for trade on the food market: Virile Crayfish, Calico Crayfish, Red Swamp Crawfish, and White River Crawfish. Only the Virile Crayfish is legal for the bait trade where smaller

crayfish are preferred. Finding an alternative market for smaller / bait-sized crayfish would allow producers the option of harvesting and holding stock without risking having to discard what the bait market cannot absorb. We have identified a food use of smaller crayfish but must refine the preparation process developing basic information for nutritional guidelines. Herein, we describe the process of preparing the crayfish drastically improving dressout resulting in an edible and visually appealing product that stimulates the palate. Live crayfish were deheaded by removing the carapace leaving periopods attached to abdomen resulting in ~70% live-weight available for cooking and consumption. In the preliminary trial we used three types of breading; whole wheat flour, Jiffy® cornbread muffin mix, and white wheat flour were we found the muffin mix was preferred. Using the muffin mix only, we varied the frying time (30, 60, 90, and 120 seconds) recording pre-cooking and post-cooking weights. Weight change (>90%) in cooking process associated with water loss occurred in the first 30 seconds. Based on palatability, the preferred duration for cooking was 90 seconds. Proximate composition analysis needed for nutritional guidelines will be reported. We now have a have a product that is both palatable and safe to eat plus provides dietary fiber.

*Angeles-Gines, Rylie, Weathers, J., Lowman, S., Schabbing, C. Southeast Missouri State University. AFFORDABLE BIOSECURITY MEASURES IN SMALL FARMS. Biosecurity is the purpose of keeping preventable diseases to a minimal spread while still keeping the farm open to tourist, visitors, and delivery people. This came to be a primary concern after the outbreak of porcine endemic diarrhea virus (PEDv) within the hog industry. Many animal farms, simply turned all visitor requests down closing off, rather than risk exposure, of the livestock. This concealed treatment is not a healthy state for the animal industry; as it lends to the perception that there is something to hide in the way a consumer's food is being raised. The problem for most biosecure tire-spray and foot bath protocols is the cost to establish and maintain the equipment necessary. This study will look into affordable options, measuring pros and cons of cost, ease of use, sustainability, and worker satisfaction. The research focuses mainly on effectiveness of disease prevention and ability of application along with follow through of workers and visitors respectively.

*Svenson, Sven. Charles Nemanick Alternative Agriculture Garden, Department of Agriculture, Southeast Missouri State University. NATIVE PERENNIALS FOR BUTTERFLY AND POLLINATOR GARDENS: FIRST YEAR PERFORMANCE IN SOUTHEAST MISSOURI. Perennials native to Missouri were evaluated for survival, growth, and flowering during the first 15 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 4 replicated plots of 7 plants of each species for analysis. During the first full year after establishment, the following species had 100% survival, excellent growth, and 100% flowering: *Coreopsis lanceolata*, *Echinacea pallida*, *Eutrochium purpureum*, *Penstemon digitalis*, *Rudbeckia fulgida* var. *umbrosa*, *Rudbeckia missouriensis*, *Symphyotrichum oblongifolium*, and *Veronicastrum virginicum*. Species having 75% to 86% survival, good growth, and 100% flowering during the first growing season included: *Echinacea paradoxa*, *Echinacea purpurea*, *Eryngium yuccifolium*, and *Zizia aurea*. *Amorpha canescens*, *Asclepias tuberosa*, and *Glandularia canadensis* had less than 50% survival, poor growth, and 100% flowering of surviving plants. Secondary plots of additional species were studied, but were not part of the butterfly-shaped garden plot. Species in the secondary plots had 100% survival, excellent growth, 100% flowering, including: *Asclepias incarnata*, *Callirhoe involucrata*, 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.

*Harriot, Nadia, OConnor, M., Mersha, Z. Lincoln University Cooperative Extension. EFFECT OF DIFFERENT INCUBATION TEMPERATURES ON MYCELIAL GROWTH AND SCLEROTIA DEVELOPMENT OF TWO SCLEROTINIA DISEASES OF LETTUCE AND TOMATO. Soilborne diseases are challenging Missouri farmers particularly those who grow their vegetables in high tunnels. *Sclerotinia sclerotiorum* (Ss) causes drop disease on lettuce and timber rot on tomatoes, also known as white mold on other crops including soybeans. *Sclerotium rolfsii* (Sr) causes southern blight on tomato. Both fungi produce overwintering structures called sclerotia which can remain dormant up to 5 – 6 years in the soil until the conditions are favorable for subsequent infection of the host plant. Knowledge about an environment which favors or disfavors these pathogens is of essence for growers from the perspective of managing these diseases. In 2014 and 2015, repeated *in vitro* experiments were carried out in laboratory at Dickinson Research Facility using a potato dextrose agar (PDA) medium in a 9-mm Petri dish. A single sclerotium was aseptically placed at the center and incubated at different

temperatures (4, 17, 20, 25, 30, 35 and 40 °C). Radial growth of mycelium and days of sclerotia formation were recorded. For *Ss*, mycelial growth was faster and days to sclerotium formation were shorter (12.2 days on average) at 17, 20 and 25°C than 30°C (no sclerotia formed). High temperatures (35°C, 40°C) were detrimental. For *Sr*, mycelial growth was faster and days to sclerotium formation were shorter at 30 and 25°C than 17 and 20°C. Mycelia grew even at 35°C but no sclerotia were formed. Interestingly, growth of *Ss* was slowest but not culminated at 4°C but *Sr* did not grow at this temperature. Future studies specific to different soil temperature and depths need to verify practical applicability of the current study.

*Turner, Kallie, Weathers, J., Lowman, S., Schabbing, C. Southeast Missouri State University. FENCE LINE WEANING VS NOSE RING WEANING IN 6 MONTH OLD SIM-ANGUS CALVES. The purpose of this research study was to determine which method of weaning provided the greatest average daily gain in six month old Sim-Angus calves. It has been suggested that nose weaning creates less stress on the calf versus traditional weaning methods. The two methods utilized in this study were fence line weaning and nose weaning rings. Fence line weaning consists of the calf being placed in a pen, in this case a confined feeding lot, and is physically separated from the mother (n=9). The nose weaning calves had a non-invasive plastic flap placed in their nose (n=12); which served as a physical barrier between the calf and the mother's teat only. Both herds were weighed at 24 hours after initial separation, and again every two days. After 14 days, the nose weaners were removed. Overall, the fence line herd had the greatest average daily gain of 0.5kg, while the nose weaning herd's average daily gain was -0.41kg. The findings of this research conclude that while nose weaning creates a less stressful environment for the calf, it does not provide a higher average daily gain than fence line weaning provides. Since this data set conflicts with previous trials of genetically similar cattle further research will be conducted to see which data set is replicable.

*Timpe, Tricia, Bayan, R., Wetzel, J., Edwards, J. Lincoln University. DIETARY INCLUSION OF BIOCHAR AND KAOLIN FOR NORTHERN BLUEGILL SUNFISH. Biochar as a soil amendment reduces subsequent need for fertilizers, although adding biochar directly does not provide benefits until the cation exchange capacity is charged with nutrients. Nutrient charging of biochar could be coupled with solving a problem where fish producers under new EPA restrictions must lower the same nutrients in their effluent waters. Nutrient leachates from feces may be reduced by dietary biochar and kaolin by adsorption or by promoting fecal integrity, reducing fragmentation. Nothing is known about nutritional benefits of biochar in fish feed. Palatability of feed mixed with biochar and kaolin are of particular concern and must be explored before more is invested in studies with volumes required for soil amendment use. We report preliminary findings with fingerling Bluegill Sunfish *Lepomis macrochirus* where we investigate consumption of feeds containing biochar and/or kaolin and impact on growth. Age-0 fish (n = 10) were stocked into nine 200-gal tanks of an indoor recirculating aquaculture system. Groups of three randomly assigned replicates were fed one of three diets: control (Bio Vita), 5% biochar base, and 5% each of biochar and kaolin mixed with Bio Vita. Three daily apparent satiation feedings were applied five days a week with weight determinations following two days of food withdrawal. Feed consumption, feed conversion ratio, and specific growth rate showed no differences as a function of inclusion. We conclude biochar and kaolin does not adversely affect feed palatability or growth. Further research is needed to investigate long-term consumption, impacts on leaching and soil amendment value.

*Ross, Kenneth, Westrich, B., Braden, I. Southeast Missouri State University. EFFECTIVENESS OF BIOLOGICAL AGENT ON CORN RESIDUE DECOMPOSITION. With current corn varieties, improved stalk quality is resulting in more residual stalks after harvest. Complete decomposition of corn residue can take several years. Products can be added to a field to improve or help to speed up decomposition. The objective of this study is to evaluate the effect of FS Breakdown, a product which claims to reduce the time needed for residue decomposition. Research was conducted at the David M Barton Agriculture Research Center, Gordonville, MO. Corn residue, including leaves, stalks and cobs, were collected following harvest fall 2015. Residue was measured and placed into litterbags. Treatments were applied to litterbags and included: FS Breakdown and urea ammonium nitrate (UAN), UAN alone, and an untreated control. Experimental design included four replications of the three treatments. After corn residue was treated, each litterbag was placed in the top 1-2 inch layer of soil (previously harvested corn field) and soil covered over them. Each bag was placed a distance of at least 5 feet from other test bags. Litterbags will be retrieved before planting spring 2016. This study is

also replicated at various other sites in southern Illinois area. Data will be collected and analyzed for effectiveness of plant residue treatments.

*Sharma, Bayan, Sharma, A. Lincoln University in Missouri. GROWTH OF SWITCHGRASS CULTIVARS ON MARGINAL LAND IN CENTRAL MISSOURI. Experimental plots were established on marginal agricultural Inceptisol in central Missouri to determine the potential of such soils for switchgrass (*Panicum virgatum*) production. Growth of four cultivars; Blackwell, Cave-in-Rock, Kanlow, and Pathfinder were monitored over four years on a flood prone site adjacent to Moreau River in Cole County. The experiment started in May, 2011 and no fertilizer was applied to plots. The amount of seed used for was 6.7 kg/ha (6 lbs/acre). A 3-day flooding event in May 2012 negatively affected the growth of Pathfinder cultivar but other cultivars were not affected significantly. The Pathfinder cultivar also showed more susceptibility to *uredinia* and *Puccinia emaculata telia* diseases than other cultivars. The yield averaged over four years for Kanlow (5.5), Cave-in-Rock (5.2), Blackwell (4.6) and Pathfinder (2.7) tonnes/ha. The results indicate that switchgrass can be grown successfully on marginal land in central Missouri but the average yield for different cultivar may vary significantly. The cultivar of choice is Kanlow but Cave-in-Rock can also do well on such soils.

*Sharma, Bayan, Sharma, A. Department of Agriculture and Environmental Sciences Lincoln University in Missouri. GROWTH OF BIOMASS CROP GIANT MISCANTHUS ON A CULTIVATED ALFISOL IN CENTRAL MISSOURI. Experimental plots were established on a cultivated Alfisol in central Missouri to determine the potential of such soils for miscanthus (*Miscanthus x giganteus* Greef et Deu.) growth without use of fertilizer. The experiment started in May, 2012. Giant miscanthus is a perennial C4 grass that is cultivated extensively in Europe as a biomass crop for bioenergy production. The treatments consisted of planting techniques that involved transplantation of miscanthus plugs (Plug) and direct plantation of rhizomes (Rhizome). The treatments were replicated eight times. Over the 4-year duration of experiment, the average yield for the Plug plots increased to 23 tonnes/ha (10.2 US tons/acre). The yield for Rhizome plots averaged 14 tonnes/ha (6.2 US tons/acre). In other words, the biomass yield for the Plug plots increased by 20 times (to 23 tonnes/ha) over four years while this number was 18 times (to 14 tonnes/ha) for the Rhizome plots. The yield differences were statistically highly significant. Therefore, transplantation is a better way to start miscanthus production. This experiment indicates that better than average yield can be obtained on Alfisols in climates similar to central Missouri when miscanthus is started from plugs.

*Haruna, Samuel, Nkongolo, N., Anderson, S. Lincoln University/University of Missouri. WATER INFILTRATION AS AFFECTED BY COVER CROP AND TILLAGE MANAGEMENT PRACTICES. Various agricultural management practices such as cover crops and tillage have the potential to influence water infiltration into soil. This study was conducted on an alluvial soil at Lincoln University's Freeman Farm to evaluate the influence of cover crop and tillage management on in situ field infiltration. The field site included three replicate blocks in a randomized block design with each plot measuring 21.3 m length and 12.2 m width. The two treatment factors included cover crop at two levels [cereal rye (*Secale cereale*) cover crop vs. no cover crop] and tillage at two levels (moldboard plow tillage vs. no till). Crop management included continuous corn (*Zea mays*). Infiltration rates were measured using ponded infiltration during the 2014 and 2015 growing seasons. Water infiltration parameters were estimated using the Green-Ampt and Parlange infiltration equations. Cover crop management significantly increased various infiltration parameters compared with no cover crop. Tillage management improved some infiltration parameters compared with no-till but this effect was not consistent probably due to reduced transmission pores caused by tillage. Cover crop management can improve soil quality which enhances the sustainability of crop production systems.

*Acharya, Shanta, Nkongolo, N. Lincoln University, Missouri. ASSESSING THE EFFECT OF FOUR YEARS OF TILLAGE, ROTATION AND COVER CROPPING ON THE YIELD OF SOYBEAN. The practices of tillage, rotation and cover cropping affect the biological, chemical and physical properties of soil and thus may affect the yield of crops. They also improve soil quality by increasing soil carbon, soil aggregation, and soil water infiltration, thus reducing year-to-year variability in yield. The objective of this research was to assess the effect of four years of tillage, rotation and cover cropping on the yield of soybean. Twenty four plots of soybean were laid out in a randomized complete block design with 8 treatments and 3 replications. Treatments were tillage at two levels- conventional and no tillage; cover crop at two levels- no cover crop and cover crop; rotation at four levels- continuous maize, continuous soybean, maize soybean and soybean maize.

Rye grass was used as a cover crop. Yield was estimated by harvesting 1 m² from 4 different areas in each plot. In 2014, the interaction effect of tillage and crop rotation was significant over soybean yield ($p = 0.0383$). Across the years, tillage was significant for the year ($p = 0.0350$). Similarly, interaction of Tillage*Cover*Rotation was significant for the yield ($p = 0.0426$). Although soybean yield responded to the various treatments combination, the response was not consistent across years of study. It is, thus, suggested that more experiments should be done, over a longer period of time to better understand the effects of tillage, cover crop and crop rotation on soybean yield.

*Shivers, Traron, Johnson, H., Piñero, J. Lincoln University. JAPANESE BEETLE COMPOSTING: CONVERTING PESTS TO SOIL FERTILIZER USING COMMON FARM MATERIALS. In an attempt to use large amounts of Japanese beetles (JB) that have been captured using mass trapping, we developed a composting method and explored potential applications of the JB-based compost that was produced. Our carbon sources were shredded paper, wood chips, and leaves while our sole nitrogen source was JB. Four compost bins were prepared using the layer method and we monitored temperature during the composting process daily. Once composting was complete, pilot studies that involved oyster mushroom production, vermicompost, and small-scale hydroponic lettuce production using compost teas and compost / vermicompost were conducted. Chemical analyses of the compost produced indicated that JB-based compost is a good quality soil amendment and can be used to augment fertilization in support of organic production. The vermicompost produced offers additional benefits such as uniform and fine product size, more nutrients readily available for plant absorption, and hormone-like chemicals to stimulate plant growth.

*Fisher, Bradley, Eaton, E., Borden, K., Eivazi, F., Ikem, A. Lincoln University, Missouri. KALE STUDY CULMINATION. This is a culmination of 2015 research with kale, the cultivar was Dwarf Blue curly kale and fertilization, was the only variant used in the study. This study helps farmers determine the ideal amount of fertilizer for an optimal kale crop. An organic fertilizer was used at a ratio of 800 ml water to 40 ml fertilizer based on label instructions. All soil was given pre-planting fertilization. Specific rows were fertilized with 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 according to soil test analysis. All rows received four applications of fertilizer and four harvests. Data was recorded for every plant to include fresh bulk weight and nutrients.

*Dudenhoeffer, Austen, Miller, J., Ja. Lincoln University Integrated Pest Management Department. OPTIMIZING A MASS TRAPPING SYSTEM DESIGN FOR ORGANIC MANAGEMENT OF JAPANESE BEETLES. Mass trapping of Japanese beetles (*Popillia japonica*) (JB) has been conducted by the Lincoln University IPM program since 2012 using a new design for mass trapping involving steel mesh and pheromone / floral-based lures. While effective, the mass trapping system still requires optimization for practical use by farmers. The objective of this study was to improve the effectiveness of the mass trapping system by evaluating the performance of 121-liter trash bins. The effects of trap height, ventilation, and background color were evaluated at an experimental elderberry (*Sambucus nigra* and *S. canadensis*) plot. Ventilation was the primary factor influencing average catch while height and background color were less important. Even though the steel mesh design caught 76% more JB on average compared to non-vented bins, adding holes made the trash bins comparable to the steel mesh design. Based on durability and capacity, this study supports the usefulness of ventilated bins for organic JB management. Plus, bins could serve as devices for on-farm composting utilizing JB biomass to produce good quality soil amendment.

*Khanal, Manzeal, Reed, M., Mersha, Z., Wuliji, T., Zheng, G. Lincoln University. POTENTIAL OF USING ENDOPHYTIC STRAINS OF ENDOSPORE-FORMING BACTERIA TO SAFEGUARD FRESH VEGETABLES AGAINST IMPORTANT FOOD-BORNE PATHOGENS. Fresh vegetables are increasingly associated with food-borne disease outbreaks in the U.S. as a result of the increasing consumption of these fresh products as part of a healthy diet. Though chemical sanitizing agents are widely used, they are not always effective and have safety concerns. Therefore, biological control using the native microbiota can be a better alternative to reduce and prevent contamination of fresh produce by pathogens. The objectives of this study were to isolate and use endophytic strains of endospore-forming bacteria as the biocontrol agents to reduce and prevent certain pathogen contamination of fresh vegetables. This study was first conducted to isolate endospore-forming bacteria from inner tissues of lettuce, then to screen their anti-pathogen activities in vitro, and finally to test their effects in planta. In total, 50 isolates were obtained and their inhibitory activities were tested against the important food-borne pathogens, including *Escherichia coli* O104:H4, *Escherichia coli* O157:H7 and *Salmonella*

enterica Pullorum ATCC 13036. In the agar spot tests, 19 isolates showed inhibition toward at least one of the pathogens. Based on the results of 16S rDNA sequencing analyses and biochemical tests, these anti-pathogen isolates were taxonomically identified to be either *Bacillus* spp. or *Paenibacillus* spp. In addition, our study demonstrated that certain strains of these isolates could be taken up by the roots of the lettuce. The preliminary data thus showed a potential of using the endophytic strains of endospore-forming bacteria isolated from vegetables to control the food-borne pathogen contamination of the vegetables.

*Lark, Justin, Navarrete-Tindall, N., Perez-Hernandez, O. University of Central Missouri. CHARACTERIZATION OF SEED FREQUENCY IN WILD AND CULTIVATED PERSIMMON FRUITS IN CENTRAL MISSOURI. Common persimmon (*Diospyros virginiana*) is a deciduous tree native to North America. In Missouri, wild persimmon trees are relatively abundant and typically found in prairies, abandoned fields, and along roads. The tree bears edible fruits that mature in the fall and may persist on the tree into winter. Recently, interest in the persimmon fruit has emerged in the U.S. due to the fruit nutritional value and consumer's preference for organic food and exotic plants. In particular, seedless persimmon fruit with thicker skin and consistent maturation is desired amongst persimmon enthusiasts and it is a characteristic sought by breeders. The presence of varying seed number in persimmon fruit is often mentioned among consumers and taken as a trivial characteristic of the tree. However, such variation has not been quantified. Determining such a frequency could allow a better understanding of the persimmon fruit seed development and provide insights into the ecology of the persimmon fruit. The objective of this research is to characterize the frequency of developed seeds in wild and cultivated persimmon fruit in Central Missouri. Available wild and cultivated persimmon trees were surveyed in central Missouri. From each tree, about 100 hundred fruits were collected and the seed in each fruit was manually extracted and counted. The frequency distribution of the seed number in the examined trees will be presented as well as a discussion of the morphology and genetic of the flower.

*Aide, Michael. Southeast Missouri State University. RESPONSE OF DENITRIFICATION BIOREACTORS TO TILE DRAINAGE EFFLUENT. The Departments of Agriculture and Chemistry, at Southeast Missouri State University, with assistance from USDA-NRCS/ARS has developed a controlled subsurface irrigation/drainage technology coupled with denitrification bioreactors. The purpose of this project was to limit nutrient migration, particularly nitrate-N. Water from Williams Creek (Cape Girardeau County, Missouri) was impounded with the assistance of levees and the water permitted to infiltrate the soil resource. Water capture by the drainage system was transported to the denitrification bioreactor. Water chemical analysis demonstrated that nitrate-N was effectively diminished by the soil resource and the denitrification bioreactor. It was estimate the system could produce 1/9 million gallons of water having less than 10 mg NO₃-N/acre-year.

*Aide, Michael, Beighley, D. Southeast Missouri State University. ARSENIC UPTAKE IN RICE. The purpose of the 2015 rice research was to assess agronomic and arsenic uptake differences in rice production involving furrow and delayed flood irrigation. Individual rice varieties involving furrow and delayed flood irrigation regimes showed rough rice yield differences; however, the mean of all rice variety yields were not significantly different between the irrigation treatments. Nitrogen, phosphorus, potassium, magnesium, calcium, sulfur, iron, boron, copper and zinc rough rice concentrations were not significantly different because of irrigation treatment; however, arsenic concentrations were significantly smaller in rough rice from the furrow irrigation system. Manganese rough rice concentrations were greater in rough rice from the delayed flood regime.

*Mikayla Morris, Abua Ikem, James Wetzel. Lincoln University Added Structure as Method to Promote Feed Intake and Growth of Black Crappie Black Crappie *Pomoxis nigromaculatus* is used for stocking recreational fisheries and could be used for food fish if growth performance were to be improved. Slow feed intake limiting growth has not responded to changes in feed quality. In natural habitats, Black Crappie typically associates with structure. Typical culture volumes, where the Black Crappie underperforms with respect to growth, are devoid of structure. This project tests structure type impact on feed intake and growth of Black Crappie. Feed trained age-0 Black Crappie (~10.5 g) were stocked twelve fish per 220-gallon cylindrical culture tank (n=24) in an indoor recirculating aquaculture system. The fish were fed 3X daily (0830, 1230 and 1630) to apparent satiation six days a week with application in a consistent location. Feed amount was recorded with final weight of fish determined following the 70-d trial. Tanks were modified to provide one of six

structure treatments: control (none), one, two, three, or five floating black plastic oil pans (dia. = 30.5 cm), or a submerged cylindrical tube (62 cm long x 26 cm wide). Mean average weight nearly doubled across all treatments although the control and the tube fish tended to be larger ($\alpha = 0.10$). Feed consumption tended to be lower for treatments with the most floating cover. Overall, an increase in the amount of cover did not lead to an increase in feed intake and/or growth. The Black Crappie's crepuscular feeding habits will serve as guide for subsequent explorations.

Atmospheric Science Oral Presentations

*Henson, Chasity, Market, P., Lupo, A., Guinan, P. Department of Soil, Environmental, and Atmospheric Sciences, University of Missouri. USING ENSO AND PDO TO PREDICT REGIONAL MISSOURI CROP YIELDS. An analysis of crop yields for the state of Missouri was completed to determine if an interannual or multidecadal variability existed as a result of the El Niño Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO). Corn and soybean yields were recorded in bushels per acre for each of the six climate regions of Missouri. An analysis using the Mokhov "method of cycles" demonstrated interannual, interdecadal, and multidecadal variations in crop yields. Cross-spectral analysis was then used to determine which region was impacted the greatest by ENSO and PDO influenced seasonal (April – September) and monthly temperature and precipitation. Interannual (multidecadal) variations found in the spectral analysis represent a relationship to ENSO (PDO) phase, while interdecadal variations represent a possible interaction harmonic between ENSO and PDO. Average crop yields were then calculated for each combination of ENSO and PDO phase, displaying a pronounced increase in corn and soybean yields when ENSO is warm and PDO is positive. Climate regions 1, 2, 4, and 6 displayed statistically significant (90% confidence level) differences in yields between El Niño and La Niña years, representing 55-70% of Missouri soybean and corn productivity, respectively. Final results give the opportunity to produce seasonal predictions of corn and soybean yields, specific to each climate region in Missouri, based on ENSO and PDO phase.

*Lupo, Anthony, Li, Y. Department of Soil, Environmental, and Atmospheric Sciences, University of Missouri. SENSITIVE VERSUS ROUGH DEPENDENCE ON INITIAL CONDITIONS IN ATMOSPHERIC FLOWS. We will demonstrate the existence of rough dependence on initial conditions (RDOIC) using the Navier-Stokes equations, and then identify this concept in atmospheric phenomena. Sensitive dependence on initial conditions was identified as a problem for weather analysis and forecasting in the mid-20th century. Sensitive dependence can be described as two initially similar atmospheric states that diverge exponentially over time with a finite Lyapunov Exponent independent of the Reynolds Number. Then, forecasting the weather using the Navier Stokes equations is useless after some characteristic time-scale. With RDOIC, two initial states diverge exponentially as a function of the square root of time with an exponent dependent on the Reynolds Number implying forecasting is impossible even on very short characteristic time-scales. Using previous work in atmospheric science, RDOIC can be characterized by using quantities that can be calculated from atmospheric data. Rough dependence will also be identified in atmospheric phenomena of different time scales. The nature of rough dependence will be studied using a research model.

*Lupo, Anthony, Jensen, A. Department of Soil, Environmental, and Atmospheric Sciences, University of Missouri. INTEGRATED REGIONAL ENSTROPHY AS A MEASURE OF KOLMOGOROV ENTROPY. Enstrophy in a fluid relates to the dissipation tendency in a fluid that has use in studying turbulent flows. It also corresponds to vorticity as kinetic energy does to velocity. Earlier work showed that Integrated Regional Enstrophy (IRE) was related to the sum of the positive Lyapunov Exponents in the Earth's atmosphere. Lyapunov exponents are the characteristic exponent(s) of a dynamic system or a measure of the rate of divergence/convergence in a system where the ensemble initial conditions are initially close. Relatively high values of IRE derived from atmospheric flow fields in the study of atmospheric blocking was identified with the onset or demise of blocking events, but also transitions in the character of the large-scale flow in general. Kolmogorov Entropy (Kole) also known as metric entropy is related to the sum of the positive Lyapunov Exponents as well. This quantity can be thought of as a measure of system predictability (higher values, less predictability) and will be non-zero in a chaotic system. Thus, the measure of IRE is related to Kole as well. This study will show that relatively low (high) values of IRE derived from atmospheric flows correspond to lower (higher) amplitude flow, which implies a greater (lesser) degree of predictability and Kole. The transition in flow state is the least predictable and should be associated with the highest values of IRE and Kole.

*Rabinowitz, Jordan, Lupo, A. R. Department of Soil, Environmental, and Atmospheric Sciences, University of Missouri. A DYNAMICAL INVESTIGATION OF INTENSIFICATION CHANGE MECHANISMS ASSOCIATED WITH INTENSE ATLANTIC AND EASTERN PACIFIC HURRICANES. It has been well-documented that unexpected rapid intensification of tropical cyclones (TC) can have devastating long-term impacts on coastal regions and societies from different parts of the planet. Over the past six decades, there has been a substantial increase in research devoted to understanding the dynamics and mechanisms most responsible for rapid intensification associated with TCs. Recent work has provided substantial evidence that strengthening TC secondary circulations are positively correlated with episodes of rapid intensification. However, details pertaining to the strength of TC secondary circulations and respective impacts of interannual ENSO variability has not been well-documented. The nucleus of this research is evaluating factors including low-level convergence, upper-level divergence, maximum deep layer shear, lowest minimum central pressure, and eyewall replacement cycle (ERC) frequency. The goal is to investigate how these components influenced cases of rapid intensification and the duration of time during which a given storm maintained its maximum intensity. The secondary goal is to assess how results from this work can be applied to future forecasting of rapidly intensifying TCs; particularly those which bear legitimate landfall threats.

*Gilmore, Willie. National Weather Service-Little Rock, AR. A COMPARISON OF TWO RECENT HIGH-IMPACT WINTER STORMS OVER ARKANSAS. A high-impact winter storm affected a large portion of Arkansas on the 21st and 22nd of January, 2016. Significant amounts of freezing rain, sleet and snow were observed, some at near record levels. Hazardous travel conditions were seen, along with many residents losing power. A similar winter storm occurred over 3 years earlier on Christmas Day, 2012. This Christmas 2012 winter storm brought many of the same forecast and warning challenges there were present leading up to the January 2016 winter storm. However, lessons learned from the December 2012 winter storm proved extremely useful as the January 2016 storm approached Arkansas. This study will compare and contrast the two high impact winter storms, and discuss the challenges each brought to the forecasters. A review of the forecast and real-time data will be presented, including Dual-Pol Radar analysis. There will also be a discussion on how the lessons learned from the earlier event were utilized, and what new forecast techniques were used to enhance the forecast confidence leading up to the January 2016 winter storm.

*Buonanno, Christopher C. National Weather Service-Little Rock, AR. STRATEGIES FOR IMPROVING TORNADO WARNING PERFORMANCE. The National Weather Service's (NWS) mission is to *provide weather, water, and climate data, forecasts and warnings for the protection of life and property and enhancement of the national economy*. As a major part of this mission, local NWS offices provide severe thunderstorm and tornado warnings for their area of responsibility. Providing the most accurate warning information is a goal of the NWS warning program. Of particular attention is the reduction of tornado warning false alarm rates (FAR), increases in tornado warning lead times, and improvements in probability of detection (POD). This presentation will examine some of the latest strategies in improving tornado warning performance.

*Crandall, K., Runk, K., Gravelle, C., Snyder, D. National Weather Service-Operations Proving Ground, Kanas City, MO. EVALUATION OF MULTIPLE SPECTRAL BANDS AND RGB SATELLITE IMAGERY FOR THE GOES-R ERA BY NWS FORECASTERS. During the spring of 2016, National Weather Service (NWS) forecasters will provide feedback through evaluations on the use of multiple spectral bands and RGB satellite imagery in the forecast process to the NWS Operations Proving Ground (OPG). The evaluations will use satellite imagery from the Himawari-8 Advanced Imager (AHI) as a proxy for the GOES-R Advanced Baseline Imager (ABI). The multiple spectral bands and RGB satellite imagery use color combinations to visualize different atmospheric phenomena. Specific goals for these operational evaluations have been identified and are as follows: (1) Gain insight into which spectral bands, channel differences, and/or multispectral imagery (including RGB recipes) offer operational value; (2) assess forecasters' ability to understand and interpret RGB imagery for various diagnostic tasks; (3) experiment with various display procedures and decision making processes; (4) evaluate whether local dynamic generation of predefined RGB recipes has negative impact on system performance and/or forecaster workflow; (5) obtain feedback on the usefulness and effectiveness of Advanced Weather Interactive Processing System (AWIPS) JustInTime training capability; and (6) discuss and gather feedback on the usefulness and practical value of existing ABI/AHI training resources for the GOESR era, and provide applicationbased

training recommendations. Data collected from the evaluations will give NWS management information on how multiple spectral bands and RGB satellite imagery will be utilized by the NWS forecaster.

*Lack, Steven, Schwedler, B., Cross, A., Runk, K., Sims-Uskievich, C., McGettigan, S. National Weather Service/Aviation Weather Center, Kansas City, MO. DIGITAL AVIATION SERVICES IN THE AVIATION WEATHER TESTBED. For aviation stakeholders, consistency between products remains a top priority. Currently, aviation forecasting duties are shared between national, regional, and local NWS entities. The Aviation Weather Center (AWC) provides international and national guidance, the Alaska Aviation Weather Unit and the Honolulu Forecast Office provide additional regional guidance, the Center Weather Service Units provide regional expertise on the Air Route Traffic Control Centers, and the Weather Forecast Offices (WFOs) provide airport specific information on the local level which includes the Terminal Aerodrome Forecast (TAF). Providing consistent aviation products is the basis for Digital Aviation Services (DAS) and involves utilizing a common production platform, which, in turn, fosters integrated collaboration between NWS entities. Adding aviation grids to the enhanced short term effort at the WFO level is critical for the success of DAS, but must be coupled with consistency among WFOs, and between WFOs and regional and national centers. To facilitate consistency of aviation grids, it is proposed that national scale cloud and visibility guidance will be provided by the AWC and would be passed to the local WFOs for manipulation at the local level. The resulting product would be considered the national picture for ceiling and visibility from which aviation products could be efficiently derived. These products include the G-AIRMET, area forecast, and the TAF. Using the NDFD framework, point-and-click TAFs and area forecasts could be provided for locations outside the current set of locations. Success of DAS involves partnerships across many stakeholders including various groups in NOAA and the FAA.

*Simpson, Micheal, Hubbart, J., Fox, N. Department of Soil, Environmental, and Atmospheric Sciences, University of Missouri. GROUND TRUTHED PERFORMANCE OF SINGLE- AND DUAL-POLARIZED RADAR RAIN RATES AT LARGE RANGES. Radar accuracy in estimating precipitation estimation at distances larger than 120-km degrades rapidly due to increased areal coverage. The performance of the recently upgraded dual-polarized technology to the NEXRAD network and its capabilities are in need of further examination, as improved rainfall estimates at large distances would allow for significant hydrological modeling improvements. Parameter based methods were applied to radars from St. Louis (KLSX) and Kansas City (KEAX), Missouri, USA, to test the precision and accuracy of both dual- and single-polarized parameter estimations of precipitation at large distances where hourly aggregated precipitation data from terrestrial-based tipping buckets provided ground-trothed reference data. For all KLSX data tested, an R(Z,ZDR) algorithm provided the smallest absolute error (3.7 mm) and root-mean-square-error (45%) values. For most KEAX data, R(ZDR,KDP) and R(KDP) algorithms performed best, with RMSE values of 37%. With approximately 100-hours of precipitation data between April and October of 2014, nearly 800 and 400 mm (i.e., 206 and 103 %) of precipitation was estimated by radar precipitation algorithms but was not observed by terrestrial-based precipitation gauges for KLSX and KEAX, respectively. Additionally, nearly 30 and 190 mm, or, 6 and 38 % of measured precipitation observed by gauges were missed by the radar rainfall estimates from KLSX and KEAX, respectively. Results advance understanding of spatial variability of radar based precipitation estimates from long ranges which aids in hydrologic modeling and flood forecasting.

*Wunsch, Katharine, Fox, N., Market, P. Department of Soil, Environmental, and Atmospheric Sciences, University of Missouri. A COMPARISON OF THE LIFE CYCLES OF ELEVATED AND SURFACE-BASED CONVECTION. Elevated convection is defined as convection that occurs above a stable layer-generally a frontal zone. These storms occur most frequently in the Midwest, where they make up a majority of the warm-season rainfall; the primary associated risks are hail, flash flooding and lightning. NCDC level II radar data were used to examine the differences in life cycles and characteristics for 16 cases that occurred from 2007-2010 in eastern KS, southeastern NE, southern IA and MO. These cases were previously selected for a study examining the correlation between rainfall rate and lightning flashes, where they were classified as either elevated or surface-based. Each case was also categorized based on its precipitation shield (trailing, leading or parallel stratiform). The data were processed into netcdf format, then compiled in MATLAB to examine the reflectivity at 1 km above radar, echo top heights for 30 dBZ reflectivity surface, divergence at the 1 km and 2km heights, below 3 km, and between 3 and 7 km. Preliminary results reveal higher reflectivity values and higher maximum echo tops in elevated thunderstorms, suggesting higher cloud tops. Less divergence below 3 km and more convergence between 3 and 7 km in elevated cases reflect the position of the updraft above the stable layer. Additionally, higher

heights of mean composite reflectivity illustrate the higher elevation of elevated cells. Finally, surface-based cells tended to last longer than elevated cells, but elevated cells had greater variability in duration, as the longest lasting cells occurred in elevated cases; this exemplifies the greater impact of mid- and upper-level flow on elevated cells.

*Difani, Ryan, Market, P., Fox, N. Department of Soil, Environmental, and Atmospheric Sciences, University of Missouri. RADAR DERIVED DIVERGENCE CHARACTERISTICS WITHIN ELEVATED CONVECTION. Elevated convection has now been widely associated with severe hazards such as large hail and heavy rainfall, however, high winds and tornadoes are not as common (e.g., Moore et al. 2003, Horgan et al. 2007). While these operational impacts of elevated convection are known, our overall understanding of the elevated convective cell remains limited, especially in comparison with surface-based convection. Furthermore, recent studies have called into question our understanding of how to identify convection as elevated as it seems more complex than once thought (e.g., Corfidi et al. 2008). Thus, this study seeks to gain further insight to elevated convection using dual-polarization Doppler radar. Analyzed cases of potentially elevated convection, including 8 intense observing periods (IOPs) which included the deployment of teams to collect upper-air data via weather balloons, are derived from the 2014-15 Program for Research on Elevated Convection with Intense Precipitation (PRECIP) field campaign. NEXRAD Level-II dual-polarization radar data was analyzed for a selection of these cases. In particular, this examination heavily focuses on the low-level radar derived divergence (convergence) fields in order to assess the possibility of using radar to determine the degree to which a convective cell may be elevated. Preliminary results provide support that the radar derived divergence (convergence) fields can be used to determine if a convective cell is elevated or if it has surface-based influences. If results can continue to be refined, these findings could have implications toward operations, especially in connection with determination of possible severe hazards.

*Kastman, Joshua, Market, P. Department of Soil, Environmental, and Atmospheric Sciences, University of Missouri. DYNAMIC ENSEMBLE MODEL EVALUATION OF THE 5 JUNE 2015 ELEVATED THUNDERSTORM EVENT OVER THE GREAT PLAINS. On 5 June 2015 an elevated thunderstorm complex formed and generated heavy rainfall and flash flooding over southeast Nebraska, eastern Kansas and western Missouri in response to a warm front. The University of Missouri's Program for Research on Elevated Convection with Intense Precipitation (PRECIP) sampled this event with balloon launches every three hours. This event has also been run through a high resolution dynamic ensemble model designed to outperform operational model forecast and provide a much more detailed precipitation forecast. This ensemble model, called the High Resolution Heavy Precipitation Ensemble Forecasting System (HRHPEFS), is generated using the Weather Research and Forecasting (WRF) model with the Advanced Research WRF (ARW) core and is made up of 48 members which vary microphysics, cumulus parametrization, boundary layer physics and moisture advection. Each member is run with a 9 km grid spacing with a 3 km inner nest. This presentation will feature comparisons of precipitation and soundings between observed, operation model and HRHPEFS output. Additionally, HRHPEFS output will be evaluated using the Model Evaluation Tool (MET). This tool will show statistics on model performance compared to observation.

*Henson, Chasity, Market, P., Kastman, J. Department of Soil, Environmental, and Atmospheric Sciences, University of Missouri. THE ROLE OF HURRICANE JOAQUIN (2015) IN THE SOUTH CAROLINA FLOOD. In October 2015, Hurricane Joaquin (2015) interacted with the large-scale atmospheric environment, creating the extreme rainfall event in South Carolina. Hurricane Joaquin (2015) intensified near the Bahamas, while a cold-core low was forming over the southeastern United States and a stationary front was lying along the East Coast. Preliminary research using the ARL HYSPLIT trajectory model, made it clear that the presence of the hurricane was a major contributor to the location and intensity of the elevated convection and associated precipitation in South Carolina. However, the cold-core low and the front placement were also factors. Without the presence of the hurricane or the upper-level low, it is possible for the associated precipitation to have been more widespread over the Southeast, with little to no elevated convection over South Carolina. To investigate the role of Hurricane Joaquin (2015), a vortex removal technique in the Weather Research and Forecasting (WRF) model was used. Following the methodology of Tang et al. (2013), preliminary results show the vortex associated with Hurricane Joaquin (2015) to be mostly removed from the model initial conditions and integration. Final model analysis will determine if the presence of Hurricane Joaquin (2015) was a necessary factor for the flooding event. A future model simulation will use the vortex removal technique to remove the upper-level low. Keeping the

coastal front constant in both simulations, outcomes will be compared to the observed event in order to analyze the impacts on precipitation intensity and location.

Atmospheric Science Poster Presentations

*Allen, Justin. Lincoln University. IMPROVING THE EFFICIENCY OF SOLAR CELLS. The current efficiency of silicon cells are around twenty five percent. Previous studies have determined that Pt(IV) complexes such as trans-Pt(PtEt3)(R)(Br)3 (R = Br, Aryl and polycyclic aromatic fragments) photo eliminate bromine with quantum yields as high as eighty two percent. Also in previous studies calorimetry and DFT calculations indicate endothermic photoeliminations with free energies from 2 to 22 kcal/mol of Br2. This study is to determine the voltage output of a solar cell made of titanium dioxide and trans-Pt(PtEt3)(R)(Br)3 with R being Perylene and then to compare the results to silicon solar cells.

Biochemistry Oral Presentations

*Du, Huixun, *Shim, Heejae and Islam, Rafiq. Laboratory of Biochemistry, Northwest Missouri State University. REGULATION OF HFE EXPRESSION BY SP1 TRANSCRIPTION FACTOR. Hereditary hemochromatosis (HH) is a common autosomal recessive disorder of iron overload among Caucasians of northern European descent. Over 85% of all cases with HH are due to mutations in the hemochromatosis protein (HFE) involved in iron metabolism. Although the importance in iron homeostasis is well established, the mechanism of sensing and regulating iron absorption by HFE, especially in the absence of iron response element in its gene, is not fully understood. Recently we have shown that PARP1 binding to an inverted repeat located at -931/-918 of the HFE promoter may serve as a novel iron sensing mechanism as PARP1 cleavage via iron treatment relieves HFE transcriptional repression (BBA 1829:1257-65, 2013). In this study, we present the ubiquitous transcription factor, Sp1 plays a role in HFE expression and rescues PARP1 inhibition. It is known that Sp1 also upregulates PARP1 (via binding to a site on the promoter) as well as physically interacts with PARP1. We believe that Sp1 upregulates HFE transcription in two ways: via binding to a Sp1-site on the HFE promoter, and by reducing PARP1 pool available for binding to the HFE promoter through Sp1-PARP1 interaction.

Mottaleb, Musavvir, Stowe, Carly, Johnson, Daniel, and *Mottaleb, M. Abdul. Northwest Missouri State University. OCCURRENCE OF DIPHENHYDRAMINE, DIAZEPAM, CARBAMAZEPINE AND METABOLITES DRUGS IN FISH OF GROCERY STORES BY GC-SIM-MS. Occurrences of pharmaceuticals are evident in aquatic organisms. A reproducible gas chromatography - mass spectrometry (GC-MS) method using selected ion monitoring (SIM) has been used to determine the anti-histamine diphenhydramine (DPH), anti-anxiety diazepam (DZP), anti-seizure carbamazepine (CZP) drugs and their metabolites in grocery stores fish that were homogenized, extracted, pre-concentrated, cleaned up, and examined. Identifications of the compounds in extracts were obtained by comparing similar mass spectral features and retention properties with standards. Among nine frequently detected drugs, only DPH and DZP were observed and ranged from 0.61 - 6.21 and 1.99 - 16.57 ng/g, respectively, in fourteen fish species. These concentration values were lower than the environmental fish. Mean spike recoveries of analytes exceeded 75% with relative standard deviations (RSD) < 10%. The statistically-derived method detection limits (MDLs) for nine compounds ranged from 0.13 - 5.56 ng/g. Average surrogate recoveries were 80 to 85% with 4 to 9% RSD.

*Islam, Rafiq. Laboratory of Biochemistry, Northwest Missouri State University. NUCLEAR LOCALIZATION SIGNAL IN MAP/ERK KINASE KINASE 1 (MEKK1). Previously, we showed that MekK1 translocates to the nucleus, interacts with tumor suppressor protein p53 and co-represses PKD1 transcription via an atypical p53 binding site on the minimal PKD1 promoter (JBC 285:38818-38831, 2010). In this study, we report the mechanism of MekK1 nuclear transport. Using GFP-linked constitutively active-MekK1 (CA-MekK1) and a deletion strategy, we identified a nuclear localization signal (HRDVK) located at amino acid (aa) residues 1349-1353 in the C-terminal MekK1 catalytic domain. Deletion of this sequence in CA-MekK1 and full-length MekK1 significantly reduced their nuclear translocation in both HEK293T and COS-1 cells.

Biochemistry Poster Presentations

*Ahlersmeyer, Michael, *Griesbauer, Mikayla, Patel, Vaibhav, Mottaleb, M Abdul. Northwest Missouri State University. PHARMACEUTICALS AND METABOLITES IN SUPERMARKET FISH: PRELIMINARY INVESTIGATION BY LIQUID CHROMATOGRAPHY – TANDEM MASS SPECTROMETRY (LC-MS/MS) METHOD. Pharmaceuticals and metabolites are the most common environmental contaminants and have increasingly been used for human and animal healthcare applications. In this study, frequently observed nine pharmaceuticals and metabolites from several classes and functionalities were targeted to analyze by liquid chromatography-tandem mass spectrometry (LC-MS/MS). Different species of fish grown in salt - and fresh -water environment originated from the USA and Asian countries have been collected from the local supermarket of the Missouri state. Fish samples were homogenized and stored at - 80oC for analysis by LC-MS/MS method. In this studies, LC-MS/MS encompassed identification of the pharmaceuticals and metabolites ions from standard compounds by multiple reaction monitoring (MRM). Infusion mode of mass spectrometer was used to determine the precursor and qualifier ions for individual analytes, surrogates and internal standard. Moreover, collision energies and capillary voltages of all standard compounds are determined and presented.

*Hicks, Maci, Ruggiero, Melissa J., Willever, Katherine, Hamilton-Brehm, Scott, Moser, Duane and Campbell, James H. Department of Natural Sciences, Northwest Missouri State University. CHARACTERIZATION OF POTENTIALLY NOVEL ALPHAPROTEOBACTERIA FROM WALKER LAKE, NEVADA. Walker Lake, NV, is a terminal lake which has been rapidly drying in recent years. Next-generation sequencing has revealed a dynamic microbiota as the lake has receded. We have isolated six cultures of potentially novel *Alphaproteobacteria* from samples collected in 2008. The isolates are most closely related to rare (<1%) OTUs from the lake biosphere. These isolates we collected from this area have been characterized using pH, sodium, phosphate and temperature gradients. Molecular cloning and sequencing of 16S rRNA genes have been used for genetic comparisons of closely related species. Our isolates have notable genetic and physiological differences from named relatives that indicate potentially novel species. Ongoing physiological and biochemical research will determine if new species can be named.

*Qi, Mengyuan, Jung, Gi Ahn, Campbell, James H., Campbell, Alisha G. Northwest Missouri State University. CHARACTERIZATION OF BACTERIAL COMMUNITIES ASSOCIATED WITH CALCIUM CARBONATE-RICH SOILS. Caliche, or soil that contains mostly hardened calcium carbonate, is a material found in arid or semiarid regions such as West Texas. The material is often used in road construction. Environments rich in calcium carbonate often show little signs of vegetative growth, and there is little information about the microbial communities associated with this environment. Therefore, we set out to determine the composition of bacterial communities within calcium carbonate-rich soils and to determine if any of these community members are producing novel antibiotics. Samples were collected along a transect of a caliche pit in Concho County, Texas. Culture-based studies were performed using oligotrophic media on two samples with the highest amounts of calcium-carbonate and lowest amounts of organic material. Sequencing of 16S rRNA genes indicated that most isolates fell within the Class *Actinobacteria*. We have also tested isolates for antibiotic production by assessing the inhibitive properties of the isolates on other microbes. Crowded plates were made from selected samples, and isolates that were able to form zones of inhibition were identified. These isolates are being tested for their ability to inhibit several laboratory strains.

*Du, Huixun, *Shim, Heejae and Islam, Rafiq. Laboratory of Biochemistry, Northwest Missouri State University. TRANSCRIPTION FACTOR SP1 UPREGULATES EXPRESSION OF HEMOCHROMATOSIS GENE HFE. Hereditary hemochromatosis (HH) is a common autosomal recessive disorder of iron overload among Caucasians of northern European descent. Over 85% of all cases with HH are due to mutations in the hemochromatosis protein (HFE) involved in iron metabolism. Although the importance in iron homeostasis is well established, the mechanism of sensing and regulating iron absorption by HFE, especially in the absence of iron response element in its gene, is not fully understood. Recently we have shown that PARP1 binding to an inverted repeat located at -931/-918 of the HFE promoter may serve as a novel iron sensing mechanism as PARP1 cleavage via iron treatment relieves HFE transcriptional repression (BBA 1829:1257-65, 2013). In this study, we present the ubiquitous transcription factor, Sp1 plays a role in HFE expression and rescues PARP1 inhibition. It is known that Sp1 also upregulates PARP1 (via binding to a site on the promoter) as well as

physically interacts with PARP1. We believe that Sp1 upregulates HFE transcription in two ways: via binding to a Sp1-site on the HFE promoter, and by reducing PARP1 pool available for binding to the HFE promoter through Sp1-PARP1 interaction.

Biological Sciences Oral Presentations

*Bowlin, Kelsey, Schaffer, K. Northwest Missouri State University. THE EFFECT OF β -ESTRADIOL ON THE GERMINATION OF ZEA MAYS. Water is one of the most important resources for an ecosystem. Pollution of major water sources has become a serious problem across much of the world. One example of water pollution caused by humans is the dumping of waste products as effluent into major rivers and waterways. While documentation for the effects of water contaminants on a variety of animals has been widely researched and documented, studies on the effects of these same contaminants on plants are relatively new. Current research has focused on the effects of these contaminants either on plant germination or on vegetative plant growth. Previous studies have found germination was reduced by 57% in *L. sativa*, 6% in *D. carota*, and 18% in *L. esculentum* when compared to the controls (D'Abrosca et al. 2008). The purpose of this research was to investigate the effects of a major pollutant, β -estradiol, on the germination of corn (*Zea mays* L.). The concentrations used in these experiments were .05 mg/L, 0.1 mg/L, 1.0 mg/L and 10 mg/L. The parameters explored were total percent germination, mean hour of germination, primary root length, coleoptile length, and number of adventitious roots. Corn kernel germination and corn seedling growth were consistently inhibited by the 10 mg concentration. The 0.1 mg treatment augmented germination and seedling growth. Future experiments could be carried out to follow the development of the corn seedlings through maturation and the production of kernels to determine if the high doses of β -estradiol affect the later stages of development as well.

*Colbeck, Gabriel, Chambers-Colbeck, C. Maryville University. CHARACTERIZING SECONDARY CONTACT IN STUDIES OF SPECIATION: USING DATA FROM A SINGLE SAMPLE TO TEST PREDICTIONS ABOUT GENE FLOW. Understanding the nature of introgression upon secondary contact is central our understanding of the process of speciation, but our ability to make pertinent inferences in natural populations remains limited. Information about the strength of selection against hybrids and asymmetries in gene flow has traditionally come from studies involving phenotypic and/or genetic gradients across both space and time. Such studies, while incredibly valuable, can be logistically challenging. Here, we develop a model that permits inferences about the genetic nature of secondary contact to be drawn from a single sample collected at a single point in time. Our ultimate goal is to apply the model to the Black-capped/Carolina chickadee hybrid zone in St. Louis, MO. By simulating populations under models of varying degrees hybrid viability and asymmetries in fitness, we show that a reduction in heterozygosity and skewness are reliable predictors of the strength of a hybrid zone and asymmetries in fitness, respectively. We apply our model to two published data sets and show that we can draw the same conclusions based on only a single sample. We have thus far been unable to apply the model to St. Louis chickadees because the population around the Maryville University campus is genetically nearly 100% Carolina chickadee. This model should have broad applicability for any study examining barriers to gene flow among populations or species in which the investigators wish to make inferences from single samples.

*Gunnnett, Andrew D. Drury University. CORAL DISEASE AND ITS PREVALENCE ALONG THE ROATAN, HONDURAS COASTLINE OF THE MESOAMERICAN BARRIER REEF SYSTEM. In recent years, researchers have taken particular interest in the major problem of coral disease in the Mesoamerican Barrier Reef System (MBRS). The MBRS, the second longest barrier reef system in the world, is home to a wide range of marine life, and the health of said marine life is dependent upon the health of the coral. This study took place at multiple dive sites along the coast of Roatan, Honduras within the MBRS. The study sought to answer the following questions: 1) what is the overall incidence of diseases with known causal agents among dive sites; 2) is the incidence of disease greater at sites in or out of the Marine Protected Areas (MPA); 3) is there a measurable difference in the incidence of disease at 30 and 50 foot depth profiles; 4) of the diseases present, what proportion represents those of bacterial vs. fungal causation; and 5) is there a relationship between the level of incidence of coral disease and distance from the shore line. Findings indicate that the incidence of diseases with known causal agents was significantly greater outside of the MPA and at the 50-foot depth profile. The diseases, which have bacterial causation, accounted for the majority of the diseases present. There was no correlation found between

incidence of disease and distance from shore. We could infer, given the data in this study, that increased tourism and development on the island of Roatan, Honduras could be linked to the incidence of coral disease observed.

*Bailey, Rachelle, McAliley, L. R., Campbell, J.H. Northwest Missouri State University. SOIL CHEMISTRY OF A HEAVY-METAL CONTAMINATED ZONE IN THE TRI-STATE MINING DISTRICT. The Tri-State Mining District of Missouri, Kansas and Oklahoma was the site of large-scale mining operations for lead, zinc, and other heavy-metals until the mid-1950s. Although mining across the area has ceased, high concentrations of lead, zinc, and cadmium continue to be found in the region's soil and water systems. Picher was included in the Tar Creek Superfund Site by the US Environmental Protection Agency in 1980. In order to elucidate the extent of heavy-metal contamination, a soil chemistry survey of the town of Picher in Ottawa County, Oklahoma was conducted. Samples ($n=111$) were collected along a cardinal-direction transect within an 8.05-km radius of Picher in August 2015 and analyzed for soil metal content, pH, and moisture content. Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) analyses of 20 metals showed high concentrations of lead (>1000 ppm), cadmium (>40 ppm), zinc (>4000 ppm), and aluminum (>5000 ppm) throughout the sampled region. Soil moisture content ranged from 0.30-35.9%, and pH values ranged from 5.14-7.42. MANOVA analysis of metal profiles determined that soils collected from the north transect were significantly different ($p<0.05$) than other sampled directions. Phospholipid Fatty Acid (PLFA) analyses and Next-Generation Sequencing (NGS) of prokaryotic 16S rRNA genes are underway. A systems biology approach will be used to compare soil-chemistry to the microbial community data of the same sampled sites.

Alhusayni, S., *Nikaido, Selene. University of Central Missouri. EXPRESSION OF FHT AND IVS GENES IN EGGPLANT (SOLANUM MELONGENA). Anthocyanin pigments are formed abundantly in some, but not all flowers and fruit. The reasons for these differences in concentration are not well understood. In 2012, Thill et al. reported an increase in anthocyanins in black dahlia (*Dahlia variabilis* hort.) over the lighter white and yellow dahlia flowers due to differential expression of FHT, IVS and FNSII genes. FHT and FNSII genes code for the biosynthetic enzymes, flavanone 3 β -hydroxylase and flavone synthase, respectively. The IVS gene is a transcription factor that activates FHT expression. Flavanone 3 β -hydroxylase and flavone synthase compete for a common precursor to divert biosynthesis toward anthocyanin formation (flavanone 3 β -hydroxylase) or flavone formation (flavone synthase). Our investigation of the FHT gene expression in eggplant (*Solanum melongena* L.) suggests that the up-regulation of FHT expression correlates with an increase in anthocyanin production as it does in dahlia. Significant differences in the mean FHT and IVS expression between purple versus white eggplant were measured through quantitative PCR. Mean expression of FHT in the epidermis of purple eggplant (10.43 ± 7.434 , $N=3$) was different from the expression in the epidermis white eggplant (0.62 ± 1.010 , $N=3$), but not different in the predominantly green leaves of purple eggplant (2.06 , $N=2$) versus the leaves of white eggplant (1.91 ± 0.558 , $N=3$). A similar pattern was seen with IVS gene expression. Further experiments with the FNSII gene expression in eggplant are planned. This work was funded by the University of Central Missouri Willard-North grant to S.A.

Berke, B., *Le, Linh, *Schlueter, Kristin. Truman State University. THE ROLE OF POSTSYNAPTIC CA DURING SYNAPTIC PLASTICITY IN DROSOPHILA. The brain encodes memories by strengthening neuronal connections (synapses), allowing information to be transferred more easily between neurons. Often, this long-term increase in synaptic strength requires gene transcription within the nuclei of the pre- and postsynaptic neurons. Central neurons are known to make synapses onto hundreds to thousands of postsynaptic cells, yet memory formation relies on strengthening only a tiny fraction of these connections. One of the most puzzling unanswered questions in learning and memory, therefore, is how only a few synapses capture newly transcribed proteins and mRNA to become strengthened while other synapses do not? The mechanisms of this phenomenon are being studied at the neuromuscular junction (NMJ) of *Drosophila melanogaster*. One of the motoneurons in *Drosophila* larvae has axon branches synapsing with multiple bodywall muscle fibers, and recent data indicates that a subset of its synaptic connections can be strengthened in a local, muscle fiber-specific manner. NMJ synapses strengthen in an activity-dependent manner by growing new presynaptic boutons and branches. Synaptic activity causes a calcium influx through postsynaptic glutamate receptors, while muscle contraction causes calcium to enter the muscles through voltage gated calcium channels. Recent experiments indicate that postsynaptic calcium signaling regulates the local growth plasticity of this divergent motoneuron, yet the mechanisms for this retrograde effect are unknown. By manipulating gene expression specifically in one muscle fiber target, we hope

to clarify the role of postsynaptic calcium during presynaptic plasticity and to provide insights into memory formation within the brain.

*Gomez, Jessica, Lankford, S. University of Central Missouri. IMPACTS OF SEX STEROIDS ON CORTISOL SYNTHESIS IN RAINBOW TROUT HEAD KIDNEY TISSUE. The concept of stress is inevitable, as homeostatic systems are constantly met by intrinsic and extrinsic stressors that can lead to multiple physiological problems (Bonga 1977). Fish, like all vertebrates, are known to be impacted by an active stress response. Potential stressors range from water temperature, water quality, season, physiological conditions, or social factors (Bonga 1977), and most result in the release of a hormone called cortisol.

Unlike mammals, which have an adrenal gland, fish synthesize cortisol with specialized interrenal cells located in the head kidney tissue. The interrenal cells release cortisol when stimulated by high levels of adrenocorticotrophic hormone (ACTH), which is produced from the anterior pituitary when an animal perceives a stressor. Past research indicates that stress, via cortisol, results in reduced reproductive performance (Tort 2011). This impact is caused by an alteration of reproductive hormones, but different researchers report varying levels of impact. It is possible that differences between reproductive status impacts the sensitivity of the animal to stressors; however, few studies have examined that possibility.

The objective of this study is to investigate the impact that estradiol and progestins (i.e., reproductive hormones) have on cortisol synthesis and the potential local regulators that orchestrate those changes. Changes in interrenal cell cortisol production and expression of TGF- β superfamily mRNA transcripts were measured in vitro as evidence of altered sensitivity and potential molecular regulators of the stress response, respectively. Our preliminary data suggest an alteration of both the sensitivity to stress and TGF- β expression.

*Foley, Leanne, McAliley, L.R. Northwest Missouri State University. MAMMAL SURVEY OF NODAWAY COUNTY, MISSOURI. A mammal survey of Nodaway County, Missouri is currently being conducted in order to provide an updated index of mammals occurring within the county. This is important to document when we consider the agricultural growth, global warming and trends in land stewardship of the county. Mammals are key indicators of ecosystem health, many of them being flag ship species, we must examine how they are affected from external stimuli. We surveyed 25 locations for mammal trapping and 27 locations for camera traps encompassing numerous diverse habitats throughout Nodaway County during fall 2015 and have continued this work into spring 2016. Survey methods include Sherman traps, Tomahawk traps, predatory distress caller, game cameras for terrestrial mammals, AnaBat SD2s and mist nets for bat species. Our survey to date yields a 15% success rate of small mammals and a total of 19 species in 694 trap nights. Species richness of mixed grasslands yields higher than all habitats surveyed. A value of 0.82 was calculated for Simpson's Diversity of Index, while a value of 0.92 was calculated for Shannon Weiner Index, this allows us to examine mammalian species diversity and evenness within Nodaway County.

*Barton, Samantha, Adam, P.J. Northwest Missouri State University. CRANIODENTAL ADAPTATIONS AND THEIR RELATIONSHIP TO RESOURCE PARTITIONING IN OTTERS. Otters are semi-aquatic mammals that can be found all over the world and are grouped within Subfamily Lutrinae. Lutrinae is composed of 13 species that show a large variation in diet. Some species have become specialized to feeding on snails, clams, and other molluscs (i.e., *Enhydra lutra*), others eat mostly fish (i.e., *Pteronura brasiliensis*), and still others eat a combination of vertebrates and invertebrates (i.e., *Aonyx capensis*). Diets should have an effect on skull and tooth morphologies that should correlate to the diet of each species. To explore these adaptations, thirty-two cranial and tooth measurements were taken from adult specimens and analyzed. These measurements have been found to be indicative of diet in previous studies conducted in carnivoran families such as Felidae, Canidae, Ursidae, and Hyaenidae. Measurements were taken using digital calipers to the nearest 0.01mm. Digital pictures of the skull and dentary were taken in different views to allow additional measurements to be taken using the software program ImageJ. Species were separated into diet groups that were determined by the prey composition of their diet. Principal component analysis and discriminant function analyses were used to validate groupings and their correlations to skull and tooth morphology.

*Harrelson, James T. Maple Woods Community College. THE ROLE OF GAMETOPHYTIC FRAGMENTS IN THE PASSIVE DISPERSAL AND ESTABLISHMENT OF ARBOREAL MOSS MICROCOMMUNITIES. The current literature has only lightly

addressed the subject of the passive dispersal of arboreal bryophyte microcommunities. Tardigrades, a member of this community, have been demonstrated to disperse strongly attached to gametophytic fragments of mosses. While the scope of these studies have been limited to the tardigrades; nematodes, rotifers, and ciliates have been noted as being observed as well. In order to better understand how this community disperses in nature it is critical to understand the role of gametophytic fragments in the establishment of new arboreal moss colonies. To gauge the role of fragments in the establishment of new arboreal moss colonies twenty trees were chosen and samples of the soil, moss colonies, bark, and other bryophyte communities were examined and the microcommunities documented. Communities were then compared as a means of gauging the possible sources of the microcommunities found on moss samples present. Given the more limited substrate compatibility of many species of tardigrades, more attention was paid to them in this study. The data collected suggests that moss colonies containing tardigrades are likely the result of the establishment by gametophytic fragments. This understanding is an essential part of a more complete picture of the dispersal and establishment of new arboreal moss colonies. The next logical question comes from noting the radial positioning of the moss colonies on the host tree. Comparing those positions to the historical seasonal wind data, it suggests that these fragments may have the most success during the winter months.

Biological Sciences Poster Presentations

*Al-Warid, Harith S., Beringer, J., Hiller, T.L., Belant, J.L., Gompper, M.E. Department of Fisheries and Wildlife Sciences, 302 ABNR, University of Missouri, Columbia, MO 65211. TICKS (ACARI: IXODIDAE) ON AMERICAN BLACK BEARS (*URSUS AMERICANUS*) FROM SOUTHERN MISSOURI, USA. Ticks were collected from 17 free-ranging, live-trapped or road-killed American black bears, *Ursus americanus*, in southern Missouri. All bears were infected with ticks, with a mean intensity of $n = 411.4$ engorged and non-engorged ticks per bear. Engorged ticks ($n=967$) were identified to species so as to discern hard tick species that are capable of successfully feeding on black bears. Five species were identified: *Amblyomma americanum*, *A. maculatum*, *Dermacentor variabilis*, *D. albipictus* and *Ixodes scupularis*. *Amblyomma americanum* was the most common tick species, collected on all surveyed bears and represented 58.7% of the total engorged ticks, while *A. maculatum* was the least common tick species, collected from only four bears and representing 2.4% of the total engorged ticks.

*Brandt, Miranda, Zoellner, J., Piercefield, J., Andrei, A. Lincoln University. SURVEY OF WINTERING BIRDS AT CAMP CLARK TRAINING SITE, MISSOURI ARMY NATIONAL GUARD. We surveyed wintering birds at Camp Clark Training Site (CCTS), Missouri Army National Guard, in Nevada, Missouri, during January 2016, to collect information needed for determining the training and testing capacity capacity of the area and to assist long-term sustainability planning and compliance with the Endangered Species Act. We surveyed 40 data collection points systematically spaced throughout the site. We surveyed birds in forests, prairies, shrubs and brush, savanna and open woodland, on mowed lawns, and among buildings. At each point, we detected and identified birds by sight and sound. We observed 691 individuals of 44 species during our survey. Populations of one third of the species observed at CCTS are declining in the Central USA. The habitat type with the greatest abundance of birds (25 species and 237 individuals) were the forests, where we observed most birds at forest edges. Alternately, we detected 27 species but only 85 individuals in the prairies and various grasslands, where most common were various small bodied seed-eating passerines. Two Northern Harriers, endangered in Missouri, were present. Surrounded mostly by tilled farmland, Camp Clark appears as an island of favorable wintering habitat to a great diversity of birds. To preserve and improve the diversity and abundance of birds wintering at CCTS and to protect the endangered Northern Harrier, managers should focus on maintaining the prairies and the dense brush along the edges of forest, prairie, and open woodland. These provide thermal cover, escape from predators, and foraging for wintering birds.

*Graves, Megan Elizabeth. Maryville University. CAPSAICIN ACCELERATES GROWTH RATE IN *SERVOMYCES CEREVISIAE*. Capsaicin is a secondary compound produced by Capsicum peppers that may play a role in deterring mammalian herbivores and/or may deter microbial pathogens. We investigated the potential for capsaicin to inhibit the growth of fungi by measuring its effects on the growth rate of brewer's yeast (*Servomycescerevisiae*) at various temperatures. I extracted capsaicin from dried Ghost pepper (*Capsicum chinese*) powder using Soxhlet extraction and 100% ethanol as the solvent. Experimental beakers consisted of 200 ml pasteurized apple cider in a 250 ml Erlenmeyer flask. I ran trials

with three groups: an ethanol control (2 ml ethanol), a capsaicin treatment (2 ml capsaicin extract), and an additional control (no ethanol, no capsaicin). Each treatment was run at 10° C and 25° C. I collected 1 ml samples every hour and analyzed growth (turbidity) with a UV-VIS spectrophotometer. To our surprise, capsaicin elevated the growth rate of the yeast in the capsaicin treatment relative to the controls. This effect was much stronger in the 10° treatment. Instead of inhibiting yeast growth, capsaicin appears to accelerate it. I hypothesize that this could be because capsaicin acts as metabolic precursor, because it affects cellular physiology, and/or it affects gene expression in the metabolic pathway. Future work will focus on elucidating the mechanism(s) of capsaicin's effects on *Servomyces cerevisiae*.

*Payne, Spencer, Goad, D. University of Central Missouri. EFFECT OF VARIOUS PLANT EXTRACTS ON THE RATE OF NEURON FIRING IN ACHETA DOMESTICS. Many companies produce dietary supplements with various plant based materials which are claimed by them to have effects on health and the nervous system. Unlike pharmaceuticals, if a substance is classified as a dietary supplement they are not required to be rigorously tested by the Food and Drug Administration (FDA). I hypothesized that examining the changes in neuronal firing rates in common crickets (*Acheta domestics*) could function as an ideal model system for determining the effect of specific plant extracts on nervous tissues. I decided to test extracts made from Ginseng (*Panax quinquefolius*), Valerian (*Valerinana officinalis*), Chamomile (*Matricaria chamomilla*), Tobacco (*Nicotiana tabacum*) and Valerian (*Valerinana officinalis*) for there effects on neuronal firing rates. All of the plant species I chose contain alkaloid compounds that have been shown to affect neuronal signaling. Crickets were anesthetized, attached to a recording contraption, then injected with either 0.1mL of plant extract or 0.1mL of saline solution. Frequency of Spikes mean (Hz) was examined pre-injection and at 30 seconds post-injection. There were no significant results to report for the assays. I hope this experiment can be used to encourage the advancement of research on the supplement industry.

Kiso, A., Hubbard, M., *Moyer, Taylor, Holliday, D. K. Westminster College. IN WAR NO ONE FIGHTS ALONE, G-FUEL™ HAS YOUR BACK THE EFFECTS OF G-FUEL ON GAMING PERFORMANCE. G-Fuel™ is an energy supplement marketed for increased e-sports performance. G-Fuel™ contains several active ingredients such as caffeine, taurine, L-Tyrosine, and ATP, and is aimed at improving focus and concentration, providing energy, and decreasing reaction time. We will test the effectiveness of this supplement using 20 male participants aged 18-20 who play the first-person shooter game Call of Duty® at least once a week. We will use a randomized, double-blind placebo crossover design. Upon arrival on testing day 1, participants will complete a questionnaire asking about perceived fatigue, alertness, focus, and energy levels. The participants will then be administered 16 oz. of G-Fuel™, or Crystal Light Peach-Mango Green Tea (a flavor-matched placebo). Twenty minutes after drinking the beverage, the participants will complete the questionnaire again. The participants will then play one round of "death match" on Call of Duty® Black Ops III. After the round is completed, game statistics will be recorded and participants will complete an X-box choice reaction time game. We will compare the change in performance as a function of treatment to determine if G-Fuel™ produces the advertised effects.

*Henke, Wyatt, Bailey, R., Davis, C., McAliley, R., Campbell, J. Department of Natural Resources, Northwest Missouri State University. EFFECTS OF HEAVY-METAL SOIL CONTAMINANTS ON TOTAL NUMBERS OF BACTERIA AND ARCHAEA AT THE PICHER, OKLAHOMA MINING SITE. The Tri-State Mining District in Picher, Oklahoma was site to over 100 years of lead, zinc and other heavy-metal mining. Although mining ceased in 1967, the toxic by-products can still be found within the soil. Water contamination has been a known issue for many years, but no work has been done to observe the contamination within the soil. Soil samples (n=111) were collected from an 8.05-km radius around the town of Picher. Whole-community-genomic DNA (gDNA) was obtained from the samples. Quantitative PCR (qPCR) is being used to enumerate 16S rRNA genes with domain-specific primers targeting Archaea and Bacteria. Results of qPCR assays will be analyzed and compared to the levels of soil contaminants as part of a larger project to characterize mining effects on soil chemistry and microbial ecology in the Picher region.

*Gomes, Grace M., Rios, C.M., Escudero, J.M. St. Louis College of Pharmacy. METHICILLIN-RESISTANT ISOLATES OF STAPHYLOCOCCUS IN DOMESTIC CATS OF THE COASTAL BEND REGION. *Staphylococcus aureus* is a common constituent of the skin and mucosal membrane microbiota of humans. The evolution of methicillin-resistant *S. aureus*(MRSA) is a growing cause for concern in clinical and community settings. The mechanism for methicillin resistance is conferred by the *mecA* cassette, which encodes the penicillin binding protein 2a (PBP2a). Due to weak affinity of PBP2a for penicillin,

methicillin-resistant isolates of *Staphylococcus* (MRS) are able to survive and reproduce in the presence of β -lactam. Interspecies transmission of MRSA is suspected between humans and domestic animals due to the close interactions between people and their pets. *The focus of this study was to determine the prevalence of MRSA among cats housed at three shelters in the South Texas Coastal Bend area and to identify them at the species level.* Ninety-eight samples were collected by swabbing the pharyngeal and perianal areas of 49 cats resulting in 67 isolates from 44 of the 49 cats. Through biochemical testing, isolates were identified as members of the *Staphylococcus* genus, but they were not identified as *S. aureus*. Sixteen of the 44 *Staphylococcus*-positive cats tested positive for methicillin-resistance *Staphylococcus*. MRS was prevalent among cats housed in the shelter in the South Texas Coastal Bend area where 32.7% of felines tested positive. Although the focus of this study was to identify MRSA in these companion animals, the results indicate that *S. aureus* is not common on these cats, but other species of methicillin-resistant *Staphylococcus* are present and are being identified.

*Patel, Jay. Rockhurst University. ELECTRICAL IMPULSES OF THE HEART. The main topic area of this abstract is actually a mix of biology and physics. The project was started as a work in the Physics of Medicine department at Rockhurst University. The purpose of this experiment was to design and build a heart impulse model that shows a breakdown of the heart's nerve impulses and their respective chamber contractions. Research was conducted on the normal heart rhythm which would then be related to an EKG in our model. The model itself would show the phase of the EKG and its respective nerve depolarization and repolarization, along with the chamber contractions. Along with the normal sinus rhythm, two major diseases were also researched, arrhythmia and bundle branch block. The primary objective of this experiment is to break down the generally known EKG wave, which happens in a matter of a few milliseconds, to a prolonged "contraction" model where you can see each phase of the EKG and what exactly happens. Thus, the understanding of the heart goes from a rudimentary "contraction" to a step by step impulse-contraction model. The secondary objective of this experiment was to see exactly how these diseased states effect the heart chamber contractions compared to the normal heart rhythm. Future experimentation would be to determine how the fluid flow through the heart would be effected by these contractions during sinus rhythm and diseased states via a chamber-pump fluid flow model.

*Moreno, Marco, Cawly, J. Lindenwood University. GENOMIC ANALYSIS OF CHITINASE AND CHITINASE-RELATED SEQUENCES IN CUCUMIS SATIVUS. Chitinases are hydrolases that cleave the linkages between N-acetylglucosamine units in chitin. They are present in bacteria, plants, and certain invertebrates. In plants, chitinases are thought to have evolved as a means of defense against infection by fungal pathogens. In this study, chitinase and chitinase-like sequences were searched throughout the genome of *Cucumis sativus* (cucumber) to determine the plausible number of such genes and sequences related to them. A total of 40 chitinase and chitinase-like sequences were found. Most sequences were found in chromosomes 3, 5, and 6, while no reliable sequences were found in chromosome 7. The NCBI's genome database was used to retrieve the cucumber's genome, and all E-values for the resulting matches were $\leq 4.0 \times 10^{-6}$ (most were far less than 1.0×10^{-10}). The query sequences used for alignment with *C. sativus* genome were: a known endochitinase precursor of *C. sativus* and a known chitinase of *Cucumis melo* (muskmelon). These known proteins were analyzed with the program SMART for domain architecture. The endochitinase precursor was found to contain a glycol-18 domain, while a glycol-hydro-19 domain was found in the muskmelon chitinase. Both are O-glycosyl hydrolase domains. Future research steps are targeted toward the alignment of the individual chitinase and chitinase-like sequences found in the *C. sativus* genome with known proteins in the NCBI database, as well as a phylogenetic analysis of chitinase sequences in *C. sativus* and related species. This will help build a better understanding of chitinase genes evolution in the cucurbitaceae family.

*Winter, Kristy, Bhattacharya, M.R.C. St. Louis College of Pharmacy. ATG9 LOCALIZES TO AXONS AND SYNAPSES AND MAY PROMOTE AXON DEGENERATION. Autophagy is the process of breaking down proteins and recycling amino acids during periods of nutrient starvation. During these periods it may be beneficial; however if it is overactive cells can be damaged and can be led towards cell death. Atg9 is a membrane molecule that is thought to contribute to autophagosomal membrane development. Preliminary data suggests that RNAi-mediated removal of Atg9 from sensory neurons protects their axons from the toxicity of paclitaxel (taxol), a common chemotherapeutic agent. How does removal of Atg9 achieve such protection? To answer this we must first ask two questions: where is Atg9 in uninjured

neurons, and is Atg9 activity sufficient to induce degeneration? To answer these questions we expressed a tagged, wild type Atg9 in *Drosophila* motor neurons. We examined the localization of Atg9 within these axons. In Atg9 over-expressing animals, we saw Atg9 proteins along the axons, in cell bodies in the ventral nerve cord and at synapses. This suggests that Atg9 proteins are present in the axons before induced injury to the flies. We are currently working to test whether Atg9 over-expression is sufficient to induce degeneration and whether loss-of-function mutations in Atg9 protect axons from injury. We hypothesize that axons in Atg9 mutants will be protected following an injury. Understanding the functionality of Atg9 in axon degeneration may give us the knowledge to delay or prevent axon degeneration in patients, especially those with chemotherapy-induced peripheral neuropathy.

*Nguyen, Uyen, Bhattacharya, M.R.C. St. Louis College of Pharmacy. INVESTIGATING THE FUNCTION OF ATG18 IN AXON DEGENERATION. Neuropathy is prevalent in a variety of conditions, ranging from Alzheimer's to diabetes, and historically presents with treatment challenges. In such diseases, axon degeneration is triggered, although the mechanism by which this happens is unclear. Preliminary data from a genetic screen in the fruit fly *Drosophila melanogaster* suggests that autophagy (atg) genes, such as atg2, atg9, and atg18, promote axon degeneration of peripheral nerves. However, the mechanism of their action is unknown. While autophagy may be a possibility, classical autophagy does not typically promote damage; instead it serves as a protective response. Thus, other potential pathways should be explored. Our hypothesis is that atg2 and atg18 affect lipid droplets in neurons, which consequently induces axon degeneration. The aim of this study is to ascertain if the absence of atg18 changes the integrity and quantity of lipid droplets. Using the *Drosophila* model system, we stained the fat bodies and nervous systems of atg18 mutant animals with dyes that label lipid droplets. Additionally, we are validating dye staining specificity by expressing a GFP-tagged lipid droplet protein in larval fat bodies using the GAL4-UAS system. At the moment, the research is still in progress. Ultimately, discovering how atg18 promotes axon degeneration may contribute to treatment of neuropathies in humans.

*Garzanelli, Caleb. Truman State University. MAMMAL DIVERSITY IN CENTRAL AMERICA. Medium-sized mammals are crucial to the survival of an ecosystem because of their role as a consumer. For this research, mammal diversity was surveyed at two locations: 1) Ometepe Biological Field Station, Nicaragua, and 2) LaSuerte Biological Field Station, Costa Rica. Our goal was to evaluate the impact of deforestation rates and human presence has had on the mammal diversity. Trail Cameras were set in several different locations at both field stations. In Nicaragua, photos were captured of a white-tail deer. In Costa Rica, pictures of a Tayra were captured. Consequently, our lack of data is likely due to the short duration of our sampling efforts. Additionally, human activity may have also influenced mammal presence as we also obtained photographs of poachers in the area passing through the area around the cameras. As deforestation and human expansion rise, mammal diversity in these places will likely diminish due to habitat loss.

*Bolander, Bethany, Brown, S. Missouri Western State University. EFFECTS OF PARKING LOT RUN-OFF ON TADPOLE DEVELOPMENT. As pollution becomes an ever-increasing issue globally, it is essential to understand its effects on animal populations. In this small scale research project, the effects of parking lot run-off water on chorus frog development was observed over a course of seven months. Different concentrations and a control were set up, and chorus frog eggs were distributed. Our results showed few significant differences and have allowed us to find different methods of improving the experiment. We have plans to soon evaluate the parking lot water through Gas Chromatography- Mass Spectrometry.

*Roberton, Daniel. Missouri Western State University. INTERMOUNTAIN BIRD OBSERVATORY; RESIDENT BIRD SURVEYS; MONTANA; AN EXAMPLE OF APPLIED LEARNING INTERNSHIP. My internship took me to South West Montana; there I worked for the Intermountain Bird Observatory (IBO). The IBO is an academic research, and community outreach program. From early-May to late-July, IBO staff conducts point-count surveys throughout most of Idaho, Montana, as a part of the Integrated Monitoring in Bird Conservation Regions (IMBCR) program coordinated by Rocky Mountain Bird Observatory (RMBO) and partners. We survey close to 100 transects in each state each year, (*funded by the US Forest Service Region 1 and the Great Northern Landscape Conservation Cooperative*). This is a coordinated bird monitoring effort that currently spans 12 western states and we are excited to continue collecting data that contributes at multiple levels. Each field assistant was required to travel extensively to reach the various survey locations and some of the hiking

was quite grueling and in very steep and wet terrain. I was also assisted with the Longed-Billed Curlew project the questions they ask are. What migratory routes do they take to reach their wintering grounds? When do curlews from the Intermountain west arrive on their wintering grounds and where do they go? What habitats do they use during migration and winter?

*Hartnett, Samantha. Maryville University. GENETIC ASSESSMENT OF A MOVING HYBRID ZONE. Observations of the chickadees living in the Town and Country area show a larger number of Carolina over Black-capped chickadees. While this may be evidence that the hybrid zone is migrating northward, it might also indicate the Town and Country area is located south of the hybrid zone. The aim of this project is to use simple genetic tests to distinguish between these two alternatives. Morphological differences in wing/tail ratios between Carolina and Black-capped chickadees can provide a rough estimate of the ratio of chickadees living in the area. Therefore, wing and tail measurements were obtained from all of the birds banded. This revealed a larger number of Carolina chickadees in the area. Next, blood samples were collected and genetic analysis was performed on the mitochondrial DNA (mtDNA), which involved extracting, amplifying, and sequencing the mtDNA from each chickadee. The sequenced DNA was then compared to sequences stored in the GenBank database, which revealed, once again, that a majority of the chickadees captured were of the Carolina species. Only one of the fifty successfully sequenced DNA samples was characterized as Black-cap. Most recently the nuclear DNA of each individual was characterized through analysis of single nucleotide polymorphisms (SNPs). This involved the amplification and sequencing of 4 different SNP regions. These results showed evidence of 2 species, Carolina and hybrid, existing in the Town and Country area.

*Lounsberry, Nicole, Wills, C. Rockhurst University. INSECT DIVERSITY IN AN URBAN ENVIRONMENT. To estimate insect diversity in a variable urban environment, sweep netting was used to collect insects along a 23 mile transect across Kansas City, MO from Jerry Smith Park in Southern Kansas City to Richard L. Berkley Riverfront Park at the Missouri River during daylight hours between June and October 2015. Collections were made within 0-25 meters of Holmes Road. Holmes Road runs North/South, approximately crosses the center of the Kansas City metro area, and transects a variety of urban environments including wooded park to urban downtown. We estimated land cover (type and approximate area along this transect) using Google Earth. Insects were frozen at -18° C until they could be classified. Approximately 31 different families were identified along the transect. As expected, we found a greater number of individuals and families in areas with more vegetation. The suburban areas were found to be the most vegetated and therefore inhabited the greatest number of families. The rural and urban areas with less vegetation demonstrated less diversity in family groups overall. Additionally, the time of collection demonstrated a correlation in which evening hours yielded greater sample sizes. This suggests that more individuals thrive during twilight hours while greater diversities reside in suburban areas.

*Martinez Reyes, Cindy, Gail, J. Lindenwood University. EFFECTS OF TERGITOL EXPOSURE ON POECILIA RETICULATA SWIMMING BEHAVIOR. Multiple environmental concerns exist regarding the effects of surfactants contained in herbicides, such as Roundup, on aquatic and marine organisms. This experiment aims to assess possible effects of Tergitol on *Poecilia reticulata*. Three samples of five randomly selected *Poecilia reticulata* individuals were exposed to different concentrations (0µL/L, 25µL/L, 50 µL/L, 100 µL/L, and 200 µL/L) of the commercial surfactant Tergitol solution (Type NP-40, 70% in H₂O) for a period of seven days. The purpose of this experiment was to assess the effects of the compound on the swimming behavior of *Poecilia reticulata* in a reduced space setting. This was studied by recording overall swimming time vs. still time for each individual in each sample and comparing it against values of other treatments. Tergitol exposure had no significant effect on swimming behavior, for no significant differences in swimming times were observed throughout the different treatments.

Stout, A., Cheung, R., *Saliu, Bola. Rockhurst University. METHOD OF GROWTH AND ANALYSIS OF CHYTRID FUNGUS. The chytrid fungus *Batrachochytrium dendrobatidis* causes an epidermal infection of frogs that has led to population declines and extinctions. Chytridiomycosis is a disease caused by this chytrid which infects the keratinized skin cells on adult amphibians and can cause infected larvae to develop deformed or missing mouthparts. Our goal is to determine the influence of plants and plant chemicals on the growth of chytrid. In order to investigate possible effects on chytrid, we developed a method to culture and quantify the growth of the fungus. The most effective way to grow chytrid is to

transfer cells into culture tubes with H-broth and incubate at 23° Celsius for approximately seven days. To quantify the growth, we centrifuge the culture tubes to form a pellet, remove the supernatant, and weigh the pellet mass. To compare amount of growth, we subtract current pellet mass from initial pellet mass. The significance of this method is to provide a standard protocol to measure chytrid growth and inhibition. We're currently working to determine the effects of oak (*Quercus* sp.) tannins and other possible inhibitors on chytrid growth.

*Jack, Brittany, *Gonzalez, Maria, Haskins, M. Rockhurst University. PREVALENCE OF PARASITE EGGS IN METROPOLITAN PARKS. Fecal contamination of soils in metropolitan parks may present health risks to humans and other animals which frequent those parks. Among those health hazards is the potential for exposure to parasite eggs. Soil samples were collected in metropolitan Kansas City, MO from five off-leash dog parks and five green recreational areas in which people exercise their dogs. A total of six samples were collected from each location and dried for approximately 12 hours. Following published protocols, soil was then sifted through a series of mesh screens and 2 g of each individual sample transferred into separate 15 ml centrifuge tubes. In preparation for a floating sucrose assay each soil sample was "washed" with eight ml of Tween 80 and centrifuged. Supernatant was gently removed from the soil pellets and thrown away. Approximately 10 ml of saturated sucrose solution was then added to each tube, the pellet re-suspended, and tubes centrifuged for an additional 10 min at 190 g. Finally, each tube was "topped off" with a saturated sucrose solution and a coverslip added to collect eggs that floated during the final centrifuge cycle lasting 5 minutes at 80 g. After centrifugation each coverslip was removed and carefully placed onto a clean slide. Each of the six slides representing one collection site were inspected for parasite eggs using a compound microscope. Approximately 30% of the soil samples examined to date tested positive for one or more parasite eggs.

Lichvar, A., *Johnston, Gail. Lindenwood University. EFFECTS OF SULFORAPHANE ON XENOPUS LEAVES GROWTH AND DEVELOPMENT. Sulforaphane is a broccoli extract that has antioxidants that act as a protector against carcinogens by mediating the function of antioxidant enzymes, controlling apoptosis, and cell cycle (Juge 2007). *Xenopus laevis* (*X. laevis*) is the model organism tested to see whether sulforaphane had an effect on tadpole growth and development, specifically looking at the lungs and intestines. Tadpoles were assigned control and three treatment levels (10%, 20%, and 50% supplemental aid to food) for six weeks. Tadpoles given 10%, 20%, and 50% treatment levels had higher intestinal indexes than the control. Only tadpoles given the 50% treatment level had a higher lung index compared to the control. However, there was no difference in the growth rates (per week) between different dosage level treatments. This supports the hypothesis that sulforaphane may have positive effects on *X. laevis* development.

*Phillips, Shannel, *Templeton, Samantha, Adam, P.J. Department of Natural Sciences, Northwest Missouri State University. CARNIVORES HAVE SPINE: FORM AND FUNCTION OF VERTEBRAE IN RELATION TO LOCOMOTION AND BEHAVIOR IN CARNIVORES. Studies of morphological correlates with terrestrial locomotor strategies have concentrated predominantly on the appendicular skeleton. However, specialization of locomotor strategies has resulted in adaptive variation in vertebrae morphology. Using measurements of select landmarks on vertebrae, the predictability of terrestrial locomotor strategies was assessed. Forty specimens representing 32 carnivore species were subjected to four landmark measurements: transverse process width (TW), total vertebral height (TW), centrum height (CH), and centrum length (CL). All available vertebrae were taken into account with the cervical #7 (C7) used to standardize measurements to account for size disparity. Missing vertebrae were estimated using mean values from present, articulating vertebrae. Specimens were categorized into five different locomotor strategies: arboreal, scansorial, cursorial, non-cursorial, and semi-fossorial. Measurements were subjected to Principal Components Analysis (PCA) to examine patterns in overall variance. Discriminant Function Analyses (DFA) were then conducted to reveal patterns in vertebral variation and presage reclassification of locomotor group classifications. Results demonstrated locomotor classification can be predicted with a high degree of accuracy ($\geq 95\%$) regardless of taxonomic alliances, with similar results for all measurements.

*Patterson, Sarah, Gomez, J., Holmes, J., Whittle, D., Lankford, S., Wilson, S. University of Central Missouri. CONSTRUCTION OF A BIOLOGICAL GIS DATABASE OF THE BACK REEF PATCH NETWORK IN SAN PEDRO, BELIZE A REEF EDUCATION AND HEALTH MONITORING TOOL. Belize is home to the world's second largest barrier reef system, which spans 187 miles of coastline. Despite its size, there is sparse information pertaining to the health of this system. The

reef also boasts a unique feature – the region of the reef that approaches the city of San Pedro is home to a large back reef network protected by the main reef. The back reef area around San Pedro, Belize is the target area for this project. Even with the diversity and pressure this region represents there is little to no published information pertaining to the current status of coral coverage, coral health, or biodiversity for this region. Protection by the main reef allows for fewer environment disturbances and associated reef modifications. This stability affords researchers the opportunity to begin to monitor long-term trends in coral health and associate those findings with anthropogenic or abiotic environmental factors of the back reef network. This study serves as a platform to monitor the health of the back reef network. The overall aim of the study is to develop repeatable monitoring techniques that can be completed by undergraduate researchers and used to generate a sustainable biological database that can be easily accessed through detailed GIS mapping of the reef network. This database will allow educators, research scientists, and policy makers' access to information pertaining to fluctuations in back reef health including biodiversity, biochemical, and genetic information.

*McCann, Cammie L., Adam, P.J. Department of Natural Sciences, Northwest Missouri State University. NOT ALL CLAWS ARE THE SAME: FORM AND FUNCTION OF CAT CLAW MORPHOLOGY. Morphological differences between claws of the fore- and hind limbs are due to differences in their functions. Forelimb claws tend to be highly curved and allow a cat to hang onto a struggling prey item. Hind-claws tend to be more sickle-shaped and are used to help disassemble prey as well as for climbing trees in arboreal species. They also help a cat to push against the ground when jumping. The cheetah (*Acinonyx jubatus*) has much straighter claws than other representatives of Felidae due to its unique hunting behavior and lack of sheaths of skin to cover the claws when retracted. My research focuses on anatomical differences between the claws of the fore limb and the hind limb to better understand how they are used. This research will be further investigated by looking at the claw curvature and how it relates to hunting habits in a survey of felid species. Measurements of claws from all cat species will be taken using calibrated digital calipers and digital photographs at the Field Museum in Chicago. Pictures will be taken of the lateral view of claws to measure curvature of claws from all of the digits on the anterior and posterior claws. After collecting data, a principal components analysis (PCA), a discriminant function analysis (DFA), and other multivariate analyses (MANOVA) will be used to determine how hunting habits in cat species can be predicted from characteristics of claw curvature.

*Wronkiewicz, Natalie, Brandt, L. Truman State University. EFFECT OF RAINFALL ON HOWLER (*ALOUATTA PALLIATE*) AND CAPUCHIN (*CEBUS CAPUCHINUS*) MONKEY BEHAVIORAL PATTERNS. Of the Central American primates visible during daylight, *Alouatta palliate* and *Cebus capuchinus* demonstrate remarkable amounts of activity on a regimented daily schedule. In order to understand the effect of precipitation on the behavior of these monkeys, two troops were observed for a set period of time for multiple trials in an area of proximal location to the La Suerte biological field station. This site is positioned in the neotropical rainforest region of the Maderas Rainforest Conservancy in northeastern Costa Rica. Each movement of the individuals studied was classified and recorded during times with and without rain. Their activity rhythm showed a distinct variation in daily cycles, which were dependent on the weather during trial periods. Despite the abundance of food in the location of study, it was observed that foraging, as well as travel, vocalization, hanging, and socialization of howlers and capuchins during and immediately after rainfall was noticeably low, with increased sedentary habits recorded in both troops. Level and duration of activity were predominantly higher during periods of zero precipitation. These observed patterns of activity fluctuations indicate the disruptive effect of precipitation on the lifestyle habits of these monkeys in this region of Central America. This leads to the conclusion that environmental stimuli strongly modulate the behavioral patterns, to the point of entrainment, in these species.

*Legaria, Alex, Cawly, J. Lindenwood University. ANALYSIS OF THE ALLELOPATHIC PROPERTIES OF THE EXUDATE OF THE ACER GINNALA SEED. In previous studies the *Acer ginnala* seed showed an allelopathic properties in its exudate. This research project has the objective of supporting and analyzing this properties. In order to perform such analysis, we removed the testa layer of the seed, we disinfected the seed coat by rinsing it with 1% for one minute, and two rinses with DI water, one more minute each. Seven seeds were cultured per plate with phytoblend for 7 to 10 days. The exudate was then collected. The plates with the exudate spots were used to culture *Lolium perenne* seeds. The *Lolium perenne* seeds were previously disinfected by rising each seed with 70% ethanol and 1% sodium hypochlorite for one minute, followed by two rinses of water of one minute each. The seeds were then cultured in the phytoblend plates

where the spots of the *Acer ginnala* exudate was diffused. The seeds were rinsed with 7 μ L of the exudate, and then observed for a week. A control group was set up by culturing 7 disinfected *Lolium perenne* seeds per phytoblend plate with no presence of exudate. After a week, ~80% of the experimental seeds showed an abnormal behavior of its root. The root did not penetrate the media until it had avoided the exudate. None of the control groups showed this behavior in any of its seeds. Also, 74% of the seeds in the experimental groups presented fungal presence while 0% of the control groups showed this presence. An HPLC will be performed during the following weeks to determine the possible composition of the exudate.

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*Mobley, G., Balakrishnan, B., and El-Dweik, M. Department of Agriculture and Environmental Sciences, Lincoln University. Rapid detection of *Staphylococcus* Enterotoxin A (SEA) from food samples. *Staphylococcus aureus* is an enterotoxin-producing bacteria responsible for a minimum of 241,000 cases of foodborne illness in the United States every year. The economic impact of these bacteria on the food industry and society as a whole is immense, with an estimated cost of \$167,697,860 per year. There are a variety of methods of *Staphylococcus aureus* detection. The faster that the presence of these bacteria can be determined, the sooner the distribution of the contaminated food can be halted. For this reason, the efficiency of detection is directly tied to a reduction in affected populations. The objective of this study was to develop a novel detection method for the *Staphylococcus* Enterotoxin A (SEA). The pure toxin was labeled with fluorescent dyes (FITC and TRITC); then the labeled toxin was captured by a magnetic bead immobilized with the anti-SEA antibody. The bead used had a dual purpose: toxin purification and toxin detection. This process allowed the immuno-complex to be observed with use of a fluorescent microscope and fluorescent spectrophotometer.

*Morin, A.F. and Smith, J.J. Biomedical Sciences Department, Missouri State University. Identification and Characterization of DNA Repair Snf2/Swi2 ATPases in *Tetrahymena thermophila*. DNA damage is a widespread process that is constantly occurring within cells; this damage can lead to cell death, and several diseases, the most common of which is cancer. The importance of repairing DNA has made it necessary for cells to have multiple mechanisms for repairing this damage. Distinct repair pathways in eukaryotic cells have led to specific types of damage recognition and repair for specific DNA lesions. In all cases of repair the processes are broken down into four basic steps: damage recognition, repair protein recruitment, DNA repair, and dissociation of repair proteins from the DNA. In silenced DNA knowledge of the factors involved in recognition and recruitment to the site of damage remain elusive. *Tetrahymena thermophila*, a ciliated protist contains two nuclei; a large macronucleus that holds an actively transcribed copy of the genome, and a small micronucleus, which contains a silenced heterochromatic copy of the genome used for reproduction. This makes *Tetrahymena* an excellent model to study DNA repair in the silenced areas of the genome. Nucleotide Excision Repair (NER) is the process by which a bulky DNA adduct is removed from the damaged DNA. Heterochromatinized DNA is tightly bound to histone proteins as a form of packaging and protection; when damage occurs in these areas the histone proteins must be moved away from the site of damage so that proteins can access the lesion. Using *Tetrahymena*, we seek to identify and classify the functionality of four Snf2/Swi2 ATPases, which are potentially responsible for this histone rearrangement.

*Bhattacharya, M.¹, Geisler, S.², Pittman, S.K.², Doan, R.A.², Weihl, C.C.², Milbrandt, J.², and DiAntonio, A.² Biology Department of Basic Sciences, St. Louis College of Pharmacy¹ and Division of Biology and Biomedical Sciences, Washington University². TMEM184b Promotes Axon Degeneration and Neuromuscular Junction Maintenance. Complex nervous systems achieve proper connectivity during development and must maintain these connections throughout life. The processes of axon and synaptic maintenance, and axon degeneration after injury, are jointly controlled by a number of proteins within neurons, including ubiquitin ligases and mitogen activated protein kinases (MAPKs). However, our understanding of these molecular cascades is incomplete. Here we describe the phenotype resulting from mutation of TMEM184b, a protein identified in a screen for axon degeneration mediators. TMEM184b is highly expressed in the mouse nervous system and is found in recycling endosomes in neuronal cell bodies and axons. Disruption of TMEM184b expression results in prolonged maintenance of peripheral axons following nerve injury, demonstrating a role for TMEM184b in axon degeneration. In contrast to this protective phenotype in axons, uninjured mutant mice have anatomical and functional impairments in the peripheral nervous system. Loss of TMEM184b causes swellings at

neuromuscular junctions that become more numerous with age, demonstrating that TMEM184b is critical for the maintenance of synaptic architecture. These swellings contain abnormal multi-vesicular structures similar to those seen in patients with neurodegenerative disorders. Mutant animals also show abnormal sensory terminal morphology. TMEM184b mutant animals are deficient on the inverted screen test, illustrating a role for TMEM184b in sensory-motor function. Overall, we have identified an important function for TMEM184b in peripheral nerve terminal structure, function, and the axon degeneration pathway.

*Owensby, C.¹, Garcia, M.³, Oestreich, A.², Phillips, C.³, and Brodeur, A.C.¹ Biomedical Sciences Department, Missouri State University¹, Department of Biology² and Department of Biochemistry³, University of Missouri. Characterization of the Skeletal Phenotype in Wild-type and IDUAW392X mice. Mucopolysaccharidosis Type I (MPS I, Hurler's Syndrome) is a lysosomal storage disease caused by a deficiency of α -L-iduronidase (IDUA). IDUA catalyzes the degradation of the glycosaminoglycans (GAGs), heparin sulfate (HS) and dermatan sulfate (DS). The continual accumulation of HS and DS makes MPS I a progressive disease with inevitable degeneration of multiple organ systems, affecting respiratory, cardiac, skeletal, ophthalmologic, and in some cases central nervous system function. The effect of accumulated GAGs on the skeletal system includes dysostosis multiplex, atlantoaxial instability, thoracolumbar kyphosis, genu valgum, acetabular dysplasia, and short stature. Skeletal biomarkers of bone formation and bone reabsorption will be compared in wild-type, heterozygous, and IDUAW392X mice. To investigate osteoblast activity, levels of the bone formation marker PINP were evaluated and to investigate osteoclast activity levels of the bone resorption biomarker TRAP5b were evaluated. Potential differences in serum PINP or serum TRAP5b concentrations could contribute to the increased cortical thickness and increased bone marrow width seen in the skeletal phenotype previously found in mice with IDUA deficiency. Lastly to further investigate bone turnover levels, transcription of the several biomarkers for bone metabolism were quantitated by measuring the mRNA levels of: collagen (I) and (II), RANKL, OPG, TNF- α , and CSF-1 isolated from tibiae of wild type, heterozygous, and IDUAW392X mice.

*Balakrishnan, B., Barizuddin, S., and El-Dweik, M. Department of Agriculture and Environmental Sciences, Lincoln University. Novel Immuno-MUG Assay for the Rapid Detection of *E. coli* O104:H4. Immunomagnetic separation hybridized with MUG assay for the rapid detection of *Escherichia coli* (*E. coli*) O104:H4 pathogen from meat samples. Monoclonal antibody specific to *E. coli* O104:H4 were immobilized on protein A-coated magnetic beads. This Protein-A-anti *E. coli* O104:H4 antibody complex was used to capture the *E. coli* O104:H4 antigen (whole cell) from enriched meat sample. The goal of using this technique was to achieve a fluorescent Protein-A-anti *E. coli* O104:H4 - *E. coli* O104:H4 complex. The eluted contents of this complex were added to the LST-MUG (Lauryl Sulfate Tryptose-4-methylumbelliferyl- β -D-glucuronide) broth, a signalling reporter. When the *E. coli* bacterium comes into contact with LST-MUG, it cleaves the substrate via the enzymatic activity of β -glucuronidase. The resulting cleavage produces 4-methylumbelliferone, a highly fluorescent species. This fluorescence was detected using a fluoro spectrophotometer. The lower and upper detection range for this LST-MUG sensing regimen was found to be between 2.05×10^5 - 4.09×10^8 CFU/ml. If qualitative detection is the primary goal, the results can be ascertained in 8 hrs. *The advantages of this technique include*, the highly specific detection of bacteria and versatility in terms of acting like a platform for detection of "any" bacteria that produces β -galactosidase enzyme should be detected.

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*Balakrishnan, B., Barizuddin, S., and El-Dweik, M. Department of Agriculture and Environmental Sciences, Lincoln University. Novel Immuno-MUG Assay for the Rapid Detection of *E. coli* O104:H4. Immunomagnetic separation hybridized with MUG assay for the rapid detection of *Escherichia coli* (*E. coli*) O104:H4 pathogen from meat samples. Monoclonal antibody specific to *E. coli* O104:H4 were immobilized on protein A-coated magnetic beads. This Protein-A-anti *E. coli* O104:H4 antibody complex was used to capture the *E. coli* O104:H4 antigen (whole cell) from enriched meat sample. The goal of using this technique was to achieve a fluorescent Protein-A-anti *E. coli* O104:H4 - *E. coli* O104:H4 complex. The eluted contents of this complex were added to the LST-MUG (Lauryl Sulfate Tryptose-4-methylumbelliferyl- β -D-glucuronide) broth, a signalling reporter. When the *E. coli* bacterium comes into contact with LST-MUG, it cleaves the substrate via the enzymatic activity of β -glucuronidase. The resulting cleavage produces 4-

methylumbelliferone, a highly fluorescent species. This fluorescence was detected using a fluoro spectrophotometer. The lower and upper detection range for this LST-MUG sensing regimen was found to be between 2.05×10^5 - 4.09×10^8 CFU/ml. If qualitative detection is the primary goal, the results can be ascertained in 8 hrs. *The advantages of this technique include*, the highly specific detection of bacteria and versatility in terms of acting like a platform for detection of “any” bacteria that produces β -galactosidase *enzyme* should be detected.

*Turner, K., Balakrishnan, B., and El-Dweik, M. Department of Agriculture and Environmental Sciences, Lincoln University. Highly specific immuno-detection method for foodborne *Shigella* spp. *Shigella* is Gram-negative and facultative anaerobic bacteria closely related to the genus *Salmonella*. *Shigella* is a major foodborne bacterial pathogen, which is the cause of shigellosis. Some serotypes can produce an enterotoxin called the Shiga toxin, which is responsible for Hemolytic Uremic Syndrome. The source of contamination is through humans, especially in cases of poor hygiene. Detection process of this bacteria remain a concern due to lack of specific culture methods of this bacteria, which leads to a high level of cross contamination with *Salmonella* species. In the present study, the bacteria were purified from the food samples using highly specific immunomagnetic beads and a specific antibody. The purified bacteria were then subjected to an immunofluorescent detection method using a spectrofluorometric assay and fluorescent microscopy. This method proved to be highly specific to *Shigella*.

*Pollard, A., Balakrishnan, B., and El-Dweik, M. Department of Agriculture and Environmental Sciences, Lincoln University. Immunomagnetic purification and fluorescent detection method for foodborne *Salmonella* – A hybrid system of immunofluorescent detection. *Salmonella* are Gram-negative enteric bacteria, known to be commensal microorganisms present in gastrointestinal tracts of humans and animals. *Salmonella* has remained the primary cause of foodborne illness over a period of 100 years, throughout the world. To avoid foodborne illness caused by salmonella, a reliable and rapid detection method is needed for monitoring in various stages of food processing. The goal of this study was rapid purification of *Salmonella* from food samples. Thus, the purified bacteria can be detected quickly. In order to achieve this, a new kind of immunomagnetic beads were used. The beads used were coated with a specific antibody capable of capturing *Salmonella*, . The purified bacteria were then taken into the immunofluorescence detection process. At this point the bacteria were labeled with a Fluorescent Dye (TRITC) and detected using spectrofluorometric assays.

*Taylor, A., Balakrishnan, B., and El-Dweik, M. Department of Agriculture and Environmental Sciences, Lincoln University. Rapid and reliable detection method for *Listeria monocytogenes* from infected food samples. *Listeria monocytogenes* is a Gram-positive facultative anaerobic pathogenic foodborne bacteria, causes listeriosis. This bacteria is typically found in both raw and processed foods. *L. monocytogenes* are capable of growing in a wide range of pH, temperature, oxygenic, and osmolarity conditions. This adaptable characteristic means that the detection process of this bacterium must be a continuous practice along with the entire process of food preparation and supply stages. The present study involved in developing a rapid and reliable detection method for this bacterium that can be used at any point in food processing and supply stages. The method includes a quick purification of bacteria from the food sample using an immunomagnetic separation technique. The purified bacteria were inoculated into Brain Heart Infusion broth for a short-term enrichment (10 Hrs) to achieve a detectable quantity. After enrichment the bacteria was labeled with a Fluorescent dye (FITC). The labeled bacteria were then captured with immunomagnetic beads that were immobilized with a specific antibody. This immune complex was visualized under a fluorescent microscope and also evaluated using a spectrofluorometer. The entire detection process including enrichment procedure was completed in just 12 Hrs, while the traditional culture-based methods require five to seven days for detection.

*Jansen, K., Robinson, C., Rockafellow, J., and Harville, B. Biology Department, Drury University. Studies on the Elution of Vancomycin from Polymethyl methacrylate. Osteomyelitis is an infection of the bone that is most commonly caused by Methicillin-resistant *Staphylococcus aureus* (MRSA). Osteomyelitis is a complication that occurs after surgery and is not effectively treated by oral or intravenous antibiotics. The most effective treatment utilizes bone cement impregnated with antibiotic, which produces a high local concentration of antibiotic at the site of the potential infection. Currently there are no standard procedures regarding the concentrations of antibiotic added to the bone cement for prevention and treatment of osteomyelitis. We compared the rate of vancomycin elution using three commonly utilized

methods for production of vancomycin impregnated bone cement. In addition the bioactivity of vancomycin eluted from the bone cement was assessed. Results from these studies showed the method of production of vancomycin impregnated cement affected the quantity of antibiotic elution but not the rate. Eluted vancomycin retained full bioactivity as measured by Kirby-Bauer assays. This work was supported by CoxHealth Systems and Drury University.

*Mullner, R., Marten, K.A., and Smith, J.J. Biomedical Sciences Department, Missouri State University. Identification and Characterization of Xeroderma Pigmentosum Complementation Group C Gene in *Tetrahymena thermophila*. Xeroderma Pigmentosum Complementation Group C (XPC or RAD4 in other organisms) is an important gene for the recognition of Cyclobutane Pyrimidine Dimers (CPDs) generated by Ultraviolet light (UV). XPC binds to UV damaged DNA to mark it for repair in the Global Genome Nucleotide Excision Repair (GG-NER) pathway. Mutations in this gene result in Xeroderma Pigmentosum, a condition characterized by increased sensitivity to UV light and cancerous tumors on the skin. In other organisms XPC/RAD4 interacts with RAD23 and is stabilized to form Nucleotide Excision Repair Factor 2 to initiate the repair process. A homolog for XPC was found in *Tetrahymena thermophila*, RAD4. RAD4 was isolated from *Tetrahymena* using PCR and then cloned into a pENTR-TOPO vector. The purified plasmid was then sequenced to confirm it contained RAD4 and contained no mutations. Using LR Clonase, the gene was put into plasmids tagging constructs containing 2HA, FH6, GFP, and RFP tags and transformed into *E. coli*. These tagged plasmids will be used to observe the gene's function in *Tetrahymena* through localization studies. To determine when RAD4 is being expressed in *Tetrahymena* following different DNA damaging agent qRT-PCR will be performed. Since *Tetrahymena* contains two nuclei, one of which is silent during growth of the cell, we can study the function in GG-NER away from the normal transcriptional activity that is happening in most other organisms. These studies will help determine even if the same set of proteins are functioning in GG-NER in both nuclei in *Tetrahymena thermophila*.

* Shen, A., Deng, F., Liu, F., Wuliji, T., Reed, M., Dolan-Timpe, M., and Zheng, G. Department of Agriculture and Environmental Sciences, Lincoln University. The association of DNA fragment IT3E with environmental *E. coli* population. Differentiation of enteric *E. coli* from environmental *E. coli* is critical for accurate identification of fecal pollution in water. The objective of this study was to determine if the DNA fragment IT3E of *E. coli* could be used as a genetic marker to distinguish the two groups of *E. coli*. One hundred and sixteen strains of *E. coli* were isolated from surface water and groundwater at 8 different locations within the Goodwater Creek Experimental Watershed in northern central Missouri. Presence or absence of IT3E for each *E. coli* isolate was determined by the polymerase chain reaction (PCR) assay. The PCR assays indicated that the rate of IT3E-positive *E. coli* was relatively steady and high in the deep groundwater samples, ranging from 66.7 to 100%, while those in surface water from 0 to 23.1% and in shallow groundwater from 0 to 100%. The results also showed that the rates in the samples taken from surface water and shallow groundwater were subject to the influence of precipitation and temperature. This preliminary data suggest that the DNA fragment IT3E of *E. coli* is associated with deep groundwater and therefore with environmental *E. coli* population. However, more research will be needed to include more water samples from different watersheds, under different precipitation conditions, and over different seasons, in order to understand the complete value of IT3E in the differentiation of environmental and enteric *E. coli* populations.

*Cook, K.J. and Smith, J.J. Biomedical Sciences Department, Missouri State University. Characterization of the SIRT2 and SIRT3 homologs in *Tetrahymena thermophila*. The ciliate *Tetrahymena thermophila* contains 18 histone deacetylase (HDAC) homologs, which are responsible for removing acetyl groups from acetylated lysines on histones and other proteins. There is a class of HDACs called Sirtuins (Class III HDACs), which have been implicated in various cellular processes like cancer, diabetes, aging, apoptosis, and transcription regulation. The model organism *Tetrahymena thermophila* has 11 homologs of Sirtuins (four more than humans and other vertebrates even). The scope of this research is to investigate the genes homologous to human SIRT2 and SIRT3, *Tetrahymena* Histone Deacetylases (THDs) 13, 15, and 16. This study will investigate their expression levels within the cell under various conditions including genotoxic stressors, starvation, and conjugation using qRT-PCR. Localization studies will be done through cloning these genes into plasmids to encode for GFP and 2HA tags. These tagged constructs were then transformed into *T. thermophila* to be used in future studies. Characterizing the function, localization, and the proteins interacting with THD13, THD15, and THD16 could help us better understand the various roles of SIRT2 and SIRT3 histone deacetylases.

*Mobley, G., Balakrishnan, B., and El-Dweik, M. Department of Agriculture and Environmental Sciences, Lincoln University. Rapid detection of *Staphylococcus* Enterotoxin A (SEA) from food samples. *Staphylococcus aureus* is an enterotoxin-producing bacteria responsible for a minimum of 241,000 cases of foodborne illness in the United States every year. The economic impact of these bacteria on the food industry and society as a whole is immense, with an estimated cost of \$167,697,860 per year. There are a variety of methods of *Staphylococcus aureus* detection. The faster that the presence of these bacteria can be determined, the sooner the distribution of the contaminated food can be halted. For this reason, the efficiency of detection is directly tied to a reduction in affected populations. The objective of this study was to develop a novel detection method for the *Staphylococcus* Enterotoxin A (SEA). The pure toxin was labeled with fluorescent dyes (FITC and TRITC); then the labeled toxin was captured by a magnetic bead immobilized with the anti-SEA antibody. The bead used had a dual purpose: toxin purification and toxin detection. This process allowed the immuno-complex to be observed with use of a fluorescent microscope and fluorescent spectrophotometer.

*Al-awwal, Nasruddeen, Balakrishnan, B., El-Dweik, M. Department of Life and Physical Sciences. Lincoln University. ONE-POT SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL ACTIVITY OF α -AMINOPHOSPHONATES. The great demand in life science for new molecules of biological and medicinal importance has led to an increased interest in the development of synthetic methodologies. The synthesis of α -aminophosphonates using aldehydes or ketones, amines and alkyl phosphites in dry organic solvents at room temperature or by heating via a Kabachnik-Fields reaction is a most promising and convenient route. α -Aminophosphonates were synthesized in a one-pot simultaneous reaction of aniline, diethylphosphite, and different aromatic aldehydes by the Kabachnik-Fields reaction in ethanol at room temperature to afford the corresponding α -aminophosphonates in good yields. All these compounds were found to exhibit moderate to good antimicrobial activity. Compounds were characterized using FT-IR and NMR analyses.

*Khopang, Jesse, Murphy, M., Starkey, B., Gilbert, L., Marsh, D. Chemical and Physical Science Department. Missouri Southern State University. SYNTHESIS CONDITIONS OF QUANTUM DOTS. Quantum dots (QDs) are quasi-spherical semiconducting nanoparticles which contain electrons that are bound in discrete quantum energy states and have a particle diameter less than that of its exciton Bohr radius. Particle size distribution can be fine-tuned through chemical processing including choices in atmospheric conditions, temperature, initial reactants, stabilizers, and solvent matrix. These synthesis settings aid in tailoring the production of quantum dots with light absorbing and emitting properties in specific frequencies. As a result, QDs have a variety of practical applications. A wet chemical process, similar to the Hines and Scholes method, was utilized to attempt the production of lead sulfide (PbS) and zinc sulfide (ZnS) quantum dots. Focus was placed on the purity of initial reactants and synthesis conditions such as temperature and atmosphere.

Conservation Oral Presentations

*Copple, L. and T. Boman., Missouri Southern State University. TESTING OF CHEMICAL, BIOLOGICAL AND PHYSICAL PARAMETERS PRIOR TO THE ADDITION OF NATIVE PLANTS IN AN EFFORT TO AID IN FLOOD CONTROL, HEAVY METAL DEPLETION, AND SOIL EROSION. Improving habitat quality is a growing need across the state of Missouri, for a range of native birds, insects, and other animals. Periods of heavy rainfall, drought, and constantly changing temperatures make land management a challenge and restoration of disturbed land a prerequisite of quality ecosystems. Planting native, Missouri Eco-type, wetland and grassland plants in an area that constantly loses soil from flooding, and that possibly contains heavy metals from previous mine work could change and improve the overall habitat of the area. Over 250 acres of land in Webb City, Missouri are currently restoration sites, with the goal of decreasing heavy metal contamination and erosion, while increasing flood control. It is anticipated that these areas will be transitioned back to the native wetlands and grasslands that once thrived in the area. Overall this study will determine the current chemical, biological and physical conditions of one such restoration site prior to restoration. Determining these conditions prior to the implementation of native plants will allow for a comparison to post-implementation and with the goal of determining the impact of such restoration projects on the site itself and surrounding areas. The methods incorporated will include water, soil, and biodiversity sampling. This study has the potential to be expanded throughout Southwest Missouri, to improve riparian zones, habitat, and the overall conservation of Missouri.

Fernando, G., U. Das, and *M. Sicay Lux, Cottey College. COMPARING LEVELS OF PHOSPHATES IN WATER BODIES IN NEVADA, MISSOURI WITH LAKE ATITLAN, GUATEMALA. The main focus of this study is to analyze the amount of eutrophication in water bodies in farms in Nevada, MO area, based on total phosphates content. Eutrophication is the accumulation of nutrients such as phosphates and nitrates, which promotes the excessive growth of algae. In recent years, these algae; mainly Cyanobacteria, have known to produce cyanotoxins that are harmful to humans as well as livestock. Lake Atitlan in Guatemala is highly polluted by these nutrients and is affected by eutrophication. The researcher conducted a three-month summer internship in 2015 studying the phosphate levels in Lake Atitlan and continues to obtain data from the facility to compare with her results from water bodies in Nevada farms. It is found that the pollution in Lake Atitlan is mainly caused by excessive use of fertilizers in rural communities surrounding the lake. Nevada, MO is a rural farming community as well, and is vulnerable for eutrophication. Regular monitoring of phosphate levels is highly important to ensure sustainable agriculture and safe water supplies for humans and livestock. Although continuous monitoring of eutrophication is done in Lake Atitlan, no regulations exist unlike in United States on safe levels of phosphates. In this study, lake water samples collected were analyzed for phosphate content, pH, DO and other water quality parameters. Hannah water meter and UV/Vis absorption of ascorbic acid complex method were used. Data were collected from Nevada area farmers about the use of fertilizers in their farms and correlated to the total phosphate content.

*Brueggen-Boman, T. R., Missouri Southern State University and J. L. Bouldlin, Arkansas State University. WATER QUALITY RESPONSE TO THE IMPLEMENTATION ON BEST MANAGEMENT PRACTICES IN THE STRAWBERRY RIVER WATERSHED, AR. Best Management Practices (BMPs) related to agriculture are continually studied in an effort to limit potential negative impacts to natural water resources. These practices have been shown to be effective at preserving natural water quality. This four-year study focused on five sites located in the upper watershed of the Strawberry River, AR. Multiple BMPs including the exclusion of cattle from waterways while providing alternative water sources and use of no-till method to plant pasture grasses were implemented. The water quality variables assessed included turbidity, total suspended solids (TSS), NO_3^- , PO_4^{3-} , and *Escherichia coli*. The average annual sediment loading was calculated for comparison to published acceptable total maximum annual load (TMAL). Following the implementation of BMPs it was determined that all sites indicated significant increases in at least one variable of the measured variables. At three of the sampling locations, *E. coli* exceeded the maximum allowable concentration. The results of the estimated sediment loading determined that sampling site were within the accepted TMAL. This study concludes that in the timeframe of the study, the quantity of BMPs implemented were not effective at improving water quality. In order to maintain the desired water quality in this watershed in the future it is suggested that BMPs targeted specifically to limit parameters of concern (e.g., *E.coli*) should be selected for implementation and implemented in specific locations of concern rather than dispersed throughout the watershed.

*Irwin, K. and L. R. McAliley, Northwest Missouri State University. HABITAT USAGE IN PROXIMITY TO WIND FARMS BY LOCAL BAT SPECIES IN NORTHWEST MISSOURI. Wind farms are becoming increasingly abundant as development of green energy in the United States becomes a priority. This rapid expansion has come a cost to local bat populations. Wind farms have been credited for hundreds thousands of bat kills nationwide and as such has become a priority of research in mitigation measures and understanding bat behavior. This loss, in conjunction with white nose syndrome, has some species in drastic decline (i.e., *Myotis lucifugus*, *Myotis sodalis*, and *Myotis grisescens*). This is of increasing concern as bats are key predators for insects and a prey item for raptors. The purpose of this study is to examine bat utilization of similar habitats located within windfarms and outside of windfarms. This data will allow us to examine bat use of habitat that may impact our development of mitigation strategies to decrease bat fatalities at this alternative energy sources. A comprehensive understanding of habitat usage in bats will allow the expanding wind farms to have a reduced impact and help conserve the bat population.

*Slagle, A. and J. McGhee, Northwest Missouri State University. AN ASSESSMENT OF LEECH PARASITISM ON TWO SPECIES OF FRESHWATER TURTLES (*CHELYDRA SERPENTINA* AND *CHRYSEMYS PICTA*). Leeches are one of the most commonly found ectoparasites of freshwater turtles, but are relatively unstudied in the northwest Missouri area. In the summer of 2015 we studied leech prevalence on populations of two species of semi-aquatic turtle (*Chelydra serpentina* and *Chrysemys picta*) at ponds near Mazingo Lake in Nodaway County, Missouri. Hoop net traps baited with cat food

were used to trap 41 turtles to determine leech prevalence. We focused on 4 aspects of study in our research: (1) leech prevalence between species, (2) leech prevalence between sexes, (3) leech location, and (4) leech prevalence due to turtle size. The bottom dwelling species, *Chelydra serpentina* had the highest prevalence of leech parasitism (*Chelydra serpentina* 87.3%, *Chrysemys picta* 12.7%; $P = 0.032$) while there was no statistical difference in leech parasitism of males versus females of either turtle species ($P = 0.706$ and $P = 0.453$ for *Chelydra serpentina* and *Chrysemys picta* respectively). Leeches were found to parasitize the posterior end of the turtle significantly more than the anterior, while no correlation was found between size of turtle and leech prevalence. Our results suggest that sex and size of the turtle does not affect leech parasitism, but species of turtle plays a vital role in leech prevalence which could be due to ecology and habit differences between these two species.

*Willand, J., Missouri Southern State University. DOES SUPPRESSION OF DOMINANT SPECIES AFFECT COMMUNITY ASSEMBLY AND PROPAGULE RECRUITMENT IN RESTORED TALLGRASS PRAIRIE? One of the central concepts of ecology is to understand the processes that influence species diversity, and how the resulting diversity affects ecosystem functioning. Diversity has been hypothesized to be responsible for long-term community stability, contrasted by the idea that dominant species regulate temporal stability (mass ratio hypothesis). Community metrics (total plant cover, forb cover, C_4 grass cover, richness, and diversity) were measured in a restoration experiment consisting of a split plot design with sown dominant grasses (*Andropogon gerardii*, *Schizachyrium scoparium*, and *Sorghastrum nutans*) and subordinate species (three unique pools of non-dominant species) as the subplot factor, with treatment (control vs. suppression of dominant grasses) as the sub-subplot factor, respectively. Dominant grass suppression had little effect on forb cover, richness, and diversity, but influenced total and C_4 grass cover. To test for microsite vs. dispersal limitation, a propagule addition was implemented. Propagule addition increased community richness and diversity in the year of sowing and year after sowing, but contributed little to total cover. Dominant grass suppression had an effect on new species recruitment in one of two species pools, with suppression of all dominant grasses having the greatest influence on total cover and richness of new species. These results suggest that dominant species collectively are responsible for modulating stable species composition during community assembly and can act as a biotic filter to the recruitment of new species, but diverse subordinate species assemblages are more important for temporal stability.

*Baepler, J., Lincoln University. OF NICHES AND FISHES: HOW THE NATURAL HISTORY OF *HYPOPHTHALMICHTHYS MOLITRIX* AND *HYPOPHTHALMICHTHYS NOBILIS* ALLOWED FOR COLONIZATION OF NORTH AMERICAN WATERWAYS. This paper attempts to summarize the origins of invasive *Hypophthalmichthys molitrix* (silver carp) and *Hypophthalmichthys nobilis* (bighead carp) in North American waterways and outline the factors that have contributed to their highly successful colonization within riverine systems. In addition the known impacts on some native fishes will be discussed as will measures and controls that could limit current population size and distribution. The further spread of these Asian carp into the Great Lakes is also addressed.

*Balogun, A., N. Nkongolo, Lincoln University of Missouri, and A. Alarape, University of Ibadan. LEVEL OF AWARENESS OF HIGH SCHOOL STUDENTS ABOUT WILDLIFE CONSERVATION IN NIGERIA. For an efficient implementation of the sustainability of wildlife resources, the level of awareness of the public should be considered especially that of the high school students as they are the leaders of our tomorrow's natural resources conservation strategies. Hence, it is an urgency to emphasize the need for them to be aware of the importance of wildlife conservation and the problems associated with wildlife survival. This study was conducted in Ibadan north local government area, Oyo state in Nigeria with the aim of assessing the student's level of awareness with regards to wildlife conservation, the medium through which they got informed and the influence of their educational level. The study was carried out using questionnaires. Three hundred questionnaires were distributed to 10 public and private schools within Ibadan north local government area, Oyo state and the data were analyzed using descriptive statistics and chi-square. The results of the analysis revealed that most respondent were between ages 11- 15yrs, with more females than male. The results also indicated that students were aware of wildlife conservation both from their schools and visual media (internet, television). This simply means that wildlife extension method, governmental and non-governmental means were poor approaches to student's awareness of wildlife conservation. Results also showed that the level of wildlife conservation awareness of students was not dependent on their level of educational level. It is suggested that the schools incorporate wildlife

studies in their curriculum. In addition, governmental and non-governmental organizations should organize wildlife programs for high schools.

*Messick, J. P., Missouri Southern State University. PRELIMINARY COMPARISON OF POPULATION DISPERSION PATTERNS MEASURED USING AN UNMANNED AERIAL VEHICLE (UAV OR DRONE) AND TRADITIONAL METHODS. Colored paper 5 x 5 centimeter squares were arranged in random, clumped and regular dispersion patterns within a 10 x 10 meter grid. The grid was photographed from a drone and the locations of the colored squares transferred to raster files in Geographic Information Systems (GIS) software. The GIS software was used to analyze the dispersion patterns and the results compared with results obtained using traditional plot and plotless methods for analyzing dispersion. Agreement between the results from the images captured with the drone and the traditional methods was generally poor. Imaging and technical limitations of the drone, operator skill, weather, and lighting conditions may have affected the results. This study supports the potential of using drones for data collection, but also indicates that we need to develop specific guidelines and methods for using this new technology.

Conservation Poster Presentations

*Athen, A. and J. McGhee, Northwest Missouri State University. THE EFFECTS OF HABITAT FEATURES ON CAPTURE RATES OF THE COMMON SNAPPING TURTLE AND THE WESTERN PAINTED TURTLE. The Common Snapping Turtle (*Chelydra serpentina*) and the Western Painted Turtle (*Chrysemys picta*) have very different ecologies but are often found in the same bodies of water. Trapping and monitoring programs may study both under particular trapping conditions. The habitat features throughout a pond vary from the shoreline to pond cover to the outside conditions. We are interested in the habitat features that turtles are frequently being trapped in. At four different ponds in Northwest Missouri, we used hoop nets baited with cat food to trap both Snapping and Painted Turtles. At each trap site, data was taken on the humidity, water temperature and conductivity, shoreline cover and pond vegetation. We compared capture rates of both species to these variables using correlation analysis. We found statistical correlations between submerged logs in the pond and Snapping Turtle captures, as well as water temperature and duckweed pond cover and Painted Turtle captures. We suggest that trapping success of Snapping Turtles will improve if hoop nets are placed near submerged logs, and for Painted Turtles in warmer conditions with high duckweed cover.

Baepler, J. and *J. Johnston, Lincoln University Missouri. A SURVEY FOR TROGLOBITIC FLATWORMS IN NORTHERN MONITEAU COUNTY, MISSOURI. Devil's Icebox Cave (Boone County, Missouri) is home to *Macrocotyla glandulosa*, a troglobitic turbellarian (Wicks et al. 2010). This is the only documented location for this species. Slay (2006) notes that there is a probability that more flatworm species are present in Missouri, but difficulties in collection and identification result in lack of documentation. A portion of northern Moniteau County is adjacent to the region in Boone County containing Devil's Icebox and the two regions share a similar karst geography. A field survey for the presence of troglobitic flatworms was conducted in several caves in northern Moniteau County. No flatworms were found inside any of the surveyed caves. However, unidentified flatworms were found within twelve meters of emergence of the cave springs at three locations. Of the flatworms found, none could be conclusively identified as having troglobitic characteristics.

*Balogun, A., N. Nkongolo, Lincoln University of Missouri, and O. Oluwagbemiga, University of Ibadan. PROMINENCE AND SPACE ALLOCATION OF BIODIVERSITY NEWS PUBLICATIONS BY SOME NIGERIAN NEWSPAPERS. The continuous loss of biodiversity and people's lack of concern in many areas of important environmental issues remains a problem for discussion in Nigeria. The newspaper has been identified as one of the daily means of disseminating news to a large audience hence, we investigated the prominence and space allotted to biodiversity news in three selected Nigerian dailies. The Punch, the Guardian and Nigerian Tribune were the three dailies purposively selected and where the content was analyzed for a period of 5 years. The prominence was based on three factors; the type of headings, the page position and the position of newspaper. The space allotted was based on the measurement of the length X breadth of individual news space. The results showed that out of a total of 1360 biodiversity related news published by the selected dailies; the Guardian had a total of 50.07% biodiversity news followed by Nigerian Tribune with 25.59% and the Punch with 24.33% of biodiversity articles. We found 646 news articles in the upper position; Guardian had 280 news

(43.3%), Tribune had 234 news (36.2%) and Punch had 132 news (20.4%). Although 1360 news articles were low for the total news of publication for three dailies, in terms of position in newspaper, a higher percentage of biodiversity articles were published in the other page with 868 news articles. The Tribune allotted more space to biodiversity news amongst the selected dailies. Biodiversity news should be given more prominence in the front and back position of the newspapers

*Long, A. and J. Willand, Missouri Southern State University. SURVEY OF THE VEGETATION OF MISSOURI SOUTHERN STATE UNIVERSITY PRAIRIE. Historically, it is estimated that Missouri had 5.7 million hectares of tallgrass prairie but there has been a 99.9% decrease of those lands. It is estimated that approximately 30,350 hectares of tallgrass prairie remains in the state, with <1.0% currently being protected. The Missouri Southern State University prairie is unique not only because it is considered a remnant prairie, but also that it is fairly large compared to many remaining tracts of tallgrass prairie. I measured plant cover, species richness, diversity, frequency, and ratio of native to exotic plant species in 40 study plots to quantify the vegetation of the prairie. Vegetation was sampled three times during the growing season to account for the different phenologies of the plant species using a modified Daubenmire cover class system. A total of 117 plant species from 35 families were encountered in the sampling plots. Six families comprised the highest number of representative species which consisted of the Asteraceae, Poaceae, Fabaceae, Rosaceae, Cyperaceae and Lamiaceae. The Shannon Diversity Index for the prairie was 4.03. The five most frequently encountered species in the prairie were *Coreopsis grandiflora*, *Carex meadiei*, *Ruellia humilis*, *Erigeron strigosus*, and *Plantago virginica*. The five plant species contributing the greatest amount of cover were *Diodia teres*, *Schizachyrium scoparium*, *Rhus copallinum*, *Andropogon gerardii*, and *Aristida oligantha*. Even with the conservative sampling method used during this study, a significant number of plant species were identified which further supports the fact that remnant plant communities such as MSSU prairie harbor significant species richness and diversity at small spatial scales.

*Olsen, S and J. McGhee, Northwest Missouri State University. EFFECT OF TEMPERATURE AND COVERAGE ON COPE'S GRAY TREE FROG CAPTURE RATES. Cope's Gray Tree Frogs are an important frog species in the state of Missouri, and PVC pipe traps can be used to capture these frogs for research. This study examined the effects of foliage cover and temperature on their activity as part of a larger analysis observing the effectiveness of PVC pipe traps as a population monitoring tool for this species. A total of 65 PVC pipes were placed at various locations in and around four ponds at MOERA. Pipes placed on the ground were 1 meter long, and pipes placed on trees were 60 cm long. Tube temperature was recorded in tubes where a frog was captured, as well as a random tube in the area, using a simple mercury thermometer. A student's t-test was used to compare capture vs. random tubes. Canopy coverage was measured above PVC pipe traps each week, and pipe use by tree frogs was analyzed graphically. While no significant relationship was found between frog use of pipes and pipe temperature, there did appear to be a relationship between canopy cover and pipe usage. However, this relationship was non-normal and highly varied. Data suggests that canopy coverage may be of greater importance in habitat selection criteria than perch temperature and warrants greater study.

*Sharma, A., Lincoln University of Missouri, W. Ambrose, Ambrose Farm, and M. R. Bayan, Lincoln University of Missouri. MISSOURI GLADE COMMUNITY RESPONSES TO PRESCRIBED FIRE AND NATIVE FLORA SEEDING. Missouri has an estimated 81,000 ha of glade habitats, the majority of which are highly degraded, leading to declines in many floral and faunal species that rely on these habitats. Restoration of these habitats typically involves removal of woody vegetation, especially red cedar, from the site and introduction of a fire regime. Seeding with native grasses and forbs is sometimes used to speedup the process of restoration. In this study, we treated a degraded glade site in central Missouri to restoration treatments including hardwoods removal, prescribed burnings, and seeding with native species. After 7 years of these restoration treatments that included three prescribed burns and seed mix application following NRCS guidelines, we re-examined the groundcover community and estimated the measures of species richness, composition, and diversity using six 0.25m² quadrats along a 20-m transect replicated three times. Overall, we observed 55 species, out of which 46 were native with average species richness of 8.7/0.25m² quadrat. 67% of these species were perennial while 30% were annual. Native forbs and grasses were the dominant physiognomic group with Relative Importance Values (RIV) of 69.3 and 65.3 respectively. Non-native forbs and grasses had RIVs of 26.7 and 12.1 respectively. On a species level, *Panicum flexile* was the most dominant with RVI of 19.9. Other species such as *Bouteloua curtipendula*, *Schizachyrium scoparium*, *Daucus carota*, *Symphotrichum oblongifolium* had RVIs between 5

and 6.1. Floristic Quality Assessment of the vegetation resulted in Native Floristic Quality Index of 23.1 and Native Mean coefficient of conservatism (C-value) of 3.4.

*Spurrier, M. and J. Willand, Missouri Southern State University. SURVEY OF THE INSECT COMMUNITY ASSOCIATED WITH THE MISSOURI SOUTHERN STATE UNIVERSITY PRAIRIE. The temperate grasslands of the northern and southern hemispheres, including the once vast tallgrass prairie region of the central United States, have been mostly destroyed or altered by human activity. Conservation of the remaining prairie remnants is of importance if the ecosystem services which they provide are to continue to benefit humans. In order to determine the best management strategy when dealing with a prairie remnant, it is helpful to gather an inventory of species which are found within that community. One such group, insects, comprise the largest described taxonomic group of animals on the earth with an estimated one million species. The purpose of this study is to collect baseline data on the insect community of Missouri Southern State University prairie and determine the diversity of the insect community. This study was designed to be realistic, rapid, repeatable, and as cost effective as possible. To our knowledge there is no record of a systematic study of the insect community from this prairie. In order to quantify the insect fauna we used a combination of three different sampling techniques: pitfall and bowl traps and sweep net sampling. Insect sampling took place during May through September 2015 in 40 study plots and along four 50 meter transects. The specimens collected during the study are being identified to family using published keys. Family-level diversity and evenness will be quantified using the Shannon-Weiner diversity index (H'). After completion of this project pinned specimens will be added to the MSSU insect collection.

Geography Oral Presentations

*Richards, E. University of Central Missouri. HOW CAN COMPACT LIVING BE SUCCESSFUL IN THE UNITED STATES? Compact living entails occupying a smaller space and using more resourceful construction methods. Living a frugal lifestyle is a big change, but it is one that holds promise for creating a more sustainable society. The intended purpose of compact living is to help deal with unsustainable urbanization fueled by the American dream of achieving a higher standard of living. This project examines how likely compact living is to succeed in the United States. It argues that compact living must become desirable to Americans, in order for it to work in America. There are at least three key aspects to making compact living work in U.S. cities: the idea must be worth investing long term; designs must be sustainable to investors' financial resources; and developers must be able to identify and sell to the right populations. The main hurdles will be the time it takes for the idea to become attractive and how much capital people have to spend. This project proposes that we must first build examples in major cities, in order to demonstrate that the concept works and for the idea to gain favor over the next generation.

Geography Poster Presentations

*Wang, J. University of Central Missouri. SUSTAINABLE WETLAND PARK DESIGN IN A RESIDENTIAL AREA IN CHINA. Rapid economic development in the past decades in China has caused severe environmental degradation. Urbanization has resulted in dense residential neighborhoods with a lack of natural vegetation and wildlife. This project aims to design a sustainable wetland park near a residential area in Siyang County, Jiangsu, China. The project reviews examples from around the world in order to determine what may be applied to the design for China. These designs tend to pay attention to biodiversity, ecotourism, and water uses, which have been lacking in wetland park designs in China. Environmental and social information for the study area will be collected, which will be used to incorporate sustainable components into the design. The design will focus mainly on a sustainable sewage water disposal system and a rain water collection system for water conservation. The collected rain water could be turned into water human consumption and landscape irrigation to benefit wildlife. In this way, the goal is to help rebuild the connection between wildlife and human beings.

Geology Oral Presentations

*Salings, E., Porter-Rentz, S., and Michelfelder, G., Missouri State University. GEOCHEMICAL AND PETROLOGIC ASSESSMENT OF RHYOLITIC ROCKS IN THE MOGOLLON-DATIL VOLCANIC FIELD, NEW MEXICO. Continental arc

volcanoes represent a dramatic expression of a fundamental phenomena in global tectonics: the subduction of an oceanic plate beneath a more buoyant continental plate. The subduction of an oceanic plate results in recycling of crustal material into the convecting mantle, partial melting, and primary basalt production; during passage through thick continental crust, magmas may substantially differentiate and melt crustal rocks, accounting for the great diversity of igneous lithologies characteristic of Earth. These are important processes that must be understood in detail in order to interpret the long-term evolution of the continental crust.

Here we present variations in the isotopic and trace element composition of volcanic rocks from Bloodgood Canyon (BCT) and Apache Spring (AST) tuffs, and the Fanney Rhyolite located in the western Mogollon-Datil Volcanic Field (MDVF). The project will address several questions. First, are the BCT, AST, and Fanney Rhyolite petrogenically related and where is the magma sourced? Second, what petrogenic processes affected differentiation? Finally, to what extent do these units represent a manifestation of the MDVF ignimbrite flare-up and the transition from arc magmatism to rifting?

The BST is a crystal-rich rhyolite tuff containing quartz>k-feldspar>biotite, pumice and lithic fragments. Rb ranges from 230-330ppm, Sr from 14-83ppm, and $^{87}\text{Sr}/^{86}\text{Sr}_m$ from 0.71619-0.72477. The AST is a rhyolite tuff containing quartz>k-feldspar>biotite, and lithics. Rb (228-233ppm) and $^{87}\text{Sr}/^{86}\text{Sr}_m$ (0.71025-0.71056) are restricted, while Sr (105-399ppm) is more variable in composition. The Fanney Rhyolite is a massive flow-banded rhyolite lava and contains quartz phenocryst clusters and k-feldspars.

*Porter-Rentz, S., Michelfelder, G., and Salings, E., Missouri State University. EXAMINING ASH FALL SEQUENCES IN CALK-ALKALINE SUBDUCTION RELATED VOLCANISM, SOUTHERN NEW MEXICO. The Mogollon-Datil volcanic field (MDVF) is a 40-20Ma cluster of caldera activity in southern New Mexico tied to the subduction of oceanic lithosphere beneath the North American continental plate. The calk-alkaline magmatism of three calderas in this field (Mogollon, Bursum, and Gila Cliff Dwellings) produced several voluminous regionally dispersed ash flow tuffs. This study will specifically examine the volcanic rocks: Cooney Formation (a compositionally zoned rhyolitic-quartz latite ash flow tuff containing quartz>k-feldspar>plagioclase>biotite, pumice and lithic fragments. Rb ranges from 213-317ppm, Sr from 104-108ppm, and $^{87}\text{Sr}/^{86}\text{Sr}_m$: 0.71326-0.71534), Davis Canyon Tuff (a phenocryst poor, high-silica rhyolite ash flow tuff containing sanidine>quartz>sodic plagioclase. Rb ranges: 214-230ppm, Sr: 42.2-63.2ppm, and $^{87}\text{Sr}/^{86}\text{Sr}_m$: 0.71383-0.71464), and the Shelley Peak Tuff (a compositionally zoned, crystal-rich rhyolite tuff containing sodic plagioclase>minor sanidine>biotite>cpx. Rb ranges: 154-213ppm, Sr: 105-245ppm, and $^{87}\text{Sr}/^{86}\text{Sr}_m$: 0.70944-0.7112) to further elucidate their petrogenic origins, attempt to determine if they may be of the same magmatic source, and yield data that could help model processes that would generate magma of these particular compositions. This study will examine compositional variation between the Davis Canyon, Shelley Peak and Cooney Tuffs and help with understanding the magma plumbing system during each eruption. More specifically, we will evaluate possible crustal components of these units, along with looking for geochemical signatures of arc or rift related magmatism. We will compare previous geochronology results (K-Ar and U-Pb fission track) and whole rock major and trace element geochemistry to data obtained via $^{40}\text{Ar}/^{39}\text{Ar}$ and U/Pb dates and new whole rock Sr, Nd and Pb isotopic ratios.

*Mikaela, R. and Schmidt, D., Westminster College. FOSSIL VERTEBRATE MICROSITES FROM THE GRAND RIVER NATIONAL GRASSLANDS: NEW INSIGHT INTO FAUNAL ANALYSIS OF THE HELL CREEK FORMATION IN SOUTH DAKOTA. In the summers of 2014 and 2015, a field team from Westminster College collected vertebrate microfossils from the Grand River National Grasslands of South Dakota. Microfossil material was recovered from three new late Cretaceous localities (DP-8, 10, and 13) within the Hell Creek Formation. Although major discoveries of Hell Creek material are known from South Dakota, little is understood about faunal assemblages collectively. Furthermore, most of what we know about microsities within the Hell Creek Formation comes from Montana and North Dakota. Therefore, the goal of this research is to obtain a better understanding of a more complete faunal interpretation from South Dakota and how it compares to sites in Montana and North Dakota. The DP-10 and 13 microsities yielded material that included a mix of fish, turtle, crocodile, champsosaur, and dinosaur. DP-8 contained a high concentration of fish scales and vertebra, and two isolated dinosaur elements. In comparison, DP-10 and 13 exhibit taxa represented by both aquatic and terrestrial environments and is interpreted to be associated with floodplain deposits. This is further supported by chemical analysis of sediments. Based on taxonomic abundances, DP-8 is interpreted to be mostly aquatic. Future work will consist of continued chemical analysis of mudstone matrix and correlation of these microsities within the Hell

Creek strata of the Grand River National Grasslands. The culmination of these data will assist in expanding our knowledge of Hell Creek faunal assemblages in South Dakota and across the Williston Basin.

*Howard, T. and Schmidt, D., Westminster College. HISTOLOGY OF A BRONOTHERE FORELIMB: NEW FRONTIERS OF BRONTOTHERIDAE BONE CHARACTERISTICS. In the summer of 2015, a large fossilized ungulate radius (TS-6-15-WC) was excavated from Toadstool Geologic Park in Nebraska. Based on size and morphological characters, the element was identified as the right radius of a brontothere. Fracturing of the bone reveal both pre and post fossilization deformation. However, rapid preservation of the bone is suggested by little diagenesis and prominent details in articulation surfaces of distal and proximal ends, as well as elevated surfaces for ligament attachments. Much of what we know about brontotheres comes from external bone morphological features. Virtually, no histological information exists regarding bone growth rates, and age of brontothere individuals. Thin sections from the shaft of TS-6-15-WC were taken to observe skeletal structures of growth rates and determine the age of the individual. Vascular canals are laminar, and lines of arrested growth are distinct and well preserved in compact bone. Thus, preliminary data exhibit rapid growth rates and that the individual may not have reached full adult growth capacity. Currently, further research is being conducted to determine gender and potential diseases using cellular structures of the bone. Future work will be dedicated to comparing our results with modern rhinos (a closest extant relative) so a better understanding of the brontotheres life history can be achieved.

*Bolen, M. and Schmidt, D., Westminster College. TAXONOMIC-SEXUAL DIMORPHIC DESTINCTION AND PALEOENVIRONMENT ANALYSIS OF A FOSSIL TORTOISE SHELL. A well preserved fossil tortoise shell (SD -1-8-12) was collected from Oligocene strata in South Dakota. The plastron contains a concave posterior and suggests the individual was a male. A CT scan revealed fore and hind limb elements preserved within matrix inside the shell. External matrix and fossil content suggest the shell was buried along a floodplain. Complete shells of Oligocene tortoises are common, but rarely contain complete limb and skull material. This study focuses on a comparative analyses between SD -1-8-12 and other collected Oligocene tortoises. In the past, identified museum specimens were typically based on stratigraphic position, geographic location, and qualitative assessments. Consequently, many collected specimens are identified as *Stylemys*. In the last couple of decades more attention has been diverted to quantitative analyses of the shell. The nuchal element of the shell shows variation among taxa, and provides an opportunity to better understand the taxonomic relationship between SD-1-8-12 and other Oligocene tortoises. The current investigation shows that many museum specimens identified as *Stylemys* quantitatively compare favorably to SD -1-8-12. However, at least two distinct trends are recognized when the length and width dimensions of the nuchal are graphed. The nuchal of the extant *Gopherus agassazii* male and females were measured to see if sexual dimorphism is expressed in the length-width ratio. Both male and females plot along the same trend line but are separated by shell size. Therefore, Oligocene tortoise shells within museum specimens should be scrutinized before osteological comparisons are made taxonomic identification.

*Hagni, R., Missouri University of Science & Technology. COMPARISONS OF SURFACE OUTCROPS WITH UNDERGROUND EXPOSURES OF MISSISSIPPIAN CHERTY LIMESTONE BEDS IN NORTHEAST OKLAHOMA, SOUTHWEST MISSOURI, AND SOUTHEAST KANSAS. Land remediation in the former Tri-State Zinc-Lead District under EPA contracts involves waste materials mined from Mississippian cherty limestone beds in Oklahoma, Missouri, and Kansas. These stratigraphic units also are involved in the petroleum industry "Mississippi Lime Play." These two current activities have prompted this comparison of the character of Mississippian stratigraphic beds in outcrop to those well-exposed beds in the underground mines. Land remediation in the Oronogo-Webb City-Duenweg mining field in Missouri involves beds at the bottom of the mined sequence, namely O, P, and Q beds, or "sheet ground" beds. These are thin beds, each up to about 10 feet thick, composed of alternating limestone and chert. Land remediation in the Picher field of Oklahoma, by contrast was mainly from M bed. The M bed is a limestone containing chert nodules and lenses, up to 110 feet thick, and altered from crinoidal limestone to sparry calcite where mineralized. In areas of intense mineralization the M bed chert forms breccias enclosed in introduced jasperoid, and may be thinned by ore fluid dissolution to five feet. Unmineralized M bed is well exposed at Goodman. Missouri.

*Hu, W., Liu, F., Dolan-Timpe, M., and Yang, J., Lincoln University. A DIFFUSIVE HYDROGRAPH MODEL IN GOODWATER CREEK EXPERIMENTAL WATERSHED: THE TIME CONSTANT AND CONTROLLING FACTORS. Low percolation rate and high runoff potential of claypan soils cause rapid stream flow rises following intense storms and increase the risk of great loss of property and life. A hydrograph model based on Darcy's law and diffusion allows for easy determination of discharge responding to storms with only a single free parameter, basin time constant b . The objectives of this study were to determine b values and to understand the factors controlling b values in Goodwater Creek Experimental Watershed (GCEW, 73 km²), located in north central Missouri. Daily flow measured since 1971 was used and 468 single storm events were selected. Results indicated the mean b values were 0.46 and 0.40 using volume and fitting methods, respectively, with a range of 0.05-1.18 and 0.06-1.5. The b values were primarily controlled by antecedent rainfall, rainfall on the day and peak flow. The b values were correlated with peak flow by a power law with a R^2 of 0.49 for fitting method and 0.54 for volume method. The range of b values varied from 0.2-1.5 in the low peak flow condition (< the 25th percentile or 62,680 m³ day⁻¹) to 0.09-0.9 in the medium peak flow condition (between the 25th and 75th percentile or 62,680-763,904 m³ day⁻¹) and 0.06-0.6 in the high peak flow condition (> the 75th percentile or 763,904 m³ day⁻¹) based on the b values from the fitting method. This study helps improve the quality of hydrograph simulation and thus water resources management in this watershed.

*Joshi, A. and Appold, M., University of Missouri. METHANE TRANSPORT POTENTIAL OF POROSITY WAVES IN ELASTIC SEDIMENTS OF THE EUGENE ISLAND FIELD IN THE GULF OF MEXICO BASIN. Geophysical and geochemical observations of the Eugene Island field in the Gulf of Mexico basin show overpressured hydrocarbons to have migrated through the Red fault at rates on the order of millimeter- to kilometer per year despite the fault's very low permeability. High pore fluid pressures can reduce effective stress and dilate porosity to form porosity waves capable of traveling at rates much greater than predicted by Darcy's law. Previous study show porosity waves were not likely to have transported oil at the Eugene Island because of restricted geological conditions for its formation. The purpose of the present study was to evaluate porosity wave behavior for methane transport at the Eugene Island using a one-dimensional numerical solution to equations of pore fluid mass conservation and Darcy's law for elastic, methane-saturated sediment. Results show that rates of gradual fluid pressure generation in a source rock caused by basin diagenesis are too slow for porosity waves to transport methane at kilometer per year rates. However, provided instantaneous fluid pressure generation, porosity waves can transport methane at rates on the order of at least 10's of meter per year over a vertical distance of 1-2 kilometers, but may also fracture the rock through which they travel. Although, earthquakes can increase fluid pressures instantaneously, it is unlikely that they produced porosity waves in seismically quiet Eugene Island. Nevertheless, porosity waves could play a major role in transporting methane from source rocks to reservoirs within 1-2 kilometer distances in seismically active regions.

Geology Poster Presentations

*Schott, A. and Schmidt, D., Westminster College. WATER QUALITY ANALYSIS OF FINGER LAKES STATE PARK: POTENTIAL IMPACTS OF A RECLAIMED COAL MINE. Finger Lakes State Park (FLSP), a reclaimed coalmine north of Columbia, Missouri, is now used as a recreational area. Because abandoned coal mines can negatively impact surrounding ecosystems, this project uses water quality analyses to understand the potential effects of this unique Missouri lake system. The only known water quality data is for *E. coli* in the designated swimming area of the lake. The current study is interested in learning more about the water quality of the entire lake and potential effects on the surrounding ecology. Therefore, several preliminary field and laboratory tests were conducted in the fall of 2015. These tests were conducted at three different locations (FL-1, FL-2, and FL-3) at three different depths. In comparison, FL-1 shows differences in water quality tests between FL-2 and 3. Surface evidence suggests location FL-1 is in close proximity to areas containing drainage from nearby tailings. Our findings are being compared to lakes associated with abandoned coal mines in Henry County, and acid mine drainage data of various locations in Missouri. Furthermore, plans to rerun water quality tests, and collect lake-bottom sediments in the summer of 2016, will provide for better comparisons between FLSP, and known aquatic systems associated with abandoned coal mines. Ultimately, our goal is to gain a more comprehensive understanding of the potential impact that a reclaimed mine, like FLSP can have on the surrounding ecosystem.

*Tjizembua, T. and Schmidt, D., Westminster College. STRATIGRAPHIC EXAMINATION AND COMPARISON OF THE HELL CREEK FORMATION WITHIN THE GRAND RIVER NATIONAL GRASSLANDS. Four stratigraphic sites within the Hell Creek Formation of northwestern South Dakota were chosen for description and analysis in the summer of 2015. The Hell Creek stratigraphy within the Grand River National Grassland is poorly understood, and offers an opportunity for a more detailed analysis. Thus, four exposed transects within the Grand River National Grasslands were measured and used for local correlation. Each location exhibits predominantly mudstone with interbedded siltstones and sandstones. Minor layers of coal are present in three of the four measured transects. Furthermore, diagenetic iron concretions are prevalent at all four measured sections, and indicate prolonged periods of water saturated sediments. In contrast, the presence of barite nodules suggest periods of desiccation as these diagenetic features fill in gaps of contracting mudstones. Fossil vertebrate material reflects late Cretaceous fauna and no evidence was observed to indicate that lower Paleocene strata is present within the field area. This is also supported by sedimentary characteristics, as all lithological units compare favorably to previously described Hell Creek strata. Currently, no distinct correlations are recognized within the measured sections and may be explained by local tectonic disturbances as several faults were recognized within the area. This study attempts to better understand the local stratigraphic relationships of each measured section and how they compare to regional Hell Creek strata of Montana and North Dakota.

Math and Computer Science Oral Presentations

*Redden, Jr, D. SECURING YOUR SMART DEVICE. Device security has become one of the hottest topics in today's society. Millions of consumers own or have access to a smart device that not only allows them to communicate verbally with another party but has the ability to carry their financial and personal information around with them. The concern today is if the device is secured. Securing your smart device should be of great concern for all consumers because of the potential goldmine of data that a thief or hacker can accumulate from such device. This discussion will talk about ways to secure your smart device and ways to protect oneself from the potential disaster a breach can cause on an individual's life.

*Gohil, P., S. Joshi, S. Singh. University of Central Missouri. RELEVANCE MAPPING AND IMPACT COMPUTATION OF WIKIPEDIA EDITS. *Wikipedia* is 'internet's largest' as well as the 'most popular general reference source'. It boasts over 38 million articles and is constantly growing. The open collaborative nature of *Wikipedia* results in 170,000 edits per day on its articles. Most revisions are minor, like spelling and grammar checks. The edits related to information alteration, addition or deletion of facts are generally classified as major edits. Edits can further be categorized as relevant and impactful or otherwise. Due to volume of edits, it is critical to automatically and instantaneously analyze the nature of these changes. We have created a repository of links to *Wikipedia* edits that is being automatically updated with each edit, minor or major. This real time database is used to calculate the relevance and impact of a major edit on a *Wikipedia* article. Ontological hierarchy, cognitive synonyms or synsets and concept based ranking is used in the calculation of relevance and impact of edits. Statistics on relevance and impact of an edit is used to predict the nature of edits and thwart any attempts to vandalize *Wikipedia* articles. We aim to help maintain the integrity of *Wikipedia* articles by making them more accurate and reliable.

*York, N. Lincoln University. MUSIC TRANSCRIPTION TECHNIQUES USING NON-NEGATIVE MATRIX FACTORIZATION FOR REAL-TIME RESULTS. During our research into non-negative matrix factorization, (informally nmf), we have found growing interest in applications pertaining to signal analysis. We looked at nmf use in relation to music transcription in particular, and at both monophonic and polyphonic situations. When compared to older transcription techniques, it was apparent how processing time would be decreased to produce real-time results. This near instantaneous processing of signals is accomplished through different methods of calculating distance and divergence. These distances are based off of the signal being analyzed and then comparing it to a database of pre-learned characteristics of other similar signals. In our research we first gained knowledge of matrix operations then progressed to Fourier Transforms. All before we could begin the in-depth focus of specific nmf methods. We first looked at the Euclidean distance equation, then moved to the Kullback-Leibler divergence, and finally worked towards the understanding of the Itakura-Saito Divergence method. Through the research of these methods a new divergence calculation method was found; Beta-divergence is an equation that allows for all three different techniques to be used through manipulation of the beta variable. Subbing in either 0

or 1 for the beta variable would result in equations that lead to either the Itakura-Saito or Kullback-Leibler divergence methods. When substituting $\text{Beta}=2$, this will result in an equation of the half squared Euclidean distance formula. This Beta-divergence method is also used with beta equalling non-whole numbers. Beta-divergence offers the highest chance of real-time signal decomposition for analysis, and will be useful in many areas.

*McKeever, J. Truman State University. A GRAPH THEORY-BASED APPROACH TO PRODUCT RECOMMENDATION USING FUNCTIONAL PROGRAMMING. User-to-user connections are an increasingly important tool quickly becoming standard practice for product recommendations of all types, but particularly when it comes to book recommendations. By warehousing large amounts of book data and comparing the preferences of readers, we can write sophisticated computer algorithms to generate accurate book recommendations for a given individual. In this investigation, our approach is implemented using the functional programming paradigm in which functions are evaluated mathematically and are equivalent in treatment to their returned values. The algorithm developed for this project involves a breadth-first search on a graph of reader nodes connected to book nodes. Reader nodes have connections to book nodes which represent the reader's opinion of a particular book: readers who are connected to the same book create a path by which books may be recommended to both of them in turn. Functional programming is particularly well-suited for this task, as it allows for high levels of parallelism at run-time, which enables the system to scale as the database of readers and books grows larger. Results thus far have indicated that the algorithm returns appropriate recommendations based on the reader's expressed preferences.

*Free, V., J. Seiffert. Truman State University. LINK STATE ROUTING WITH SIMULATED ANNEALING. Computer networks are a valuable way to facilitate communication in businesses, home applications, and more, with the Internet being a prime example. It is worth exploring how communication happens in a computer network. At the network layer, a computer network consists of routers and links between the routers. To communicate, the routers send packets to each other. Routing algorithms are used by computer networks to find the best path to send packets from one router to another. The network layer must choose appropriate paths to minimize the time and distance each packet travels while also evenly distributing the network traffic and accounting for changes in the network topology. One type of routing algorithm is link state routing. In this algorithm, each router discovers the costs to its neighbors, shares this knowledge with every other router, and computes the shortest path to each router using Dijkstra's algorithm. In this research, we investigate both a straight-forward implementation of link state routing as well as one in which we use the machine learning technique of simulated annealing to attempt to improve the process of finding best paths. This is especially valuable in a situation where the network topology can change.

*Dawson, M., J. Wright, M. Omar. University of Missouri - St. Louis MOBILE DEVICES: THE CASE FOR CYBER SECURITY HARDENED SYSTEMS AND METHODS TO ADDRESS SECURITY RELATED ISSUES. Mobile devices are becoming a method to provide an efficient and convenient way to access, find and share information; however, the availability of this information has caused an increase in cyber attacks. Currently, cyber threats range from Trojans and viruses to botnets and toolkits. Presently, 96% of mobile devices do not have pre-installed security software while approximately 65% of the vulnerabilities are found within the application layer. This lack in security and policy driven systems is an opportunity for malicious cyber attackers to hack into the various popular devices. Traditional security software found in desktop computing platforms, such as firewalls, antivirus, and encryption, is widely used by the general public in mobile devices. Moreover, mobile devices are even more vulnerable than personal desktop computers because more people are using mobile devices to do personal tasks. This review attempts to display the importance of developing a national security policy created for mobile devices in order to protect sensitive and confidential data. Results of this review provide methods to address security related issues in mobile devices.

*Dawson, M., M, Leible. University of Missouri - St. Louis. OSINT EXPLOITATION OF UNIVERSITY TWEETS. With the rise of Web 2.0, Twitter has become a tool of choice for universities looking to increase their digital footprint. However there is not much guidance given into the protections of these tweets or the secure integration of Twitter into other Web 2.0 applications. As the debate for cyber threats continue to increase, these tweets must be protected and delivered in a manner that protects the sender. Explored in this report are the methods, which Twitter, and its data can be exploited for nefarious use.

Physics & Engineering Oral Presentations

*Chandrasekhar, Meera, Menon, D., Kosztin, D., Steinhoff, D. Department of Physics and Astronomy, University of Missouri – Columbia. USE OF A CURRICULUM APP IN TEACHING AND LEARNING. Mobile devices are replacing textbooks in classrooms. We describe a conceptual physics curriculum app and its use in a college-level class for elementary education majors. The Exploring Physics curriculum app, based on inquiry and modeling pedagogies, is a combination textbook, workbook and lab-book. Students can enter text, drawings, graphs, tables or data in the app. They submit their work for grading and receive feedback through the app. Two studies have been conducted on the use of this app in the classroom. The first study compared the technology self-efficacy of two sections of the class; in one that used a traditional workbook, and the other that used the app. In the second study students' growth in physical science content knowledge was measured as they used the app. Results of the studies will be presented. Findings have implications for preservice teacher preparation for future use of technology in science teaching.

*Cobb, Michael L. Department of Physics and Engineering Physics, Southeast Missouri State University. DOUBLE BLIND PEER TO PEER GRADING. Students don't fully appreciate the value of writing a good lab report or documenting an effort like writing computer programs. Because of privacy concerns, students are not aware of how their works compare to their colleagues'. I have noticed that when we hand back graded lab reports students hardly look at them, except to see their grade and maybe to flip through some pages, and then place them in their binders. I also notice that the same students have the same deficiencies in their reports from week to week. Double Blind Peer to Peer grading hopes to address these issues by: 1) forcing students to rely on documentation to follow computer code, 2) allowing them to see how other students approach the tasks at hand, 3) working on their evaluation skills, and 4) it does this in a non-threatening, anonymous manner. I plan to implement this model on homework assignments and projects as part of a Computer Programming for Scientists and Engineers course that I will be teaching in the fall for the first time. If this is successful, I plan to try the same technique for laboratory reports the following semester in our majors' Physics II course.

*Howard, Tyler. Department of Physics and Engineering Physics, Southeast Missouri State University. SIMULATION OF SPACE CRAFT REENTERING THE EARTH'S ATMOSPHERE. Objects reentering the Earth's atmosphere experience a myriad of forces acting upon them. Scientists have a hard time modeling the motion of the craft by hand because they must use an iterative method to continuously update distance, forces, air density, momentum and finally position. By using the computer language VPython, the trajectory of the space shuttle can be tracked as it reenters the Earth's atmosphere from a stable orbit that is 500 kilometers above the Earth's surface, or about the altitude of the International Space Station. This program will begin by asking the user to input a speed by which to slow the craft down, and as the craft loses altitude, taking into account the forces of gravity and air resistance the program will display the acceleration, velocity, altitude and/or the potential and kinetic energy of the craft as a function of time. From this program we can compare the amount of energy lost and acceleration when the craft is slowed down gradually or in large increments. We can also demonstrate the effect of increasing the speed of the craft, which will result in an elliptical orbit. With this program we can accurately model the path of an object as it reenters the Earth's atmosphere and simulate the forces and energy transfer that the object will experience.

*Bucklein, Brian K.¹, Moody, J. W.², Hintz, E. G.² ¹Missouri Western State University. ²Brigham Young University. THE EFFECT OF NEARBY VOIDS ON GALAXY NUMBER COUNTS. The size, shape and degree of emptiness of void interiors sheds light on the details of galaxy formation. A particularly interesting question is whether void interiors are completely empty or contain a dwarf population. However, the nearby voids that are most conducive for dwarf searches have large angular diameters, on the order of a steradian, making it difficult to redshift-map a statistically significant portion of their volume to the magnitude limit of dwarf galaxies. As part of addressing this problem, we investigate here the usefulness of number counts in establishing the best locations to search inside nearby ($d < 300$ Mpc) galaxy voids, utilizing Wolf plots of $\log(n < m)$ vs. m as the basic diagnostic. We examine the signatures of three void profiles, "cut out", "built up", and "universal profile" carved into Monte-Carlo Schechter function models. We investigate the signatures of voids in the Millennium Run dark matter simulation and the Sloan Digital Sky Survey. We find that evidence

for cut-out and built-up voids is most discernible when the void diameter is 40% of the distance to its center or more. However, the density distribution of the universal profile that is characteristic of actual voids is essentially undetectable at any distance. A useful corollary of this fact is that galaxy counts are a reliable measure of survey completeness and stellar contamination even when sampling through significant voids.

*Haboub, Abdelmoula¹, MacDowell, A. A.², Stefano, M.², Dilworth, Y. P.² ¹Lincoln University. ²Lawrence Berkeley National Laboratory. HIGH NUMERICAL APERTURE LENSLESS IMAGING FOR FLUORESCENT X-RAYS. Modified Uniformly Redundant Array (MURA) coded apertures with about 50% open area were designed and developed at the Advanced Light Source (ALS), Berkeley National Laboratory. These coded apertures were employed in front of a pixilated charge coupled device (CCD) detector to image fluorescent x-rays that are emitted from samples when irradiated with synchrotron x-ray radiation at the micro-tomography beamline 8.3.2, ALS. The replacement of the previous 0.4% open area No-Two-Hole-Touching (NTH) coded apertures by the newly designed MURA coded apertures has significantly improved the throughput by more than 100 times, and consequently improved the system optical sensitivity of the coded aperture x-ray imaging detector. Using these coded apertures, several coded x-ray images were obtained with different fluorescent samples. The algorithms to reconstruct the x-ray images from the recorded encoded patterns have been developed by means of modeling and confirmed by imaging experiments. 3D x-ray images of fluorescing samples have been also reconstructed by using the MURA coded aperture detector and by scanning an x-ray 80-mm slit combination across the sample. To allow elemental imaging of samples, the energies of fluorescent x-ray photons were resolved by image processing of the x-ray coded images that were obtained with very short exposure time.

*Khopang, S., Pritchard, K., Daugherty, M., Lathrom, G., McKee, D., Marsh, D., Missouri Southern State University. DESIGN OF A LOW-COST RING-IMAGING CERENKOV DETECTOR. Technology available today permits us to detect and measure muons in an undergraduate physics lab. We are developing a low-cost RICH detector by modification to a digital camera. The detector may be used in an undergraduate physics teaching laboratory. We will present the materials selection and engineering involved in building the detector from commercial off the shelf equipment, and plans for making a non-trivial measurement with the detector.

*Burrow, Damon, OConnor, T., Hart, V., Strosnider, J., Strief, D. William Woods University. MEDIAL SPLINE REPRESENTATIONS FOR AUTO-CONTOURING OF MALIGNANT LESIONS DURING EXTERNAL BEAM ADAPTIVE RADIOTHERAPY. Medial representations of 2-Dimensional objects can be accomplished by defining the medial locus points as products of a 2D boundary. The objective of this project was to develop a robust algorithm for generating medial representation (skeletal) splines for incomplete and non-closed 2D organ contours. Surface contours are used in the treatment planning process during external beam radiotherapy. After initial diagnosis, a patient returns for treatment days or weeks later. At this time, their anatomy may differ significantly. The ability to automate an adaptive treatment plan based on a current CT image would lead to improved treatment plan confidence. Manually creating a new plan is not feasible and auto-contouring is required to identify organ boundaries. Existing segmentation algorithms often fail when organs, such as the prostate, bladder, or rectum, impinge on each other. The proposed algorithm would be capable of forming a complete medial spline from which the closed 2D spline could be generated. The medial spline could also be warped during deformable image registration and used to align the planning and treatment images. A 1D spline would contain less information and would be less prone to warping errors. This would lead to more accurate tumor localization, lower toxicity from diffused radiation, and decreased treatment times. Medial splines constructed using our algorithm will be presented. 2D surface contours generated from the 1D medial splines will also be compared with conventional spline techniques and discussed.

*Murphy, M., Starkey, B., Khopang, J., Gilbert, L., Marsh, D., Missouri Southern State University. SYNTHESIS AND APPLICATIONS OF LEAD SULFIDE AND ZINC SULFIDE QUANTUM DOTS. Quantum dots (QDs) are quasi-spherical semiconducting nanoparticles with a diameter less than that of its exciton Bohr radius which contain electrons that are bound in discrete quantum energy states. Due to quantum effects, QD size can be fine-tuned through chemical processes to absorb light in specific frequencies. As a result, QDs have a variety of practical applications. Lead sulfide (PbS) QDs were synthesized using a wet chemical process similar to the Hines and Scholes method at varying

temperatures. PbS is an exciting QD material due to its relatively low band gap energy and large exciton radius which allows for a wide range of tunability. We also used a similar process to synthesize zinc sulfide QDs.

*Kovach, P., Gilbert, L., Marsh, D., Missouri Southern State University. SYNTHESIS OF ZINC SULFIDE QUANTUM DOTS ON A GRAPHENE SUBSTRATE. Graphene, as a material, displays incredible conductivity in layers as small as one atom thick. Quantum dots made of Zinc Sulfide (ZnS) have shown absorbance within the UV range of the electromagnetic spectra. By attaching these quantum dots to graphene, it is theorized that the energy absorbed by the ZnS can then be transported by the graphene to create an electric current. One such method, a one-step synthesis, grows ZnS quantum dots directly on the graphene substrate. This method may lead to transparent layers for solar cells.

*Haddock, Tyler, Meziani, M., Richardson, D. Northwest Missouri State University. SILVER NANO-RODS: PRODUCTION AND INTERACTIONS. This study looked at the production of silver nanorods that are coated in a surfactant and the interaction of these nanorods with external electric fields of varying strengths. The use of a surfactant prevents clumping of the nanorods which would negate their usefulness in the latter part of the study. The nanorods were characterized using UV/Vis spectrometry and Scanning Electron Microscope imaging and their quality and aspect ratios determined. After dilution to various concentrations, the nanorod solution was placed within cuvettes that were then placed within an externally applied electric field. Using a temperature-stabilized HeNe laser operating at 632.8nm, the solutions were probed with and without applied electric fields. Without an applied electric field, the orientation of the nanorods would be random and no polarization-dependent features were expected. This data was compared to that obtained when the electric field was applied to determine if the nanorod solutions gained a preferred direction which had significant interaction with various polarizations of the laser light.

*Sundararajan, Jency. Missouri Southern State University. Golam Rabbani, M. University of Washington, Anant Anantram, M.P. University of Washington. SIMULATION STUDIES ON SCHOTTKY MODULATED SILICON NANOWIRE FET SENSOR FOR SPECIFIC DETECTION OF BIOLOGICAL AND CHEMICAL SPECIES. Direct detection of biological and chemical species is one of the greatest potentials of nanotechnology which can deliver highly sensitive, label-free, cost-effective, portable, low-power and reliable sensing devices. In this project, simulation studies on the electrical properties of p-type Silicon nano-Field Effect Transistor (p-Si nano-FET) devices were investigated for specific detection of biological and chemical ions. Schottky modulation in p-Si nano-FET devices were achieved by making two specific changes to the device structure. One set of nanodevices were given a Schottky-Ohmic contact and the variations in transport properties were compared with the conventional Ohmic-Ohmic contacts in order to understand the influence of barrier properties in affecting device sensitivity and selectivity. In the second set of devices the surface of p-Si nanoFET was modified by creating localized Schottky barriers via metal nanoparticle functionalization leading to an inhomogeneous / homogeneous depletion within the FET device depending upon nanoparticle density. The influence of positive and negative charges were studied for both device types. From the simulation results, it can be observed that the Ohmic-Ohmic device displayed a minimal response to the influence of charges (<1%), whereas, a gigantic response of ~70-90% was observed with Schottky-Ohmic contacted device. The doping concentration of the conducting channel, work function of the metal electrical contacts, concentration of interface charges and the doping concentration of Schottky contact are influential in modifying the charge transport in silicon nanowire devices for detection of specific biological and chemical species.

*Shaw, John, Zhang, Y., Monismith, D., Chakraborty, H. Department of Natural Sciences, Northwest Missouri State University. COMPUTATIONAL SIMULATIONS OF CHARGE TRANSFER FOR A HYDROGEN ION SCATTERING FROM NANOSTRUCTURED SURFACES. Nanostructured surfaces can be broadly defined as substrates in which the typical features have dimensions in the range of one to several nanometers. The recent surge of interest in these systems originates from the remarkable quantum effects that may arrive from critical size reduction. We studied the electron dynamics in mono-crystalline metal surfaces with stepped vicinal surfaces. The unoccupied bands of the surface are resonantly excited via the charge transfer interaction of the surface with a moving hydrogen ion. The interaction dynamics are simulated via a quantum mechanical wave packet propagation approach in which the survival probability of the interacting ionic species was calculated. Results clearly show resonant states in the ion survivability. The velocities at which peaks in survival probability occur do not depend on where the ion approaches the vicinal steps on the surface

nor do they depend on the height or width of the vicinal steps. The velocities at which peaks in survival probability occur do depend on the ion trajectory as well as the distance of closest approach, which indicates a strong dependence on the time of interaction.

*Schultz, Conrad. University of Missouri – Columbia. ANALYSIS OF ADSORBED NATURAL GAS TANK TECHNOLOGY. With gasoline being an ever decreasing finite resource and with the desire to reduce humanity's carbon footprint, there has been an increasing focus on innovation of alternative fuel sources. Natural gas burns cleaner, is more abundant, and conforms to modern engines. However, storing compressed natural gas (CNG) requires large, heavy gas cylinders, which limits space and fuel efficiency. Adsorbed natural gas (ANG) technology allows for much greater fuel storage capacity and the ability to store the gas at a much lower pressure. Thus, ANG tanks are much more flexible in terms of their size, shape, and weight. Our ANG tank employs nanoporous activated carbon as its adsorbent material. This makes it 4.5 times what a tank without carbon would hold at 35 bar. Several different configurations of this Flat Panel Tank Assembly (FPTA) along with a Fuel Extraction System (FES) were examined to compare with the mass flow rate demands of an engine.

Seydel, Florian¹, Gillespie, A.¹, Stalla, D.¹, *Bal, A.¹, Lee, M.², Pfeifer, P.¹ ¹Department of Physics, University of Missouri – Columbia, ²Department of Chemistry, University of Missouri – Columbia. ENHANCING THE SURFACE AREA OF GRAPHITIC CARBON NITRIDE FOR HYDROGEN STORAGE. Hydrogen is a desirable alternative fuel source for vehicular applications because its full energy cycle produces less pollutants. However, hydrogen storage requires large, heavy tanks and extremely high pressures. Adsorbent materials, such as nanoporous carbon (NPC), can increase the storage capacity of tanks because they are able to store the gas at lower pressures. This opens the possibility for more space-efficient tank design with thinner walls. Though NPC materials have a specific surface area ca. 2500 m²/g, they adsorb a low amount at ambient temperatures due to their relatively low binding energy to hydrogen. Therefore, new high binding energy materials need to be characterized. One possible material is graphitic carbon nitride (GCN). Theoretical calculations of the electronic structure suggest that the material has a higher binding energy and an increased surface area due to regular, in-plane voids. Thus, GCN materials may outperform NPC. Initial surface area measurements on bulk GCN showed that the specific surface area is between 5-20 m²/g. In order to compete with NPC it is necessary to increase the specific surface area of the material. To accomplish this, we attempted to exfoliate the surface using sonication and high energy ball milling. We study the effects of these treatments using analyses of the structure via x-ray diffraction spectroscopy, nitrogen sorption, tunneling electron microscopy, and x-ray photoelectron spectroscopy.

*Haboub, Abdelmoula¹, Ivanov, V.² ¹Lincoln University. ²Nevada Terawatt Facility. STUDY OF ABLATION AND IMPLOSION PHASES IN CYLINDRICAL AND STAR WIRE ARRAYS. An advanced set of laser probing diagnostics was applied for the investigation of implosion dynamics and magnetic fields in cylindrical, nested, and star wire arrays at the Nevada Terawatt Facility. Plasma diagnostics at a wavelength of 532 nm provide a five-frame optical probing of the z-pinch including shadowgraphy, Faraday rotation diagnostics, interferometry, and schlieren diagnostics. The Faraday rotation was applied for the investigation of magnetic fields and currents as well as structures in the plasma column of the precursor in wire array z-pinch. Faraday images and their complimentary shadowgrams reveal the presence of magnetic fields (B) that have opposite directions between both sides of the precursor, inside which the current was flowing since the early stage of the implosion of cylindrical and conical wire arrays. The current in the precursor plasma column was estimated to be 0.05-0.15 MA. Measurement of the electron plasma density with regular laser interferometry meets the zero-number fringe issue on the axis of the z-pinch. We suggested a new diagnostic to record a continuous history of the interferograms and the individual evolution of the fringes. In this case, the plasma density could be measured by deriving the shift of the fringes on the slit of a streak camera. A new type of "star" wire array was designed and studied. These loads consist of multiple nested, low-wire-number, cylindrical arrays aligned azimuthally such that the wires appear as "rays" extending from the axis of symmetry.

Physics & Engineering Poster Presentations

*Hibbeler, Leah, *McCarthy, M., Myers, H., *Storer, M. Rockhurst University. TYMPANOGRAM MODELING TO OBSERVE THE EFFECTS OF FLUID BEHIND THE TYMPANIC MEMBRANE. The purpose of this Physics of Medicine project was to

design and build a tympanic membrane model to investigate the physics principles that are involved in the functioning of the middle ear under standard and adjusted pressure values. Research was done to understand how a tympanogram can be used to measure hearing impairments in the ear due to increased fluid pressure. Through trial and error, a simplified model of a tympanogram was constructed. In the model, a frequency generator emitted sound through a latex covering, representative of the tympanic membrane, and into a plastic container that represented the middle ear. The sound was then received on the opposite side of the container by a microphone. To change the pressure behind the membrane, water was added to the container to represent fluid behind the eardrum. The sound was emitted from a speaker at a frequency of 516 Hz, and the amount of sound transmitted through the system was collected by the microphone, and measured using Logger Pro. Results from the experiment indicated that when fluid is present behind the membrane, the amount of the sound wave transmitted is decreased because more sound is reflected due to a difference in impedance. The model of the tympanic membrane will be used in the Rockhurst University Physics of Medicine program to study the effect of fluid pressure on the ear. Future experimentation plans are to use the model to integrate physics principles of hearing and sound when investigating other hearing impairments.

*Van Deuren Jr., Leo D., Deligkaris, C. Drury University. A COMPUTATIONAL STUDY OF TRANSIENT BEHAVIOR OF SIMPLE CIRCUITS. In most undergraduate physics courses that cover electromagnetism, surface charges and transient behavior in circuits are mentioned but not covered in great detail. Surface charges help in connecting electrostatics with circuits in physics courses and explain why the electric field inside a current-carrying wire is non-zero. We used Python and Python's visual module (VPython) to numerically model the transient behavior a simple RC circuit. We calculate the electric fields on each cell by taking into account their finite propagation speed, then we allow charges to move according to Ohm's law and continue iterating. We will present the latest results, discussion, and 3-D visualization of the electric fields for a simple RC circuit. Eventually, our goal is to make the code available to the community for other physics instructors and students to use as a tool for learning and research.

*Haboub, Abdelmoula¹, Shepherd, D.¹, MacDowell, A. A.², Nasiatka, J. R.², Bale, H. A.³, Parkinson, D. Y.². ¹Lincoln University. ²Advanced Light Source, Lawrence Berkeley National Laboratory. ³Materials Sciences Division, Lawrence Berkeley National Lab. NOVEL INSTRUMENTATION FOR 3D IMAGING WITH X-RAYS ON THE MICRON SCALE. Hierarchical structured silicon carbide ceramic composites are a contender for high temperature (~1700°C) turbine blades, hypersonic flight and space re-entry vehicle components. Operating turbines at higher temperature improves efficiency for the power generation and transportation fields. Their mechanical performance at high temperature is required to be measured as input parameters for numerical modeling code. For this reason, an ultrahigh temperature tensile testing load cell has been fabricated at the Advanced Light Source (ALS). It consists of a high temperature furnace that includes a sample load cell and also allows for the x-ray micro-tomographic imaging of the sample as it undergoes loading and failure. The compactness and adaptability of the instrument lends itself to being applied to earth science where high temperature and sample loading is required. It has been used in this field to investigate the evolution of magma texture deformation at loads and high temperature.

*Sweany, Mark. University of Missouri Physics Department ALL-CRAFT Lab. APPLICATION OF HENRY'S LAW FOR BINDING ENERGY MEASUREMENTS OF NITROGEN AND ARGON ON ADSORBENT MATERIALS. As consumption of fossil fuels increases, so do the concerns with depleting availability and emissions of greenhouse gasses. This necessitates further development of alternative fuels, such as hydrogen and natural gas. Gas storage for vehicular use currently requires large, heavy compressed gas cylinders. One option to address these problems is to use adsorbent materials, which employ Van der Waals potentials to densify the gas on their surfaces. This generates higher gas storage capacities at lower pressures, compared to simply compressing the gas, through an increased binding energy of the surface to the adsorbent gas. Binding energies to hydrogen can be determined by applying Henry's law to the low pressure regime of the adsorption isotherms between 77 and 87 K. This method has yielded binding energies as high as 10 kJ/mol for hydrogen on activated carbon. In this study, we investigate whether or not it is possible to use nitrogen and argon adsorption isotherms to determine binding energy of various adsorbent materials.

*Torres, James, Buck, Z., Zhang, T., Winholtz, R., Kaiser, H., Taub, H. University of Missouri – Columbia. NEUTRON SCATTERING STUDY OF THE FREEZING OF WATER NEAR A CUPRIC OXIDE SURFACE. Oscillating heat pipes (OHP) offer

promising two-phase heat transfer for a variety of applications, including cooling of electronic devices.¹ Recently, it has been shown that a hydrophilic CuO coating on either the evaporator or condenser sections of a flat-plate OHP can significantly enhance its thermal performance.¹ Our water contact angle measurements and environmental-SEM images show superhydrophilicity of CuO nanowire bundles of length $\sim 2 \mu\text{m}$. These findings have motivated us to assess the strength of the CuO/H₂O interaction by investigating the freezing behavior of H₂O in proximity to a CuO surface. Using the High-Flux Backscattering Spectrometer at NIST, we have measured the intensity of neutrons scattered elastically from a well-hydrated sample of CuO-coated copper foils that mimic the oxide surfaces in a flat-plate OHP. We observe both abrupt- and continuous freezing of H₂O above the CuO surface. This freezing behavior is qualitatively similar to that found for water near a zwitterionic single-supported bilayer lipid membrane.^{2,3} Further studies are planned to compare the diffusion coefficients of the interfacial water for the coated and uncoated OHPs. Supported by NSF/DGE-1069091.

¹F. Z. Zhang *et al.*, *J. Heat Transfer* (in press).

²M. Bai *et al.*, *Europhys. Lett.* 98, 48006 (2012).

³M. Miskowiec *et al.*, *Europhys. Lett.* 107, 28008 (2014).

*Prosniewski, Matthew, Gillespie, A., Stalla, D., Seydel, F., Knight, E., Pfeifer, P. University of Missouri – Columbia. VOLUMETRIC STORAGE CAPACITIES OF HYDROGEN AND METHANE ADSORBED ON CARBON NANOMATERIALS. With the growing economic and environmental cost of gasoline, there is increased interest to develop cost effective and clean burning fuels. Two options that have been gaining recent popularity for vehicular applications are methane and hydrogen gas. Storing these gases with an energy density comparable to conventional fossil fuels requires compression to prohibitively high pressures. To achieve sufficient storage we develop activated carbon and graphitic carbon nitrides, which are able to densify the gas in their pores through the process of adsorption. Compared to compressed gas, adsorptive materials allow us to store up to 6 times more methane at 296 K and up to 2 times more hydrogen at 77 K and 35 bar. In adsorbent materials, gas is stored in a highly dense film. The increase in storage from traditional gas compression is known as excess adsorption. Using various models to analyze our excess measurements, it is then possible to determine the density of this film, which revealed a saturated film density approaching 410g/L for methane and 100g/L for hydrogen. We have shown that adsorbent materials can increase storage of gaseous materials, and we hope to better our materials by increasing surface area or the binding energy.

*Pritchard, K., Khopang, S., Daugherty, M., Lathrom, G., McKee, D., Marsh, D., Missouri Southern State University. EXTRACTING ENERGY SPECTRA FROM RING-IMAGED CHERENKOV DATA. Technology available today permits us to detect and measure muons in an undergraduate physics lab. We are developing low-cost RICH detectors by modification to a digital camera. The analysis of the data produced by the device is non-trivial, and we discuss how the raw events can be processed to measure the cosmic muon spectrum.

Science Education Oral Presentations

*Haskins, Mary, Rockhurst University, GEOSPATIAL ANALYSIS USING SMARTPHONES. Geospatial analysis is becoming an integral component of many careers and is increasingly used in businesses. Therefore, incorporating geospatial labs into science courses may be useful for all students including non- majors, e.g., recent trends in business applications will be explored. Historically, learning these skills required expensive equipment and software. However, relatively new software, available free of charge, makes it easier to incorporate geospatial problems into a lecture and/or laboratory. Data collection pages can be developed by instructors in less than ten minutes and then accessed by students using a variety of electronic platforms, e.g., smartphones, iPads and tablets. After data collection is complete, the class can then seamlessly move the data onto maps for geospatial analysis. In this session participants will collect data, observe the processing of transferring the data onto a map, and create their own geospatial questionnaire ready for data collection. A brief discussion will also explore the possibility of “mining” public data for geospatial analysis in the event electronic devices are not available for student use. Because instructors can adjust question complexity as well as the method of data collection projects can be geared to any subject and/or age group.

*Ward, Katherine, Lincoln University, THE EVOLUTION OF CONSERVATION EDUCATION IN POST-COLONIAL MALAWI. Malawi is a very poor African nation with a natural resource-based economy. Those natural resources have come under increasing pressure due to expanding human populations and their activities. The country faces serious food insecurity, pollution, overfishing, soil degradation, deforestation, and global climate change concerns. The future wellbeing of Malawians depends on whether the protection of their natural environment can be secured before recovery becomes unachievable. In response to these numerous challenges, important educational advancements are being made in agriculture, nutrition, post-harvest management, adult literacy, cooking practices, climate change adaptation strategies, natural resource conservation, pollution reduction, legal rights awareness, disease management and prevention, and the communication of innovative ideas. This presentation will examine the evolution of conservation education in Malawi from the end of the colonial period in 1964 to the present day with a focus on areas in which education has achieved notable results. The role of dire poverty as the greatest threat to progress will also be discussed.

Social and Behavioral Sciences Oral Presentations

*Williamson, M., *Hoover, M., *Miller, C., & Homann, G., Lincoln University. RACIAL DIFFERENCES IN REACTIONS TO RECEIVING RESULTS OF THE IMPLICIT ASSOCIATION TEST. The Implicit Association Test (IAT) is a commonly used instrument designed to measure automatic biases. Because bias detected by the test may be unconscious, many people are unaware of them and surprised by the result. In particular, people may be uncomfortable when the test indicates racial bias. In this study, we will examine the reactions of white and black participants when given their results on race-related IATs. We hypothesize that whites will be more egodystonic and blacks more egosyntonic when given results indicating an automatic preference for their own race. We will measure how surprising the results were, how comfortable participants are with the results, and to what extent they agree with the findings. Limitations and implications will be discussed.

*Smith, P.S., Independent Scholar. AN INCLINATION TOWARD THE ABOVE AND THE ARCHITECTURE OF THE ANCIENTS. The focus of this presentation will be to explore the existential anthropological basis to the ceremonial structures of ancient primary people. Given the extreme conditions of survival and physical vulnerability, with heightened levels of awareness and memory, combined with the need to make an assumption about knowing, helps the researcher to better understand the notions primary people made about themselves and their environment. In fact, the ingeniousness and complexity to their thought processes, as they created and invented social reality is indicated at the start of social development. That so many beliefs, practices and architectural features in primary cultures had remarkably common characteristics over a wide range of time, region and culture indicates a universal dynamic of physical condition and behavior in reaction to environment. But it was the factor of not-knowing, combined with the development of associative reasoning that drove assumptions and beliefs about self and environment, finding expression in ceremonial practice and architectural form. Thus, primary architecture with the inclination toward the above, extends from the like-equals-like association and is consequent of the existential condition of vulnerability and the elements of reason and the need to know in relation to what is not known that leads to a desire for and belief in continuation. At this juncture inclination toward the above and the role of assumptive reality and exertion play an important part in the design and intended purpose of ancient ceremonial structures, namely celestial connection.

*Johnson, G. C., and White, M. M. , Lincoln University. COLLEGE STUDENTS ATTITUDES TOWARD INTIMATE PARTNER VIOLENCE. This study examined college students attitudes towards intimate partner violence (IPV) by having participants evaluate hypothetical IPV. One hundred Lincoln University students were given one of four paragraph scenarios which varied by whether the relationship was a same-sex or a heterosexual relationship and the ethnicity (Black, White) of the couple. After reading each paragraph, participants were asked a series of questions in identifying how they felt about prosecution of the abuser and treatment of the victim, the extent to which they defined the violence as severe or abusive, and the probable influence of drugs/alcohol. Based on previous research, we expect to find that participants will not view the severity of violence differently between heterosexual and homosexual couples, but will find violence more severe when the heterosexual male is the perpetrator (Bendimez, 2015). We also expect to find that participants will view the IPV as more acceptable among the African American couple (Langhinrichsen-

Rohling, Misra, Selwyn & Rholing, 2012). IPV should be studied further in other minority cultures in order to find ways to raise awareness and prevention efforts.

*Jones, M., Lincoln University. THE PERCEPTION OF SEXUAL SATISFACTION IN MEN AND WOMEN. This study examined the meaning of sexual satisfaction for men and women. Four scenarios were distributed to college students. The scenarios consisted of a single man, a man in a relationship, a single woman, and a woman in a relationship. Men were given the scenario of either the single man or man in a relationship and women were given the scenario of either the single woman or woman in a relationship. Students were then given a survey to measure the physical attractiveness, lifestyle attractiveness, sexual behavior, character perception, and sexual satisfaction. Based on the results of published research, expect that men will view the single man as more sexually satisfied than the man in a relationship, and women had high satisfaction in comparison with the woman in a relationship. Both men and women found the lifestyle to be of great interest. This study may have some inconsistencies, further research may require studies to exam the emotional aspect of sexual satisfaction in both men and women.

McGill, M., *Crawford, T., Welschmeyer, C., Scarlet, R., Flores, M., Westminster College. TO DRINK OR NOT TO DRINK: THE INFLUENCE OF CULTURAL DIFFERENCES AND SOCIAL ANXIETY ON ALCOHOL CONSUMPTION. This study examined the differences among domestic and international students' drinking habits and social anxiety. Previous literature suggests that among general college student populations, drinking habits increase as social anxiety increases (Buckner & Heimberg, 2010; Caballo, Salazar, Iruiria, Arias, & Hofmann, 2014; Terlecki, Ecker, & Buckner, 2014). Other research also suggests that certain international students experience higher social anxiety than domestic students. Research by Woody, Miao, and Kellman-McFarlane (2015) found that students of East Asian backgrounds experience higher social anxiety than other Western cultures, such as Western Europeans. However, research has not adequately addressed the connection between these three variables. There has not yet been a study specifically designed to measure and compare domestic and international college students' drinking habits and social anxiety. This study focused on this lack of knowledge in how both of these variables affect the social anxiety levels on certain student groups. The hypotheses for this study were that domestic students' drinking habits would increase as their social anxiety increased. Additionally, international students were hypothesized to have higher social anxiety than domestic students regardless of either group's drinking habits.

*Gant, G. & Martin, K., Lincoln University. COLORISM BIAS IN COLLEGE STUDENTS. This study researched the perceptions of African-Americans who varied in skin tone. One hundred students were given a description of a female student who had positive and negative attributes. The description was accompanied by a picture of the same student with either light or dark skin tones. Participants rated her on attractiveness, leadership, and general personal characteristics. We believe that the participants will rate the lighter version of the student more positively than the darker version of the student. The results will show that dark-skinned women face more biases even when they are equally qualified as light-skinned women.

*Gretlein, R. & *Jones, S., Lincoln University. CELL PHONE USE, STUDY HABITS, AND GPA. Our study examined whether cell phone use in the classroom lowers scores on coursework. We gave one psychology class a restrictive cell phone use policy while the other class was given a lenient policy during a 50-minute lecture. We then observed how often students used their phones during class. At the end of class, students took a short quiz over the lecture material. Afterward, they were given a survey which measured demographics, attitudes about cell phone use in class, academic motivation, grade point average, tasks completed using cell phone, study skills, preference for task-switching, frequency of in-class cell phone use, and anxiety. We anticipate that cell phone use during class will result in lower quiz scores. Our results suggest that electronic devices distract students and decrease the efficacy of the learning environment.

*Jaehn, A., *Knoche, K., & *Johnson, A., Park University. CREATIVITY EXPERTS RATE THE CREATIVITY OF PICTURES. Assessing creativity has been a challenging prospect historically due to its multidimensionality. There are a range of creativity tests from subjective ones, e.g., Picture Completion Task, to objective ones, e.g., Remote Associates Test (RAT). In this presentation we report the results of a follow up study using experts to assess the creativity of pictures.

More specifically, three members of the Park University faculty body were invited to participate in our creativity study through a peer-nomination process. We gathered demographic information for each of the experts and each completed a self-report creativity trait instrument (http://ipip.ori.org/newHEXACO_PI_key.htm#Creativity). Following this the experts completed a two-minute Remote Associates Test (RAT) – an objective creativity test. Then, the experts rated their own set of 15 Picture Completion Task artifacts on: target difficulty, creativity, originality, and artistry. Finally, the experts were asked to rank order their 15 pictures from most to least creative. We will present the ratings and rankings of the experts in context to comparison groups. Our results suggest that creativity judgments of experts map closely to comparison samples on some of the measurements.

*Knoche, K., Jaehn, A., Johnson, A. & Griffith, R., Park University. USING CROWDSOURCING TO RATE THE CREATIVITY OF PICTURES. Assessing creativity has been a challenging prospect historically. There are a range of creativity tests from subjective ones, e.g., Picture Completion Task, to objective ones, e.g., Remote Associates Test (RAT). The study reported here presents the judgments of creativity for three sets of 15 Picture Completion Task artifacts. We used a crowdsourcing solution (Amazon Mechanical Turk – Mturk) to gather ratings from a sample of 453 participants. Our presentation will focus on the descriptive analysis of the overall sample and their ratings of Picture Completion artifacts across measures of: target difficulty, creativity, originality, and artistry. The results indicate that ratings of creativity, originality, and artistry are separate and independent judgments. These results clarify prior research that suggests creativity and originality are synonymous.

*Kliethermes, A., *Potter, C. & DeBord, K., Lincoln University. STIGMA, RACE, AND MENTAL ILLNESS. This study was designed to determine whether stigmatization of people with mental illness is influenced by race or the type of disorder a person has. Participants were given one of four stories depicting a White or Black man with schizophrenia or borderline personality disorder. The degree to which participants engaged in stigmatizing the person in the story was assessed by a 21-item scale on stigma. Participants were also assessed on social desirability. Once social desirability is factored out of the stigmatization scores, we will assess how the stigma scores varied for each one of the scenarios.

Ebersole, A., *Kiso, A., & Kopyy, E., Westminster College. SWIPE RIGHT OR SWIPE LEFT: WHAT INFLUENCES YOUR DECISION? When making decisions while online dating, judgments are often made about the provided biography. Prior research has discovered that the categorization of others can affect these judgments. In the present research, undergraduate college men were surveyed to determine whether the word “athlete” has an influence on how they perceive someone romantically. Our first hypothesis predicts that those who have less self-doubt are more likely to “swipe right” to the dating profile with “athlete” in the bio. The second hypothesis is that the presence of the word “athlete” will influence the decisions made by the participants. Through research, the goal is to find the influence of perception of characteristics on decisions made about dating.

*Mills, R. & Ghinescu, R., Lincoln University. PERCEPTIONS ABOUT ADOPTIONS BY GAY AND LESBIAN COUPLES. The present study based on terror management theory (TMT) will examine the effect of mortality salience on perception of gay and lesbian couples as parents. Half of the participants will be exposed to a mortality salience induction in which they will be asked to write about, a) what will happen to them when they physically die, and b) the emotions that the thought of their own death arouses in them. The other half of participants will be assigned to a control condition in which they will be asked to write about a) what happens to them when they watch a TV movie and b) the emotions that the TV movie arouses in them. Participants will be asked to evaluate scenarios describing a gay/lesbian/heterosexual couple by answering to the question " Would you agree that the couple in this scenario will make good parents?" The answers will be given on a scale from 1 (strongly disagree) to 10 (strongly agree) with higher scores reflecting better perceptions about parenting. In addition to the first dependent measure, we will administer a modified version of the Gay and Lesbian Parents' Adoption Scale (Shelley-Sireci, L. & Ciano-Boyce, C., 2001). We hypothesize that participants in the mortality salience condition will have higher scores on the dependent measures than those in the control condition.

*Welschmeyer, C. & *Mayson, H., Lincoln University. RACIAL AND TATTOO STIGMA AMONG COLLEGE STUDENTS. This study examined the influence of race and tattoos on college students' judgments of women. Four groups of students were randomly assigned to receive photographs of an African American woman with tattoos, an African American without tattoos, a Caucasian woman with tattoos, or a Caucasian woman without tattoos. The participants also read a paragraph description of the woman in the photo, which was kept constant. Finally, students were asked to rate trustworthiness, professionalism, attractiveness, competence (e.g., GPA), and lifestyle choices (e.g., drug use, sexual promiscuity) on a Likert scale. They were also asked questions about stigma toward tattoos, health risks of tattoos, and pain of tattoos. Based on previous research, we suspect that men and African Americans will have more negative attitudes towards tattoos than women and Caucasians. Results indicate the dangers of stigmatization when choosing to expose tattoos in ethnically mixed environments.

*Hoover, M., *Miller, C. *Williamson, M. & Homann, G., Lincoln University. CHANGE IN IMPLICIT RACIAL ATTITUDES AS A FACTOR OF TIME SPENT AT AN HBCU. Lincoln University (LU) is an HBCU with a racially diverse student population. This fact might lead one to hypothesize a diminishing of racial bias with more time as a student. However, selection bias between matriculating black and white students could conceivably exacerbate racial stereotypes. In this study, we will explore the relationship between racial bias and length of time as a student at LU. Methods: The Implicit Association Test (IAT) will be used to assess automatic racial bias. Three different versions of the IAT will be utilized: A general race IAT, weapons IAT, and grades IAT. A cross-sectional design will be used to examine the relationship between IATs and length of time at an HBCU. We hypothesize that bias will diminish with time on the general and weapons IATs due to exposure, but that the grades IAT will show an increase in racial bias due to selection effects present upon matriculation. Implications and limitations of the findings will be discussed.

*Smith, J.E. & Schnieders, A. L., Lincoln University. PREDICTORS OF POLITICAL PARTICIPATION AND ATTITUDES AMONG COLLEGE STUDENTS. This study was designed to predict students level of political participation and attitudes based on demographic characteristics. Students from psychology classes at Lincoln University completed a survey measuring the age, ethnicity, gender, class, success in school, and involvement in school, completion of social justice and political science classes, socioeconomic status, apathy, belief in equality, government trust, presidential preference, political affiliation, and political participation. Based on previous research, we expect students who attend social justice classes and political science classes will participate more in politics than students who do not. The results will suggest collegiate interventions that might serve as to increase student political engagement.

Social and Behavioral Sciences Poster Presentations

*Louiselle, K., VanDyke, M., Griggs, S., & Steffen, A., St. Louis College of Pharmacy. EXAMINING THE RELATIONSHIPS BETWEEN DEMENTIA SEVERITY, HOARDING BEHAVIORS, AND MEDICATION ADHERENCE. Older adults with symptoms of dementia may be at an increased risk of poor medication adherence, generalized hoarding behaviors, and increased medication savings behaviors, requiring assistance from a family caregiver to manage medication and healthcare appointments. These caregivers ($N = 127$) completed an online survey of the older adults' dementia symptoms, medication adherence, generalized hoarding, and excessive medication collecting. Correlational analyses indicated that increased symptoms on the Clinical Dementia Rating (CDR) scale indicated increased problems on the Adherence to Refills and Medications scale ($r = 0.32$; $p = 0.002$). Increased CDR symptoms were also positively correlated with generalized hoarding behavior on the Hoarding Rating Scale ($r = 0.30$; $p = 0.001$); however, there was no correlation between the CDR and the Saving Inventory-Revised (generalized hoarding measure; $r = -0.02$; $p = 0.795$) nor between the CDR and Medication Saving Behavior ($r = 0.03$, $p = 0.764$). Increased dementia severity is significantly related to reduced medication adherence and some generalized hoarding behaviors, but dementia is not associated with excessive medication collection. These effects are important since poor medication adherence is associated with many detrimental outcomes, including adverse events, preventable disease progression, diminished quality of life, and increased nursing home admissions. Further investigation is needed to both clarify the relationship between dementia and hoarding behavior and discover the correlates of medication saving behaviors. This study highlights the need for assistance with medication management in older adults with dementia.

*Gall, L.B., Marsh, P.A., & Sá, M., Park University. SELF-REGULATION OF ACADEMIC ACHIEVEMENT. Past studies have proposed a variety of self-regulated learning strategies in both academic and occupational setting. However, few have narrowed in on the interplay between personality and metacognitive regulation of learning processes that occur in academic settings. Cognitive learning regulation was measured with the Metacognitive Awareness Inventory (MAI; Schraw & Dennison, 1994) and the Core Self-Evaluation Scale (CSES; Judge, Bono & Thoresen, 2003) assessed the personality trait of self-regulation. Correlations were examined among the independent variables of CSES and the six MAI subscales to see if they were related to academic achievement. Regression analyses were used to identify which variables predicted students' ($N = 45$) exam grades and course grades. Results show that course grades were predicted by two of the MAI subscales, declarative knowledge and planning. The equation containing these two predictors accounted for a statistically significant proportion of the variance in *exam grade*, $F(2,43) = 8.92, p = .001$, Adjusted $R^2 = .26$. The equation containing declarative knowledge (MAI subscale) predictor accounted for a statistically significant proportion of the variance in *course grade*, $F(1,43) = 6.58, p = .014$, Adjusted $R^2 = .11$. Results did not find CSES to be related to or predictive of academic achievement. This was partially unexpected, because past studies found a relationship between CSE and academic outcomes (Lian, 2014) while others found the measure to be a poor predictor of objective outcomes (Judge et al., 2003). Implications of these findings will be discussed.

*Tillman, D., Tillman, K. & Pfautsch, M., Central Methodist University. THE EFFECTS OF TATTOOS ON HIRING. In today's society, visible tattoos have become a commonality, making them a topic of scrutiny when it comes to how they are viewed in the workplace. The purpose of this study is to find out if the presence of visible tattoos on your body can affect your chances of getting hired for the job you want. To test this, we intend to ask 30 participants to rate how likely they are to hire the people based on photos they are shown. In one condition, participants will be shown a photo of both a male and female with no visible tattoos, and then asked to rate how likely they would be to hire the person for a variety of jobs ranging from babysitting to being a tax preparer. Participants will also be asked to rate each person on several personality characteristics. In the second condition, they will be shown pictures of the same two people, but who now have visible tattoos. They will be asked to perform the same ratings as the control group. We hypothesize that people who have visible tattoos will be rated more negatively than those who do not have visible tattoos across all types of jobs.

Booth, T., Duncan, S., *Hicks, S., Keller, L. Newcomb, K. Snyder, M. & Swift, A., Missouri Western State University. SOCIAL MEDIA AND PERCEPTIONS OF LAW ENFORCEMENT. The purpose of this study was to expand on extant literature linking social media and perceptions of law enforcement. Historically, there has been correlational data and very little experimental data—this study establishes an experimental footing. In particular, we investigated the impact of how the information we receive via social media about law enforcement influences our perceptions of law enforcement depending on the closeness of our relationship to the source of the information. In addition, we examined how varying levels of procedural justice impact general perceptions of law enforcement. We predicted an interaction such that a close relationship to someone posting an encounter with law enforcement will be more sensitive to the level of procedural justice reported in that encounter than reading an identical post from an acquaintance. A 2 (close friend v. acquaintance) x 2 (high v. low procedural justice) design was used. Participants thought of a close friend or acquaintance on Facebook and wrote that name. Next they read a hypothetical Facebook post ostensibly written by the name they listed. The post described an interaction with law enforcement at a drunk driving checkpoint, demonstrating either high or low procedural justice. In the high procedural justice condition the poster was allowed to give voice, officers behaved in a fairer manner, and treated the poster with more respect. The low procedural justice condition was the opposite on all factors. Following the posts, participants then rated their satisfaction with law enforcement. Analyses are pending completion of data collection.

*Mosier, A., Cottey College. THE EFFECT OF SOUND ON CRITICAL THINKING TASK PERFORMANCE IN COLLEGE STUDENTS. This study looked at the effects of listening to silence and music during a critical thinking task, as well as the mediating effects of arousal and mood and the moderating effect of personality. The existing research shows mixed results regarding whether listening to music during a task facilitates or hinders cognitive performance. The study's purpose was to further explore methods for stimulating critical thinking in college students, an ability which is

important for student success yet is not always adequately taught in colleges. It was hypothesized that sound would affect critical thinking, that arousal and mood would mediate sound and critical thinking, and that personality would moderate arousal, mood, and critical thinking. Forty-five participants completed the Assured-Dominant and Unassured-Submissive scales of the Interpersonal Adjectives Scale, and then had their blood pressure and pulse recorded and completed the Positive and Negative Affect Schedule three times: following the personality measure, following a ten-minute listening period of one condition (jazz, pop, or silence), and following a thirty-minute listening period of the same condition during which they completed the Halpern Critical Thinking Assessment. Independent samples t-tests, Wilcoxon signed-rank tests, Kruskal-Wallis tests, and bivariate correlations were run. A statistically significant difference was found between Halpern scores for participants in the silence and jazz conditions, with silence scoring higher. There were also statistically significant correlations between Halpern score, ACT score, and GPA. This study suggests that silence may improve critical thinking and that GPA and ACT scores may have strong influence on critical thinking as well.

*Rudd, L. & Livengood, J., Missouri Valley College. EFFECTS OF DANCE ON BODY IMAGE. Previous studies have indicated that dance, as well as Dance and Movement Therapy (DMT), have influenced aspects of psychology such as body image, confidence, depression, PTSD, etc. in a positive way. For example, Muller-Pinget, Carrard, Ybarra, and Golay showed that the participants in a DMT session showed more positive body perception than those who had not participated (2012). Another previous study showed that dance sessions not only improved body image, but also made the participants feel more in control of their bodies in which they called "connectedness" (Grogan, Williams, Kilgariff, Bunce, Heyland, Padilla, et al., 2014, pg. 270). Overall, many studies show the positive influence of dance on many aspects of the human body, mind, and psyche. The current set of studies sought to examine 1) student's perceptions of DMT and 2) the impact of dance/movement sessions on those perceptions and on body image. The first study concentrated specifically on students' perspectives of DMT and whether they believed that it would be beneficial to victims of trauma. The second study includes participants' engagement in three dance sessions that focus on movement activities geared towards improving body image. Researchers hypothesize that students who engage in dance sessions will have an improved self body image as well as an improved perspective of DMT.

*Thorup, J. & England, B., Missouri Western State University. THE RELATIONSHIP BETWEEN THE UNDERSTANDING OF ONES OWN MENTAL PROCESSES AND PERCEPTION OF INDIVIDUALS WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER. With the increasing prevalence of attention-deficit/hyperactivity disorder (ADHD) in school-age children, not only is it important to understand the disorder but also stigmatization toward diagnosed peers. The purpose of the current study was to investigate if ones understanding and perceived control of ones mental processes, or lack thereof, alters perception of individuals with mental disorders, specifically ADHD. Participants completed counterbalanced tasks, one of which measured stigma of individuals with ADHD (as well as individuals with Autism) and another measured their understanding of their own mental processes (including understanding and control). Participants were middle school and college students, to evaluate whether stigma, perception of self, and the relationship between the two may change per age group, as well as other pertinent factors. Overall, there seemed to be little differences between groups and overall level of stigma. However certain factors such as age, knowing someone diagnosed with ADHD, and gender did seem to alter level of stigma, especially stigma toward disclosure of ADHD and ASD. Interestingly, although perceived level of control and understanding did not differ between the age groups, the correlation between control and understanding was only significant for college-aged participants. As such, although we agree with previous literature about stigma and mental disorders, in that it may develop during middle school, the underlying cause of or influences on stigma may differ per age.