

MAS 2011 Abstracts Division and Sections

SENIOR DIVISION:

Agriculture:

Section Chair: Michael T. Aide, Southeast Missouri State University

*Aide, M.T., S. L. Taylor, D. Dunn, J. Henggeler. Department of Agriculture, Southeast Missouri State University and University Missouri – Delta Center. **WATER RESOURCES IN SOUTHEASTERN MISSOURI.** A survey of water sources was conducted to determine (1) the quantity of surface and groundwater, (2) the quality of surface and groundwater, (3) the usage of water resources by public water utilities, irrigation and other uses, and (4) estimate the future water demands. Four aquifers were observed (i) unconfined alluvial aquifer, (ii) confined Claibourne, (iii) confined Wilcox, and (iv) confined McNairy. The alluvial unconfined aquifer is the dominant aquifer for irrigation and accounts for the majority of the groundwater withdrawals. The deeper confined aquifers have smaller yields and are typically calcium-magnesium carbonate type waters. The McNairy confined aquifer in Pemiscot and Dunklin Counties typically has sodium chloride type water. The replenishment rates for the aquifers are adequate to support continued industrialization and expanded irrigated agriculture.

Aide, M., D. Beighley, I. Braden, S. Duncan, D. Mauk, W. Mueller, P. Schnare, S. Svenson, and J. Weathers. Southeast Missouri State University, **TRANSFORMING A DEPARTMENT OF AGRICULTURE.** At Southeast Missouri State University, the Department of Agriculture has substantially altered its curriculum, teaching and research infrastructures, and broadened its student base. Key to orchestrating the department's transformation centers on developing and maintaining an extensive network of agribusiness and community individuals who advise and review the department and solicit financial support. The University Foundation provided leadership for these outreach activities, whereas the department provided faculty access to listen to community stakeholders and then responding by re-designing the curriculum, developing teaching/research infrastructures, offering of main campus teaching programs, and promoting faculty professional development expectations that serve the service area. The willingness of the department to address local agribusiness needs and expectations and spend the time required to develop and maintain the network assessment process resulted in appreciable community support and financial contributions.

Atmospheric Science:

Section Chair: Katie L. Crandall, University of Missouri-Columbia

*Aldrich, E., and A.R. Lupo. Department of Soil, Environmental and Atmospheric Science, University of Missouri - Columbia. **THE VERIFICATION OF WEATHER FORECASTS COMPARED TO NUMERICAL MODELING, CLIMATOLOGY, HUMAN FORECASTS AND SEASONAL VARIATIONS.** The accuracy of weather forecasts has always been a topic of discussion for many years, and a reliable and usable method for quantifying forecast accuracy has been an issue for meteorologists over time. This study using a previously developed methodology for the comparison of meteorological computer forecast models coupled with climatology data and a human produced forecast (from meteorologists at KOMU-TV, Columbia, MO) produced some interesting results. Not surprisingly, the computer models and human produced forecasts were, by far, more accurate than the climatology, or persistence, forecasts, but when we compared all of the data and results with the seasonality variance of temperature data, the outcome was more interesting. Essentially, all forecasts and outcomes had distinct seasonal variability. It is my hope that the findings in this research will instill more confidence in a human produced forecast and forecasters can determine which computer model has a better handle on seasonal variance based on the model physics.

*Bogowith, M., and A.R. Lupo. Department of Soil, Environmental and Atmospheric Science, University of Missouri Columbia. **THE VERIFICATION OF WEATHER FORECASTS, NUMERICAL MODELING, CLIMATOLOGY, AND VARIATIONS IN ENSO CYCLES IN FORECAST ACCURACY.** Let's go back 100 years, before the days of satellite and radar. Before there were calculations based upon the natural laws that produced a weather forecast. Before the invention of the television that would one day broadcast the local news and weather forecasts. Imagine how difficult it was for meteorologists to understand the atmosphere, let alone make weather forecasts. Now fast forward now to present day, we have come a long way since then. Today, we have numerous models and advanced technologies to look at atmospheric data and analyze in order to produce the most accurate forecast possible. But how accurate are these forecasts? Our research and this paper will focus on the accuracy of the human forecaster (from meteorologists at KOMU TV 8 in Columbia, Missouri) and how the forecast compares to predictions from numerical models and local climatology. Initial results suggest that the

human produced forecast outperformed not only climatology but also numerical models overall. However, when breaking down the data and analyzing it during ENSO cycles, while this result was true for most seasons and ENSO phases, it was not always the case. With the analysis of the data, it is intended that we will gain an understanding of systematic biases human forecasters or models possess for this region with respect to season and ENSO phase. If we understand the biases, it will help to improve our forecasting skills even more so by accounting for them and increasing accuracy. This, in turn, will boost confidence in the human generated forecast.

***Crandall, K. L., and P. S. Market. Department of Soil, Environmental and Atmospheric Sciences. University of Missouri. A SEVERE WINTER STORMS CLIMATOLOGY FOR MISSOURI FROM 1990–2010.** Severe winter storms cause significant economic and societal hardships for the state of Missouri. Severe winter storms can produce significant snowfall, freezing rain, sleet and blizzard conditions. These storms have caused structural damage to businesses and homes, countless auto accidents, and loss of crops and livestock. The harshest impacts of severe winter storms in Missouri come from the injury and loss of human life. To date there has never been an all-inclusive climatology done on severe winter storms for the entire state of Missouri. This work follows the severe winter storm climatology in Changnon et al. 1969 but is for Missouri between 1990 and 2010. The purpose of this work is to understand the long-term impact of severe winter storms on the state of Missouri. Future work will complete the climatology by adding the years 1960 through 1989. The climatology will be used to analyze various global teleconnections that could affect winter weather in Missouri. Also, data from the climatology along with climate models will be used to look at how climate change may affect future severe winter storm intensity. The climatology will help forecasters to better predict severe winter weather in Missouri presently and in the future. With the inclusion of economic impacts in the climatology, people that work in agriculture, local government and transportation will be able to anticipate better how severe winter storms will impact them and the state of Missouri.

***Kozlowski, D.M., and A.R. Lupo: Department of Soil, Environmental and Atmospheric Science, University of Missouri - Columbia. MEASURING FORECAST PERFORMANCE DURING BLOCKING AND NON-BLOCKING PERIODS IN MISSOURI DURING THE 2010–2011 COLD SEASON.** Blocking is a quasi-stationary, mid-latitude 500 hPa ridge in the jet stream that has a substantial impact on weather in the region where it persists as well as upstream and downstream as well. Previous studies have shown that blocking in the Eastern Pacific and Gulf of Alaska region tends to bring cold and wetter weather to the Missouri region. There is also anecdotal evidence that blocking, which lives on the edge of the domain for North American forecast models, can have a substantial impact on the quality of the forecasts.

Using the NCAR-NCEP re-analyses, Northern Hemisphere blocking events were identified at 500 hPa and added to the University of Missouri Blocking Archive (<http://weather.missouri.edu/gcc>). Blocking events which persisted within the domain from 180° to 100° W longitude were considered to be events that could potentially impact the forecasts in Missouri. The 12 to 48 hour forecasts were examined throughout the cold season beginning in November 2010. We compared the forecasts of the National Weather Service, the North American Model (NAM) system, and the GFS, and compared these against climatology and persistence using a forecast scoring system developed at the University of Missouri.

***Lupo, A. R., J.J. Abraham, and I.I. Mokhov: Department of Soil, Environmental and Atmospheric Science, University of Missouri - Columbia. SUMMER SEASON DROUGHT IN EASTERN EUROPE AND WESTERN RUSSIA.** During the summer of 2010, a severe drought impacted Western Russia, and this was accompanied by high temperatures. Moscow recorded 100° F for the first time in over 130 years of record keeping. The combination of heat, dry weather, and smoke from forest fires caused increased mortality rates during July and August, 2010. The excessive heat and humidity was the result of strong atmospheric blocking from late June through early August. The NCAR-NCEP re-analyses were then used to examine blocking in the Eastern European and western Russia sector during the spring and summer seasons from 1970–2010. It was found that the drier years were correlated with more blocking during the spring and summer seasons and these years correlated with transitions from El Niño to La Niña years. Blocking during these years were also stronger, but not necessarily of longer durations.

***Mohd. Anip, M. H., and A.R. Lupo. Department of Soil, Environmental and Atmospheric Science, University of Missouri - Columbia. A CLIMATOLOGICAL STUDY OF THE BORNEO VORTEX DURING THE NORTHERN HEMISPHERE WINTER MONSOON.** During Northern Hemisphere winter monsoon, most regions over the equatorial belt are covered with convective clouds due to the transition of the Inter Tropical Convergence Zone (ITCZ). Detailed studies of this episode over southern portion of the South China Sea indicate the existence of a semi-permanent feature; a quasi-stationary vortex embedded within the trough. Since the vortex is always found off coast of the Borneo, it is sometimes known as Borneo vortex. A Climatological study of the vortex has been conducted using ECMWF reanalysis data between 1970/71 and 2009/10 winter monsoon. In general, the vortex center tends to shift southeastward as the winter monsoon advances from November through February. It has the longest life span in December, which causes the monsoon to become more active at that time. A long-term trend indicates that there has been a slight decrease in its frequency. In addition, a fewer number of vortices is formed during PDO1 as compared to PDO2 while the vortex center shifts further north (south) of its mean position

during La-Niña (El-Niño) years. These show that the Borneo vortex has significant interannual and interdecadal variations during the winter monsoon over the South China Sea.

Biology:

Section Chair: Kurt Hartman, Missouri Western State University

Payne, S.M. and J.S. Ely*. Department of Biology & Earth Science, University of Central Missouri. **PLANT COMMUNITIES OF VERNAL POOLS ALONG CLEAR FORK CREEK FLOODPLAIN, KNOB NOSTER STATE PARK, MISSOURI.** Vernal pools and flat woods are temporary aquatic habitats characterized by unique flora, fauna (invertebrate), and hydrology. There have been very few floristic and ecological studies of these habitat types within the state other than technical reports for natural area designations and floodplain studies addressing hydrology on alluvial depressions. The primary purpose of this study is to survey and characterize vernal pools and flat woods of Clearfork Creek floodplain, Knob Noster State Park, Missouri. Specifically this includes (1) identifying, locating, and delineating each habitat and (2) surveying and characterizing the plant communities and associations along Clearfork Creek floodplain within Knob Noster State Park. A stratified random sampling will be used to sample the herbaceous, shrub and sapling and tree strata. Three to five transects will be placed at each vernal pool and flat wood site. Four to six nested $\frac{1}{4}$ -m² quadrates (within a 1-m² plot) will be placed along each transect. In addition, three to four 100-m² plots along each transect will be used to assess the woody elements (shrub and saplings and trees). Species cover estimates, height, density and cover, and diameter at breast height data will be collected for herbaceous species, shrub and saplings, and trees, respectively. Herbaceous plant data will be collected three times throughout the growing season. Species richness, Shannon-Wiener diversity and native species richness will be compared among vernal pools and flat woods using a blocked multi-response permutation procedure. Plant communities and associations will be classified using cluster analysis and indirect ordination procedures. It is expected that there will be differences among the habitat types.

***Quick, L.N. and J.S. Ely.** Department of Biology & Earth Science, University of Central Missouri. **THE EFFECTS OF ELK (*CERVUS CANADENSIS*) AND BISON (*BISON BISON*) GRAZING ON NATIVE PLANT COMMUNITIES AT PRAIRIE STATE PARK, BARTON COUNTY, MISSOURI.** Tall grass prairie once extended throughout a large portion of the American Midwest and central Canada. Elk (*Cervus canadensis*) and bison (*Bison bison*) once roamed freely in Missouri. Today, there is less than one percent of the

original native tall grass prairie that remains in Missouri. Prairie State Park, Barton County, Missouri, contains one of the largest contiguous areas of unplowed tall grass prairie in the state. The purpose of this study is to examine the impacts of elk and bison grazing on native tall grass prairie plant communities. We expect there to be differences in plant communities, species richness, and diversity between grazed and ungrazed areas and among bison and elk. A stratified random sampling will be used to sample the herbaceous, shrub and sapling and tree strata. A nested $\frac{1}{4}$ -m² quadrate within a 1-m² plot will be surveyed for herbaceous species percent cover. Fifty to sixty 0.01 ha (100-m²) plots will be used to assess the woody elements (shrub and saplings and trees). Species cover estimates, height, density and cover, and diameter at breast height data will be collected for herbaceous species, shrub and saplings, and trees, respectively. A total of 360 quadrates ($\frac{1}{4}$ -m² and 1-m²) will be surveyed three times during the growing season and woody elements will be sampled once. Species richness, Shannon-Wiener diversity and native species richness will be compared among treatment and control areas using a blocked multi-response permutation procedure. Plant communities and associations will be determined through cluster analysis and indirect ordination procedures. It is expected that there will be differences among bison and elk grazed sections and between the control and treatments.

***Taulman, J.F.** Department of Natural and Physical Sciences, Park University. **DISPLAY OF ANIMAL LOCATION AND HOME RANGE DATA IN GOOGLE EARTH.** Researchers studying animal habitat use patterns often have to learn and use several different software programs in order to create home ranges and analyze animal activity data. Interoperability of data among the varieties of software, and graphical presentation of results, can present daunting challenges. I have found a set of freely available online tools that offer a unified solution to processing and displaying animal activity data. I provide simple step-by-step instructions that will allow a researcher to take animal location data and create home range boundaries and to display those home ranges in Google Earth. The program Home Ranger creates kernel probability density distributions based on a set of animal locations. Home range contour data files output from Home Range in UTM format can be converted to decimal degrees using a free, online spreadsheet. These contour files are then ready for entry into Google Earth Path, a program which configures animal location and home range graphics for display onto Google Earth satellite photographic imagery. Google's detailed, photographic landscape imagery is an ideal background on which to display animal activity data, showing habitat features that often are important for understanding animal movement patterns. Google Earth Pro has added features, allowing the researcher to perform a few GIS-like functions, such as on-screen digitizing and area calculation. It also provides terrain views from many perspectives, further enhancing the analytical value of the imagery.

***Thompson, S.C. and J.S. Ely. Department of Biology & Earth Science, University of Central Missouri. PLANT COMMUNITIES OF OXBOW WETLANDS ALONG CLEARFORK CREEK FLOODPLAIN, KNOB NOSTER STATE PARK, MISSOURI.** Oxbows and sloughs are typically classified as marshes, shrub swamps, and swamps of floodplain systems and are characterized by unique flora, fauna (invertebrate), and hydrology. There have been very few ecological studies of oxbows within the state other than technical reports for natural area designations and floodplain studies. The primary purpose of this study is to survey and characterize oxbow plant communities along Clearfork Creek floodplain, Knob Noster State Park, Missouri. Stratified random sampling will be used to sample the herbaceous, shrub and sapling and tree strata. Three to five transects will be placed at each oxbow site ($n = 4$). Four to six nested $\frac{1}{4}$ -m² quadrats (within a 1-m² plot) will be placed along each transect. In addition, three to four 100-m² plots along each transect will be used to assess the woody elements (shrub and saplings and trees). Species cover estimates, height and density, and diameter at breast height data will be collected for herbaceous species, shrub and saplings, and trees, respectively. Herbaceous plant data will be collected three times (May, July and September) throughout the growing season. Species richness, Shannon-Wiener diversity and native species richness will be compared among oxbow types using a blocked multi-response permutation procedure. Plant communities and associations will be determined through cluster analysis and indirect ordination procedures. It is expected that the extent of plant communities and associations will be related to oxbow type.

Biomedicine/Biotechnology:

Section Chair: Colette M. Witkowski, Missouri State University

***Ashtekar A. S., R. S. Lovely, and J.P. Ramsey. Department of Biomedical Sciences, Missouri State University. THROMBIN INDUCED INTRA-PLATELET CALCIUM MOBILIZATION IS INHIBITED BY FIBRINOGEN GAMMA' CHAIN.** Fibrinogen is a plasma protein precursor to fibrin, the main structural protein of the blood clot. Fibrinogen gamma' is a minor isoform of fibrinogen that contains an altered gamma chain. The fibrinogen gamma' chain binds thrombin at exosite II, mainly through its interactions at residues 410–427. This binding has been shown to change thrombin's enzymatic activity. Several recent studies have shown that binding of fibrinogen gamma' inhibits thrombin induced platelet aggregation. However, the molecular mechanisms of fibrinogen gamma' chain inhibition of thrombin induced platelet activation have not been fully investigated. We aim to study the effect of fibrinogen gamma' on thrombin induced intraplatelet calcium mobilization, which is one of the immediate responses in activation

of platelets. Calcium mobilization was studied using a fluorescent dye FURA-2, and taking the ratio of absorbance's at 340/380 nm. Our studies have shown that gamma' fibrinogen peptide as well as fibrinogen A gamma/gamma' chain inhibits thrombin induced calcium mobilization in platelets in a dose dependent manner.

***Harvey, J. and J.J. Wang*. Department of Biomedical Sciences, Missouri State University. ESTABLISHMENT OF PRIMARY CULTURED MICROVASCULAR ENDOTHELIAL CELLS FROM MOUSE.** Endothelial cells (EC), pivotally lining the innermost layer of blood vessels, play important roles in the regulation of vascular functions including homeostasis, immunity, vascular tone, angiogenesis, and vascular exchange. Our previous work demonstrated intrinsic sex-specific differences in vascular EC permeability using rat primary cultured microvascular EC. The purpose of this study was to establish primary cultured microvascular EC derived from mouse skeletal muscle. EC were dispersed enzymatically and isolated with Dynabeads coated with Griffonia simplicifolia lectin. The isolated EC were cultured and characterized by EC markers, PECAM-1 and DiI-Ac-LDL, as well as by EC unique functional property, capillary-like tube formation. We found that PECAM-1 and DiI-Ac-LDL were expressed in primary cultured EC. Flow cytometry analysis revealed that approximately 90% of primary cultured cells isolated with this method expressed PECAM-1, an EC specific protein. These findings demonstrate that the methodology described here is able to produce 90%-pure population of mouse primary cultured microvascular EC. Therefore this study suggests that mouse primary microvascular endothelial cells derived from a variety of genetically modified mouse models can be produced. As a result, this study provides a powerful approach to investigate molecular mechanisms of microvascular function/dysfunction associated with EC including angiogenesis, endothelium-dependent vascular constriction or dilation, leukocyte-EC interaction, and tissue edema.

***Islam, M.E.^{1,2}, T. Jimenez¹, C. Pelham¹, M. Rodova², S. Puri², B. S. Magenheimer², R. L. Maser³, C. Widmann⁴, J.P. Calvet².** ¹Department of Chemistry/Physics, Northwest Missouri State University; ²Department of Biochemistry and Molecular Biology, University of Kansas Medical Center; ⁴Department of Physiology, Biology and Medicine Faculty, Lausanne University, Switzerland. **MEKK1 MEDIATES TRANSCRIPTIONAL REPRESSION OF PKD1 BY INTERACTING WITH PROMOTER-BOUND p53 TUMOR SUPPRESSOR PROTEIN.** Mitogen-activated protein kinase (MAPK) cascades are involved in a wide variety of cellular functions including cell proliferation, cell differentiation, cell migration, and cell death that ultimately depend on changes in gene expression. One of the key MAP3 kinases, Mekk1 propagates signals through Mkk4/7 to c-Jun N-terminal kinase (JNK), which then translocates to the nucleus to regulate the activities of multiple transcription factors including AP-1

and p53. To determine whether the Mekk1-Mkk4/7-JNK pathway regulates PKD1 gene expression, cells were transfected with full-length Mekk1 or a truncated, constitutively active CA-Mekk1 construct. Both proteins markedly reduced transcriptional activity from a 200 bp proximal PKD1 promoter-luciferase construct. However, inhibitors of the three major MAPK pathways, ERK, p38, and JNK, failed to block this Mekk1-mediated effect. Kinase-inactive forms of Mekk1 also repressed the promoter, excluding the involvement of a Mekk1 phosphorylation cascade. Mutation analysis and DNA-pull down assay determined that a p53 element in the 200 bp proximal promoter mediates Mekk1 repression. The inhibitory effect of Mekk1 was attenuated by transfection of a dominant negative p53 construct, and by p53 siRNA knockdown. Mekk1 repression of the PKD1 promoter was not seen in p53-null HCT116 cells further implicating p53 in this repression mechanism. Mekk1 was shown to be present in the nucleus and to co-immunoprecipitate with p53. Chromatin immunoprecipitation demonstrated p53-dependent Mekk1 binding to the PKD1 promoter. Transient or stable transfection of kinase-active or kinase-inactive Mekk1 constructs as well as PMA, H₂O₂, and TNF α , that endogenous Mekk1 and/or p53, significantly decreased endogenous PKD1 mRNA levels. Mekk1 was also able to decrease mRNA levels from the IEX-1 gene and the bradykinin B2 receptor gene, which were both known to be downregulated by p53. As such, these results have identified a novel transcriptional mechanism whereby one of the key MAP3 kinases, Mekk1, regulates transcriptional activity through an interaction with p53. The tumor suppressor protein p53 downregulates a number of genes, including the gene most frequently mutated in autosomal dominant polycystic kidney disease, PKD1. We have discovered that Mekk1 translocates to the nucleus and acts as a co-repressor with p53 to repress PKD1 transcriptional activity. Mekk1-p53 repression does not require Mekk1 kinase activity. A functional Mekk1-p53 interaction at p53-regulated promoters suggests a new mechanism by which stress-pathway stimuli can directly affect p53 function, in this case downregulating the PKD1 gene and possibly causing haploinsufficiency. These results also suggest the possibility that Mekk1 variants could have a role in human cancer susceptibility. Supported by NIH.

Reyes-Reveles, J., DeLong, R.K., Witkowski, C.M., Sedaghat-Herati, M. R. Department of Biomedical Sciences, Missouri State University. ANALYZING THE STABILITY OF mPEG-PAMAM DENDRIMERS WITH RNA. PAMAM dendrimers are novel compounds that are being used as prospective gene delivery agents for their ability to bind DNA and RNA. Dendrimers are highly branched nanocompounds with amino groups on the periphery that give dendrimers cationic properties. The study addressed two common complications that are associated with RNA delivery; aggregation and stability. Experiments involving the mPEG-PAMAM dendrimer of generation 4 with RNA considered the interactions at varies N/P ratios (3^o, 1^o, amine groups of dendrimer/phosphate groups on RNA) of 10, 5, 1, .4, .2. The study demonstrates that at different N/P

ratios on an agarose gel the interaction between the RNA and mPEG-PAMAM complexes occurs. As the N/P ratio decreased below one, the RNA was able to move freely through the agarose gel compared to when it was retained at an N/P ratio ≥ 1 . Dynamic laser light scattering was used to analyze aggregation of the nanomolecules using the same N/P ratios. The nanomolecules were analyzed using the DLLS instrument throughout a timeframe of one week with sizes remaining at the nanoparticle range. Aggregation did not occur over time, as seen in size data from the DLLS. These results indicate that the dendrimer/RNA complexes have high stability and low aggregation.

Computer Science:

Section Chair: David R. Naugler, Southeast Missouri State University

***Naugler, D. R., Department of Computer Science, Southeast Missouri State University, PARALLEL PROGRAMMING IN THE UNDERGRADUATE COMPUTER SCIENCE CURRICULUM.** Where does parallel programming belong in the undergraduate Computer Science curriculum? Most computers now have multi-core processors and the number of core is increasing with each generation of processors. Most Computer Science students learn sequential programming and little, if any, parallel programming. To make effective use the computational capability of a multi-core computer of requires parallel programming. Many specialized machine designs and languages for parallel programming languages have come and gone. HCI (high performance computing) deals with the efficient use of computer resources and uses the established languages C, C++ and Fortran which have been augmented by precompilers and libraries to allow programming in to openMP and MPI. OpenMP is used mainly to parallelize loops in shared memory multiprocessor machines, and MPI is used for distributed memory systems, mainly clusters. OpenMP can be used to incrementally parallelize sequential programs and it can be learned incrementally. MPI requires substantial modifications of program code and is substantially harder to master. Modern functional languages such as Erlang require thinking about programming, sequential and parallel, quite differently. When C/C++ are core language taught in a Computer Science curriculum and openMP can be introduced incrementally over several semesters. Erlang and other functional languages are usually introduced in upper level courses on programming languages.

Conservation:

Section Chair: Cary D. Chevalier, Missouri Western State University

***Atwood, J.J., Missouri Botanical Garden. THE STATUS AND FUTURE OF BRYOLOGY AND BRYOLOGICAL**

COLLECTIONS IN MISSOURI. The primary repository for Missouri bryophytes is the Missouri Botanical Garden, which includes the herbarium specimens of most bryophyte collectors in the state. Based on these approximately 20,000 specimens, several floristic trends are apparent. The Missouri bryophyte flora is composed primarily of taxa that also occur in eastern North America, but it is somewhat less diverse. Some common Missouri taxa often have rare or localized distributions in eastern North America, while some common taxa in eastern North America become rare or localized in Missouri. In addition, some taxa in eastern North America reach their western-most distribution boundary in Missouri. Although there have been numerous collectors of Missouri bryophytes, counties throughout Missouri have been unevenly collected and differ widely in the total number of taxa. Mosses have been collected more than hepatics, and some counties lack hepatic collections altogether. Counties located south of the Missouri River and north of Crowley's Ridge have been the best collected and have the highest taxonomic diversity. Counties north of the Missouri River and south of Crowley's Ridge have not been well collected, giving the appearance of low taxonomic diversity. The Missouri Botanical Garden is currently planning a floristic treatment of Missouri mosses. The first stage of this project will be to document the mosses of under-collected counties and database all of the existing moss herbarium specimens.

***Bossert, A.J., M.V. Cove, and S.W. Wilson. Department of Biology and Earth Sciences, University of Central Missouri. EFFECT OF HABITAT ALTERATION ON WING DIMORPHISM IN A DELPHACID PLANTHOPPER (HEMIPTERA: FULGOROIDEA).** Many delphacid planthoppers are wing dimorphic, where individuals are either flight capable macropters or flight incapable brachypters. Most of the research on wing dimorphic planthoppers has centered on the ecological factors that trigger the development of brachypters or macropters in agricultural pests, or in relatively stable salt marsh habitats. There have been no studies demonstrating the response of planthoppers to large scale alterations in a stable system. The delphacid *Pissonotus piceus* Van Duzee is monophagous on the persistent emergent aquatic plant *Polygonum hydropiperoides* Michx. In this poster, we document a shift in the ratio of brachypters/macropters after destruction of their plant hosts by draining a lake and subsequent restoration of the habitat.

***Cove, M.V., B.M. Jones, and V.L. Jackson. Department of Biology and Earth Science, University of Central Missouri. MAMMAL CAMER TRAPPING SUCCESS IN A FRAGMENTED SUBURBAN LANDSCAPE.** Camera traps are commonly used for mammal surveys and many recent studies have published variable trap success rates. All published reports have focused survey efforts in protected areas or large contiguous forests, but we used camera traps in a highly altered suburban landscape. We selected 22 camera trap sites in Warrensburg and Lee's Summit, Missouri and surveyed for a total of 308

trapnights (TN) of effort. *Procyon lotor* (raccoon) had the highest trap success (38.96/100 TN), followed by: *Didelphis virginiana* (Virginia opossum, 37.34/100 TN); *Odocoileus virginianus* (white tailed deer, 27.92/100 TN); *Sciurus niger* and *S. carolinensis* (fox and gray squirrel, 19.48/100 TN); *Vulpes vulpes* (red fox, 8.77/100 TN); *Canis latrans* (coyote, 7.79/100 TN); *Sylvilagus floridanus* (cottontail rabbit, 3.90/100 TN); *Urocyon cinereoargenteus* (gray fox, 2.92/100 TN); *Lynx rufus* (bobcat, 1.95/100 TN); and *Mephitis mephitis* (striped skunk, 1.62/100 TN). These results are higher than any other published findings. We used 1–3 kg of deer meat as bait at each camera station and we believe this increased our trap success of mesopredators (medium-sized carnivores and opossums) versus studies that used no bait. However, our trap success for deer, squirrels, and rabbits were also higher than those published and these species were not attracted to bait. We hypothesize that the increased trap success in our study reflects (1) a true state of increased mesopredator abundance due to increased human-derived resources in the suburbs, and (2) concentrated activity of mammals in small fragmented forest patches versus the expansive forest tracts in other studies. Supported by UCM Honors College.

***Edmond, B. S. Department of Computer Services, Missouri State University. A ROLE FOR CITIZEN SCIENTISTS IN THE ACCUMULATION AND MANAGEMENT OF BIOLOGICAL INFORMATION.** Field observation projects that utilize members of the public, or "citizen scientists", have grown dramatically in numbers in recent years, primarily due to widespread availability of the Internet and the maturation of mobile communications devices. A widespread "army of volunteers" can provide researchers with a level of data collection and monitoring that simply was not possible in the past. Several recent projects facilitate the observation and documentation of natural events, including flora and fauna encounters, using interactive web technology. Researchers are able to access vital and timely information from individual participants and communicate directly with them, while the participants are able to develop a personalized profile, add photographs, write blogs, comment on others' contributions, create and manage outside events, and form outside relationships with the researchers or other participants. Such methods that encourage participation and ownership by citizens typically transcend the project itself, resulting in a greater appreciation of the study subjects and scientific research in general. Two citizen scientist projects for Missouri, the active Missouri Herpetological Atlas Project (MOHAP) and the proposed Missouri Native Plant Society Database (MONPS-DB), fulfill the criteria for public participation in documenting natural history events that are otherwise difficult to obtain on a large scale within a short time period. Citizen scientist contributions include, at a minimum, the collection of baseline natural history data, such as observation details for a particular species in a particular location. However, less obvious contributions might include verification of species' identity, manual entry of handwritten notes from various

sources, on-line community organization of field trips, meta-analysis of others' contributions, and the creation of profiles for particular taxa or localities. Future efforts to accumulate and manage biological information in Missouri should seriously consider the inclusion of citizen scientists as participants and stakeholders.

***Heth, R. K. Department of Biology and Environmental Health, Missouri Southern State University. A PRELIMINARY REPORT OF THE MAYFLIES OF THE INTERIOR HIGHLANDS.** Mayfly studies are hampered by the current state of taxonomic resolution and a lack of specific regional keys, resulting in most studies limited to family or generic level identification. This lack of resolution is especially true for the Interior Highlands, the mountainous regions of southern Illinois, Missouri, Arkansas, and Oklahoma with nearest regional key published in 1953 (Illinois). I assembled a list of Interior Highlands mayfly species from USGS data, available published literature, and my personal collections. Taxonomy in this list was updated to match the most current nomenclature in the Purdue University mayfly database. Of the 562 nominal species in 23 families in North America, I listed 163 species in 15 families collected in the Interior Highlands. Most diverse families include Baetidae, 47 species, Heptageniidae, 32 species, Ephemerellidae, 23 species, and Leptophlebiidae, 17 species. Mayflies of three regional watersheds are especially well known, the Kiamichi River of the Southwestern Ouachitas, 55 nominal species, Spring Creek in the Western Ozarks, 44, and Little Piney Creek of the Arkansas Ozarks, 38. A specific regional key as well as accessible reference collections are needed by both regional agencies and educational institutions.

***Leahy, M. Missouri Department of Conservation. THE MISSOURI NATURAL AREAS PROGRAM – AN APPROACH TO CONSERVING MISSOURI'S BIOLOGICAL DIVERSITY.** Missouri covers about 2% of the land mass of the U.S. but ranks 21st in the nation in terms of a composite index of native plant species and certain faunal groups. For example, the state ranks ninth in the nation in native fish diversity and contains more native plant species than are found in all of Alaska. How do conservation biologists meaningfully attempt to manage for this native biological diversity? One key approach is by conserving natural communities – the habitats on which our native species depend upon. For 34 years the Missouri Natural Areas Program has taken a “coarse-filter” approach to the conservation of the state's biological diversity. By conserving representative examples of the 16 major natural community types in the state, representing terrestrial, aquatic and cave ecosystems, the Missouri Natural Areas Program seeks to conserve vital lands and waters critical for the preservation of Missouri's natural heritage. Although threats to Missouri's natural heritage are legion, conservation of key natural community sites with high ecological integrity in the various ecological regions of the state is an important strategy to conserve the state's biological diversity.

Stephan, K., E.M. Magrowski*, M.J. Ordway and S.E. Hearne. College of Agricultural and Natural Sciences, Lincoln University. HETEROGENEITY IN ABANDONED URBAN LIMESTONE QUARRIES - POTENTIAL FOR CONSERVATION? In this study we quantified heterogeneity in an abandoned limestone quarry with respect to a) soil physical and chemical parameters, b) vegetation composition and cover, and c) microclimate. Eight 3m × 20m plots were established in geomorphologically distinct areas of a Jefferson City limestone quarry (LU quarry) abandoned 70 years ago. For comparison, one plot was established in a nearby undisturbed forested area and a recently abandoned quarry, respectively. Soil properties in LU quarry were variable but were bookended by the recently abandoned quarry (pH=8.8, bulk density=2.0 g/cm³, 58% gravel) and the undisturbed forest (pH=6.5, bulk density=1.1 g/cm³, 12% gravel). Vegetation cover (<1m height) was 2% and 35% in the recently abandoned quarry and the undisturbed forest, respectively, and ranged from 30–85% in LU quarry. Average species richness ranged from 6 to 13 in LU quarry and was higher than in the recently abandoned quarry (4) and the undisturbed forest (6). October microclimate in the recently abandoned quarry was warm (air temperature 16°C) and dry (volumetric soil water content 9%). In LU quarry, microclimate was variable and on average cooler (maximally by 2°C) and moister (maximal soil moisture 33%). Our preliminary data suggest that LU quarry has recovered significantly since abandonment and that heterogeneity in LU quarry is significantly greater than in the recently abandoned quarry but also in the supposed climax community of the undisturbed forest. This heterogeneity could be exploited for conservation or educational purposes. Supported by McIntyre-Stennis Project MOX-EIVAZIF2.

***Mills, M.S.*, and T. Ausberger. Department of Biology, Missouri Western State University. USING COVERBOARDS TO EXAMINE HERPETOLOGICAL BIODIVERSITY OF THE LOESS HILLS AT SQUAW CREEK NATIONAL WILDLIFE REFUGE, MISSOURI.** In the fall of 2009, we began a research project in the Loess Hills at Squaw Creek National Wildlife Refuge, Missouri. We placed cover boards (2x4 feet) in prairie and forested areas in order to examine the biodiversity in the Loess Hills and determine species composition and abundance for reptiles and amphibians. Sampling began in the spring of 2010 and since that time period, a total of 68 individuals of six species have been captured: 48 *Diadophis punctatus*, 8 *Thamnophis sirtalis*, 5 *Lampropeltis triangulum*, 3 *Coluber constrictor*, 2 *Carphophis vermis*, and 2 *Pseudacris triseriata*. Of these six species, *Diadophis punctatus* was the most commonly captured with males more commonly found under cover boards than females. Throughout the course of the sampling season, most (89%) were captured in prairie versus forested habitat. Our goals for this project included: (1) determine reptile and amphibian biodiversity in the Loess Hills through long-term sampling, (2) obtain measurements for captured organisms, and (3) determine habitat associations of these species.

***Pace, J., R. Peterson* and R. K. Heth. Department of Biology and Environmental Health, Missouri Southern State University. DECOMPOSITION AND COMMUNITY STRUCTURE OF LEAF-PACKS IN OZARK STREAMS.**

Leaf decomposition and invertebrate community structure are important ecosystem and community measures in headwater streams. Spring and fall 2010 we repeated leaf decomposition studies undertaken fall 2008 and spring 2009, measuring decomposition rate and community structure of red elm leaf packs as well as community structure of plastic leaf-packs. Macroinvertebrate biomass was also estimated fall 2010. Leaf-packs were composed of pre-dried (fall green, spring senescent) red elm leaves or polyethylene leaves bagged in 2 by 4 mm mesh laundry bags. Replicates were removed and processed weekly. Leaves were rinsed and all pieces > 4 mm air dried. All macroinvertebrates were identified and (fall 2010) lengths were used to estimate biomass. Spring 2010 results were limited by flood events, but decomposition rates, fraction lost/day were 0.0067–0.0085 in Turkey Creek and 0.018 in Jones Creek, similar to spring 2009 results. Chironomidae dominated spring leaf-packs. Fall 2010 decomposition rate in Jones Creek, expressed as percent dry mass remaining, was % remaining = $101e^{-0.048}$ days in stream with an R^2 of 0.82, similar to fall 2008 rate. Macroinvertebrate biomass fall 2010 rose for the first 6 weeks and then declined in the last week, but line fit was poor ($R^2 = 0.20$). Within three weeks of placement, leaf-packs were heavily colonized by macroinvertebrates (total numbers 228 /leaf pk \pm 123 95% CI). Chironomidae dominated numbers (69–78%). Large-bodied Plecoptera and Trichoptera dominated biomass. Lirceus, a common shredder in spring, were few in fall samples, less than 1% total numbers and 8% total biomass. Fall 2010 plastic leaf-packs were similar to red elm leaf-packs in total numbers, similar to spring 2009 plastic leaf-packs. Macroinvertebrate biomass in plastic leaf-packs fall 2008 declined to 57% of the red elm leaf-packs by the 6th week but differences were not significant (t-test, $\alpha = 0.05$, $P = 0.09$).

***Riedle¹, J.D., R.T. Kazmaier², and W. Littrell³. ¹Lincoln University, ²West Texas A&M University, ³Texas Parks and Wildlife Department. COMMUNITY ECOLOGY OF TURTLES IN A SMALL FLOODPLAIN ENVIRONMENT.**

The southeastern United States is considered a diversity hotspot for aquatic turtles with 18–19 species co-occurring within the same river drainage. As previous research on turtle community structure has focused on landscape level effects driving turtle diversity patterns, our objective was to intensively sample at a smaller scale to determine how species assemblages are governed by niche and metacommunity dynamics. Between 2006–2009 we sampled Catfish Creek and adjacent aquatic habitats on the Gus Engeling Wildlife Management Area, Anderson County, Texas. We captured eight species of aquatic turtles, and results from niche overlap indices and ordination analyses revealed segregation among species based on water depth, flow, and availability of basking structure. When analyzed in conjunction with fish community data (31 species captured

simultaneously during turtle sampling), both turtles and fish exhibited similar patterns in habitat partitioning across the landscape. Results from Monte-Carlo Permutation tests run in simultaneously with ordination analyses showed the single most important variable in determining species scores for both taxa was the presence of downed woody debris. Based on relative abundances of both fish and turtles, species dispersal and mixing occurred during seasonal flood pulses, and species richness decreased with increasing distance from a lotic source.

***Decker, J., J. Jennings* and J. Rushin*. Department of Biology, Missouri Western State University. THE EFFECT ON SPECIES COMMONNESS VALUES OF SPRING AND A SUMMER BURNS OVER A FIVE-YEAR PERIOD (2005 – 2010) IN A LOESS HILL MIXED-GRASS PRAIRIE IN NORTHWEST MISSOURI.**

Quadrat plot surveys of native loess hill prairie and successional plants were completed along random transects on the southwest facing slope of a loess hill at the Jamerson McCormack's Conservation Area near Forest City, Missouri, before and after a spring burn and a summer burn. Seventy-nine plant species were identified from the plots. Several of the plants found in plots during this study are listed on the Missouri Species of Conservation Concern because they are mostly limited to the loess hill mixed-grass prairies along the Missouri River in Northwest Missouri. These species include skeleton weed (*Lygodesmia juncea*), snakeroot (*Liatris punctata* var. *nebraskana*) and dalea (*Dalea enneander*). Big bluestem (*Andropogon Gerardi*), redbud (*Cercis canadensis*), smooth sumac (*Rhus glabra*), buckbrush (*Symphoricarpos orbiculatus*), little bluestem (*Andropogon scoparius*) and rough-leaved dogwood (*Cornus Drumundi*) were the most common species surveyed throughout the study area from 2005 to 2010. Other very common plant species surveyed were greenbriar (*Smilax tamnoides*), Black locust (*Robinia pseudoacacia*), Virginia creeper (*Parthenocissus quiquifolia*) and river grape (*Vitis riparia*). Major increases in commonness following the spring and summer burn treatments during this study were observed for big bluestem, leadplant, side oats gramma (*Bouteloua curtipendula*) and Indian grass (*Sorghastrum nutans*) in the hilltop portion of the study area. Toward the bottom of the loess hill, woody pioneer species including redbud, smooth sumac, buckbrush, rough-leaved dogwood, and greenbriar showed substantial increases in commonness value after the burns. Although the invasive herb white sweet clover (*Melilotus alba*) maintained a fairly low commonness value during the first two years (2005 and 2006) of the study it did increase during the final years (2008 and 2010).

***Sample, T. and J. Yang. 2011. Department of Biology and Environmental Health, Missouri Southern State University. EFFECT OF ZINC ON LEAF DECOMPOSITION AND ISOPOD SURVIVORSHIP.** Zinc is a common mining contaminant in southwestern Missouri streams and is known to reduce survivorship of aquatic organisms and subsequently affect processing rates of organic matter. Our questions were

fourfold: what is the 1) effect of [Zn] on isopod survivorship, 2) combined effect of the microbial community and isopods on leaf decomposition, 3) effect of [Zn] on microbial leaf decomposition, and 4) combined effect of [Zn] on leaf decomposition by microbes and isopods? We constructed aerated laboratory microcosms using 1 pint canning jars. Zinc was added in the form of a zinc sulfate solution with lower [Zn] similar to local ambient conditions. Isopod treatments were composed of ten 4–6 mm *Lirceus hoppinae*, regionally common, but absent in mining affected streams. All treatments included 400 ml of decanted Jones Creek water (not affected by mining) and 5 pre-conditioned dried senescent red elm leaves. The 8 treatments were 1) leaves and water only, 2) + 10 μM [Zn], 3) +20 μM [Zn], 4) + isopods, 5) +10 μM [Zn] + isopods; 6) +20 μM [Zn] + isopods 7) + 40 μM [Zn] + isopods, and 8) + 80 μM [Zn] + isopods. Five replicates of each treatment were run simultaneously for 28 days. Leaf decomposition was measured as fraction lost/day, and survivorship as number remaining at 28 days. Isopod survivorship declined significantly at 80 μM [Zn]. Regression of survivorship and [Zn] was significant ($P = 0.0007$), best fitting an exponential decay model ($R^2 = 0.50$). Effect of isopods leaf decomposition was only significant at the 90% level ($P = 0.09$). Low [Zn] did not significantly affect microbial decomposition. Zinc affected the leaf decomposition by isopods at 40 and 80 μM [Zn] (exponential regression, mass lost/day = $0.014e^{-0.016x}$, $R^2 = 0.75$) probably by reduced survivorship. We concluded ambient [Zn] levels in local streams alone do not affect adult isopod survivorship or leaf decomposition. High [Zn], which occurs during flood events, may influence survivorship and leaf decomposition.

***Vanderpool, S. and M. Scott. Department of Life and Physical Sciences, Lincoln University. TRANSITIONAL STAGES AND GROWTH IN SMALL BIOLOGICAL COLLECTIONS.** Curators of small biological collections face a multitude of challenges that extend beyond the scope of limited funding, time and space. Many small biological collections are primarily oriented toward the educational needs of the institution where they are located, are often based on an accumulation of student collections and may be housed in less than ideal conditions. Prior discussion of the symposium “Challenges to Management of the Biodiversity of Missouri” prompted us to consider some of the impediments that small collections may face as they participate in broader based biodiversity programs. We will discuss a number of topics including the need for a coordinated management plan, articulated goals and objectives, data base and dissemination plans, participation in inter collection loans, facilities, health and safety issues and obtaining permits.

***Wildhaber, K. and N. Navarrete-Tindall. Native Plants Program Cooperative Extension, Lincoln University. REVIVING AN OLD-ART: CORDAGE MADE FROM NATIVE PLANTS.** The purpose of this project is to show cordage made of native plants as a cultural and artistic tool that

should be included in outreach and education activities that allow children and adults to interact with nature and better understand peoples of the past. Cordage is any kind of rope, string, twine or thread made from animal ligaments or the leaves or stems of plants. Among the native species that provide materials for cordage are common milkweed (*Asclepias syriaca*), dogbane (*Apocynum cannabinum*) and rattlesnake master (*Eryngium yuccifolium*). Fishing nets, mats, baskets, wearable ornaments, and footwear were made with these and other plants by early inhabitants. At present, cordage has potential in fine arts, crafts, and household items. Plant materials are usually collected at the end of the growing season, causing little or no damage to existing plant populations. Dogbane and common milkweed are very common native plants that grow in disturbed sites and old pastures. Rattlesnake master less common, however, it can be easily propagated from seed and underground runners and grows naturally in prairies and glades. Stems of milkweed and dogbane produce high quality fibers that are typically stronger than those of rattlesnake master. Besides increasing awareness about using native plants for cordage, food, natural dyes, and other value-added uses, the Native Plants Program emphasizes native plants importance in ecosystems during annual events and seminars. Events and seminars are open to the public. Supported by National Institute of Food and Agriculture (NIFA).

***Yatskievych, G., and R. L. Hill. Missouri Botanical Garden. THE FLORA OF MISSOURI PROJECT: PROGRESS AND CHALLENGES IN THE COLLECTION, MANAGEMENT, AND DISSEMINATION OF INFORMATION.** Begun in 1987 as a collaboration between the Missouri Department of Conservation and the Missouri Botanical Garden, the Flora of Missouri Project has evolved from a simple attempt to update Steyermark’s (1963) *Flora of Missouri* into a permanent project to collect and disseminate information on the state’s vascular plants. A hallmark of this approach has been the assistance of a large group of amateur and professional botanists who have contributed specimens and other field observations. Currently, the Flora of Missouri Database contains about 3240 taxon names and 173,000 specimen records (the latter believed to represent about 25% of the cumulative specimens in herbaria). Although incomplete, the database has sufficient sampling density to allow us to summarize species distributions and documented plant diversity at the county level. Additionally, the database can be queried to suggest species that are undergoing historical declines in Missouri and to track the expansion of selected invasive exotics. However, because the museum record is historical and cumulative in nature, for most counties we currently do not have accurate data on the present-day (vs. historical) floras. Existing data do allow prioritization of regions in the state most in need of additional inventory. Various text and image data sets relating to the Flora also recently have become available online through the MBG Tropicos database (<http://www.tropicos.org/Project/MO>), which allows integration of information on Missouri flora with more general nomenclatural, specimen, and literature resources.

Mills, M.S., J. Haley, N. Wallace*, and C. Zirkle. Department of Biology, Missouri Western State University; Central High School, St. Joseph. URBAN BIODIVERSITY: POPULATION ECOLOGY OF TURTLES ON THE CAMPUS OF MISSOURI WESTERN STATE UNIVERSITY. Over the past two years we have marked 60 turtles of four species on the campus of Missouri Western State University: 29 *Chelydra serpentina*, 22 *Chrysemys picta*, 8 *Trachemys scripta*, and 1 *Apalone spinifera*. Based on mark-recapture estimates, we have at least 100 turtles living in the nine ponds on campus, with estimates ranging from 2–24 turtles per pond. One individual, a female painted turtle, moved between two ponds, a distance of about 200m. In the summer of 2010 we captured no turtles or invertebrates in Pond 3, perhaps as a result of ongoing construction near this pond. Our invertebrate samples during the summer of 2010 revealed a negative correlation between turtle species richness and invertebrate abundance.

Geography:

Section Chair: Gary J. Cwick, Southeast Missouri State University

***Fox, D. P. Department of Natural and Physical Sciences, Park University. A PRELIMINARY ASSESSMENT OF THE INTENSITY AND SIGNIFICANCE OF THE “MIDLAND EMPIRE” AS A MISSOURI VERNACULAR REGION.** In 1980 Wilbur Zelinsky called upon geographers to take up the task of expanding our knowledge of North America’s vernacular regions. Although Zelinsky himself typically focused on relatively large-scale vernacular regions (i.e., those often spanning across multiple states), other geographers have increasingly identified and studied various aspects of such regions at the sub-state and even highly-localized scales. The “Midland Empire” is a vernacular regional label that has been used by citizens of the city of St. Joseph, Missouri, and several of the surrounding communities in northwest Missouri and northeast Kansas since the late 1940s. Previous research efforts to map the areal extent of this region have suggested that this is indeed a label that has some level of common usage and meaning to the population in this area. However, no attempts to date have been made to actually assess either the actual intensity of its usage by the people within the study area, let alone if it has acquired any significant meaning to them. Preliminary results from a commonly used questionnaire methodology by cultural geographers to measure such vernacular regional identity issues will be presented and discussed.

Peterson, A., S.A. Hageman*, D.P. Fox, C.T. Roye, and R.L. Bailey. Department of Natural and Physical Sciences, Park University. KEY FINDINGS FROM A WASTE AUDIT OF PARK UNIVERSITY. Park University received a recycling grant from Mid-America Regional Council (MARC) in 2009

which required a small-scale waste audit of the university. The university worked collaboratively with staff, faculty, and students to do a series of dumpster sorts representing several key locations on campus. Environmental services provided OSHA required training for volunteers on blood-borne pathogens and the use of the personal protective equipment and helped transport dumpsters to one location making the audit possible. Waste was separated by recyclables from the trash and weighed to determine what percentage of our waste is still recyclable. The audit revealed 45% of the waste was actually garbage and the largest wasted recyclable by weight was food waste (18%) while second was essentially a tie at 9% each for cardboard, recyclable plastics, and ruined paper. The least wasted recyclable by weight (2%) was metals. The key findings of the audit were that two easy to recycle materials are found in higher levels than expected. Those were recyclable plastics and white paper / ruined paper combined (11%). The fact that 71% of all white paper was ruined by food waste suggests a potential need for composting. Most encouraging was that the average sort resulted in only four pounds of metal indicating that aluminum cans are finding their way to the recycling bins.

***Hoffman, B.L. Department of Natural and Physical Sciences, Park University. EPIDEMIOLOGICAL EVIDENCE OF A HERALD WAVE OF THE 1918 PANDEMIC INFLUENZA VIRUS IN ST. JOSEPH, MISSOURI.** While the 1918/1919 H1N1 influenza pandemic is widely recognized as a “worst-case scenario” for the emergence of new influenza strains, relatively little is known about the origin of the responsible virus and its pattern of spread. Most studies of this virus in the United States rely on temporally and spatially aggregated data. Location-specific studies of the impact of the 1918 pandemic strain in the United States have been confined primarily to large cities on the East Coast or West Coast. In this study, data on pneumonia and influenza fatalities from 1910–1923 have been extracted from death certificates for Saint Joseph, Missouri, a typical mid-sized city in the central United States. An increase in pneumonia and influenza mortality was noted starting in the 1915/1916 influenza season. Initially, increased mortality was observed in infants and the elderly. In February 1918, an age-shift typical of pandemic strains of virus was seen, as the burden of mortality shifted to young adults, a characteristic of the 1918 pandemic virus. These results provide one of the first confirmations of the existence of a “herald wave” of influenza activity in the United States prior to the recognized start of the H1N1 pandemic in Spring 1918. This study is one of very few that measures the impact of 1918/1919 influenza impact in a particular location in the central United States.

***Hoffman, B.L. and D.P. Fox. Department of Natural and Physical Sciences, Park University. USING TOTAL MORTALITY DATA TO DETERMINE THE IMPACT OF THE 1918–1919 INFLUENZA PANDEMIC ON MISSOURI COUNTIES.** All Missouri death certificates prior to 1960 are available online, and have greatly facilitated our studies of the

1918–1919 H1N1 influenza pandemic in Northwest Missouri. However, reading through every death certificate for cause of death is cumbersome. The coding of cause of death is also highly variable amongst doctors. Total death records are available for each Missouri county, as well as Missouri cities with a population in excess of 10,000 from 1910–1925. Information on deaths from pneumonia and influenza (P&I) are also available for Missouri cities with populations in excess of 10,000. We determined total mortality rate baselines for Missouri counties and cities using years free of pandemic influenza activity: 1915–1917 and 1921–1923. Baseline P&I death rates were determined for Missouri cities in the same time frame. Total mortality figures from 1918–1920 were compared to baseline data to determine excess mortality rates for each county and independent city in Missouri. As expected, relatively high numbers of excess deaths were seen in and around cities such as St. Joseph, Kansas City, Hannibal. Lower than expected mortality was observed in St. Louis city and county. Surprisingly, the highest mortality cluster was seen in the Missouri Bootheel. Excess total mortality in Missouri cities in 1918 was positively correlated with excess P&I mortality ($r^2 = 0.6436$).

Geology/Geosciences:

Section Chair: Damon J. Bassett, Missouri State University

***Berger, M.L., and T.G. Plymate, Department of Geography, Geology and Planning, Missouri State University. PETROGRAPHIC ANALYSIS TO DETERMINE SPATIAL VARIATION OF POROSITY AND MINERALOGY IN THE LAMOTTE SANDSTONE IN SW MISSOURI.** Anthropogenic release of carbon dioxide has been accepted as a possible cause of global climate change. In order to reduce the amount of CO₂ released into the atmosphere from the burning of fossil fuels, several countries are taking steps to capture and sequester the carbon from these emissions. A proposed target unit for CO₂ sequestration is the Lamotte Sandstone, the deepest porous media available in southwest Missouri. This study will contribute to the overall body of knowledge on this basal Cambrian sedimentary unit, as well as to the suitability of this unit for the Missouri Carbon Sequestration Project. A detailed petrographic analysis of the Lamotte Sandstone, consisting of porosity and bulk mineral composition, is used to determine horizontal and lateral variation within the unit. Thin sections from an historic core and a new core drilled on-site are prepared at intervals of approximately ten feet. At least 1000 points per slide are counted. This data will be used to interpret the depositional environments of the Lamotte Sandstone in southwest Missouri and, in conjunction with subsequent hydrologic studies, can be used in determining the potential storage capacity of the unit, as well as in geochemical modeling of interactions of the CO₂ with the constituent minerals. This material is based upon work supported by the Department of Energy National Energy Technology Laboratory under Award Number DE-NT0006642 to City Utilities of Springfield, MO.

***Chinnasamy, P., and J.A. Hubbart. Department of Forestry, University of Missouri. INFLUENCE OF GROUNDWATER ON STREAM WATER QUALITY IN A MID-MISSOURI FORESTED RIPARIAN WETLAND/FLOODPLAIN.** Streams supply water for irrigation and human consumption. Streamwater passes between the active channel and groundwater, passing through the surrounding soil. Hynes (1975) stated, “We may conclude that in every respect the valley rules the stream,” stressing that potential changes occurring in the stream valley (i.e. land use) will be reflected in the streamwater. It is expected that water and nutrients will cycle from stream to floodplain (and vice-versa) at various concentrations that will vary spatially and temporally. For example, depending on spatial location, land use, and seasonality, higher nutrient concentrations may move towards the stream, supplying nutrients to the aquatic ecosystem and affecting primary production and water quality. Studies are warranted that quantify interactions between the stream and valley. The following research is on-going in the Baskett Research and Education Area, in the Ozark border region of south-central Missouri, where flux of water and nutrients (NO₃, P, K, and NH₃) are being monitored year-round. Analysis of streamwater resulted in average concentrations of 0.3mg/L NO₃ and 352mg/L TDS. Groundwater samples from the forested riparian zone averaged 0.07mg/L NO₃ and 336mg/L TDS. Stream-stage (used for quantifying hydraulic gradient) averaged 19cm. Average difference of groundwater level measured between 9m and 3m from the stream along the riparian ranged from 24cm to 50cm, indicating on an average that the groundwater flux is towards the stream. Ongoing data analyses will result in computation of mass-balance, and groundwater and nutrient flux, providing regionally specific information that will improve understanding of current and future land use management practices. Supported by EPA/CD97701401.

***Eicks, P. Mokane Missouri. AN OCCURRENCE OF LATE PALEOZOIC (MID PENNSYLVANIAN) PETRIFIED WOOD, CALLAWAY COUNTY, MISSOURI.** Localized occurrences of silicified wood occur in stream channels near Cedar Creek, Callaway County Missouri. These occur as silicified gnarly, brown petrified logs believed to be from large tree ferns possibly associated with the Bevier? Coal which occurs in the upland regions of western Callaway County. Associated with these logs have also been found sections of the tree fern *Psaronius* as well as the buttressing “roots” of what are believed to be large tree ferns. The age of these petrifications are definitely Pennsylvanian however other occurrences of petrified wood in the Ozark region to the south of Callaway County may be of younger geologic age, possibly either Late Mesozoic (Cretaceous) or early Tertiary (Eocene). These occurrences, like those of Callaway County occur in upland areas, often associated with “knobs” which represent outliers of rocks which were otherwise removed millions of years ago by erosion.

***Gentile, R.J. Department of Geosciences, University of Missouri-Kansas City. WEATHERING RATE OF A LATE PENNSYLVANIAN PYRITIZED FOSSIL ASSEMBLAGE, MIDCONTINENT, UNITED STATES.** The weathering rate of a pyritized fossil assemblage, consisting predominately of mollusca, brachiopoda and coccoliths, was recorded over an interval of several years in a road excavation near St. Joseph, Missouri. Megafossils include the ammonoid cephalopod *Gonioloboceras* sp., about 4 cm in diameter. The microfossil specimens only about 3 μ m in diameter are represented by the problematic coccolith *Paleococcolithus, missouriensis* Gartner and Gentile, n. sp. At the time the highway was under construction, hundreds of well-preserved pyritized specimens were collected from a dark gray shale bed several cm thick of Late Pennsylvanian (Virgilian) age. Trenching of the section to a depth of 1 m revealed that the microfossils were destroyed by weathering processes in a continental-type climate after one year and the largest megafossils after five years. Upper Pennsylvanian strata of the midcontinent North America are abundantly fossiliferous with calcareous specimens that are not significantly altered after exposure to weathering over an interval of many years but pyritized specimens are rarely recovered. Workers are reminded that post-depositional changes are among the many important factors affecting the preservation of an organism or assemblage of organisms. The stratigraphic section is often biased toward calcareous specimens in weathered exposures but in reality, pyritized forms may be abundant in deeply buried parts of the section not yet exposed to weathering processes.

***Hageman, S.A., C. Anderson, and B.L. Hoffman. Department of Natural and Physical Sciences, Park University. UTILIZING GEOGEBRA IN THE REDISCOVERY AND CLASSIFICATION OF A UTAH HADROSAUR FOOT-PRINT.** Park University has housed a mysterious dinosaur track for at least 60 years. The locality and specific dinosaur that made the track were determined by a literary search and by the free mathematical software GeoGebra. The physical characteristics of the specimen match tracks found in the Upper Cretaceous Castlegate D Coal Seam (Campanian) Blackhawk Formation in East-Central Utah. Measurements of the track and of the digital image of the track by GeoGebra resulted in determining a track length (65 cm) and width (61 cm), digit lengths (50–59 cm) and widths (18–21 cm) and angles between digits (30–32°). Known Hadrosaur tracks from Utah produced ratios of 1.06 for track length/width, 2.83 for digit length/width, and 1.00 for digit angles. GeoGebra resulted in very similar ratios for the Park University specimen of 1.07, 2.81, and 1.07 respectively. The comparison of these values with known dinosaur tracks revealed that it is a large hadrosaur track that corresponds to a poorly named ichnogenus in 1932 of *Dinosauripodes Bransfordii* Lull. GeoGebra very quickly and inexpensively allows for precise data collection to allow for morphology comparisons and its utilization to classify a dinosaur track is a grandiose example of the use of this free software.

***Hagni, R.D. Department of Geological Sciences and Engineering, Missouri University of Science and Technology. ASPECTS OF THE BAUXITE INDUSTRY IN JAMAICA.** Jamaica was the world's largest producer of bauxite for one quarter of a century, and currently is the world's seventh largest producer. In contrast to most other Caribbean islands that are composed mostly of basalts and related rocks, rocks exposed on Jamaica are predominantly Tertiary limestones. Limestone deposition took place in warm seas formed by the uplift of the northern edge of the Caribbean Plate. Bauxite deposits formed on the karstified surface of the Tertiary limestones, especially in sink structures. The deposits were thought to have formed as a weathered and leached product of insoluble clay mineral residues from the limestones, but the clay contents of those limestones are very small. An alternative genetic interpretation is that the aluminum was derived from the weathering of tuffaceous limestones higher in the limestone sequence.

Bauxite and red aluminum-rich material occur over limestones throughout much of Jamaica, and mining operations are conducted in Clarendon, St. Ann, and several other Jamaican parishes. About 25% of Jamaica's production comes from ferruginous bauxites mined at St. Ann, and the bauxite is shipped from the nearby, north shore, seaport of Discovery Bay to a refinery in Louisiana for conversion to aluminum oxide. The aluminum oxide is subsequently barged up the Mississippi River to New Madrid, Missouri where it is reduced to aluminum metal. The aluminum metal is distributed to three U.S. fabrication plants.

***Hoffman, B.L. and S.A. Hageman. Department of Natural and Physical Sciences, Park University. SHARK "TEETH" OF THE FORM GENUS *GUNNELLODUS* WILIMOVSKY (*IDIACANTHUS* GUNNELL) REPRESENT STETHACANTHID DENTICLES.** In 1933, Frank Gunnell assigned the generic name *Idiacanthus* to a set of shark "teeth" with a pointed blade and heavy bony base found in Pennsylvanian deposits in Missouri and Kansas. *Idiacanthus bellistriatus* carried a single blade with striations and ridges; *I. cameratus* had a single blade with striations only and *I. trispinosus* had three striated spines. These ichthyoliths are common to the marine shales and limestones of the Missourian and Virgilian series of the Midcontinent region. In 1954, the generic name *Gunnelloodus* was proposed for these remains, as the generic name *Idiacanthus* was preoccupied by an extant group of marine fishes. Literature review reveals similar remains with generic names *Scolopodus* Pander and *Multidentodus* Harlton are also found in Mississippian as well as Pennsylvanian marine deposits. We show by comparative morphology that *Gunnelloodus*-type ichthyoliths share affinities with denticles of stethacanthid sharks, including *Akmonistion zangerli* and *Stethacanthus altonensis*. *G. bellistriatus*, *G. cameratus* and *Scolopodus* are cranial cap and brush denticles, while *G. trispinosus* and *Multidentodus* are buccopharyngeal denticles. Also found with these ichthyoliths are stethacanthlike cladodont teeth and tooth whorls. These stethacanthid remains are found

in sediments that contain insect cuticle, conodonts, and actinopterygian scales, all of which have been found as gut contents of stethacanthids.

***Nold, J. L. Earth Science, University of Central Missouri. AN UNUSUAL OCCURRENCE OF COVELLITE WITHIN IMMISCIBLE SULFIDE DROPLETS IN THE SHEPHERD MOUNTAIN GABBRO, PROTEROZOIC ST. FRANCOIS MOUNTAINS TERRANE, MISSOURI.** The Shepherd Mountain Gabbro is a 400 foot thick horizontal dike within the Proterozoic St. Francois Mountains Terrane in south-east Missouri. The dike is principally known from intersections in five surviving core holes drilled into the Pilot Knob Magnetite deposit beneath Pilot Knob, Missouri (two complete intersections and three partial). Rounded sulfide blebs are immiscible magmatic droplets and are composed principally of pyrrhotite with lesser chalcopyrite, pyrite, covellite, and sphalerite. Some of the sulfide blebs have a similar mineralogy but have an irregular shape caused by being located in the interstices of the gabbro minerals plagioclase, pyroxene, olivine, plus titanomagnetite and ilmenite. In copper ores covellite is most commonly found as a supergene mineral within the zone of sulfide enrichment. In addition, primary hypogene hydrothermal covellite has been reported with the best known occurrence being at Butte, Montana. Localities where magmatic covellite has been reported in the literature include the Skaegaard intrusion, Greenland, the Tellnes ilmenite deposit, Norway, and the Kiglapait layered intrusion, Labrador. In the Shepherd Mountain gabbro, in addition to the sulfide droplets, there are similar rounded oxide blebs composed of titaniferous magnetite and ilmenite. The origin of the rounded oxide crystals is uncertain, but the occasional euhedral crystal within them suggests that they are not immiscible droplets, but instead may have been rounded by partial resorption of previously crystallized magnetite-ilmenite.

***Pope, J.P. Department of Geology/Geography. Northwest Missouri State University. THE BANDERA SHALE AND ALTAMONT LIMESTONE IN IOWA.** The name Bandera Shale was used by Adams in 1903 for all strata above the Pawnee Limestone and below the Altamont Limestone. The type section was designated for exposures in Bourbon County, Kansas. In Iowa, the Bandera includes two named beds and one named member in ascending order: Mulberry Coal bed, Farlington Limestone Member and McBride Coal bed. The Mulberry Coal, named by Broadhead in 1874, was once called the Lonsdale Coal in Iowa. The Farlington Limestone, just above the Mulberry Coal, has been confused with the stratigraphically higher Worland and Amoret (Tina) limestones. The McBride Coal was named by Pope in 2010 for exposures in Madison County, Iowa.

The Altamont Limestone comprises three members in ascending order: Amoret Limestone, Lake Neosho Shale and Worland Limestone. The limestone just below the Lake Neosho Shale was originally named the Tina Limestone by Cline in

1941, until Cline and Greene in 1950 discovered that the type Tina was actually the stratigraphically lower Higginsville Limestone, and renamed it the Amoret Limestone. The Lake Neosho Shale, named by Jewett in 1941, overlies what is now called the Amoret Limestone, but was once used in southern Iowa and northern Missouri where the Amoret Limestone is absent, to include all strata down to what is now called the Farlington Limestone. The Worland Limestone was named by Greene in 1933 and the name was retained by Cline in 1941 for the upper limestone of the Altamont. In 1896, Bain referred to the Worland Limestone as the 'fifty-foot limestone' in reference to its position above the Mystic Coal.

***Stinchcomb, B. L. Ferguson, Missouri. CONOPHYTON FROM CAMBRIAN CHERT ASSOCIATED WITH THE STE. GENEVIEVE FAULT SYSTEM, EASTERN OZARK UPLIFT, MISSOURI.** Extensive field work has found (as float) specimens of the puzzling cone shape stromatolite Conophyton in proximity to major fault systems of the eastern Ozarks in Ste Genevieve and Jefferson Counties, Missouri. Conophyton is a distinctive stromatolite best known from the Mesoproterozoic as well as being associated with modern geothermal areas where it appears to be produced by physiologic activities of thermophilic bacteria. The suggestion is offered that its occurrence in these faulted areas of Missouri may imply geothermal activity concurrent with and supportive of a thermophilic moneran community in the region of the fault when deposition of the carbonates (Eminence Formation) was taking place. This also could imply that initial movement and other activity on these faults may have taken place concurrently with marine carbonate deposition rather than later.

Physics:

Section Chair: Sunder Balasubramanin, Lincoln University

Dweik, M., I. Moore, J. Greene, K. Hayes*, and A. Molitoris. Cooperative Research and Department of Life and Physical Sciences, Lincoln University. NOVEL IMPLANTABLE OPTICAL NANOBIOSENSOR FOR DIABETES. Development of an *in vivo* optical sensor requires the utilization of Near Infra Red (NIR) fluorophores since these fluorophores can operate within the biological tissue window. The fluorophores, Alexa Fluor 750 (AF 750) and Alexa Fluor 680 (AF 680), are NIR fluorophores that were examined as potential fluorescence resonance energy transfer (FRET) dye pairs. AF 680 and AF 750 were conjugated to streptavidin and biotin, respectively, and the percent energy were determined. Next, the dye pair was utilized in a competitive binding assay to detect glucose. This protein and inhibitor system is utilized as a glucose biosensor. In this study, the effect of dextran size on FRET was examined in order to obtain optimal energy transfer. Dextran with molecular weights of 10,000 and 3,000 and Con A were labeled with AF 680 and AF 750 respectively, and

incubated to form the dextran/Con A complex. The percent energy transfer was then obtained upon exposure to glucose. The experiments revealed that dextran with molecular weights of 10,000 demonstrated the highest energy transfer in responding to glucose between 3.33 and 13.29 mM. In conclusion, the NIR pair of AF 680 and AF 750 was a viable FRET pair that can be utilized to determine glucose via a competitive binding assay of dextran (10,000) and Con A. These results will help improve the development of FRET based optical glucose biosensors.

Dweik, M., L. White, and A. Molitoris*. **Cooperative Research and Department of Life and Physical Sciences, Lincoln University of Missouri. TRANSFORMATION OF EDUCATIONAL NANOTECHNOLOGY TO APPLIED RESEARCH.** Nanotechnology covers a wide range of applications. Understanding fundamentals of investigated nanotechnology through Hands-On-Experimentations (HOE) has transformed this knowledge to applied research. These experiments are based on the execution of protocols and observation of outcomes. HOE covers four areas. The first area covers fundamentals from physics, chemistry, and biology experiments. The second area investigates the fabrication of nanomaterials. In the third and fourth areas, the properties and characterization of nano-materials are examined through use of different modalities such as Atomic Force Microscopy (AFM). This project resulted in two developed courses added to the biotechnology minor program and one course required for all agriculture majors at Lincoln University. In addition, it has transformed the gained experience to obtain three funded projects from NSF, NIH and NASA. There are total of 19 students who participated in this project, two of whom were from K-12. Eight of those students have advanced to work on the newly funded applied research. This research has gained and continues to gain interest from different student levels.

***Shaw, J.** **Chemistry/Physics Department, Northwest Missouri State University. OBSERVING SESSIONS IN INTRODUCTORY ASTRONOMY AT NORTHWEST MISSOURI STATE UNIVERSITY.** The laboratory portion of the introductory astronomy course at Northwest Missouri State University requires the students do an observing session using telescopes at the observatory. The students are required to find five objects to complete the observing session. With the time it takes to align the viewfinder with the telescope, the students generally take a couple of hours to complete the observing session. The role of this observing session in the student's education will be discussed as well as the mechanics of the observing session. Important issues are the choice of telescopes and eyepieces, the objects to be viewed and the manner by which students will be expected to find these objects. Whether the telescope will be used to track the motion of the object or not will affect the choice of telescopes. Lists of the objects observed in the fall and spring will be given along with the reasons for these choices. The objects viewed by the students depend on whether the moon is in view or not. If the moon is up

then no object with magnitude greater than 3.5 can be seen with the naked eye. This narrows the list of objects that can be viewed. If the observing is done in town, the lights from the town also limit the magnitude of objects that can be seen. Typical magnifications and fields of view for different telescope-eyepiece combinations will also be discussed.

***Tansil, J.El.** **Department of Physics & Engineering Physics, Southeast Missouri State University. LAB EXPERIMENTS USING RADIOACTIVE SOURCES WITH A WIDE RANGE OF HALF-LIVES.** There are, in general, two common techniques for experimentally determining the half-life of a radioisotope in a student laboratory setting. The first method involves measuring the activity of the sample as a function of time and is limited to radioisotopes whose half-lives are short compared to the length of the lab period, yet long enough so that the activity is well above background during the time of measurement (typically a few minutes). The second method is for long-lived radioisotopes and requires measuring the activity, assumed constant over the measurement time, and calculating the number of the radioactive atoms from the known chemical composition of the sample. We have been using two radioisotopes in student lab experiments whose half-lives differ by a factor of 10^{14} . The short-lived radioisotope is Barium-177m ($T_{1/2} = 2.55$ min) and is commercially available from a Cesium-137/Barium-137m Isogenerator. The long-lived radioisotope is naturally occurring Potassium-40 ($T_{1/2} = 1.277 \times 10^9$ yr) which is found in a variety of common potassium compounds. We will discuss specific procedures with these lab experiments and how they fit in the overall nuclear science curriculum.

Science Education:

Section Chair: Gouranga C. Saha, Lincoln University

***Smith, P.S., Independent Scholar. THE PSYCHOLOGY OF TOTEMISM.** Since humans have few instinctual faculties to assist survival of physical circumstances, those instincts are instead replaced with a more complete complex of remembrances, constant logical deductions and conceptual associations which directs the vicarious use of physical things. Thus it is to this primary state we owe our intelligence, our greater cognitive abilities, creative instincts and our desire to build and to fashion out of the elements complex structures. But because of our physical circumstance, we not only accomplish infrastructure we build and landscape for aesthetics. Socially, we do not organize just for survival, but we create fashion and art. We have ideals, ideology and religion. All for the same reason society, technology and mental capacity develops, because of the vulnerable and dependent place we occupy in physical reality. Using historical and ethnographic reference, as an addendum to the ongoing application of existential anthropology, it is at this connection we will draw conclusions about social organization

and religious formation and will propose to show how totemic religion formed and became an institution because of psychological reaction to physical conditions. This paper will first review the characterization and common elements of totemism and will conclude with the psychology behind its features.

COLLEGIATE DIVISION:

Agriculture:

Section Chair: Sven E. Svenson, Southeast Missouri State University

***Baumbach¹, C., C. Cave¹, L. Wilbers¹, C. Clifford-Rathert¹, E.K. Inskeep² and A.K. Wurst¹.** ¹Department of Cooperative Research, Lincoln University and ²Division of Animal and Nutritional Sciences, West Virginia University. **EMBRYONIC AND FETAL LOSSES IN GOATS: CHARACTERIZATION OF AMOUNT, TIMING, AND FACTORS ASSOCIATED WITH LOSSES.** Embryonic and fetal mortality are large sources of economic loss in the livestock industry. Although average ovulation rates are sufficient, a significant economic loss results from a large percentage of those oocytes not resulting in live offspring. Recent research in ewes has shown that embryonic and fetal losses occur relatively evenly throughout pregnancy. Although, current estimates of embryonic and fetal wastage in goats are similar to those found in early sheep studies, detailed real-time evaluations of pregnancy loss have not been conducted. The objective for the study is to determine if embryonic and fetal loss patterns and rates are similar among small ruminant species and to determine if loss can be associated with a dam, embryo/fetus, or buck influence. This project will involve real-time ultrasonographic examination of pregnant does throughout gestation in order to discover how much embryonic and fetal loss occurs in goats and when these losses occur. Bred does in multiple herds will be scanned on approximately days 25, 40, 60 and 110 post-breeding (Day 0 = buck introduction) by transrectal or transabdominal ultrasonography. At kidding, owners/managers of the respective herds will record the doe number, kidding date, and number of kids born, along with comments on any abnormalities or difficulties with the pregnancy or birth. For the 2009 breeding season, a total of 284 does in 9 herds were ultrasounded through day 110. Herds were primarily composed of Boer and Boer-crosses, with one herd including French Alpine, Angora, and Saanen does. Initial pregnancy rates of does within herds were good, and averaged 89% at first scanning. A total of 24.6% of does pregnant at first scanning had some pregnancy loss (either partial or total) before kidding time, with 12.3% showing total pregnancy loss, and 12.3% showing partial loss of fetuses. However, within-herds losses varied considerably, with one herd having 50% of pregnant does showing loss, and one herd having 10% loss. Interestingly, most (98.6%) losses occurred past day 60 in

the does studies. The 2010 breeding season included a total of 189 does in 6 herds. Herds were primarily composed of Boer and Boer-crosses, with some Nubian, Nubian-crosses, Lamancha, Kinder, Saanen, Pygmy and Pygmy-crosses. Preliminary data up to day 110 for the 2010 breeding season have been reported. Initial pregnancy rate of does within herds averaged 93.6% at first scanning. A total of 11.1% of does pregnant at first scanning had some pregnancy loss by day 110, with 4.2% showing total pregnancy loss, and 6.9% showing partial loss of fetuses. Similar to the results in 2009, 76.2% of losses occurred past day 60 in the does in the 2010 breeding season. These results suggest that embryonic and fetal wastage in goats may be significant problem for some herds. Further, preliminary data suggests that these losses occur at a different rate than those found in sheep, and that losses seem to primarily occur relatively late in pregnancy.

***Callaway, J.E. and J.E. Wetzel. Cooperative Research, Lincoln University. EFFECTS OF FEEDING REGIMEN ON GROWTH, SURVIVAL AND PROXIMATE COMPOSITION OF FINGERLING NORTHERN BLUEGILL.** Developing northern bluegill *Lepomis macrochirus macrochirus* as a food fish is limited by growth rate and production cost. Feeding regimens used by most producers and researchers involve two daily feedings, usually by hand. A more continuous system using automated feeders (i.e. belt feeder) could reduce labor investment and take advantage of the bluegill's natural feeding habits. We compared three feeding regimens (twice daily, continuous 12 h and continuous 24 h) with respect to growth, survival, feed conversion, body composition, and with respect to labor costs. Commercial hatchery fish (weight = 6.8 g) were adjusted to 200 fish / tank. Twice daily treatment was applied by hand to apparent satiation, and continuous feedings by belt feeders with either 12-h or 24-h timers adjusted by apparent interest in further feedings on days 3 thru 6. Regimens were based on a 7-day cycle with feeding withheld on day one for all treatments and the PM of day seven for twice daily treatment. Total weights of fish / tank determined at 28 d intervals throughout 128 d trial. Feeds were formulated for trout with pellet sizes adjusted to compensate for growth. Trial's end, fish were measured for weight, weight on the round, visceral somatic index, and liver somatic index. Study showed a variation in feed conversion, labor cost, and weight gain, but not in respect to carcass composition.

***Gravino, N., J.C. Barnett*, S. Hohenadel*, and M.F. Haskins. Biology Department, Rockhurst University. USING MALONIC ACID TO EXTEND THE "SHELF LIFE" OF STRAWBERRIES.** Most produce has a very short lifespan once removed from the parent plant. This lifespan is influenced by the rate at which stored energy is depleted and agents, e.g., fungi and bacteria, enhance the decomposition process. These degradation factors, impacted by moisture and temperature, contribute to the expense of transporting and storing fresh fruits and vegetables. In an effort to extend the

“shelf-life” of fruits and vegetables, agricultural companies have investigated the effectiveness of cellular respiration inhibitors, and have filed patents for inhibitors targeting Krebs Cycle enzymes. Unable to use these proprietary inhibitors, we wanted to explore the effect of a well known cellular respiration inhibitor, malonic acid (MA) and determine if it slowed the degradation process in strawberries. We dipped strawberries in one of four MA concentrations (0.01%, 0.10%, 1.00% and 5.00%), “stored” the strawberries, and then made daily observations of the decomposition process for one week. A variety of methods were used for “storing” the fruit and included: single storage, bulk storage, and suspension of the fruit. Using a microscope the fruit was analyzed and rated based on the amount of decomposition that had taken place. Suspended strawberries were colonized by significantly fewer fungi than the other treatment methods ($p < 0.01$). This difference was attributed to reduced moisture levels making fungal colonization more difficult. MA showed potential in slowing down the decomposition of strawberries but further trials are necessary to determine if this effect is both consistent and practical. Health issues related to consuming items treated with MA were not analyzed.

Biological Sciences:

Section Chair: Staria S. Vanderpool, Lincoln University

***Baer¹, L.E., K.M. Swain¹, N.L. Donaldson¹, and A. Foley.** ¹Department of Physics and Math and ²Department of Physical Therapy, Rockhurst University. **EFFECT OF ECCENTRIC STRETCHING ON FLEXIBILITY IN ROCKHURST UNIVERSITY STUDENTS: A PHYSICS OF MEDICINE RESEARCH STUDY.** Prior research has shown that eccentric stretching and contractions can increase the length of the connective tissue of the hamstring muscle causing an increase in the force generating capacity of the muscle with a possible side effect of increased muscle soreness and stiffness. During an eccentric contraction, the stretched components of the muscle that store elastic recoil potential energy allow for greater storage and release of the elastic energy. If the released energy is able to be recovered, it is able to amplify the force and power during the next shortening cycle. This increase in force and power can cause tissue damage, which is a sign of delayed onset muscle soreness (DOMS). DOMS can be explained by a cascade of events following structural damage to muscle proteins, which in turn builds muscle and can prevent possible injury. The objective of this current study is to determine the effect of daily eccentric hamstring stretching on flexibility scores on a standard back-saver sit and reach box test in injury free college-age students performed over the course of a four week period. Data was collected from an experimental group that performed an eccentric stretch over a four week period and from a control group that performed no stretching. Participants in the experimental group were asked to perform a

specific hamstring stretch daily using a latex resistive exercise band. Measurements were taken at the beginning and end of the study using a back-saver sit and reach test. Results on the flexibility similarities and differences between the experimental and control group will be discussed. A follow-up study is planned to investigate the usefulness of eccentric stretching on flexibility with hamstring injury prevention.

***Bamber, A. and J. Benne. Department of Life and Physical Sciences, Lincoln University. ANALYSIS OF A NATURALLY OCCURRING NUTRIENT SUPPLEMENT ON LARVAL Aedes Aegypti DEVELOPMENT TIME AND MASS.** Studies have shown that detritus type can influence larval development as well as interspecific competition in mosquitoes. Because both interspecific and intraspecific competition influences mortality, the resulting dead larvae may provide additional nutrient resources in a natural setting. Previous studies have shown the addition of animal detritus to impact adult mass; however these studies have relied on adult *Drosophila melanogaster* as the added resource. Based on the inherent relationship between larval survival and the quantity of nutritional resources available, this study examined the effects of deceased larvae as a natural nutrient resource on the growth and development of *Aedes aegypti*. Microcosms with 20 first instar *Aedes aegypti* larvae were provided artificial diet (rat chow) for one week. Following this week, half of the microcosms were supplemented with animal detritus in the form of 10 mechanically killed *Aedes aegypti* larvae. Surprisingly, this additional nutrient resource had no effect on mass for either males or females. There was, however, a significant decrease in female development time ($P < .05$) in response to this treatment. Although this study did not exhibit the anticipated increase in adult mass, this could have been due to the small number of individuals in the microcosms and the small number of larvae provided as an added resource.

***Barth, K. J. and N. L Donaldson, Department of Math and Physics, Rockhurst University. THE INFLUENCE OF BODY POSITION ON BLOOD PRESSURE.** Previous literature reveals that altering the body from a supine position to an erect position produces variation in blood pressure. Upon approval by the Rockhurst University Institutional Review Board, this study was conducted to determine the effects that variation of body position had on blood pressure. Blood pressure readings were obtained and compared from subjects in three different positions: supine, sitting and standing. Participants included adults between the ages of thirty and fifty who did not smoke, were not on heart medications, and were neither hypertensive nor hypotensive. Blood pressure readings were obtained from participants in each of the three positions after participants had been in the position for two minutes. Twenty-five Rockhurst faculty and staff members participated in the study that was conducted in a conference room at Rockhurst University. The influence of body position on blood pressure was statistically analyzed using ANOVA and results will be discussed.

***Hare, R.T. and I. Popescu. Department of Biology, Drury University. EFFECTS OF SEED ABORTION ON SEED DISPERSAL IN THE GOLDEN RAIN TREE.** We observed that about half the seeds in most fruits of the tree *Koelreuteria paniculata* (Golden Rain Tree) are commonly aborted. The fruits are three-parted bladder-like capsules with two seeds on each carpel. When one of these two seeds is aborted the leaf-like carpel becomes unevenly weighted. This may cause the structure to spin and meet with more wind resistance when falling thus allowing the seed to be carried farther. Though environmental factors such as the amount of rainfall and other factors affecting how many seeds the tree can support in a given year may also be used to explain the seed abortion, we are planning to test if maturing only one of the two seeds on each leaf-like carpel could affect the aerodynamics of the carpel and help disperse the seed further away from the parental tree. We have collected samples from multiple trees in several locations and the majority of seed pods have aborted one of the two seeds. Future experimentation will attempt to determine to what extent the seed abortion can influence the individual carpel aerodynamics. The 155 collected carpels will be allowed to free fall in a controlled setting and observe falling patterns. We also plan to compare how far carpels with two seeds fall, comparative with carpels that matured only one seed.

***Jacobs, J. and J. Benne. Department of Life and Physical Sciences, Lincoln University. INFLUENCES OF SURFACE AREA AND DENSITY ON LARVAL *Aedes aegypti* DEVELOPMENT TIME AND MASS.** Due to the strong relationship between larval development and adult success, controlling mosquito populations and the diseases they transmit depends greatly on a thorough knowledge of the environmental parameters that influence larval development. In this study, larval *Aedes aegypti* were reared in microcosms constructed from three diameters of PVC pipe (10.2 cm, 15.2 cm, and 20.3 cm) to provide variable surface areas (81.67 cm², 181.37 cm², and 323.49 cm²). Larvae were added at densities of 20 or 100/microcosm to each of the different surface areas and the resulting life history parameters of development time and adult mass at eclosion were measured for each individual. Variation in surface area significantly affected male mass ($P < 0.05$) but not female mass or development time for either males or females. Density had a significant effect on both male and female mass ($P < 0.005$ males and $P < 0.05$ females) but did not influence development time. Interestingly, although development time for both males and females were not significantly affected by either surface area or density independently, the data exhibited a significant interaction between surface area and density ($P < 0.0005$) for both males and females indicating a more complex relationship between these factors.

***Pruitt, B. and J. Benne. Department of Life and Physical Sciences, Lincoln University. INFLUENCES OF TEMPERATURE AND DENSITY ON LARVAL *Aedes aegypti* DEVELOPMENT TIME AND MASS.** Larvae of *Aedes*

aegypti (the yellow fever mosquito) exhibit dramatic plasticity in development time and adult mass at pupation in response to numerous environmental factors. The timing of adult emergence and the mass of adult females are key factors for disease transmission cycles involving this vector. The effects of two larval densities (20 or 50 1st instar/microcosm) and two temperatures (15°C and 25°C) were examined by measuring the life history traits of development time and adult mass at eclosion. The results of this study showed a significant ($P < 0.05$) decrease in male adult mass with increased larval densities. In addition, female development time was significantly decreased in response to increased density ($P < 0.0005$) and temperature ($P < 0.005$).

***Watson, L.C. and M.L. Spratt, Department of Biology, William Woods University. BACTERIAL AGENTS OF BORRELIOSIS FOUND IN MISSOURI TICKS.** *Borrelia burgdorferi* and *Borrelia lonestari* are vector-borne spirochetes found in Missouri ticks causing Lyme disease and STARI (Southern Tick Associated Rash Illness) respectively. Ticks from counties throughout Missouri were tested for the presence of these bacteria. The following *Ixodid* tick species: *Amblyomma americanum*, *Dermacentor variabilis*, and *Ixodes scapularis* are known to carry these diseases. The ticks are collected by flagging in public areas in Missouri such as national and state parks, lake and river shores, picnic areas, and road side rest areas. Ticks were classified according to sex, stage of development, and county from which they were collected. Ticks were titrated and DNA was extracted using a commercial kit. DNA samples were frozen until separately amplified. *B. burgdorferi* is most commonly found in *I. scapularis* while *B. lonestari* is found mostly in *A. americanum* ticks. The goal is to determine the prevalence and distribution of these bacteria among *Ixodid* species within Missouri using Real-Time PCR (qPCR) with fluorescent probes and specific primers. To date, 5.3% (24/451) of the processed samples have tested positive for *B. burgdorferi* and 1.3% (4/319) of the processed samples tested positive for *B. lonestari*. The presence of these disease-causing bacteria in public areas in Missouri ticks may pose a serious public health problem.

***Weber, R. E. and M. L. Spratt. Biological Sciences, William Woods University. THE PREVALENCE OF RICKETTSIAL BACTERIA FOUND IN MISSOURI TICKS.** Using real-time PCR (qPCR) and specific fluorescent probes, tick DNA samples are tested for the presence of *Rickettsia rickettsii* and *Rickettsia amblyommii*. Ticks are collected throughout Missouri by a technique known as flagging. The following tick species have been found in Missouri and tested for the Rickettsial bacteria: *Dermacentor variabilis*, *Amblyomma americanum*, and *Ixodes scapularis*. *R. rickettsii* is an obligate intracellular bacterium that causes Rocky Mountain Spotted Fever (RMSF) and has been found primarily in both *A. americanum* and *D. variabilis*. *R. amblyommii* is also an obligate intracellular bacterium that retains a candidatus status and is

also primarily found in *A. americanum* ticks. First, a general test is done using R17 primers and probes, which detects the presence of most Rickettsial species. Samples testing positive for R17 are then tested for the two Rickettsial species named above. To date, over 35 counties have been tested for Rickettsial bacteria. For R17, 479 tick samples have been individually tested with 38% testing positive or 182 samples. There have only been 2 positive samples, or 0.9%, for *Rickettsia rickettsii* out of the 220 tested. For *Rickettsia amblyommii*, 25 samples, or 17.1%, have tested positive out of 146 samples.

Chemistry:

Section Chair: Alan J. James, Columbia College

***Detchou, C.S. and G.A. Frerichs. Department of Chemistry, Westminster College. BATCH pH OSCILLATIONS IN THE BRAY-LIEBHAFSKY REACTION.** Previous investigators of the Bray-Liebhafsky reaction have observed periodic oscillations in the rate of oxygen evolution, in iodine concentration, and in the potential of a Pt electrode. Until now, no pH oscillations significantly greater than experimental error have been reported for this reaction. By using acid concentrations substantially lower than those used by Bray and Liebhafsky, we have obtained periodic oscillations in pH for this batch system at 60°C. Reaction was initiated by combining potassium iodate (KIO_3), hydrogen peroxide (H_2O_2), and perchloric acid (HClO_4). With $[\text{H}_2\text{O}_2]_0 > [\text{KIO}_3]_0$, two types of pH oscillations are generally observed. After an initial pH drop, spike-like oscillations occur as the pH rapidly increases. When the pH becomes sufficiently large, the peaks become saw-tooth-shaped and the pH tends to level off. Studies were carried out with $[\text{H}_2\text{O}_2]_0 = 0.170 \text{ M}$; $[\text{KIO}_3]_0 = 0.0325\text{--}0.0900 \text{ M}$; and $[\text{HClO}_4]_0 = (1.00\text{--}4.50) \times 10^{-3} \text{ M}$. With $[\text{H}_2\text{O}_2]_0 \leq [\text{KIO}_3]_0$, the peaks are more symmetrical and of relatively large amplitude (up to 0.6 pH unit), especially for higher reactant concentrations. The general features of the periodic oscillations have been simulated successfully using a previously proposed model for the Bray-Liebhafsky oscillator.

Geosciences:

Section Chair: John P. Pope, Northwest Missouri State University

***Blackwell, C., and J. Nold. Department of Biology and Earth Science, University of Central Missouri. A PETROGRAPHIC STUDY OF THE SHEPHERD MOUNTAIN GABBRO DIKE, ST. FRANCOIS MOUNTAINS TERRANE, SOUTHEAST MISSOURI.** The Shepherd Mountain gabbro dike is known primarily from several core holes drilled

during the exploration of the Pilot Knob magnetite deposit during the 1960s. The dike is approximately horizontal, averages about 400 feet in thickness, and sharply cross-cuts the Pilot Knob magnetite deposit. Previous work by Lowell and Ramo (1999) yielded a Sm-Nd isochron age of 1333 Ma. The current study was done on twelve samples from the upper half of the dike intersection in core hole PKM-1159, and is part of a more comprehensive study currently being done by John Nold and students. The gabbro is mainly medium and coarse grained and has an aphanitic basalt chill zone at the bottom and top contacts. The dike is principally composed of calcic-plagioclase and clinopyroxene, and nine of the twelve samples contain olivine in amounts up to approximately 15 percent. Lesser abundant minerals in the dike include hornblende, biotite, apatite, and opaques. Late-stage igneous deuteric alteration minerals include green amphibole, chlorite, sericite, epidote, and calcite. The opaques have been shown by Nold, Dudley, and Phillips (2009) to be composed mostly of the oxides magnetite and ilmenite, with lesser amounts of sulfides, principally pyrrhotite, chalcopyrite, pyrite, sphalerite, and covellite.

***Hunter, B.S., and J.P. Pope. Department of Geology/Geography, Northwest Missouri State University. POSSIBLE HIGH-ORDER CYCLES PRESERVED IN THE HIGH-STAND SYSTEMS TRACT OF THE QUEEN HILL SHALE MEMBER OF THE LECOMPTON FORMATION (SHAWNEE GROUP, VIRGILIAN STAGE, UPPER PENNSYLVANIAN) OF NORTHWEST MISSOURI.** Evidence of small-scale glacio-eustatic sea-level fluctuations (transgressive-regressive cycles) in the Queen Hill Shale are seen as interbedded gray and black shales. The Queen Hill Shale Member lies above the Big Springs Limestone Member (transgressive limestone) and below the Beil Limestone Member (regressive limestone), and normally displays a lower black fissile shale facies overlain by an upper light gray shale facies. At a location in southeastern Holt County, Missouri, (two miles west of the town of Nodaway) the Queen Hill displays this "normal" facies, but 25 meters to the west it consists of four medium to dark gray shales (each approximately 2 cm thick) interspaced with four light gray shales (each approximately 4 cm thick), capped by a 60 cm thick light gray shale just below the Beil Limestone. These lateral facies changes seem to occur over a topographic high in the underlying Big Springs Limestone. We interpret these facies changes to represent meter scale fluctuation in sea level during the high-stand phase of the major Queen Hill cyclothem. The darker shales were probably deposited during higher sea level stands with more anoxic bottom conditions, with the lighter gray shales being deposited during lower sea level stands and more oxic bottom conditions. Overall, the Queen Hill was deposited during a major sea level high-stand, but in the relatively shallow northern shelf region of the Midcontinent Basin, it exhibits a complex architecture recording several probable minor sea level fluctuations.

***Katuwal, M. and S.A. Hageman. Department of Natural and Physical Sciences, Park University. TAPHONOMIC ANALYSIS OF BORINGS ON THE BIVALVE (*CHIONE ELEVATA*) BY THE GASTROPOD (*POLINICES DUPLICATUS*), ST. PETE'S BEACH, FLORIDA.** Examination of 1,256 bored shells of the modern clam *Chione elevata* (formerly *C. cancellata*) collected from St. Pete's Beach, Florida revealed a preferred boring position. The borings are most likely from the gastropod predator *Polinices duplicatus*. Bore holes indicate no significant preference for boring left valves (51.3%) over right valves (48.7%) but do show a strong preference for boring the anterior half (70.1%) of both valves. Nearly 79% (992) of borings fell into two locations defined as 1) right side of anterior half of valves (56.3%) and 2) right side of posterior half of valves (22.7%). Due to the majority of all bore holes falling into the first location, this area was further subdivided into four quadrants to better refine the most frequently bored location. These subdivisions resulted in 78% falling into one of four quadrants suggesting that there is an optimal kill shot for a gastropod and it was achieved 43.6% of the time. The kill shot corresponds on the interior side a few mm away from the adductor muscle scar. The results of this modern study are then being applied to boring accuracy over geologic time to determine evolutionary changes in drilling behavior of *Polinices* and other carnivorous gastropods.

***Tounzen, M. R. and D. P. Fox. Department of Natural and Physical Sciences, Park University. GIS ANALYSIS OF POTENTIAL WIND ENERGY PRODUCTION IN MISSOURI.** The November 2008 voter approved Missouri Proposition C, "Clean Energy Initiative," established the state's first Renewable Electricity Standard (RES) requiring investor-owned electric utility companies to generate or purchase an incrementally increasing amount of their retail sales from a variety of specified renewable energy sources, including wind, from 2% by 2011 to 15% by 2021. Despite efforts by legislators during early 2011 to eliminate geographic sourcing provisions that would require the utilities to actually generate this electricity from renewable energy facilities located within the state itself; this study investigates the potential amount of wind energy that could be readily developed within Missouri over the next few years. Using data related to the five wind energy farms already constructed by St. Louis-based Wind Capital Group in four northwest Missouri counties since 2006 as a guideline, geographic information system (GIS) software will be utilized to perform spatial analysis in order to estimate the total amount of wind energy that could be viably produced within the state to help achieve the RES requirements over the next ten years.

***Windett, J. R. and D. P. Fox. Department of Natural and Physical Sciences, Park University. ANALYSIS OF INTEGRATED PASSIVE SOLAR WATER HEATER TECHNOLOGY FOR SUSTAINABLE COMMUNITY DEVELOPMENT.** Of the many solar water heating technologies available today, the Integrated Passive Solar Water Heater

(IPSWH) was determined to be the most desirable for use at a sustainability demonstration site in Lawrence, Kansas, during the summer of 2010. Evaluation was conducted by comparing the IPSWH design with the ten criteria that make up the framework of the *Appropriate Technology Sourcebook*. The exploratory analysis was followed by the construction of this system for use in an outdoor shower facility. Data was collected during the construction and use phases of the project in order to draw conclusions and make improvements. Despite the numerous potential benefits that this project demonstrates for providing a simple and reliable technology that could easily be implemented to help create more sustainable communities, analysis of the future possibility for widespread adoption of IPSWH systems suggests that there exist several prominent socio-cultural barriers yet to be overcome.

Physics and Engineering:

Section Chair: Daniel B. Marsh, Missouri Southern State University

Dweik, M., L.J. White, and J. Spillers*. Cooperative Research, Life and Physical Sciences, Lincoln University. PHOTOVOLTAIC CELL AND NANOTECHNOLOGY.

Photovoltaic is the direct conversion of light into electricity at the atomic level. Some materials exhibit a property known as the photoelectric effect that causes them to absorb photons of light and release electrons. When these free electrons are captured, electric current is generated, which can be used as electricity. Efficiency of photovoltaic cell has been a major problem in solar energy. There are many factors that affect solar cell output. Some of the main factors are wavelength of the light hitting the cell and band gap of cell materials. Utilizing organic materials can control the above problems. In assembling the cell, NANOCS ITO coated glass covered with paste. The paste is made out of Triton, Acetic Acid, Iodide, and nanocrystalline TiO₂. Fruit juices such raspberry and orange were used in the assembly of solar cell. An output of 0.4V/in² was measured. The output can be improved by modifying the process which will result in higher output.

***Sundgren, C. and M. Hill. Department of Physics and Engineering Physics, Southeast Missouri State University. TWISTING BIOMECHANICS IN GYMNASTICS AND DIVING.**

In diving and gymnastics, there are four twisting styles: elbows-out, diver's, wrap, and arms-down. The styles were analyzed via computer software to look at what position each athlete was in for each style of twist, how each style of twist was initiated, and what position the athlete finished in. The wrap style of twist was further investigated to understand how angular momentum along a particular axis was created with no external torque. We began analysis by trying to model the gymnast as a rigid object. However, this approach was not

accurate enough or adequate for analyzing the transfers of angular momentum between axes. Thus, we employed a turn table in order to measure the gymnast's moment of inertia in various positions more accurately. Using a low friction turntable, we found the moments of inertia for the gymnast rotating about various axes. Then, using computer software, we were able to calculate the angular velocity for all three measured positions. Angular momentum about each axis was calculated to verify the law conservation of angular momentum. We found that angular momentum from the axis in which the athlete is initially rotating decreases in order that the athlete can gain angular momentum along a different axis, when no external torque is applied.

Dweik, M., L. White*, K. Wilson, and A. Molitoris. Cooperative Research, Life and Physical Sciences, Lincoln University. NOVEL BIO-MEMS FOR DETECTING E-COLI O157:H7 IN REAL-TIME. *Escherichia coli* O157:H7 is a toxic type of bacteria and is responsible for an estimated 73,000 cases of infection and 61 deaths that occur in the United States each year. *E. coli* O157:H7 can be found on fruit in fruit, vegetables, unpasteurized milk, juice, un-chlorinated water and on most cattle farms and can live in the intestines of healthy cattle. *E. coli* O157:H7 can have significant impact on businesses such as the food processing and packing industry. Bacteria testing requires extensive analysis which has to meet certain and challenging criteria. Sensitivity and response time for the analysis are imperative factors related to the usefulness of microbiological testing. In this project, a *novel* 3-dimensional (3-D) interdigitated microelectrode array (IDE) based impedance biosensor was developed. It is capable of rapid detection and selective for accurate identification of *E. coli* O157:H7 in fruit and vegetables. The uniqueness of this design is the use of 3-D IDE increases the surface area compared to a single (2-D) IDE

sensor and decrease the amount of fluid used in the experiment. The increased surface area will enhance the sensitivity and speed of impedance detection. This bio-detection instrument for *E-coli* provided detection range (10^4 – 10^7 CFU/mL) in food samples (e.x., tomatoes samples), reduce the detection time to 6 minutes, and improve the sensitivity of the biosensor by a factor of 10^2 CFU/ml.

Social/Behavioral Sciences:

Section Chair: Mara S. Aruguete, Lincoln University

***Ilango, G., N. Petronic*, and M. Humo. Department of Psychology, Westminster College. OPTIMISM SEEMS TO BE ONE OF THE INFLUENTIAL FACTORS ON HEALTH.** It appears that people who are high on the optimism scale tend to be mentally and physically healthier than those who are low on the optimism scale. Positive beliefs and attitudes as well as positive life outcome expectancies are a part of optimism. This correlational study will examine how optimism affects mental and physical health and to what extent. The study will include 60 participants; half of them will be females and other half will be males. The participants will be undergraduate students enrolled at Westminster College in Fulton, Missouri. Both domestic and international students will be participating in this study. They will complete several tests assessing their mental and physical health as well as their level of optimism. Those tests will include PANAS-X, LOT-R and a self-report on physical health. The participants will also have their heart rate and blood pressure measured as a part of the physical health assessment. We hypothesize that more optimistic students will be mentally and physically healthier than less optimistic students.