

MAS 2010 Abstracts By Division and Sections

SENIOR DIVISION:

Agriculture:

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

***Aide, M.¹, S. Svenson², and D. Dunn². ¹Department of Agriculture, Southeast Missouri State University and ²University Missouri-Delta Center. POTATO NUTRIENT UPTAKE PATTERNS AND SOIL NITRATE CONCENTRATIONS.** The purpose of this research was (1) to monitor the growth of a production potato (*Solanum tuberosum* L.) to determine the need for which types of research studies would best impact grower performance and profitability, and (2) to begin to develop standardized soil and plant tissue guidelines for commercial potato production in southeastern Missouri. Nutrient uptake patterns during the time from emergence to harvest demonstrated that tuber bulking occurred from 52 to 98 days after emergence. Nitrogen, phosphorus, potassium, and copper were effectively partitioned into the tuber, whereas magnesium, sulfur, iron, boron and zinc were evenly distributed into the vegetation and the tuber. Calcium and manganese were largely confined to the vegetation and did not show any appreciable tendency to partition into the tuber. Soil nitrates were abundant throughout the soil profile and do constitute a nitrate risk to the shallow groundwater.

***Aide, M., W. Mueller, I. Braden, and N. Hermann. Department of Agriculture, Southeast Missouri State University. NITRATE CONCENTRATIONS IN TILE-DRAIN EFFLUENTS.** Controlled subsurface drainage irrigation systems promote crop productivity; however, these land management systems also afford an efficient pathway for the transport of elements from soils to surface water resources. In this manuscript we describe the nitrate and macro-element composition of tile-drain effluents from a 40-ha controlled subsurface drainage irrigation system and compare the effluent chemistry with the soil nitrate availability. Soil nitrate concentrations reflect soil N fertilization practices and are sufficiently abundant to promote their transport from the soil resource to the tile-drain effluent waters. Phosphorus concentrations may also contribute to surface water eutrophication. We conclude that: (1) the transport of nitrate-N in tile-drain effluent waters is appreciable, (2) soil denitrification pathways do not effectively reduce soil nitrate-N, even when the controlled drainage system establishes winter-early spring anoxic soil conditions, and (3) the best strategy for reducing nitrate-N concentrations in tile-drain effluent waters in adjusting N fertilization rates and timing of application.

***Aide, M., W. Mueller, I. Braden, and N. Hermann. Department of Agriculture, Southeast Missouri State University. CORN AND SOYBEAN GROWTH ON A CONTROLLED SUBSURFACE DRAINAGE IRRIGATION SYSTEM.** Controlled subsurface drainage irrigation systems have been designed to promote agronomic performance and to limit overland transport of nutrients during high rainfall events. However, drainage systems may promote nutrient transport through the drainage tiles, potentially impacting surface water resources. In this manuscript we describe the design of a 40-ha controlled subsurface drainage irrigation system, describe the soil resource and describe the performance of corn (*Zea mays* L.) and soybean (*Glycine max.* L.), with a special focus on nutrient uptake. Crop yields approach regional yield thresholds, and the soil water contents were maintained between field capacity and the maximum allowed soil water deficit, thus optimizing crop growth and development. Nitrogen, P, K uptake patterns are described and are demonstrated to be an important reservoir for limiting nutrient leaching.

***Aide, M., W. Mueller, I. Braden, and N. Hermann. Department of Agriculture, Southeast Missouri State University. MICRONUTRIENT CONCENTRATIONS IN TILE-DRAIN EFFLUENTS.** Controlled subsurface drainage irrigation systems promote crop productivity; but also afford an efficient pathway for the transport of elements from soils to surface-water resources. Limited research has focused on the chemical composition of tile-drain effluent waters, especially alkali metals, alkaline earth metals, transition metals, metalloids and the rare earth elements. In this manuscript we describe the chemical composition of tile-drain effluents from a 40-ha controlled subsurface drainage-irrigation system and compare the effluent elemental composition with the elemental recoveries from the soil resources using selective extractions. Aqua regia digestion and a water leach extractions show that Ca, Mg, K, Na and Cl are the dominant macro-elements, whereas other alkali metals, alkaline earth metals, transition metals, metalloids and the rare earth elements are present in secondary to trace abundances. The dominant macro-elements include Ca, Mg, K, Na and Cl, whereas other elements are largely not detectable at the detection limits established for inductively-coupled plasma-emission mass spectroscopy. The transport of secondary and microelements in tile-drain effluent waters is limited because of the complex soil chemistry.

***Kidwaro, F. Department of Agriculture, University of Central Missouri. EVALUATION OF LOWLAND, UPLAND AND INTERMEDIATE SWITCH GRASS (*PANICUM VIRGATUM* L.) FOR BIOMASS PRODUCTION IN MID-MISSOURI.** Switch grass a warm season C4 perennial native

grass to North America is commonly used as a forage crop, an ornamental grass and for soil conservation; however, recent developments have focused on the use of Switch grass as a biomass crop for energy and fiber uses. It is becoming the darling of alternative fuels research through direct combustion and possibly production of lignocellulosic ethanol. Switch grass is expected to be the main feedstock for cellulosic ethanol, a new type of alternative fuel made from breaking down the woody bits of plants. The objectives of our study were to determine the cultivar that can be produced in Mid-Missouri and ascertain the effect of nitrogen on the amount of energy released in kilo joules per gram (KJ/g). Results from a two-year study indicate that upland cultivars Kanlow and Blackwell out yielded Alamo and Cave - in - Rock cultivars. Kanlow was the highest yielding cultivar followed by Blackwell during both study years. Yield differences by cultivar were significant at .01 level. Nitrogen treatments had a significant ($F = .05$) effect on yield; however nitrogen treatments did not have a conclusive effect on Switch grass KJ/g. There was a direct relationship between nitrogen levels and KJ/g in three cultivars (Blackwell, Kanlow, and Cave-in-Rock; however an inverse relationship was observed in the cultivar Alamo in which the amount of energy released reduced to 1.61 at 100 KJ/g pounds of nitrogen per acre.

Atmospheric Science:

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

***Buonanno, C.C., National Weather Service Little Rock AR. SIGNIFICANT WEATHER IMPACTS ACROSS ARKANSAS DUE TO LANDFALLING TROPICAL SYSTEMS.** A number of significant weather impacts due to land-falling tropical systems have been recorded across Arkansas. Since 1950, six tropical systems have had their center of circulation cross into Arkansas while the storms were still of tropical storm strength. Several of those systems affected the state in recent years, including Rita (2005), Gustav (2008), and Ike (2008). These storms produced a variety of significant weather impacts including floods, widespread damaging wind gusts, and tornados. This presentation will include a review of the tropical systems that have affected Arkansas, and a description of the meteorological parameters associated with them. The results of this study will provide a basis to promote situational awareness for local forecasters concerning such tropical systems.

***Lupo¹, A.R., R.S. Hayward², and G.W. Whitlege³.** ¹Department of Soil, Environmental and Atmospheric Science, University of Missouri-Columbia, ²Department of Fisheries and Wildlife Sciences, University of Missouri-Columbia and ³Department of Zoology, Southern Illinois University,

Carbondale. SYNCHRONIZATION OF FISHES' TEMPORAL FEEDING PATTERNS WITH WEATHER IN MID-MISSOURI. Daily food consumption was estimated over 30 successive days in summer for bluegill (*Lepomis macrochirus*) in a 13-ha impoundment, and simultaneously for green sunfish (*Lepomis cyanellus*) in a second-order Mid-Missouri stream from the same watershed during July and August 1996 (Whitlege and Hayward 2000). Using temperature data from the Sanborn Field Station provided by the Missouri Climate Center for July and August 1996, a relationship between daily food consumption rate of the two fish species and synoptic-scale weather patterns or cycles was established. Analyses of the two species in their respective aquatic environments showed that their daily consumption rates over 30-d periods were cyclical and maximized on a time scale of 2 and 14 days. A spectral analysis of the temperature data from that period showed that there were statistically significant temperature variations on the time scale of two, five and 15 days. The latter two periods are related to well-known synoptic meteorological rhythms (the passage of cyclones and large-scale vascillation in the jet stream). This same technique, method of cycles, when applied to the fishes' consumption rate data showed that similar spectral peaks occurred. Thus, it is theorized here that the food consumption patterns of these two fishes are linked to variations in the local synoptic and large-scale weather conditions. For the fish species the 2-day and 14-day feed deprivation periods applied in advance of unrestricted feeding of hybrid bluegills in the lab setting, promoted significantly higher growth than a control group or when the alternative (4-, 6-, or 10-d) feed deprivation periods were applied.

***Weber, E.E., and A.R. Lupo. Department of Soil, Environmental and Atmospheric Science, University of Missouri-Columbia. THE CLIMATOLOGICAL CHARACTER OF AIR POLLUTION EVENTS IN THE CENTRAL PLAINS STATES.** High air pollution concentrations are a major problem facing larger cities across the world. One such type of pollution is ground level ozone, which is formed through a reaction with heat or sunlight and nitrogen oxides, and has been shown to have adverse health and environmental impacts, such as irritation of the respiratory system or reduction in crop production. The main focus of this study was to analyze the atmospheric conditions that are associated with high concentrations of ground level ozone in Missouri cities. This information can be useful for air pollution forecasting in the central plains region. Also, knowing the conditions favorable for the formation of ground level ozone could also provide a basis for pollution control and mitigation. The main objective was accomplished in three steps. First, an Air Quality Index for ground level ozone in Missouri was created using Environmental Protection Agency (EPA) procedures to help locate times when high ozone concentrations took place. Next, mixing heights, transport wind speeds, and ventilation rates were analyzed to determine their contributions to these high ozone concentrations. Finally, surface weather features and 500mb weather features were examined

for each high pollution day to locate patterns at both levels. Overall, the air quality in Missouri was found to be favorable. Only a few days of high ozone concentrations were found to have occurred during the ten-year study period. Mixing heights over central plains region were found to be fairly constant, and using only this data to predict high ozone days lacked reliability. In contrast, transport wind speeds were found to be highly variable, and offered a more reliable representation of when high ozone days would occur. Ventilation rates also proved to be highly variable due to the fact that they are highly dependent on the transport wind speed. At the local level, ventilation rates were a reasonable indicator of when high ozone days would occur. At the surface, seven synoptic categories were found to be High to the North, High to the Northeast, High to the East, High to the Southeast, High to the South, High Over Missouri, and Miscellaneous Surface Features. At 50 mb, four categories were found to be Ridge axis to the West, Ridge axis to the East, Ridge axis to both the East and West, and Zonal Flow.

Biology:

Section Chair: Kurt Hartman, Missouri Western State University

***Corrigan, G. E. PRACTICAL DATA MANAGEMENT ANALYTICS IN EPIDEMIOLOGICAL ANALYSIS OF FORENSIC TOXICOLOGICAL AUTOPSY DATA USING MICROSOFT ACCESS DATABASE SOFTWARE.** In a controlled population study derived from forensic toxicology mortality data, a database analysis of the fifty drugs used by the mortality group (28 persons) was established to derive relationships of the various drugs to the demographic characteristics of the victims. The group was anonymous and no individual relationships were employed or derived. The variables included age, sex, height, associated pathological disease states, heart size, liver size, and brain size.

The study was independent of any previous established relationships or theoretical propositions. The database analytical results are presented in the report form of the designated data management software (Microsoft Access). Drug related relationships can/could be used to identify anonymous overdose victims.

***Dudenhoefler¹ N., D. Tran¹, T. Thorn¹, P. Nam², K. Lee¹.** Bioenergy Research Laboratory, Cooperative Research, Lincoln University, ²Department of Chemistry, Missouri University of Science and Technology. **BIO-SEQUESTRATION OF CO₂ BY GROWING ALGAE USING FLUE GAS FROM THE COAL POWER PLANT AT CHAMOIS, MISSOURI.** We have established a pilot algal culture system at the power plant Central Electric Power Cooperative (CEPC), located at Chamois, Missouri. CEPC is an affiliate of Missouri local Electric Cooperative, Associated Electric Cooperative Inc. (AECI), and it produces 60 MW per year of electricity by

coal combustion. The flue gas from the coal combustion contains about 12% of CO₂. The pilot algae culture system has been aimed to convert CO₂ from flue gas into biomass for the production of renewable bio-fuels (biodiesel, ethanol, syngas, etc.), and other valuable bio-products such as bio-fertilizer while reducing the green house gas emission. A locally isolated strain of *Scenedesmus* was chosen and used at the power plant pilot set up in order to find out optimal growth conditions that produce the maximum amount of biomass with a high rate of CO₂ sequestration. A mixture of flue gas and air containing 5% CO₂ was aerated directly into the algae cultures. The growth was measured with the optical density with a spectrophotometer using a wavelength of 680nm. The algae cultures supplemented with 5% CO₂ from the flue gas showed higher growth rates than the controls without flue gas. We also have initiated screening for the acidophiles that can tolerate the high pH created by the addition of flue gas to the medium.

***Hartman, K.M. and B.S. Guyer. Department of Biology, Missouri Western State University. COMPARISON OF FOREST VERSUS PRAIRIE MICROCLIMATES IN A LOESS HILL ECOSYSTEM.** Our goal was to investigate and analyze data collected by two weather stations, one of which was placed in a densely forested habitat, and the other was placed on an adjacent virgin prairie in a loess hill ecosystem at Squaw Creek National Wildlife Refuge in NW Missouri. This habitat is unique in that it is a relatively intact ecosystem with little human disturbance of the vegetation and soil. We found that for the months of July to November, the prairie versus the forest habitat had significantly greater temperature deg C (22.05 ± 0.08 SE prairie; 21.38 ± 0.06 forest), canopy through-fall precipitation per month cm (9.03 ± 1.56 ; 0.24 ± 0.08), evapotranspiration per month cm (9.72 ± 0.20 ; 1.71 ± 0.03), solar radiation $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{sec}^{-1}$ (339.84 ± 6.03 ; 43.1 ± 0.61), average windspeed $\text{m}\cdot\text{s}^{-1}$ (0.71 ± 0.021 ; 0.466 ± 0.0052), wind gusts $\text{m}\cdot\text{s}^{-1}$ (1.79 ± 0.034 ; 1.40 ± 0.017); cooling degree days (0.33 ± 0.005 ; $0.26 \pm .004$), and heating degree days (0.05 ± 0.002 ; 0.03 ± 0.001). For two variables, values in the forest were greater than the prairie, which were relative humidity (81.01 ± 0.17 ; 77.92 ± 0.21) and dew point deg C (27.23 ± 0.92 ; 25.51 ± 0.12 ; paired t-tests, $P < 0.01$ for all). Overall the prairie demonstrated greater variability in all of these factors and likely represents an environment which requires greater breadth of adaptation.

***Hasty, M. C., A. Oller, N. Babrakzai, and V. Jackson. Department of Biology and Earth Science, University of Central Missouri. THE EFFECTS OF THE MISSOURI RIVER AS A GEOGRAPHIC BARRIER FOR THE INCIDENCE OF PARASITIC INFECTIONS IN THE WHITE-FOOTED MOUSE, *PEROMYSCUS LEUCOPUS*.** The white-footed mouse, *Peromyscus leucopus*, is a ubiquitous rodent species in Missouri and is a host for many species of parasites, such as *Syphacia peromysci*, *Hymenolepis nana* and

Trichuris muris. The mouse is found mainly in woodland habitat and sometimes in cropland with many populations separated by natural barriers. This geographic separation may cause a difference in the community of helminth fauna in the separate rodent populations. For example, a large river, such as the Missouri river, may act as a barrier that prevents the interaction of white-footed mouse populations found on either side. If so, this may influence differences in both the amount and types of helminths found in these locations. The aim of this study was to investigate the differences found in the helminth fauna of the white-footed mouse living north and south of the Missouri river. Mice were collected from summer 2007 through winter 2009 using Sherman live traps. Mice were dissected and the lungs, liver, stomach and intestines were searched using a dissecting microscope. Helminths were processed according to type. Nematodes were cleared in glycerol and mounted using glycerin jelly while cestodes and trematodes were fixed using alcohol formalin acetic acid, stained using Grenacher's alcoholic borax carmine, cleared in clove oil and mounted in Canada balsam. Slides were used for identification using morphological characteristics. Nematodes have been found in 57% of the mice with cestodes found in 29% and trematodes found in 14%.

***Hoffman, B.L. Department of Natural and Physical Sciences, Park University. EPIDEMIOLOGICAL EVIDENCE FOR EVOLUTION OF INFLUENZA A VIRUS IN A MID-WESTERN US CITY PRIOR TO THE 1918–1919 H1N1 INFLUENZA PANDEMIC.** The H1N1 Influenza A strain that became apparent as “Spanish Influenza” in 1918–1919 caused in excess of 675,000 deaths in the United States and likely more than 50 million deaths worldwide. While this virus has recently been characterized, its origin is still a mystery. One popular interpretation is that a virus showing increased ability to cause primary pneumonias originated in Haskell County, Kansas during the 1917–1918 influenza season. A review of death certificates from Saint Joseph, Missouri from 1910–1923 indicates that fundamental changes in the virulence of influenza were occurring between October 1915 and May 1918 in the US Midwest. From October 1910 to May 1915, the average overall influenza season mortality rate from pneumonia and influenza in Saint Joseph was 151 per 100,000 population. The mortality rate jumped to 246 per 100,000 from 1915–1918 before peaking at 679 per 100,000 during the 1918–1919 influenza pandemic season. The increases in overall mortality were accompanied by increases in mortality in the under 1 year, 1–5 year and over 65 year age groups. Mortality in the under 1 year and 1–5 year age groups increased each year from 1915–1918, while mortality in the over 65 age group reached a high in 1915 and decreased back to 1910–1915 baseline during the 1918–1919 pandemic season. These results indicate that an influenza virus with increasing virulence was circulating in the central United States prior to 1918–1919. The largest change in the virus during the pandemic year was the ability to cause primary pneumonias in the 15–44 year old age groups. Recombination of a new virus from the US with emerging European strains during WWI may explain this pattern.

***Paine-Saunders³, S, B. Viviano², and S. Saunders^{1,2}. Departments of ¹Pediatrics and ²Developmental Biology, Washington University School of Medicine and ³Department of Biological and Physical Sciences, Fontbonne University. GLYPICAN-3 AND GLYPICAN-6 EXPRESSION IN MAMMALIAN DEVELOPMENT.** The cell-surface heparan sulfate proteoglycans of the glypican family have been shown to be important for FGF and BMP signaling in addition to a likely role in IHH signaling, and their function has been implicated in a number of developmental processes. The core proteins of the six members of this gene family can be divided structurally into subfamilies with conserved structural features that imply distinct functions. Two members of this gene family that represent examples of distinct subfamilies, glypican-3 and glypican-6, have natural mutations in humans that give rise to the Simpson Golabi Behmel Syndrome (SGBS) and Omodysplasia, respectively. Individuals with SGBS are characterized by their bone overgrowth and a number of developmental abnormalities involving the teeth, heart and kidney. In contrast to the skeletal overgrowth seen with glypican-3 deficiency and SGBS, human patients with Omodysplasia have skeletal undergrowth and dwarfism. In an effort to better understand the developmental requirement for these gene products, particularly in light of their opposing phenotypes in bone development, *in situ* hybridizations were carried out on embryonic sections. Results show that the expression patterns of these two genes overlap both spatially and temporally during development in a wide range of tissues suggesting the intriguing hypothesis that these two subfamilies of glypicans have evolved to balance signals through FGF, BMP, and IHH signaling pathways during development.

***Norton, J.R., D. T. Dieckhoff, and J.G. Steiert. Department of Biology, Missouri State University. COMPARISON OF *ESCHERICHIA COLI*, *BACTEROIDES* SP., AND *ENTEROCOCCUS* SP. METHODOLOGIES AS INDICATORS OF FECAL CONTAMINATION IN A FRESHWATER STREAM.** The fecal contamination of recreational freshwater streams in Missouri is of concern because of possible health risks due to gastrointestinal pathogens that may be present. In this study we evaluate several methods currently used to detect fecal indicator organisms. Two defined-substrate methods, Colilert® and Enterolert® (**Idexx**), commonly used by many health departments and state agencies were compared to recently developed PCR-based molecular methods. In addition, two different microbial source tracking methods used to detect human-associated markers were compared. Water samples for analysis were collected weekly, over a seven-month period, from two different locations on Wilson's Creek in southwest Missouri. Stream flow rate and monthly rainfall were recorded for the sampling period. Water samples were collected for the Colilert and Enterolert assays and PCR-based assays. DNA was extracted from a 500 ml water sample for human-associated bacteroides and enterococci PCR assays and quantitative PCR (qPCR) assays: total bacteroides (AllBac), enterococci (qEnt),

and human-associated bacteroides (HuBac). Quantitative results showed a strong correlation ($r > 0.96$) between Colilert and the qPCR results: AllBac, qEnt, and HuBac. Poorer correlation ($r < 0.87$) was observed between the Enterolert, qPCR and Colilert results. Very strong correlations were observed between stream flow rate ($r > 0.95$) and monthly rainfall ($r > 0.85$) with Colilert, AllBac, qEnt, and HuBac results. No correlation was observed between flow rate ($r < 0.001$) and monthly rainfall had low correlation ($r = 0.62$) with Enterolert results. When comparing the end-point PCR assays for human associated markers, the bacteroides assay was more sensitive than the enterococci assay for detecting human fecal contamination.

***Taulman, J. F. Department of Natural and Physical Sciences, Park University. A COMPARISON OF FIXED-WIDTH TRANSECT AND FIXED-RADIUS POINT COUNT METHODS FOR BREEDING BIRD SURVEYS IN A SMALL HARDWOOD FOREST IN MISSOURI.** Bird census data are routinely collected using a variety of methodologies, including strip transects and circular plot point counts. The uniformity of data produced by these two methods has not been well studied. In order to evaluate the comparable effectiveness of these two common bird survey methods, I installed a fixed-width strip transect and 4 fixed-radius point count plots and surveyed breeding bird in 2009 in a 150 ha hardwood forest surrounded by urban development in Parkville, MO. The 2 ha strip transect (80 x 250 m) and four 0.5 ha fixed-radius plots (40 m radius, 2 ha total area, 150 m separation) were placed in adjacent riparian forest areas and visited on 14 different days between 0630 and 1030 during May and June. Species richness and relative densities of all bird species encountered were not different between survey methods. Frequency of detection of the 23 species common to both survey areas, Shannon's diversity indices, and species evenness indices were also similar. However, abundance of birds of all species, and abundance and densities of the 23 common species, compared in a pairwise manner, were greater on the fixed-radius point count plots. The larger area of forest sampled by a group of dispersed circular plots may overlap more bird territories than a set of strip transects of equal enclosed area, and result in higher recorded bird abundances in surveys using fixed-radius point counts, though species richness values are similar between the two methods.

***Yates, D. L. and J. F. Taulman. Department of Natural and Physical Sciences, Park University. INVERTEBRATES ASSOCIATED WITH NESTS OF SOUTHERN FLYING SQUIRRELS- A PRELIMINARY REPORT.** Little has been reported on the invertebrate community associated with the nests of flying squirrels. In a study of population dynamics and habitat use of southern flying squirrels under a range of experimental forest management regimes, invertebrates were collected from nests constructed by southern flying squirrels in artificial nest boxes placed on trees in 21 study areas in the Ouachita National Forest of Arkansas. Nests were removed from boxes during the spring of 1993 and 1994. Invertebrates

were extracted from nests using the Berlese method and were preserved in 95% EtOH. Preliminary evaluation of the invertebrates represented in this collection was made in 1994 and included 29 families from 11 orders of insects, 10 families from 2 orders of arachnids, a diplopod, and a nematode. In 1995 additional analyses revealed representatives of 3 more families of mites and a hemipteran. First results of an ongoing study to further catalog and identify the invertebrate community in this collection are presented. Initial work carried out during 2009 and 2010 has yielded a Podurid (Order Collembola) and a *Nemadus spp.* (Order Coleoptera, Family Leoididae: Subfamily Cholevinae: Tribe Anemadini).

Biomedicine/Biotechnology:

Section Chair: Colette M. Witkowski, Missouri State University

***Cuebas, D. Department of Chemistry, Missouri State University. WE HAVE BEGUN TO INVESTIGATE THE EXQUISITE STEREOSPECIFICITY DISPLAYED BY THE REACTIONS CATALYZED BY B-OXIDATION ENZYMES INVOLVED IN THE DEGRADATION OF FATTY ACIDS.** It is now known that the classic mitochondrial 3-hydroxyacyl-CoA dehydrogenase is catalyzing the dehydrogenation reaction on substrates that contain α -methyl branches. The reason for this exclusivity is unknown. In contrast, the 3-hydroxyacyl-CoA dehydrogenase domain of the peroxisomal multi-functional enzyme I (perMFE-1) catalyzes the oxidation of L(S)- β -hydroxyacyl-CoAs to β -ketoacyl-CoAs for straight-chain or α -methyl-branched substrates. Our group was the first to observe that only (R)- α -methyl- β -hydroxy substrates are acted upon by this enzyme, demonstrating that the stereochemistry of the methyl group, while not part of the actual reaction mechanism, completely determines whether or not the substrate is acted upon. Others have determined the crystal structure of the classic mitochondrial 3-hydroxyacyl-CoA dehydrogenase complexed with NAD cofactor and 3-hydroxyacyl-CoA substrate. In addition, the crystal structure of the dehydrogenase domain of perMFE-1 has been determined, but no structures are available of this enzyme bound with substrate. Therefore, we have undertaken molecular dynamics computations in explicit solvent using the AMBER molecular dynamics package and the AMBER ff99SB force field to examine the factors that could explain the interactions responsible for the exquisite stereoselectivity that is observed within the active sites of these enzymes.

***Jaiswal, S. and C. Witkowski. Department of Biomedical Sciences, Missouri State University. CARBON NANOTUBE HYBRIDS: POTENTIAL FOR RNA DELIVERY.** The main purpose of this study is to test the ability of single walled carbon nanotubes (SWNTs) to deliver RNA in *C. elegans*. This model

organism, *C. elegans* offers a great potential for such a study due to some of its characteristics and rapid identification of gene knockdowns generated by RNA interference using standard siRNAs like *unc-22*. UNC-22 is required in muscle for regulation of actinomyosin contraction-relaxation cycle and for maintenance of normal muscle morphology. Decrease in *unc-22* activity produces severe twitching and loss of function results in impaired mobility of the worms. RNAi plasmids, pPD34.09 and pPD128.117, provided in a microtiter plate by Andrew Fire's lab, were transformed into DH5 α competent cells using heat shock method and isolated using alkaline lysis method. *unc-22* inserts carried by these plasmids were PCR amplified using M13 forward and reverse primers. RNAi was produced at concentration of 5 mg/mL by *in vitro* transcription of the amplified inserts. These RNAi can be used to functionalize SWNTs using standard protocols. For the uptake of f-SWNTS, *C. elegans* cultures were synchronized at L1 stage using sodium hypochlorite. L1 larvae were introduced into CeHR medium and growth rates monitored. Second synchronization performed at this stage would establish axenic cultures. Worms exposed to just SWNTs can serve as controls for treatment population that are exposed to f-SWNTs. The growth rate and knockdown phenotype can be monitored by observation of the treatment population using Nomarski optics. A chi-square test done to analyze the uptake of f-SWNTs would help in determination of toxicity and ability of SWNT uptake by *C. elegans*.

*Wang¹, J.J., V.H. Huxley², L. Erb³, and G.A. Weisman³. **¹Department of Biomedical Science, Missouri State University, ²Med. Pharm. and Physiol., ³Biochemistry, University of Missouri-Columbia. P2Y₂ NUCLEOTIDE RECEPTOR ACTIVATION INCREASES MICROVESSEL PERMEABILITY.** Extracellular nucleotides including ATP and ADP, released during hypoxia, hyperglycemia, and inflammation, have been demonstrated to regulate profoundly cardiovascular function via nucleotide receptor activation. Relatively little is known the role of nucleotide receptors in the regulation of microvascular exchange. We hypothesized that *in vivo* stimulation of the P2Y₂ nucleotide receptor would impair microvascular barrier function. Venular permeability to albumin (P_s) was quantified by microspectrofluorometry in adult male mouse (C57B/L) cremaster *in vivo*. In wild type mice, perfused UTP (10^{-5} M), a P2Y₂ receptor agonist, induced 5.2 ± 1.7 -fold ($n = 5$) transient increase in venular P_s from basal levels ($3.3 \pm 0.5 \times 10^{-7}$ cm/s, $n = 14$). In contrast, in mice lacking the P2Y₂ receptor, venular P_s did not change in response to UTP compared to basal levels ($P_{test}/P_{control} = 0.92 \pm 0.07$, $n = 4$). The *in vivo* pharmacological data from wild type and P2Y₂ receptor knockout mice demonstrate that P2Y₂ receptor activation elevates microvessel P_s , consistent with its playing a role in the regulation of microvascular barrier dysfunction under pathophysiological conditions.

Computer Science:

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

*Liu, H. **Department of Computer Science, Missouri State University. PREDICATING DISULFIDE BOND CONNECTIVITY IN PROTEINS VIA MODIFIED SVM MODELING.** Disulfide bonds play a critical role in the folding and stability of many proteins. A precise prediction of disulfide connectivity can strongly reduce the conformation search space, increase the accuracy in protein structure prediction, and reveal the relationship between protein structures and functions. However, the prediction accuracies of current methods are still limited so far (~74%). Also the datasets of disulfide bond connectivity are highly imbalanced, especially in proteins with five bridges the ratio of positive samples to negative ones becomes 1:945. Traditional classification algorithms can be limited in their performance on highly unbalanced datasets. In this research, we focus on designing modifications to Support Vector Machine (SVM) to appropriately tackle our specific problem of class imbalance. We proposed a novel cluster SVM, which incorporate different "rebalance" heuristics in SVM including cost-sensitive learning, oversampling, and undersampling to predict disulfide bond connectivity. The cluster SVM is compared with various state-of-the-art approaches on the highly unbalanced datasets by using various metrics, including Gmean, Area Under ROC Curve (AUC-ROC), F-measure, and Area Under Precision/Recall Curve (AUC-PR). Our experimental results show that our method is able to surpass the previous known best algorithms on the datasets, and achieve a better prediction accuracy.

*Naugler, D. R. **Department of Computer Science, Southeast Missouri State University. CONCURRENT ERLANG: AN ANSWER TO TEACHING MULTICORE PROGRAMMING?** Many modern computers have multi-core processors but few undergraduate Computer Science programs explore concurrent programming in depth. Concurrent programming in traditional programming language is error prone and often very difficult. OpenMP can let C/C++ take advantage of only certain kinds of parallelism and is far from a complete solution. MPI, widely used in HPC, must be honed to each particular hardware setup. The main languages used with MPI are FORTRAN and C with C++ a distant third. Erlang is a relatively mature functional language, which was designed from the ground up for writing highly concurrent; fault tolerant and scalable applications, which can allow hot code swapping. Although Erlang is elegant it is notationally and conceptually quite distinct from the languages students and many faculty have experience with. In Computer Science programs learning how to think in a different and useful way about a important kind of problem that makes writing many applications much easier to develop should be considered a good thing. Unfortunately, it can be difficult to get students and faculty to think differently after they have

developed some competence in a particular programming language, a particular approach to databases, or a powerful IDE. Experiences in attempting to teach Erlang to undergraduate students and giving several Erlang workshops to undergraduate Computing Sciences faculty at conferences are used to explore ways that Erlang can be included in the undergraduate curriculum. Many of the same problems are obstacles to the introduction of distinctly unfamiliar but potentially very fruitful ways of thinking about problems.

***Shade, E. Computer Science Department, Missouri State University. TOWARDS AN IMPROVED LIGHTWEIGHT MARKUP LANGUAGE.** Users of computers and smart mobile devices want written material, especially technical documentation, to be available in many formats, including an e-book (such as a PDF file), a set of hyperlinked web pages, and a help file for their preferred operating system. Authors want to write a single document from which all of these formats can be generated. Traditional word processors and markup systems like TeX are designed around the concept of a printed page, and make it difficult or impossible to generate high-quality output in other formats. SGML, like its simpler derivative XML, is a semantic markup language that in principle allows output to any format, though in practice assembling the tools required for all common output formats can be difficult and/or expensive. Many authors find documents in SGML to be verbose and hard to write correctly, with no visual resemblance to the output formats. Thus a number of “lightweight” markup languages have been created, such as Markdown and reStructuredText, that use “natural” input formats with common conventions like writing emphasized phrases **in asterisks** and using ‘>’ characters to indicate quoted text. Though popular, these systems suffer from three major drawbacks: their “naturalness” leads to ambiguities that make them difficult to parse, they are not extensible by authors, and none support all the features necessary for complex documents (indices and mathematical equations being common omissions). We present an initial design for a lightweight markup language that is unambiguous, contains all features necessary for complex documents, is extensible by authors, is easily translatable to arbitrary output formats, assigns special meanings to as few characters as possible, and is simpler than TeX or SGML.

***Thompson, M. and Y. Wang. Department of Computer Science, Missouri State University. ON EFFICIENCY OF POINT CLOUD VISUALIZATION.** Point clouds are data sets collected via LIDAR or other similar technology, which represent the visible surfaces of the objects in a scene. They are commonly used in industry for visualization, measurement, and inspections. A point cloud data set typically is unordered and contains points numbered in the millions. Thus, it can be difficult to visualize and process, especially in an application with a desire for real-time feedback. This project examines several methods to render point clouds in OpenGL as well as to speed up nearest neighbor searches, with a focus on the needs of real-time performance. Rendering methods with a naive approach,

vertex arrays, and vertex buffer objects were compared with real-world data sets collected from a LIDAR scan of a room. A naive approach renders points one by one, whereas vertex arrays can send batches of points to the videocard. Rendering with vertex buffers is twice as fast as with vertex arrays in almost all tested cases. The points are attenuated with an OpenGL extension to visualize depth. Normal point rasterization in OpenGL uses a fixed size by default, which can create a confusing visualization. Simple caching is examined to minimize data set load times. The simplest approach reduces load times to 2.5% of a non-cached load from an ASCII formatted point cloud set. Further, as spatial lookups are integral to many point cloud-processing algorithms, a KD-tree implementation and various tuning methods were tested. This includes an examination of splitting rules and bucket sizes. Both approximate and exact lookups were investigated. These were benchmarked with a very simple triangulation algorithm.

Conservation:

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

***Hrabik, R.A. S. Sheriff, and C. Kennedy. Missouri Department of Conservation, Resource Science Division, Open Rivers and Wetlands Field Station. SAMPLING STREAM FISH COMMUNITIES: AN APPROACH TO IMPROVE SPECIES DETECTION, ESTIMATE SPECIES RICHNESS, AND RELIABLE DETERMINE TREND THROUGH TIME.** Stream fish populations have long been sampled in Missouri. However, tracking biodiversity through time has been problematic but can be improved if we begin to explore sampling designs that characterize fish communities with precision. The commonly used biodiversity index, Shannon’s H' , requires that the number and abundance of species within the community *be known*. The only way to absolutely know species richness and abundance is to count every fish, an impossible task in most situations. So, sampling designs must be used in which one can *estimate* species richness and abundance. In this presentation we use data collected from aquatic habitats in Mingo National Wildlife Refuge where we are examining the possible effects of reintroduced alligator gar on species richness through time. Using a multiple-gear approach, we developed a “capture history” of each species and estimated species richness, sampling error, and confidence limits using the computer program CAPTURE. We modified CAPTURE by simply substituting gear type for capture occasion in the capture history matrix. CAPTURE uses the capture history matrix to compute several models that can be compared to what the investigator observes in nature. Using statistically based estimates that account for variation in capture probabilities of species under different conditions through time will provide the investigator with a measure of change in the fish community along with a measure of precision of these estimates.

Geography:

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

***Hoffman, B.L. and D. P. Fox. Department of Natural and Physical Sciences, Park University. DISTRIBUTION OF INFLUENZA DEATHS IN SAINT JOSEPH, MISSOURI DURING THE 1918–1919 INFLUENZA PANDEMIC.** Our previous studies have focused on analysis of deaths from H1N1 influenza in Saint Joseph, Missouri during the 1918–1919 pandemic as recorded from Missouri death certificates. Statistical treatment of data from the 10 city wards detected only two areas of town (State Hospital No. 2 and Ward 7) with a significantly higher than expected incidence of death compared to the death rate for the entire city (644 per 100,000). Two wards (Wards 3 and 4) had significantly lower than expected death rates. We have refined this analysis by utilizing the 84 enumeration districts from the 1920 United States Decennial Census for spatial analysis. Analysis of data using the Poisson distribution indicate that seven enumeration districts experienced a significant increase in deaths and 16 districts had death rates that were significantly lower than the death rate for the city. The seven enumeration districts with the highest death rates accounted for 103 of 502 deaths (20.5%) with valid address information. Contour mapping and trend surface mapping using geocoded information in ArcGIS 9.3 indicate that enumeration district death rates typically gradually increase as “hotspots” for influenza deaths are approached and decrease as areas with significantly lower death rates are approached. Regression analysis suggests that mechanisms other than strict contagious diffusion influenced the spread of influenza in 1918–1919, as no significant correlation between population density and influenza deaths is indicated. This creates a tool with which the role of factors such as place of employment, number of school aged children attending school and ethnicity in transmission of influenza can be examined in greater detail.

***Hoffman, B.L. Department of Natural and Physical Sciences, Park University. TOPOGRAPHICAL FEATURES SHAPING THE STREET GRID IN SAINT JOSEPH, MISSOURI.** The street grid of St. Joseph, MO has been organized with numbered streets oriented north-south and named streets oriented east-west. Two areas of the city deviate significantly from this orientation: the vernacular North End, generally defined as an area around St. Joseph Avenue and South Side, which is organized mainly by King Hill Avenue. In the North End, the orientation of Prospect Hill (Wyeth Hill) and the Blacksnake Creek drainage were major influences in turning areas of the grid away from cardinal directions. King Hill drives the grid in the South End. The curvature of the Parkway system is determined by the several water drainages that most of its branches follow. Geographic memory of features no longer extant is also preserved in the street grid. For instance, the roads around Lake Contrary, which curve in places for no apparent

reason, preserve evidence for the former boundaries of an oxbow lake that has decreased dramatically in size over the past century.

***Martin, J.R.¹, A.N. Zahner*¹, S.A. Hageman² and D.P. Fox. ¹Harvesters: The Community Food Network, ²Department of Natural and Physical Sciences, Park University. IMPLICATIONS OF COLLEGE STUDENT POPULATIONS ON FOOD BANK DISTRIBUTION: A CASE STUDY USING GIS.** Harvesters: The Community Food Network distributes food and products in Missouri and Kansas. The organization relies on ESRI population projections to obtain the number of people living in poverty at the zip code level. Harvesters calculates a pounds per person in poverty (PIIP) value, which determines distribution amounts. If this number is inaccurate it can incorrectly distribute 100’s-1000’s of pounds to distribution sites. The census bureau attempts to account for college students living in dormitories, however, any college town will have students recorded into the poverty data, especially those living in off campus housing. Thus, an examination of known college student populations is one way to assess the impact students may have on PIIP values. Geographic analysis using GIS software reveals 15 university populations contained within the 26 counties receiving assistance from Harvesters. All 15 universities reveal an increased level in population density at the block level demographic. Class limits on the map key are commonly distributed for populations in terms of 100’s per square mile but the largest class limits for some block level maps are commonly 2–3x higher with a few 30–50x higher than expected on college concentrated areas. This study demonstrates the importance of understanding data collection and reporting issues regarding unique populations for organizations that make critical decisions based upon them.

***Yang, N. Department of Geography, University of Missouri – Columbia. THE IMPACT OF THE CHINESE AIR CARGO HUB PROJECT ON THE BUSINESS CLIMATE OF ST. LOUIS.** In 2006, business and civic leaders in St. Louis approached the Chinese government with a proposal called the “Big Idea”, which called for the creation of an air cargo hub at St. Louis Lambert International Airport. This set in motion a process in which the Chinese government evaluated the prospect of locating an air cargo hub in several midwestern cities of the United States. In this process the Chinese delegation met with a diverse group of business, government, and education leaders in each perspective city to assess the merits of each location. This process has not only led to cultural exchanges, but also created new interactions between business and civic leaders in each prospective city. Using St. Louis as a case study, this study will analyze how the business climate in St. Louis is altered because of the professional interaction associated with the “Big Idea”. Through interviews with business, government, and education leaders, the study will explore how this experience has altered perceptions of international business opportunities and government and business collaboration. The findings

shed insight on how international collaboration can foster collaborations within a region and open up possibilities for future cooperation and business growth.

Geology/Geosciences:

Section Chair: Damon J. Bassett, Missouri State University

***Eicks, P. A. and B.L. Stinchcomb, 9819 County Road 455, Mokane, MO. THE UNUSUAL GREGARIOUS TENDENCIES OF THE GASTROPOD *PLATYCERAS* FOUND IN THE KEOKUK FORMATION OF BOONE AND CALLAWAY COUNTIES OF MISSOURI.** These Paleozoic gastropods occur in multiples in close proximity to one another lacking indication of attachment to crinoids, blastoids or cystoids. Found in groups in this environment there appear to be no projections or indentations of the apertural margin or flat folds, which could conform to irregularities of a host, while found singly in the same environment there appear re-entrants in the gastropod aperture, although rarely if ever found with attachment to a host. The genus *Platyceras* usually occurs in shale or other detrital sedimentary rocks in other regions and settings. In this environment it frequently is attached to crinoids. Associations of this gastropod in Missouri are often different, occurring in gregarious associations or groups often preserved in chert masses of the Keokuk Formation, the common occurrence of this gastropod in these masses may have something to do with its deposition or with ecological preferences of *Platyceras*. This peculiarity has been observed over years of collecting in Missouri's Boone and Callaway counties.

¹Ray, J. H., H. J. Falcon-Lang², K. R. Evans^{*1}, and J. F. Miller¹. ¹Missouri State University, USA and ²Royal Holloway, University of London, UK. **A RARE SILICIFIED PTERIDOSPERM TRUNK RECOVERED FROM THE ELSEY FORMATION (MISSISSIPPIAN SUBSYSTEM, OSAGEAN SERIES), GREENE COUNTY, MISSOURI, USA.** Seven fragments of an anatomically preserved tree trunk (10.8 kg) provisionally identified as a pteridosperm, were found disarticulated in the bank of a road recently cut 2–3 m into Elsey Formation chert and clay residuum. The Elsey Formation, which is Mississippian (Osagean/upper Tournasian), is a shallow marine limestone extensively replaced by chert. The discovery was made near the standard stratigraphic reference section for the Elsey Formation, 5 km east of Springfield, Missouri. Pteridosperms are an extinct group of arborescent gymnosperms that ranged from Late Paleozoic to Mesozoic times. The three largest fragments are intact segments of a trunk. Two segments refit and measure 0.33 m in length, whereas the third is 0.22 m long. They have a diameter of 78–105 mm with exceptionally wide pith, 35–50 mm diameter, that exhibits prominent sclerotic nests. The surface of the specimen is covered by druse-like quartz crystals up to 5 mm thick that cover the woody axis. Adhering to the quartz crystals on one

fragment is an 11 mm thick deposit of mottled white and light gray chert that is comparable to chert in the Elsey Formation. The woody part of the specimen is medium to dark grayish brown and comprises several quasi-concentric rings. Fossil wood has been reported previously in the underlying Reeds Spring Formation (Osagean Series) in southwest Missouri, but this collection represents a new stratigraphic occurrence and locality. Silicified wood is rarely preserved in shallow marine carbonate such as the Elsey Formation. The prominent chert beds in the Elsey Formation may have contributed to the early preservation of the trunk. Studies are underway to describe the anatomy of the specimen, improving knowledge of its identity, systematic position, and paleoecological significance.

***Evans, K.R. Department of Geography, Geology, and Planning, Missouri State University. GEOLOGY OF THE CIVIL WAR IN THE SOUTHERN MISSOURI.** Geology has had a profound impact on the history of Missouri, particularly with regard to settlement patterns, agricultural practices, transportation networks, and cultural and economic development. During the Civil War (1861–1865) strategic considerations included mineral resources, such as lead and iron as well as saltpeter (potassium nitrate) for the manufacture of gunpowder. Small saltpeter mining operations were located near caves on the heavily karstified Salem Plateau. The control of lead mining operations at Granby, Missouri was crucial. Early in the war southern forces mined and smelted lead pigs, which were transported overland to Van Buren, Arkansas and shipped to the Tennessee Ordnance works in Memphis. In contrast, lead mining in the St. Francois Mountains was mostly in Union control. The main iron mining area at Pilot Knob, Missouri remained in Union control for most of the war. Geology directly affected tactical aspects of the war, especially the terrain on which battles and skirmishes were fought. Terrain also influenced transportation networks. Steamships operated on the upper White River from 1851–1861, but Forsyth, the northernmost landing, changed hands several times. As a consequence, Confederate shipping on the river was restricted to Arkansas. Missouri railroads remained in Union control for most of the war. The trunk line from St. Louis to St. Joseph ran through northern Missouri. Spur lines to Sedalia, Rolla, and Pilot Knob facilitated transport of materiel for Union forces.

***Forir, M. Missouri Institute of Natural Science. THE DISCOVERY OF A NEW *ASAPHUS* TRILOBITE FROM THE LOWER ORDOVICIAN COTTER FORMATION OF SOUTH CENTRAL MISSOURI AND SOME IDEAS AS TO ITS OCCURRENCE.** The fossils of the lower Ordovician Cotter Dolomite of Missouri are mainly known from cherts associated with Cryptozoon reefs. A number of gastropods and cephalopods have been described from these cherts, an even more rare occurrence are the fossils found within the dolomite itself and these have gone largely unstudied because of the lack of good preservation and the rarity of the specimens themselves. A recent discovery of a trilobite of the Genus *Asaphus* from an

outcrop of Cotter Dolomite near Mountain Grove, Missouri appears to be the same genus as a specimen found near Busch, Arkansas in the 1950's. The Arkansas specimen was lost and is now only known from an old souvenir postcard advertising both the trilobite and the rock shop in Eureka Springs where it was displayed. The Cotter Dolomite is thought to be a hyper saline water and therefore unsuitable to sustain most organisms. A number of ideas can explain the occurrence. One can be that fossils found in the dolomite are accidentals that have found their way into a harsh environment and were unable to escape and died. Another could be that they were brought here by a predatory organism that was able to exploit the hyper saline waters and then dropped their intended food source. Yet another explanation is that this represents a species of hyper saline tolerant trilobite that was able to thrive in this harsh environment.

***Gentile, R. J. Department of Geosciences, University of Missouri-Kansas City. THE LATE 19TH CENTURY FOSSIL CRINOID DISCOVERY AT KANSAS CITY, MISSOURI.**

An exceptionally well-preserved fossil crinoid collection was recovered in the excavation for the basement of the Emory, Bird and Thayer (EBT) Building in Downtown Kansas City, Missouri in 1889. Over 450 crinoid specimens embedded in slabs of gray shale were collected and prepared by amateur paleontologists who were responsible for bringing the discovery to the attention of professional paleontologists. The specimens are housed in museum, departmental and private collections throughout the central and eastern United States and Europe. The discovery led to the naming of 8 new species of inadunate dicyclic crinoids. Three of these were named in honor of amateur paleontologists Edward Butts and Sidney J. Hare and include *Aesiocrinus harii* Miller and Gurley, *Ethelocrinus harii* (Miller) and *Ulocrinus buttsi* Miller and Gurley. The collection emphasizes the contribution that amateur paleontologists can make to the science of paleontology. The crinoid-bearing bed occurs throughout the Greater Kansas City area near the middle of the 6 m thick Liberty Memorial Shale, Kansas City Group, Pennsylvanian Subsystem, Carboniferous System. Crinoid skeletal parts are frequently found in excavations for roads and large buildings. Unfortunately, present day contractors use heavy machinery and the work proceeds rapidly and on strict schedule. In the late 19th century work proceeded at a more leisurely pace. Men wielding picks and shovels and horse drawn scrapers broke the shale into large slabs that were loaded onto drays pulled by teams of horses. I doubt if a collection of the size and quality as the one exposed during the excavation for the EBT Building in 1889 will ever be made again. It is a relic of a by-gone age.

***Hageman, S.A.¹, M.J. Everhart² and B.L. Hoffman¹.¹Department of Natural and Physical Sciences, Park University and ²Sternberg Museum of Natural History, Fort Hays State University. HISTORICAL AND SCIENTIFIC SIGNIFICANCE OF THE GUT CONTENTS OF A FOSSIL FISH (*ICHTHYODECTES*).** George F. Sternberg is famous

for collecting a "fish-within-a-fish" specimen, *Gillicus arcuatus* within *Xiphactinus audax* from the Late Cretaceous of Kansas in 1952. Ironically, his father had already achieved the collection of a "fish-within-a-fish" at least 34 years earlier. In March of 1919 George H. Sternberg sold a collection of fossil fish to Park University that has recently been cataloged and is currently being studied. One of the six plaster jacketed fish specimens from the Late Cretaceous of western Kansas (Logan County) is of *Ichthyodectes ctenodon* Cope, 1870. This specimen is the only known example of the species with stomach contents. Stomach contents of the specimen are tentatively identified as partially digested remains of *Enchodus petrosus*. The identification is based on the caudal fin, several vertebrae and the overall estimated size of the prey. Due to preservation characteristics of both specimens and the posterior location of the prey, it appears that the larger *Ichthyodectes* died after partial digestion of the prey. Most of the prey fish was lost to erosion prior to discovery and Sternberg's fossil preparation removed some of the ribs nearly destroying the evidence that allowed for the confirmation of gut contents and not two overlaid fossils. Although *I. ctenodon* has long been assumed to be one of the major mid-sized predators in the Western Interior Sea, this Park University specimen provides the first evidence of a *piscivorous* diet.

***Hagni¹, R.D. and E. Mwelwa².¹Department of Geological Sciences and Engineering, Missouri University of Science and Technology, ²Mindola Mine, Zambia. ORE MICROSCOPIC STUDY OF REPLACEMENT OF PYRITE BY COPPER SULFIDES AT THE MINDOLA MINE, ZAMBIAN COPPERBELT, NORTHERN ZAMBIA.** Because copper shale-type deposits elsewhere in the world (e.g., Polish Kupferschiefer; Creta, Oklahoma) commonly exhibit prominent copper sulfide replacement of syngenetic-diagenetic pyrite forms such as fine-grained framboidal and colloform pyrite, ores from several mines in the Zambian Copperbelt were examined by ore microscopy to search for such pyrite forms. Copper ores from Konkola underground, Chambishi open pit, and Mufulira underground mines were examined by ore microscopic techniques. Because those ores had suffered significant metamorphism, additional copper ores were subsequently obtained from the Mindola copper-cobalt mine. The ores at the Mindola mine are the least metamorphosed in the Zambian Copperbelt, but unfortunately even those ores have been affected by sufficient metamorphism to recrystallize the original syngenetic-diagenetic pyrite forms. Chalcopyrite, bornite, and covellite have veined and partially replaced Mindola pyrite (and cobaltite) crystals, but the pyrite crystals are large cubes with octahedral modifications that appear to have formed by recrystallization during metamorphism.

Interestingly, recent sulfur isotope studies of Zambian Copperbelt ores by others have shown that the pyrite sulfur isotopic compositions differ from the sulfur isotopic compositions of the copper sulfides. That difference in the sulfur isotope

characteristics has been interpreted to indicate that syngenetic/diagenetic pyrite has been replaced by subsequent copper sulfides in the Zambian copper ores.

Davidson¹, P., J. Nold^{*2}, and M. Dudley². ¹ARC Centre of Excellence in Ore Deposits, University of Tasmania and ²Department of Biology and Earth Science, University of Central Missouri. **NEW ANALYTICAL AND MINERALOGICAL INFORMATION ON THE PILOT KNOB MAGNETITE DEPOSIT, MISSOURI.** A number of new findings on the Pilot Knob magnetite deposit have come from microprobe work and from whole rock chemical analyses. New rare earth element minerals have been found, principally ferriallanite with the main REE's being Ce and La. The La content is sufficiently high to place this mineral about midway between ferriallanite and a currently un-named La analogue of ferriallanite. Five whole rock samples of high grade magnetite ore were sent for chemical analysis, and one of the five is elevated in all the REE's, especially Ce and La, evidently because it contained high concentrations of ferriallanite. This same core sample is also elevated in uranium.

Garnets within the deposit have been found to be of two species, an Fe-Mn almandine-spessartite garnet, and a Ca-Fe andradite garnet. The almandine-spessartite garnet is euhedral, zoned, and is present within layered magnetite ores about 110 feet above the Shepherd Mountain gabbro dike and is suspected to be of contact metamorphic origin. This is also the same sample with elevated REE's and ferriallanite. In addition, a brown andradite garnet occurs in late veins associated with apatite, calcite, epidote, and quartz. Andradite also occurs within the magnetite ore where calcite is present as a matrix mineral, but how it originated is uncertain.

Calcite inclusions within magnetite crystals prove the existence of magmatic carbonate and strengthen our previous inference of carbonatitic affinity for the magnetite ores, which was based on the presence of carbonate-bearing pods within the ores. In addition, an inclusion of anhydrite within magnetite has been found, indicating the probable existence of magmatic anhydrite. Also, tennantite and galena have been added to a growing list of trace sulfides, both having been found as melt inclusions in magnetite.

***Stinchcomb, B. L. Ferguson Mo. LARGE SHELLS OF THE CAMBRIAN ONYCHOCHILID *SCAEOGYRA* USED BY HYPOTHESIZED HERMIT-ARTHROPODS.** Fossils of the peculiar snail-like *Scaevogyra* occur with a monoplacophoran fauna associated with digitate stromatolites in the Cambrian Potosi Formation of Missouri. Specimens of *Scaevogyra swezeyi* of 2–3 cm length are a dominant mollusk in this Cambrian stromatolite dominated ecosystem. Rare, large (5–6 cm) specimens of *Scaevogyra* found in otherwise non-fossiliferous, presumably hypersaline zones of the Potosi Formation are suggested to be transported shells utilized by trilobitormorph-like arthropods (hermit-crab-style) for protection when moving into a less favorable hypersaline, non-stromatolite environment or even a terrestrial environment.

Trackways of trilobiteomorph arthropods are found on bedding surfaces of associated Cambrian sandstones like the Lamotte, Davis and Gunter formations so that it is believed that during their deposition, trilobiteomorph arthropods were a frequently occurring element of Missouri's Cambrian faunas

Physics:

Section Chair: Sunder Balasubramanin, Lincoln University

***Hill, M. P.¹, N. Golden¹, M. Clark¹, J. Shoemaker¹, A. Pathak², I. Dubenko² and N. Ali².** ¹Department of Physics and Engineering Physics, Southeast Missouri State University, ²Department of Physics, Southern Illinois University-Carbondale. **EFFECT OF AL SUBSTITUTION ON THE STRUCTURAL AND MAGNETIC TRANSITIONS OF THE FERROMAGNETIC SHAPE MEMORY ALLOY Ni₂MnGa.** Variants of the shape-memory alloy Ni₂MnGa have been found to have interesting magnetostrictive and magnetocaloric properties which make them candidates for magnetic actuator and magnetic refrigeration materials. By “tuning” the transition temperatures of these alloys through elemental substitution, applications in magnetic cooling systems can be envisioned. Here we look at the effects on the magnetic, electrical and structural properties of substituting Al for Ga in the stoichiometric Ni₂MnGa alloy. Ni₂MnGa undergoes an austenitic to martensitic transition upon cooling at 202 K (T_m) and a paramagnetic to ferromagnetic transition at 375 K (T_c). An anomaly in magnetization, termed a pre-martensitic transition, is observed at T_p = 260 K. By substituting Al for Ga in varying percentages, the effects on the structural transition temperatures of the alloy and on its magnetic properties were investigated. Ingots of Ni₂MnGa_{1-x}Al_x, x = 0.0, 0.05, 0.10, 0.15, 0.20 and 0.25 were prepared by arc-melting in an argon atmosphere and annealing in a vacuum. Powder x-ray diffraction measurements at room temperature showed all samples to be single phase and have the cubic L2₁ structure. Results of magnetization measurements showed little effect of Al substitution on T_c. However, T_m and T_p decrease monotonically as the amount of Al substitution increases.

***Manivannan, K. Department of Physics, Astronomy, and Materials Science, Missouri State University. AN INTERACTIVE APPROACH USING SPREADSHEETS TO UNDERSTAND THE CONCEPT OF REVERSIBLE WORK.** In real world thermodynamic processes some work is always gets wasted as heat transfer. If a process is carried out reversibly, the amount of wasted work is minimized. In a given process, the system goes through certain equilibrium states in a sequence, and in the reverse process it goes through the same states in a reverse order, undergoing the same amount of heat transfer to the surroundings as was taken during the corresponding part in the forward process. Accordingly, any work done by

the system in the forward process is recovered by the equal amount of work done on the system in the corresponding reverse process. For a process to be reversible, it must be quasi-static and non-dissipative. In theory, this may sound easy, but in terms of a pedagogical point of view the concept of reversible work may not be easy to understand. Here we present an interactive approach using Excel spreadsheets to better understand the concept of "reversible work." We show interactive spreadsheets that can be used in teaching and learning to explore the concept of reversible mechanical work in an ideal spring and ideal gas, and other related examples.

***McCune, M., J. Shaw, J. Department of Chemistry and Physics, Northwest Missouri State University. EXPERIMENTAL OBSERVATION OF CHAOTIC MOTION IN AN ELASTIC PENDULUM.** When a mass on a spring is allowed to swing back and forth as well as oscillate on the spring it is known as an elastic pendulum. Theoretical studies show that, for a range of energies, the motion of an elastic pendulum is chaotic. To observe the chaotic motion experimentally, the motion of an elastic pendulum was recorded with a digital video recorder. The video was analyzed using the Videopoint computer program. Exporting the data from Videopoint to an Excel spreadsheet, the velocities of the pendulum mass could be calculated. A phase plot can then be done in which the y-component of position is plotted against the y-component of velocity. This is the easiest way to distinguish between regular and chaotic motion. The experimental phase space plots are compared to theoretical phase space plots to clearly demonstrate that the motion of the elastic pendulum is chaotic.

***Nag, N., R. Gupta, J. Darabi, K. Manivannan, K. Ghosh, P. Kahol. Department of Physics, Astronomy, and Materials Science, Missouri State University. SYNTHESIS AND CHARACTERIZATION OF ZINC OXIDE (ZnO) NANOPARTICLES FOR BIOMEDICAL APPLICATIONS.** ZnO nanoparticles being biocompatible and chemically stable have much potential for bio-medical applications that include anti-bacterial and mold prevention, air ventilation and purification, water purification, photosynthesis, and disease detection. Therefore, the fabrication of ZnO nanoparticles and their binding to bio molecules would be a notable contribution to this field. This research is aimed at the fabrication of ZnO nanoparticles using a safe, cost effective and easy to handle technique that is capable of producing nanoparticles free of any contamination, and functionalization of those particles with bio-molecules. ZnO nanoparticles have been fabricated at room temperature by laser ablation of ZnO thin film prepared with a pulsed laser deposition (PLD) technique. Characterization of the nanoparticles has been done using UV-Visible spectroscopy, fluorescence spectroscopy, dynamic light scattering (DLS), and transmission electron microscopy (TEM). UV-Vis absorption and fluorescence emission peaks at ~280 and ~410 nm respectively validate the exact nature of ZnO nanoparticles. Size determination of these particles by DLS and TEM have demonstrated that majority of the particles are in the range of

80 to 90 nm, which authenticates the presence of nanoparticles. Effects of the laser parameters on the growth of the nanoparticles have been investigated. Enhanced homogeneity and stability of these ZnO nanoparticles have been observed when produced in presence of 0.2% glucose solution. Assemblage with protein molecules has successfully established fictionalization of these nanoparticles. These results could play a significant role in future development of antibiotic free approach for treating microbial infection where antimicrobial enzymes attached to nanoparticles could be used.

***Shaw¹, J., A. Schmitz¹, H. Chakraborty¹, and U. Thumm².** ¹Department of Chemistry and Physics, Northwest Missouri State University and ²Kansas State University. **ROLE OF SURFACE BAND STRUCTURES IN THE SURVIVAL OF ANIONS SCATTERED FROM METAL SURFACES.** Resonant charge transfer between ions and metal surfaces is a valuable tool to explore surface electronic structure. The time-dependent Schrodinger equation is solved numerically to simulate the scattering of a hydrogen anion from flat metal surfaces for Li(110), Cu(111), and Pd(111). The electronic evolution during the scattering and the final ion survival probability as a function of the anion's incident angle are calculated. It is found that the survival of the ion reflected from a plane surface is very sensitive to the perpendicular component of the anion's speed. It is also found that the ion-survival probability is strongly enhanced at two different surface-specific perpendicular velocities of the anion. The simple ion-surface interaction-time model predicts a monotonic ion survival probability. It is determined that the low velocity enhancement emerges from a spectral confinement of the ion's affinity level inside the metal band gap as the interaction becomes non-adiabatic in character. The high velocity enhancement is due to a boost in the recapture probability as the surface image states are dynamically populated by energetic resonant charge transfer from the ion.

***Tansil, J. E. Department of Physics & Engineering Physics, Southeast Missouri State University. CONTRIBUTIONS TO AVERAGE ANNUAL IONIZING RADIATION RECEIVED BY A U.S. RESIDENT.** Over the last 25 years, the average annual effective dose of ionizing radiation per individual in the U.S. population has increased by 70% from 3.6 mSv to 6.2 mSv,¹ where 1 mSv = 0.001 sievert = 100 mrem. Almost all of this increase is due to the increasing utilization of ionizing radiation in diagnostic and interventional medical procedures which currently account for 50% (3.1 mSv) of the total radiation dose. The other contribution to the total dose is from ubiquitous background radiation with radon the primary contributor (2.3 mSv) and smaller contributions from internal radioactive nuclei (0.4 mSv) and other sources. We have previously shown that the contribution from internal radioactive nuclei has a small variability; however this is not necessarily true for the other contributors. The doses presented here are whole-body doses. To put these average annual doses in perspective, consider that the Nuclear Regulatory Commission

mandates the yearly limit for radiation workers in the U.S. to be 50 mSv and that a dose of 3000–4000 mSv results in severe radiation poisoning with 50% fatality after 30 days (Lethal Dose 50/30).

¹*Ionizing Radiation Exposure of the Population of the United States*, Report No. 160, National Council on Radiation Protection and Measurements, Bethesda, MD, 387 pp. (2008).

***Whitaker, R. J. and W. E. Thomas. Department of Physics, Astronomy, & Materials Science. Missouri State University. INTERNATIONAL YEAR OF ASTRONOMY AND THE GALILEOSCOPE.** The year 2009 was designated as the “International Year of Astronomy.” It was to commemorate the 400th anniversary of Galileo’s first telescopic discoveries. As part of this celebration a professionally designed telescope was designed and manufactured at a low cost to make possible clear viewing similar to that of Galileo. This was called the “Galileoscope.” A brief discussion of IYA2009 will be presented, and the Galileoscope will be demonstrated.

***Wieggers, J. F., A. M. McMahon, and P. C. Gibbons*. Science Outreach and Department of Physics, Washington University in St. Louis. LEARNING HOW WE KNOW WHAT WE KNOW IN AN ASTRONOMY COURSE.** “How do we know what we know about the solar system?” is the question we use to organize our graduate-level astronomy course for in-service K-8 teachers and is a central question in fostering critical thinking and inquiry learning/teaching. We present them with the heliocentric model that explains all the observations of planetary motions and apparent sizes, and we present the geocentric model, with epicycles, that also explains all the observations available before telescopes were used. We emphasize that both models work, and that if one is preferred it must be for reasons other than the naked-eye observations. We tell the story of the evolution of models through Copernicus, Brahe, Kepler, and Newton. With Newton’s theory of universal gravitation, the heliocentric model becomes preferred, but not because of results from observations. We challenge the students with the question “How did Copernicus know, and later Kepler know, the size and shape of the orbit of Mars?” We give them observations, pictures from a telescopic sky survey, they can use to construct a map of Mars’s orbit, one that shows it is different from circular. Showing whence our knowledge comes leads, we believe, to more confident understanding and teaching by those in our course.

Science Education:

Section Chair: Gouranga C. Saha, Lincoln University

***Gilbert-Saunders, L.J. Physical Science Department, Missouri Southern State University. READING FUNDAMENTALS AND SCIENCE SUCCESS.** In our fast-paced,

interdependent society filled with tweets, texts, and online postings, our science classrooms are experiencing a shift in paradigms towards reflection, self-directed study, and exploration. Educators typically agree there are several essential attributes students must have in order to be successful: a support system, motivation, relevance of material, and academic skills such as math and reading comprehension. For computational courses, such as chemistry and physics, prerequisite courses in math are often part of a university’s academic policy. However, if a learning process, such as self-directed study, is to occur, where lies the importance of reading ability, and what skills are needed? At times students and professors may experience frustration and possible academic failure due to the discontinuity between classroom expectations and a personal reality. How then do educators bridge the gap between what should be and what is? Through a re-examination of some basic reading comprehension skills applied to scientific literature such as text awareness, generalization, and inferences, one may impart fundamental tools to the student while simultaneously refocusing instructional methods and content.

***Manivannan, K., E. Williams, K. Ghosh, P. Kahol. Department of Physics, Astronomy, and Materials Science, Missouri State University. NANOSCIENCE EDUCATION FOR THE CLASSROOM: HANDS-ON ACTIVITIES TO EXPLORE NANOSCALE SCIENCE.** Traditional fields such as science, technology, engineering, and mathematics (STEM) have been around for a long time and over the years significant progress has been made in education research and curricular development in these fields. Numerous studies have shown that teaching and learning based on science education research findings have positively affected the way teachers teach and students learn. However, the relatively new and fast growing interdisciplinary field of *nanoscience* and *nanotechnology* is still in its infancy, and science education research findings and curricular development are still emerging. The National Nanotechnology Initiative (NNI) that coordinates Federal nanotechnology research and development supports the development of nanoscience education materials as well as research into how students best learn nanoscience concepts. In general, appropriately integrating nanoscience into the school classrooms is expected to have outcomes such as supporting inquiry-based teaching and learning, increasing levels of interest and engagement in learning science, understanding of core science concepts, and increasing understanding of nanoscale STEM concepts, and applications. In this presentation we will see the “science” of nanoscience and nanotechnology. Once we understand what “nano” is all about, we will explore the underlying science that rules the nanoworld, what exactly are nanoscience and nanotechnology, and why there is such a big deal about the size “nano,” which is about one hundred thousandth times smaller than the diameter of human hair. At the nano level, we will quickly begin to appreciate the intimate connection among each and every discipline under STEM. Nanoscience is truly an interdisciplinary field of science! We will demonstrate the

behavior of materials at nano level using paper models as well as plastic building blocks, and discuss as well as demonstrate other activities suitable to be used in school classrooms. We will assemble paper models to simulate some of the unique properties of nanoparticles. We will also discuss preliminary results of our pre- and post-tests based on a Nano Concept Inventory.

***Rushin, J., D. Ashley, J.C. Baker, C. Chevalier, M. Daggett, T. Eckdahl, K. Hartman, K. Koy, M. Mills and K. Walton. Department of Biology, Missouri Western State University. TWO-WEEK LONG LEARNING CYCLE BLOCKS IN GENERAL BIOLOGY: PROS AND CONS.** The Test of Integrated Process Skills (TIPS) was used to measure gains in student understanding of science process skills after intervention with several Two-Week Learning Cycle Blocks (LCBs) in a 1st-year college general biology laboratory (Bio 101 Principles of Biology). In this course, all students are enrolled in a traditional lecture of from 35 to 130 students that meets four times per week and each student is also enrolled in a weekly 2-hour lab that has a maximum enrollment of 24 students. In each of the Two-Week LCBs, **Week 1** at least involves the students in engagement, exploration and concept explanation using short demonstration-type experiments followed by discussions. Toward the end of the **Week 1** lab session (or at the beginning of the **Week 2** lab session) the students typically work in small groups to set up their own scientific mini-investigations in order to elaborate upon the processes and concepts learned earlier during week 1. These independent mini-investigations are completed over the next seven days and /or during the next (**Week 2**) laboratory session. The results and conclusions of the mini-investigations are shared with the entire class through oral presentations during the **Week 2** lab. An evaluation (quiz) of the learning of science concepts and processes by the students during the LCB is also completed at the end of the **Week 2** lab session through the grading of lab *questions and data entry*, *oral presentations* and a *written quiz* over the LCB. Significant positive gains in student understanding of science processes were determined with the standardized TIPS survey for one Bio 101 summer class experiencing the LCB intervention compared to a control class without the intervention. In addition, on a separate survey students indicated a positive view of how the LCBs helped them to understand the nature of science investigations.

***Smith, P.S. Independent Scholar. THE EXISTENTIAL SITUATION AND THE EMERGENCE OF EVIL.** With ethnological corroboration, historical reference and conversant to other social scholars, the following exegesis, as an addendum to the ongoing application of existential anthropology to behavior within the context of culture, will seek to establish a general definition of evil and find the circumstance, at a primary level, for the origin and personification of its idea, but will also

establish not just its disruptive, but useful place within social organization. Some questions which will be asked and answered are: is the difference between bad and evil a matter of degree? Does evil find its realization with the individual or is it a socially influenced phenomenon? While many cultures have organized themselves with oral and written laws around an idea of what is bad, why is behavior found acceptable to some, reviled by others? Other pertinent questions will be, have all past cultures delineated ideas about bad and evil and does that necessarily stand in contrast with concepts about good? In relation to that, how then did evil become personified to stand out and in contrast to a person or persons considered wholly good?

COLLEGIATE DIVISION:

Agriculture:

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

***Morant, D., G.A. Dudenhoeffer, T.R. Omara-Alwala. Department of Agriculture and Environmental Science, Lincoln University of Missouri, Jefferson City, MO 65101. THE EFFECT OF DIETARY PURSLANE (*PORTULACA OLERACEA*) SUPPLEMENTS ON SELECTED GROWTH PERFORMANCE PARAMETERS IN BLUEGILL, (*LEPOMIS MACROCHIRUS*).** Purslane (*Portulaca oleracea*) has the potential to become a new nutritious food source for both humans and animals. It has the richest source of omega-3 fatty acids of any vegetables analyzed, which is beneficial to coronary heart diseases in humans. Bluegill (*Lepomis macrochirus*) is a freshwater fish that is raised year-round in indoor water recirculation systems at Lincoln University of Missouri. Bluegill has been recognized as a potential food fish for the north central region of the United States by the North Central Regional Aquaculture Center (NCRAC). However, the nutritional requirements have not yet been defined. The objective of this study was to develop a least cost diet that would maintain or optimize the growth performance characteristics of bluegill. Four diets were evaluated for their efficacy. The diets were commercial feed only, which served as the basal diet; basal diet with gelatin; basal diet supplemented with 10% purslane; and basal diet supplemented with 20% purslane. The purslane supplemented diets were isonitrogenous and isocaloric. The diets were fed to experimental units stocked with 12 bluegill fingerlings. There were three replications for each diet. Initial weights and lengths were taken before the start of the experiment and the final weights were recorded on day 43. There were no significant differences among treatments in terms of the growth performance characteristics measured. Therefore, a least-cost could be developed, supplemented with as much as 20% purslane without effecting bluegill fingerling growth.

Biochemistry:

Section Chair: Rafiqul Islam, Northwest Missouri State University

***Schroer, W.L., V. Butano, and S. D. Zimmerman. Biomedical Sciences Department, Missouri State University. ALTERATIONS IN GAIT IN THE TG2576 MOUSE MODEL OF ALZHEIMER'S DISEASE.** Treadmill gait analysis has been used to assess disease processes in a variety of different mouse models. Based on our observations, APP transgenic mice (Tg2576) move in ways much different than their wild-type (WT) littermates. To quantify these observations, we examined the time components of gait between age-matched Tg2576 and WT mice. However, body mass can play a role in the timing of gait so we compared a subset of two pairs of weight-matched 7 month old Tg2576 and WT mice to assess the effect of body mass as well. The Tg2576 mouse model has been shown to develop measurable plaque at about 9 months of age. Therefore, the two groups of mice were divided into three age categories; young (3–5 months old, Y), pre-plaque (6–8 months, PrP), and post-plaque (>9 months, PoP). Gait data were gathered at a treadmill speed of 20 cm/sec. Videos were digitized (DigiGait, Mouse Specifics) and data analyzed by 2-way ANOVA with $\alpha = 0.05$. Variables measured included swing, break, propulsion, stance, and stride times as well as stride frequency. A significant age by genotype interaction was found for swing ($p = 0.018$), stance (0.049), and stride times (0.007) as well as stride frequency (0.031). Post-hoc analyses show that the greatest changes occurred in PrP-Tg2576 mice, which had significantly reduced times and increased stride frequency compared to PrP-WT; and the PoP-Tg2576 group, which were different from PoP-WT but not from Y-Tg2576. The weight-matched Tg2576 had significantly lower swing and stride times and increased stride frequency compared to their WT counterparts. Therefore, we found significant gait changes in the Tg2576 mouse model prior to expected plaque accumulation that are unlikely to be exclusively related to body mass. This may suggest that the Tg2576 model phenotype differs in more than just plaque accumulation. The small sample size may prove to be problematic.

Biological Sciences:

Section Chair: Staria S. Vanderpool, Lincoln University

***Bonansinga, S. and I. Pillay. Department of Biology, Culver-Stockton College. OPPORTUNISTIC PATHOGENS ISOLATED FROM BIO-FILMS FOUND IN CULVER STOCKTON COLLEGE SHOWERHEADS.** Recent studies have shown that shower usage is a source of exposure to pathogens. Due to the environment being moist, warm and dark, it is ideal for microorganisms to thrive. Fifty-five samples were taken from metal and plastic showerheads on the campus

of Culver Stockton College. The samples were incubated for twenty-four hours in Brain Heart Infusion media; growth occurred in all samples except for five. The samples were tested for hemolysis on Blood Agar plates. Pyrolidonyl Aminopeptidase test disks (PYR), which detect the activity of pyrolidonyl aminopeptidase in certain groups of bacteria, revealed the possible presence of Group A streptococci, Group D enterococci, *Citrobacter* and *Klebsiella* species and coagulase-negative *Staphylococcus* species in eleven sites. Twelve more sites indicated growth of *Staphylococcus aureus* as determined by Mannitol Salt Agar fermentation and *Staphylococcus* – specific latex agglutination assays. The preliminary data clearly indicates the presence of many different potential pathogens growing on showerhead bio-films. The implications of these results are that people with immune-compromised systems may be at an increased risk of infection.

***Dumbach, D.¹, P. Markway¹, R. Jones¹, P. Nam², K. Lee¹. ¹Bioenergy Research Laboratory, Cooperative Research, Lincoln University, ²Department of Chemistry, Missouri University of Science & Technology. MICROALGAL BIOMASS AS A SLOW-RELEASE BIOFERTILIZER.** Mass cultivation and processing of algal biomass for biofuels will generate a large quantity of residual materials that are high in protein and nitrogen content. Whole algal biomass or processing by-products may be used as a fertilizer for vegetable crops that require nitrogen from the soil in which they are growing. The use of blue-green algae as a soil conditioning amendment and as a biofertilizer for rice cultivation has been studied previously (Metting, 1996). Algae grown on dairy manure effluents have shown a potential as a slow-release fertilizer (Mulbry et al., 2004). The feasibility of the algal biofertilizer using the algal biomass obtained from our laboratory was initially tested with sweet corn grown in Farfard C-2 potting mix with different amounts of dried algae applied to the soil with water. Following the procedures used by Mulbry, et al., the germination and growth of sweet corn seeds was recorded. After 21 days, the corn seedlings were cut at the base and oven-dried. The samples were then ground using a mill and analyzed for nitrogen content using the Kjeldahl method which involves block digestion and flow-injection analysis. The AOAC official method (2000) for determining crude elemental nitrogen composition in plant tissue was used. Our preliminary tests have shown the algal biomass promoted the corn seedling growth and increased the total percentage of available nitrogen by 3.5–4.6%, which was equivalent to those grown using commercial fertilizers, when as low as 20 g algal biomass per 250g soil were applied.

***Gerke, B.A. Department of Biology, State Fair Community College. ANALYSIS OF COLEOPTERA IN SUCCESSIONAL COMMUNITIES OF A TROPICAL FOREST.** Succession of communities can impact many factors, such as species diversity, richness, and evenness. Preliminary analysis shows that insect communities should be affected by changing plant communities. This analysis consists of data collected from

three distinct successional locations of a tropical forest: old-growth forest, re-growth forest, and a pasture. Found at La Suerte Biological Field Station in North-Eastern Costa Rica, our research was conducted over a 1,000-acre site consisting of each of the successional areas. Coleoptera specimens were collected using a stratified random sampling technique, various common sampling methods, sorted, and identified as our research. Using the data collected, we were able to calculate species diversity using two different indices: Shannon-Weiner Index, and the Simpson Index. In addition to diversity, species richness and evenness was determined for each location. Preliminary analysis suggested the re-growth forest to have the highest species richness, which our data supports. In addition, species evenness was greatest in the old-growth forest. The Simpson Diversity Index shows a higher diversity of species of coleoptera in the old-growth forest. Whereas the Shannon Diversity Index shows higher diversity in the re-growth, but does not indicate a significant difference in diversity between the old growth and the re-growth forests.

***Halpin, C. and I. Pillay, Department of Biology, Culver-Stockton College. COMPARISON OF DIFFERENT COMMERCIAL DIETS ON THE TOTAL WEIGHT LOSS AND PERCENTAGE OF CARBOHYDRATE, FAT, AND PROTEIN CONTENT IN *MUS MUSCULUS*.** Within the past few decades, there has been a significant rise in obesity in the United States. In an effort to address this problem, several diets, including Volumetric and the Atkins diet, have become popular throughout the country. This study is designed to not only test the total body weight lost by these diets, but it also determines the amount of protein, fat, and carbohydrates left in the body. Mice were subjected to three different diets: Volumetric, Atkins, and the normal American diet. The food for each diet is based on the percentages of carbohydrates, fat, and protein suggested by each company. The mice were fed carefully monitored amounts of food and weighed weekly to determine the weight lost/gained. After five weeks of feeding, the mice were sacrificed and the percentage of protein, carbohydrates, and fat content in each mouse was determined. The results indicate that the Atkins diet made the mice gain weight, the American diet appears inconclusive, and the Volumetric diet indicates weight loss. However, the mice in the Atkins diet ate more food on average compared to the other mice and these mice showed a higher yield of carbohydrates rather than fat content. In conclusion, the mice subjected to the Volumetric diet had the healthiest balance of carbohydrates to fat content. The Atkins diet may be a sufficient diet for weight loss, however calorie intake will have to be closely monitored and exercise is needed to burn the excess carbohydrates.

***Hamilton, B. Department of Biology, State Fair Community College. PRELIMINARY ASSESSMENT OF HYMENOPTERA PRESENT IN SUCCESSIONAL AREAS OF LOWLAND TROPICAL RAINFOREST.** Community succession is one of many factors influencing species richness,

diversity, and evenness. As plant communities change, insect communities should change accordingly. In this analysis data was collected for insect communities in three successional areas of a tropical forest (old-growth, fifteen-year regrowth, and a pasture that had historically been original forest) found at La Suerte Biological Field Station, Costa Rica. The research focused on hymenoptera, with particular emphasis on parasitoid wasps. From species collected using various common sampling methods, species richness and community composition for each successional area was determined. Species diversity and evenness was also calculated for these areas. Preliminary analysis suggested the regrowth area had greatest species richness and community composition, changing from one habitat to the next. In addition, species diversity was also greatest in the regrowth area, whereas, the pasture area showed the highest level of species evenness for Hymenoptera. Data focusing specifically on parasitoid wasps also showed the greatest species richness in the regrowth area. However, species evenness among the parasitoid families was greatest in the old-growth forest, with diversity indexes varying between areas.

***Hirsch, L.P. and J.E. Wetzel. Department of Agriculture and Environmental Science, Lincoln University of Missouri. BREEDING AND REARING WARMOUTH SUNFISH INDOORS WITH OBSERVATIONS ON MORPHOLOGICAL VARIATION.** Warmouth sunfish *Lepomis gulosus* are often included in the creels of pan fishermen and used to produce intrageneric hybrids. In regards to early life history and culture requirements, warmouth are a largely understudied species. Herein, we set out to propagate warmouth indoors using a range of methods, while observing spawning behavior and larval development. Three methods of spawning and four methods of rearing were evaluated. Spawning methods included: a multi-male and multi-species set up using a 1200-gal indoor tank, a two-male set up using a 120-gal fiberglass raceway and partition system, and a single-male using a 40-gal static glass aquarium. The rearing methods included: static 10-gal aquariums, with brine shrimp feedings hourly from 0800–1700; a static 40-gal protein tub fed brine shrimp 3x daily at 0800, 1200, and 1500; 40-gal glass aquarium plumbed to a water reuse system with larva being fed brine shrimp nine times daily; and 65-gal polyethylene cylindrical stock tanks with brine shrimp feedings occurring hourly from 0800–1700. Spawning was accomplished using all methods. The best rearing method tested used a 40-gal aquarium plumbed to a water reuse system. Embryological and larval development was recorded using photos taken at various intervals starting two minutes post fertilization. Early development was not unlike that of other centrarchids.

***Montano M.A., A. Nugent, and L.K. Felzien. Department of Biology, Rockhurst University. ANALYSIS OF CONSERVED AMINO ACID SEQUENCES IN ZEBRAFISH PROGESTERONE AND GROWTH HORMONE PATHWAYS.** Progesterone is a steroid hormone produced by ovaries.

Signaling by progesterone is complex, involving different possible pathways and a variety of regulatory molecules. Precise mechanisms for the regulation and expression of many hormone receptor proteins and binding factors have not yet been defined. Yet, the basic functions of some receptors, such as progesterone Immunomodulatory binding factor (PIBF1), progesterone receptor membrane 1 (PGRMC1), progesterone receptor membrane 2 (PGRMC2) and progesterone receptor (PR) proteins, have been determined. In this study, BLASTp searches were performed to compare levels of homology of zebrafish proteins involved in progesterone signaling to proteins from other organisms in the database. The PGRMC1 and the similar but less characterized PGRMC2 were shown to be the most conserved among the species examined. Both PGRMC1 and PGRMC2 are in the membrane-associated progesterone receptor (MAPR) family and function in non-genomic activities involved in the response to progesterone. BLASTp searches were also performed with proteins involved in growth hormone signaling found in zebra fish as a point of comparison for the progesterone pathway.

***Perdue, K.M., and A. R. Oller. Department of Biology and Earth Science, University of Central Missouri. ANTIBIOTIC RESISTANCE OF *ACINETOBACTER BAUMANII*.** Studies have shown antibiotic resistance persistence in *Acinetobacter baumannii* (*A. baumannii*) to be a growing predicament in wound infections. This study was conducted to determine the effects of UV exposure on antibiotic susceptibility of *A. baumannii*. Serial dilutions determined initial concentrations of the bacteria used for plating. *Acinetobacter* was cultured on Nutrient Agar and 50 µl were spread to create a lawn of growth. This experiment was performed in duplicate. Plates were subject to UV at 30s intervals until 180s. Time 0 served as a control. The antibiotics Vancomycin, Gentamycin, Clindamycin, Tetracycline, Penicillin, Spectinomycin, Cefactor, Nitrofurantoin, Ciprofloxacin and Polymixin B were added to plates and then plates were incubated at 37C for 24h. Plates showed growth of *A. baumannii*. at 180s of UV exposure alone, and also on plates with antibiotic discs added. Penicillin, Vancomycin, Polymixin B and Cefactor showed little to no inhibition. However, Tetracycline and Ciprofloxacin proved to be more effective with a clearing zone of at least 16 mm. For UV growth alone, the plates showed consistency at different recorded times. For the antibiotic Spectinomycin, the bacteria seemed to not be affected by UV exposure. At 0s growth was 14 mm while at 150s, growth was 14 mm.

***Riepe, J.J., N.R. Wilson*, and L.K. Felzien†. Department of Biology, Rockhurst University. EFFECTS OF GLUCOCORTICOID EXPOSURE ON THE PHENOTYPE AND EXPRESSION OF GENES INVOLVED IN INNATE IMMUNITY IN ZEBRAFISH.** The embryo of the zebrafish (*Danio rerio*) offers a revealing model in understanding the roles of genes involved in the development of the innate and adaptive wings of immunity. The zebrafish adaptive immune

system develops between four and six weeks following fertilization, allowing a generous span of time in which to study the innate immune system, in isolation. In this inquiry, the effects of cortisol upon developing zebrafish embryos were explored. Cortisol, a glucocorticoid associated with stress response and the suppression of immune function, was introduced into a zebrafish developmental environment. Phenotypic variations and survival rates were then compared with control groups. Zebrafish genes with known roles in immune system development were also investigated. Two of interest, *MPX* and *Ccl1*, are expressed within the 'innate window', yet have not been fully characterized. *MPX*, a homolog of the human *EPX* gene, participates in granulocyte differentiation in both species. *Ccl1*, a chemokine ligand encoding gene, participates in chemotaxis to sites of injury. Previous inquiries explored the timing of expression of both genes, under near ideal developmental conditions. Here, the timing and level of expression of *MPX* and *Ccl1* were investigated further, where zebrafish embryos developed in non-ideal conditions, high cortisol exposure.

***Rog, E., L.B. Schellenberger and I. Pillay. Department of Biology, Culver-Stockton College. DETECTION OF COLIFORM BACTERIA IN WASTEWATER DRAINED FROM THE NORTH SHORE CHANNEL IN WILMETTE, ILLINOIS.** The North Shore Channel was designed to flush the sewage-filled North Branch of the Chicago River down the Chicago Sanitary and Ship Canal. The canal drains out of Lake Michigan in Wilmette and connects to the North Branch at the junction of several North Side community areas. The subsequent development of the Tunnel and Reservoir Plan (TARP), is supposed to reduce water pollution and sewer backup problems in Cook County. Therefore the channel is no longer used for sewage drainage, but occasionally heavy rainfall overloads the tunnels, and sewage is dumped into canal. This can contain a host of toxic chemicals that kill fish and threaten human health. Households, businesses, industries have dumped chemicals into the sewage systems and some are harmful in very low concentrations. In this study, samples were taken from the North Shore Channel to determine if sewage drainage into the canal could have a significant effect on recreational visitors using the waterway. The first sample taken was the initial site where the sewage is drained into the canal. The subsequent samples were taken in increments of 25 meters north and south from the initial sample site. Water quality tests showed that levels of chloride at numerous sites exceeded maximum contaminant levels. Copper levels were also high. Coliform bacteria were also found in the sewage water and in all the other sample sites. The data indicates that humans and animals in contact with this body may be at an increased risk of contracting a water-borne illness.

***Welschmeyer, S., M. Mire, J. Dinan, and J. Benne. Department Head of Life & Physical Sciences, Lincoln University. MOSQUITOES ARE IMPORTANT IN TODAY'S SOCIETY BECAUSE THEY ARE VECTORS FOR MANY DEADLY DISEASES.** Some of these are on the pandemic

level because of the ability for mosquitoes to transmit the diseases quickly and easily. Mosquito populations and subsequently the potential diseases they may be carrying are surveyed by capturing adult females in baited traps. One example of such a trap is the CDC miniature light trap baited with carbon dioxide. Although carbon dioxide is the most commonly used bait for trapping adult female mosquitoes, new lures have been introduced to attempt to increase the variety and number of mosquitoes collected. This study examined the efficacy of utilizing carbon dioxide alone, octanol alone or carbon dioxide and octanol in concert to attract mosquitoes. In addition, CDC miniature light traps (without the UV light engaged) were utilized at various heights ranging from one foot off the ground up to five feet. By varying the trapping conditions and the type of bait utilized it was determined that although octanol alone was ineffective, the species diversity could be increased by combining both types of attractant and varying trap heights between two and four feet. This data is vital information when examining mosquito populations for species associated with transmission cycles of specific diseases.

Chemistry:

Section Chair: Alan J. James, Columbia College

***Gerke, B.A., D. E. Casillas. Department of Chemistry, State Fair Community College. SYNTHESIS OF BIOETHANOL FROM LAWN CLIPPINGS.** As concerns of global warming, and the quality of air consumed continue to rise in the United States, the desire for biofuels is becoming greater. Many cultural factors play a role in the expansion of the research conducted on biofuels. Our objective is to produce and sustain production of bioethanol from lawn clippings that will have a lower carbon footprint on the environment. Also, though lawn clippings may only be accessible under certain environmental circumstances, the bioethanol produced will help ease the cost of fuel consumed. The lawn clippings, after being collected, must be ground and pretreated with a diluted sulfuric acid to break down lignin and sugars, such as Xylose, that are more resistant to fermentation, and will increase the overall fermentable sugars when complete. Then, through fermentation using *Saccharomyces cerevisiae*, a common brewer's yeast, the sugars from the lawn clippings will ferment to ethanol. This species of brewer's yeast ferments most sugars that will be present in lawn clippings into ethanol. Then, simple distillation is used to extract the fermented bioethanol from the lawn clippings. As preliminary results show, when using the sulfuric acid pretreatment and *Saccharomyces*, the ethanol produced may be used as an additive to most fuel systems. Calculations will show the carbon footprint of bioethanol compared to gasoline when consumed in a combustion engine, and the efficiency of production of bioethanol from lawn clippings on a micro-scale production.

***Hobbs, J. M., N. Patel, D. Kim, and A.K. Wanekaya. Department of Chemistry, Missouri State University. AN UNDERGRADUATE LABORATORY EXPERIMENT INVOLVING GLUCOSE DETERMINATION IN BEVERAGES BY CARBON NANOTUBE-MODIFIED ELECTRODES IS PRESENTED.** The determination of glucose is one of the key analytical problems in clinical chemistry or food science. In our approach, conventional electrodes were modified with carbon nanotubes and with glucose oxidase enzyme via the layer-by-layer procedure. Chronoamperometric experiments using a simple 3-electrode cell arrangement enabled sensitive and selective determination of glucose in various beverages. The method was optimized with respect to various parameters. The results compared very well with standard methods used for glucose determination. The procedure is simple and versatile and can be performed by sophomores and juniors using simple galvanostats/potentiostats. It can easily be integrated in laboratory classes for chemistry, biotechnology, or biochemistry students to demonstrate the important principles and techniques of nanoscale science, materials science, biochemistry, electrochemistry and sensor technology.

***Barnes, L. and L. Miley*. Department of Chemistry, State Fair Community College. GLOBAL CONCERNS ARE RISING DUE TO THE QUICKLY DIMINISHING RESERVES OF NONRENEWABLE FUEL SOURCES.** As a result, the development of economical and ecological alternative fuel source technologies has grown from conceptual ideas into a cultural necessity. To address this concern, we obtained tire tread from waste tires and through pyrolysis in a sand bed; vacuum reactor explored the yields, composition and uses of the products. The aim of our experiment was to analyze the products of waste tire pyrolysis and then determined if they could be used as an alternate fuel source. The tire samples were pyrolyzed in an evacuated system at 500 °C, producing char, oil, and gases. Each were analyzed for yield percentages, and composition and then compared to comparable commercial grade products currently used as fuel sources. Preliminary results indicate that the pyrolysis derived oil products contain a mixture of alkylated benzenes, alkylated naphthalenes, alkanes and alkenes. Derived gases consist heavily of methane, hydrogen, and carbon dioxide as well as less abundant amounts of other hydrocarbons and the char consists primarily of carbon (>80 wt%), with the remaining wt% consisting of sulfur, hydrogen and nitrogen, decreasing in abundance respectively.

Geosciences:

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

***Dove, L., and M. Forir. Missouri Institute of Natural Science. DESCRIPTION OF A PLEISTOCENE BONE DEPOSIT DISCOVERED WITHIN RIVERBLUFF CAVE, GREENE COUNTY MISSOURI.** This research was done to

document the various species found within a concentrated bone deposit located in Riverbluff Cave, Greene County Missouri. An effort has been made to compare these fossils with those found elsewhere in the cave, as well as with fossils found in Pleistocene bone deposits from other area caves. Pollen data collected is presented to establish the paleoenvironment of the area immediately surrounding Riverbluff at the time the deposit was forming. Dating techniques used on fossil bone and sediment provides the reader with proof of the deposit's age at approximately 650,000 years old. Research is still being conducted identifying the many species it contains and verifying the reasons for its existence, with a special emphasis on deposition by predators or scavengers of the canine variety. Evidence in the form of bite marks and the sheer size of some of the victims supports this hypothesis as a possible explanation, with the age of the deposit making *Canis armbrusteri* the most likely culprit. The location of the deposit within the cave is also suggestive of the space being utilized by the animals as a den, with smaller bite marks on some of the bones supporting the theory that juveniles may have been present.

***Price, J.D., *J.R. Sawyer and S.A. Hageman. Department of Natural and Physical Sciences, Park University. EPIBIONT AND TAPHONOMIC ANALYSIS OF PENNSYLVANIAN RUGOSE CORALS.** Examination of 300 solitary rugose corals (*Caninia torquua*) from the Beil Limestone Member (Upper Pennsylvanian) reveals seven different epibionts. Three major epibionts (algae, bryozoans, and worm tubes) represent the majority (96%). Worm tubes (*Serpulopsis insita*?) are dominant (47%) and have an inverse relationship in abundance with the equally distributed algae (*Archaeolithophyllum sp.*?) and bryozoans (*Fistulipora*). Epibionts were recorded for four upper and four lower quadrants. A chi-square test on the results confirms that the epibiont distribution had preferred quadrants. Overall, the bottom surface contained 12% more epibionts with algal epibionts being 34.6% and bryozoans 25.8% more likely on the bottom surface while worm tubes were only 4.8% more likely to occur on the top. Algae and bryozoans preferring to grow into a soft muddy substrate is improbable, suggesting that overturned corals are common in this depositional environment. This would create new substrates for algae and bryozoans to colonize as they became available. Corals displaying reoriented growth were common and completely overturned corals were present in 6.3% of the corals, some showing multiple occurrences of overturning on a single specimen. Taphonomic analysis revealed compaction is present in at least 34% of the corals. Broken surfaces only possessed worm tubes implying they were the only post-mortem epibiont. The worm tubes are fewer in number if algae and bryozoans are present. Algae and bryozoans have preferred locations on *Caninia torquua* but determining their preference is problematic because the corals are being reoriented during higher energy storm events and diagenesis is most likely obscuring epibionts on the top surfaces.

***Pyles, J. R., B. Hua, and J. Yang. Department of Agriculture & Environmental Sciences, Lincoln University. UNDERSTANDING THE CORRELATIONS AMONG ARSENIC, IRON, AND PHOSPHORUS IN SOIL AND DETERMINING THEIR ROLE IN ARSENATE SOLUBILITY AND PHYTOAVAILABILITY.** Arsenic (As) contamination in soils is a health and environmental concerns due to its threat to humans and the ecosystem. The human and environmental risks are directly related to As solubility and speciation in soil. The overall goal of this research is to study the As uptake by rice cultivars as affected by As addition and water management, with a specific focus on As solubility under various soil conditions. Three rice cultivars were grown in plots with or without the addition of monosodium methyl arsenic (MSMA) under flooded or saturated water conditions. Soil, water, and plant samples were collected biweekly during the growing season and analyzed for As using ICP-OES. Water analyses indicated that there was little As present in water during the growing season. However, total As concentrations were higher in MSMA-treated and water-saturated soil, as compared with those in control and flooded soils. Arsenic solubility was positively correlated with iron ($R^2 = 0.6327$) and phosphorus ($R^2 = 0.6655$) present in the soil. There was also an inter-correlation between soil Fe and P ($R^2 = 0.6413$). Data suggested that the formation of iron plaques and/or non-occluded iron phosphates may play a critical role in controlling As solubility and uptake by rice plants. Then next phase of this research will be focused on plant tissue analyses in an effort to investigate the plant uptake and soil As interactions.

Physics and Engineering:

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

Ukah, N., R. K. Gupta, G. Aboagge-Asare*, K. Ghosh, P. K. Kahol. Department of Physics, Astronomy and Material Sciences, Missouri State University HIGH QUALITY DILUTED MAGNETIC SEMICONDUCTORS FILMS GROWN BY PULSED LASER DEPOSITION. Recently, diluted magnetic semiconductors (DMS) have attracted numerous attentions due to their potential applications in spintronic devices. There are several host such as ZnO, TiO₂, SnO₂, In₂O₃, etc. for transition metals doping is popular. Among them In₂O₃ is a highly transparent opto-electronic material, and has been shown to be critical in the realization of DMS. We have deposited high quality Cr-doped In₂O₃ diluted magnetic semiconductor thin films using pulsed laser deposition technique. The effect of growth parameters on structural, optical, and electromagnetic properties of these films has been studied. These films exhibit cubic In₂O₃ single phase with (222) preferred orientation with no characteristics peaks due to addition of chromium.

We observed that electrical properties such as resistivity, carrier concentration, and mobility strongly depends on growth conditions. These highly transparent and conducting films could be used for transparent spintronic applications.

***Bishop, D. J., D. B. Marsh¹, and G. H. Lathrom², ¹Department of Physical Science, Missouri Southern State University, ²Department of Mathematics, Missouri Southern State University.** **A SIMPLE AND STRAIGHTFORWARD SIMULATION FOR PARTICLE INTERACTIONS.** We present a relatively simple and straightforward approach that we have developed to produce computer simulations of physical situations using simple code. Our approach works by using the approximation that whatever physical system we are interested in may be represented as points with an array containing the relevant information about the points such as position and velocity vectors as well as mass and charge. Some advantages of this approach are that the code can be easily changed to explore different physical situations and even extended to unphysical situations thus shedding light on why a certain approach was taken. This approach also permits one to use as simple or complex a physical model as the person setting it up cares to do. Allowing one to start with simple principals and add more detailed approximations as desired. Since the example code is in an interpreted BASIC it can be run on multiple platforms and operating systems. However, the same methods can be applied to a compiled language like C or C++, still producing light weight fast code but using the resources of the target system better.

Ghosh, A. R. K. Gupta, T. Williams*, K. Ghosh, and P. K. Kahol. Department of Physics, Astronomy and Material Sciences, Missouri State University. **EFFECT OF GROWTH CONDITION ON PROPERTIES OF CO-DOPED In_2O_3 DILUTED MAGNETIC SEMICONDUCTORS.** Diluted magnetic semiconductors (DMS) have attracted considerable attention to the scientific community due to their wide application in spintronics. In DMS, small amount of magnetic materials are incorporated in non magnetic host. In_2O_3 is a popular non magnetic host because of its wideband gap and high optical and electrical properties. We have studied the effect of Co doping on properties of In_2O_3 films. These films are grown using Pulsed Laser Deposition (PLD) technique on c-plane sapphire substrate. Structural properties which largely depend on growth conditions are studied using X-ray Diffraction and Atomic Force Microscopy. The magneto-transport properties have been also studied. It is seen that films grown at high temperature have preferred orientation along (222) direction, while films grown at low temperature show amorphous nature. The effect of growth conditions on electrical properties show some interesting phenomenon. It is observed that resistivity of the films decreases with increase in growth temperature while mobility increases with increases in growth temperature.

Social/Behavioral Sciences:

Section Chair: Mara S. Aruguete, Lincoln University

***Berhorst, S. and Ghinescu, R. Department of Social and Behavioral Sciences, Lincoln University.** **RELIGIOSITY AND REASONING ABOUT ABORTION.** Research regarding people's religiosity has shown a distinction between extrinsic and intrinsic religious orientations (Allport & Ross, 1967). Extrinsically religious individuals use religion to obtain safety, social standing, and self-justification. Intrinsically religious individuals have a sincere religious orientation and they are guided in their lives by deeply religious convictions. Research on religious orientations showed a positive correlation between extrinsic religiousness and prejudice as well as dogmatism, whereas no correlation was found between intrinsic religiousness and such negative traits. Building on this research, we will investigate how reasoning about abortion is influenced by one's religious orientation. Participants will complete the Intrinsic and Extrinsic Orientation Scales (Feagin, 1964) and the Abortion Scale (Parsons, Richards & Kanter, 1990). We hypothesize that extrinsically religious individuals will support a prolife choice of reasoning whereas intrinsically religious individuals will adopt a prochoice line of reasoning.

***Herrejón Ayala, L. L., Department of Psychology, Southeast Missouri State University.** **GENDER AND RELIGIOUS DIFFERENCES IN PERCEPTIONS OF RELATIONSHIP VIOLENCE.** Gender differences in perceptions of relationship violence were analyzed to detect correlations between religious beliefs, perceptions of relationship violence, and personal backgrounds. Participants answered a 207-question survey mostly based on the Conflict Tactics Scales (Straus, 1979). Pearson correlations of demographic variables with Emotional Violence (EV), Sexual Violence (SV), Physical Violence (PV), Perception of Women (PW), Personal Perception of Treatment (PPT), Perception of Treatment by Partner (PTP) and Total Perception of Treatment (TPT) were conducted, revealing significant correlations of gender (G) with PW, $r(190) = .24, p < .001$; marital status of parents (MEP) with EV, $r(190) = .17, p < .02$; religious affiliation (RA) with PW, $r(188) = .16, p < .04$; attendance of religious services (ARS) with PW, $r(190) = -.31, p < .001$; length of current relationship (LCR) with EV, $r(190) = .15, p < .04$; LCR with PV, $r(190) = .16, p < .03$; population growing up (PGU) with PPT, $r(190) = .18, p < .02$; PGU with TPT, $r(190) = .16, p < .03$; and MEP with PV, $r(190) = .15, p < .04$. Regression analyses with ARS, marital status, race, income, G, PGU, MSP, RA, age and LCR as Independent Variables and PW, EV, PV, SV, PPT, PTP and TPT as Dependent Variables were conducted. Inspection of beta weights revealed significant contributors to PW: G and ARS, $R(177) = .45, p < .001, R^2 = .20$. The findings reinforce earlier research suggesting that relationship violence is a multifaceted issue, indicating potential targets for intervention.