Oral Presentation Room Schedule

	C3331	C3380	D2441	D2444	F1622	F2442	F2445
9:00am	Botany		Zoology			Agriculture	Chemistry
9:20am	Botany	Botany	Zoology		Environmental Science	Cellular, Molecular, & Developmental Biology	Chemistry
9:40am	Botany	Botany	Zoology		Environmental Science	Cellular, Molecular, & Developmental Biology	Chemistry
10:00am	Botany	Botany	Zoology	Zoology	Environmental Science	Health Science	Computer Science
10:20am	Botany	Botany	Zoology	Zoology	Environmental Science	Health Science	Computer Science
10:40am	Botany	Botany		Zoology	Environmental Science	Health Science	Computer Science
11:00am		Botany		Zoology	Environmental Science	Microbiology	Engineering & Technology
11:20am		Botany		Zoology	Environmental Science	Science Education	Engineering & Technology

Oral Presentation Abstracts

*represents presenter; room & time noted, student status of presenter provided if applicable

Agriculture (Room F2242)

9:00am Grad F2242

Chemical and Physical Properties of Biofuel Crops (Poaceae) pretreated with *Trametes versicolor* (Polyporaceae)

*Erin Tuegel, Michael Bilek, Thomas Canam [Eastern Illinois University]

Lignin, hemicellulose, and cellulose constitute primary components of plant cell walls, providing necessary structure and rigidity for growth, development, and survival. These lignocellulosic chemical structures have proven resistant to degradation by both inorganic corrosives and most biological activity. White- and brown-rot fungi, however, possess enzymes that are highly effective in breaking down lignin, hemicellulose, and cellulose in nature. By treating lignocellulosic plant tissue with a cellobiose dehydrogenase-deficient strain of *Trametes versicolor*, otherwise recalcitrant lignified tissues may be digested while leaving a significant portion of cell wall polysaccharides intact. This study was designed to quantitatively identify changes in *Miscanthus* x *giganteus* and *Zea mays* stem and blade cell wall chemistry due to digestion by *Trametes versicolor* via gas chromatography (GC) and high performance liquid chromatography (HPLC) analyses, and to qualitatively observe changes in cell wall structure via differential staining and light microscopy. This biologically mediated process of delignification is of potential value in the cellulosic biofuel industry, where recalcitrant lignin must be removed before cellulose and hemicellulose may be digested into monosaccharides for use in ethanol fermentation.

Botany (occurring simultaneously in Rooms C3331 & C3380)

9:00am C3331 **Undergrad**

New Records of Mycorrhizal Fungi from the Eastern Prairie Fringed Orchid, *Platanthera leucophaea*, and Physiological Confirmation through Symbiotic Seed Germination

*Claire Barclay, Douglas Allgaier, Lawrence Zettler [Illinois College]

Once widespread across the Midwest, the Eastern Prairie Fringed Orchid, *Platanthera leucophaea* (Orchidaceae), has experienced long-term decline mostly from habitat loss and poaching. In 2007, 79 extant populations were known of this orchid, but only 28% of these sites were afforded legal protection. Given that orchids are highly sensitive to habitat changes, they are especially vulnerable to environmental degradation placing a heavy burden on existing populations. In nature, all orchids require the presence of mycorrhizal fungi to facilitate seed germination leading to spontaneous seedlings. As habitats change, however, there is a serious concern that the fungal community will also change, including the fungi that orchids rely upon for survival. Consequently, isolating, identifying, and safeguarding mycorrhizal fungi in existing habitats is of paramount importance for the conservation of species like *P. leucophaea*. We report new records of mycorrhizal fungi isolated from *P. leucophaea* from populations in Illinois, Michigan, and Wisconsin, acquired during a three year period. Most of these fungi were assignable to the anamorphic genus *Ceratorhiza*, and were deposited into the University of Alberta Micofungus Collection and Herbarium in Canada (UAMH) for safekeeping. Three of these fungal strains facilitated seed germination of *P. leucophaea* in vitro, confirming that these fungi are of physiological significance to the orchid.

9:20am C3331 **Undergrad**

Conservation of Critically Endangered Orchids from the Central Highlands of Madagascar: Results from the First of a Five Year Project

*Hana Thixton, Korrie Edwards, [1]Helen Sanford, [1]Jonathan P. Kendon, [2]Landy Rajaovelona, [1]Stewart Cable, Lawrence Zettler, [1]Viswambharan Sarasan [Illinois College; [1]Royal Botanical Gardens, United Kingdom; [2]Kew Madagascar Conservation Centre, Madagascar]

Few regions harbor more endemic species than Madagascar. Of the island's 12,000 vascular plant species, 80% are found nowhere else on earth, and among the Orchidaceae, 90% of the family's 1,000 species are endemic. In the central highlands, a number of rare orchids have been the subject of interest by conservationists consisting of epiphytes in forest remnants, terrestrials near standing water, and lithophytes on sun-exposed rocks. In 2012, a collaborative 5-year research project was initiated between Illinois College and the Royal Botanic Gardens, Kew, aimed at studying selected species from that region. Among the aspects investigated include the isolation and use of mycorrhizal fungi, and subsequent development of symbiotic germination protocols leading to seedling reintroduction. Approximately 75 taxa were targeted for study the first year, including several noteworthy *Angraecum* species (e.g., *A. longicalcar*, *A. protensum*, *A. magdalenae*), as well as species of *Aerangis*, *Bulbophyllum*, *Cynorkis*, *Eulophia*, *Habenaria*, *Jumellea*, and *Polystachya*, among others. In June (2012), root segments and/or mature seeds from 19 taxa spanning 6 genera were

collected for mycorrhizal fungus isolations, seed viability assessment, and seed germination on asymbiotic media: *Angraecum* (8 spp.), *Bulbophyllum* (2), *Cynorkis* (1), *Eulophia* (1), *Jumellea* (4), *Polystachya* (3). This talk will present an overview of some of the results we acquired the first year.

9:20am C3380 **Morphological Variability of Hill's Oak (*Quercus ellipsoidalis*: Fagaceae) and Scarlet Oak (*Quercus coccinea*: Fagaceae) in Eastern United States**

*David Shepard [Moraine Valley Community College]

Quercus ellipsoidalis (Hill's Oak), an endemic to the Western Great Lakes of North America, is morphologically similar to *Q. coccinea* (scarlet oak) and has been included into that species in several floristic treatments. The question as to whether *Q. ellipsoidalis* be considered a legitimate species as suggested by some oak taxonomists, or part of a wider ranging *Q. coccinea* complex is evaluated in this paper. To address this problem, seventeen morphological variables utilizing discriminant function and regression statistics were used to determine patterns of relationships between populations of *Q. ellipsoidalis* and *Q. coccinea*. The study also included an assessment of ecological data, herbarium material, and previous morphometric and DNA research . The conclusions of the study show *Q. ellipsoidalis* and *Q. coccinea* as infraspecific polymorphic taxa with clinal and local site variation. *Quercus ellipsoidalis* is interpreted as part of a wide ranging *Quercus coccinea* species complex with regional ecotypical variation. *Quercus velutina* (Black oak) and *Quercus palustris* (Pin oak) included in the discriminant function study were well differentiated ecologically and morphologically. The results show disagreement with recent DNA studies which found *Q. ellipsoidalis* as a genetically distinct species well separated from *Q. coccinea*. Correlating DNA with morphological and ecological data is essential to understanding the species concept of the *Quercus* section Lobatae in eastern North America.

9:40am C3331 **Undergrad** **Mycorrhizal Fungi and Symbiotic Seed Germination of *Spiranthes vernalis* (Orchidaceae), in the Florida Panther National Wildlife Refuge**

*Samuel Porter, Ellen Radcliffe, Andrew Stice, [1]Larry Richardson, Lawrence Zettler [Illinois College; [1]US Fish & Wildlife Service, Naples, FL]

North America, excluding Mexico, harbors ca. 210 native orchid species, few of which have been propagated from seed given their fastidious germination requirements involving mycorrhizal fungi. Several members of the genus *Spiranthes*, however, have been successfully propagated from seed leading to reintroduction by means of symbiotic seed germination, i.e., inoculating seeds with fungi in vitro. The focus of this study was to propagate the grass-leaved ladies' tresses, *Spiranthes vernalis*, and to identify the mycorrhizal fungi that this terrestrial orchid may utilize in situ to fulfill its early seed germination needs. In the Florida Panther National Wildlife Refuge in Collier Co. a large (>300) population of *S. vernalis* was observed in flower in a secluded open field in mid-March of 2013. Roots were collected for fungal isolations, and seeds were obtained from mature capsules collected during a return trip two weeks later. Root pelotons yielded four strains of mycorrhizal fungi assignable to ubiquitous anamorphic genera *Ceratorhiza* and *Epulorhiza*, all of which were deposited into the University of Alberta Micofungus Collection and Herbarium in Canada

(UAMH) for safekeeping. Seeds inoculated with the *Epulorhiza* strain (UAMH 11737) in vitro germinated rapidly and developed to leaf-bearing stages after 84 days, whereas seeds inoculated in the absence of fungi (control) and with one *Ceratorhiza* strain (UAMH 11740) failed to yield seedlings. Considering that orchids are highly vulnerable to environmental changes, such information may be useful for conservation projects.

9:40am
C3380

Does Shortest Path Adjustment Improve Ordination of Community Data with High Beta Diversity?

*Peter Minchin, [1]Jari Oksanen [Southern Illinois University Edwardsville; [1]University of Oulu, Finland]

In community data with high beta diversity, many pairs of sampling units (SUs) have no species in common. Dissimilarity measures such as the Bray-Curtis index take their maximum value for such pairs and cease to provide information about the magnitude of large ecological differences. This causes linear methods like principal coordinates analysis (PCoA) to recover compositional trends as curved structures - the "horseshoe effect." Shortest path adjustment (SPA), which re-estimates dissimilarities between disjunct SUs as the sum of dissimilarities along the shortest path through SUs that do share species, has been proposed as a solution to this problem. Preliminary evaluations of SPA using simulated data suggested it is sensitive to sampling. Furthermore, previous work has shown that nonmetric multidimensional scaling (NMDS) can successfully ordinate high beta diversity data without adjustment. We performed a multi-factorial experiment to compare the effectiveness of PCoA and NMDS, with and without SPA, in recovering the structure of simulated community data. Provided sampling was dense and even, SPA significantly improved Procrustes fit between PCoA ordinations and the simulated gradient space. Otherwise, SPA overestimated the ecological difference between disjunct SUs, causing deterioration of ordination performance. Improvements in PCoA performance by SPA were greatest at higher beta diversities, especially when the beta diversities of gradients were unequal. NMDS performed well without SPA, and improvements in fit due to SPA were modest. NMDS without SPA often gave results that were better, or no worse, than PCoA with SPA. The robust assumption of a monotonic fit between ordination distances and dissimilarities apparently allows NMDS to utilize information in the smaller dissimilarities to resolve the ambiguity of dissimilarities among disjunct SUs. We conclude that SPA is not required for effective ordination of high beta diversity data.

10:00am
C3331

Phenotypic Plasticity of the Invasive Honeysuckle *Lonicera maackii* (Caprifoliaceae) in Response to Simulated Drought

*Kurt Schulz, Sabrina Ashbaker [Southern Illinois University Edwardsville]

Amur honeysuckle (*L. maackii*) is a successful exotic invasive shrub in the lower Midwest. Phenotypic plasticity is widely cited as a reason why some invasives achieve broad success. Phenotypic plasticity has two manifestations, a generalized response to variation in the environment (E), and responses to the environment that differ between genetic individuals (G x E). The existence of G x E is a prerequisite for the evolution of ecotypes. We examined the phenotypic

response of seedling *L. maackii* to cycles of simulated drought in a greenhouse experiment. Seeds from widely separated shrubs in forest edge habitats were collected, separating collections into seeds originating from the sunlit and shaded sides of the shrub. (Light availability has large effects on seed size in this species.) Plants were grown in 1L pots using a randomized complete block design of 5 blocks x 18 maternal plants x 2 sides of shrubs x control/drought treatments (N = 380). At 70d age, drought was inflicted by withholding water until all plants were wilted. Watering was resumed and another cycle of drought was initiated about 30d later for a total of three cycles. MANOVA revealed effects on below ground biomass and allocation as functions of maternal plant, drought treatment, and the interaction of sun/shade origin with maternal plant. ANOVA detected significant effects on total mass due to maternal plant and drought treatment. Repeated measures ANOVA showed reductions in height growth rate associated with drought and maternal plant. Overall, drought caused small changes in allocation (±2-8%), while maternal differences varied much more widely (means for maternal shrubs range 20-40% of grand mean). *L. maackii* appears to be preadapted to drought and seemingly possesses considerable genetic variation among individuals on which selection may operate.

10:00am
C3380

The Vegetation of Reed-Turner Woodland: Implications for Management

*Wayne Schennum

Reed-Turner Woodland is a 40-acre Illinois Nature Preserve located in Long Grove, Illinois. The Woodland is a grove, once surrounded by prairie. Kildeer Creek, an intermittent stream, has carved a deep ravine in glacial till, creating a complex of communities based on slope, aspect, and soil moisture. They include dry mesic and mesic forest, oak woodland, and floodplain forest. The Woodland has been managed for 30 years to convert the entire site to an open woodland using prescribed burning. The 2011 to 2013 vegetation study was conducted to validate this goal. The Woodland was divided into 5 units based on the community type and location. In 2011 total species lists were compiled for each unit. In 2012 to 2013, quantitative sampling of all woody plant layers was conducted. Importance values and diameter classes were calculated for the canopy. Stem frequencies were recorded for understory trees and shrubs. Floristic quality indices were calculated from the species lists for each unit. Letter grades were calculated using the Illinois Natural Areas Inventory system. There was little variation among units in the floristic quality indices and ecological grades. The quantitative woody plant data varied considerably. Red and white oak dominated the canopy in the woodlands and dry mesic forest but oak reproduction was limited. Only red oak was frequent in small size classes. White oak seedlings occurred in one small location. Sugar maple and basswood dominated the north-facing slope and in the floodplain in the lower size classes. The herbaceous layer on the ridge tops has several species of open woodlands, both grasses and forbs. Woodland shrubs are frequent in these locations. The 30 years of effort to create open structured woodland communities has partially succeeded. However the Woodland retains a community series which varies from woodland to forest, depending on topographic position. The goals of management should be to retain this community diversity and associated species

diversity, and increase oak reproduction. The modest use of fire, much thinning of invasive native trees, and the reintroduction of some open oak community herbs can achieve this goal over a long time period.

10:20am Grad C3331

Epizoochory as a Seed Dispersal Mechanism for *Alliaria petiolata* (Brassicaceae)

*Chris Loebach, Roger Anderson [Illinois State University]

Garlic mustard (*Alliaria petiolata*), an herbaceous Eurasian plant, has aggressively invaded Eastern North American deciduous forests, and is a major threat to native groundlayer species. The impact of garlic mustard on the groundlayer community has been extensively studied, but seed dispersal mechanisms of this wide-spread species have not been investigated. Epizoochory (external animal transport) is often cited as a dispersal mechanism for garlic mustard, but this has never been tested. The purpose of this study was to test for epizoochory under field conditions. A randomized block design was used. Each block contained a mammal inclusion treatment (MIT), designed to increase activity of mammals the size of a raccoon or smaller over a germination tray filled with potting soil, and a control, which excluded mammal activity over its tray. Four treatment blocks were placed around three garlic mustard patches 3 July 2013. After most seeds were dispersed, germination trays were transported to ISU on 7 August 2013 and placed outdoors to receive cold-moist stratification, which enhances germination of garlic mustard. On 20 February 2014, trays were placed in a heated greenhouse, and emerging garlic mustard seedlings in each tray were counted daily. If epizoochory is a dispersal mechanism, then there should be significantly more seedlings in the MIT trays than the control trays. Our results indicate epizoochory is a dispersal mechanism. We found significantly ($F_{1,11}$=48.89,P<0.001) more seedlings in MIT (40.8±8.40) than control (6.0±1.5) trays. In addition non-garlic mustard seedlings were counted this past fall to test if the experimental design was effective. The MIT trays contained an average of 7.25 (±3.03) seedlings compared to 2.42 (±0.85) in the controls. This difference was significant ($F_{(1,10.76)}$=6.64, p=0.026), and it suggests mammals transported seeds of other species into the MIT supporting our results with garlic mustard.

10:20am C3380

Phenological Separation from Native Species Enhances Success of the Invasive Plant, Garlic Mustard (*Alliaria petiolata*), in Eastern North America Deciduous Forest Understories

*Roger Anderson [Illinois State University]

Native herbaceous groundlayer species in eastern deciduous forest understories are well defined by phenological niches. Successful invasion of the Eurasian, biennial, garlic mustard (*Alliaria petiolata*) in this community appears to be in part due to temporal differences in vegetative growth and flowering between garlic mustard and native species, and utilization of resources not accessible to most later growing native species, in early spring of its second year. North American deciduous forest groundlayer species can be placed into three generalized groups with different phenological and ecophysiological strategies to avoid shading (wintergreen and spring ephemerals) or compete for low irradiance following canopy closure (summer dominants). Like wintergreen species, garlic

mustard can remain photosynthetically active during late fall and early winter of its first year. In its second spring, before the tree canopy is well developed, garlic mustard's rosette of leaves efficiently captures high levels of early spring irradiance reaching the groundlayer, a pattern also displayed by native spring ephemerals. Garlic mustard exhibits rapid stem elongation later in its second spring, a characteristic of later growing summer dominant species, with stem elongation of 1.9 cm per day between 18 April and 13 May and leaf elevation thereby increasing its competitiveness for light. In response to declining irradiance in the groundlayer, garlic mustard produces shade-adapted leaves with lower maximum rates of photosynthesis (AMax).

10:40am C3331 **Undergrad**

Effect of Herbivory of Painted Lady Caterpillars (*Vanessa cardui*) on Photosynthetic Values in Soybean (*Glycine max*) Plants of Different Ages

*Kendra Peterson, Judy Parrish, Travis Wilcoxen [Millikin University]

This experiment explores the effect of herbivory on different aged soybean (*Glycine max*) plants. We planted soybeans at different times to get four different age groups of plants. Then plants were exposed to one of three treatments: five day old painted lady caterpillars (*Vanessa cardui*) were allowed to feed on the soybean plants for ten hours, or the plants had holes punched in the leaves to mimic herbivory, or plants were left alone as a control. We measured photosynthetic rate of the leaflet adjacent to damage and the middle leaf above the damage every day for five days following feeding. The soybean plants that were 58 days old showed the greatest increase in photosynthetic rates when caterpillars fed on the plants. Compared to the control plants, there was a significant difference between the treatments given, the age of the plants, and the day that they were tested. Overall, the photosynthetic rates were significantly different, with the caterpillar and mechanical damage treatments showing a compensatory increase in photosynthetic rate in the remaining leaf tissue.

10:40am C3380 **Grad**

Mycorrhizal Fungi from Endangered Orchids of Madagascar - First Documentation from the Indian Ocean Island

*Audrey Knight, [1]Jonathan P. Kendon, Andrew Stice, [1]Kazutomo Yokoya, [2]Landy Rajaovelona, [2]Gaëtan Ratovonirina, Laura Corey, Lawrence Zettler, [1]Viswambharan Sarasan [Illinois College; [1]Royal Botanic Gardens, United Kingdom; [2]Kew Madagascar Conservation Centre, Madagascar]

In the second year (2013) of a five-year collaborative project aimed at recovering endangered orchids in Madagascar, a vigorous attempt was made to isolate and identify mycorrhizal fungi, with emphasis on peloton-forming fungi from spontaneous seedlings. More than 100 taxa were targeted, ranging from epiphytes, terrestrials, and lithophytes collected from seven different regions and habitats in the central highlands. During April and May (2013), shortly after the rainy season, orchid-rich substrates were closely inspected for seedlings and root pieces were detached, placed into vials, and promptly returned to labs at Kew and Illinois for fungal isolations. Root pieces from mature orchids were also obtained for this purpose. Mature and unripe capsules were collected for long-term experiments, namely involving symbiotic and asymbiotic seed germination, respectively. Our combined efforts yielded several strains of orchid mycorrhizal

fungi tentatively assignable to ubiquitous basidiomycete genera *Ceratobasidium* and *Tulasnella* from terrestrials, epiphytes, and lithophytes alike. Of particular interest was the prevalence of pelotons in seedlings of epiphytic species, lending support to the hypothesis that tree-dwelling orchids continue to utilize mycotrophy after initiating leaves. Efforts are underway to verify the identification of these isolates using ITS sequencing. To our knowledge, this is the first report that documents orchid mycorrhizal fungi from Madagascar.

11:00am Undergrad C3380

The Ghost Orchid, *Dendrophylax lindenii*, in South Florida and Cuba: A Mysterious Tale of Two Very Different Habitats Catering to One Orchid Species

*Kavita Patel, [1]Ernesto Mujica, Lawrence Zetter [Illinois College; [1]ECOVIDA, Cuba]

Few orchids native to North America have received as much attention as the Ghost Orchid, *Dendrophylax lindenii* - the subject of best-selling books and a hit movie. The species is restricted to Cuba and the Big Cypress Basin eco-region of south Florida where it is found attached to host trees as a leafless epiphyte. In Florida, the species has suffered from habitat loss and poaching for its alluring floral display coupled with its favorable (sweet) scent. Although most people are familiar with *D. lindenii* inhabiting south Florida, few have ventured to Cuba to study populations in that country and how they are similar or dissimilar to those on the mainland. This talk will present a general overview of Cuban ghost orchid populations compared to those in the Big Cypress Basin eco-region after visits were carried out during the summer of 2013 to Florida, and January of 2014 to the Guanahacabibes National Park, Cuba. One striking difference between the two areas was the lack of standing water in the Cuban population and differences in host tree species. Orchids in both regions, however, were sheltered from wind (except for periodic hurricanes) and appeared to have continuous access to high relative humidity. By studying both habitats, we hope to provide useful insight for anticipated conservation projects this century aimed at *D. lindenii's* long-term survival.

11:20am Grad C3380

Detection of the Common Commercial Orchid Pathogen Cymbidium Mosaic Virus (CymMV) in a Wild Orchid in the Florida Panther National Wildlife Refuge

*Sovit Chalise, Laura Corey [Illinois College]

The Orchidaceae is the largest and most diverse plant family and includes species both of great commercial and economic importance. Interest in orchids engendered by collections of commercially produced specimens increases support for conservation of wild orchids. However, commercial orchid production can also threaten wild orchid populations through the spread of common pathogens by insect vectors. The Florida Panther National Wildlife Refuge in the Big Cypress Basin ecoregion of Collier County, FL is home to many threatened orchid species found nowhere else in North America. Using the Enzyme-linked Immunosorbent Assay (ELISA), we have verified that two common orchid pathogens, Cymbidium mosaic virus (CymMV) and Odontoglossum ringspot virus (ORSV), are present in local commercially-produced orchids. We have begun a survey of orchids in the Refuge and have identified one specimen

of the Florida Butterfly Orchid (*Encyclia tampensis*) that is positive for CymMV. We will expand our survey to other plants in the area.

Cellular, Molecular, & Developmental Biology (Room F2442)

9:20am Grad F2442

SR110, a Peroxynitirite Decomposing Catalyst, Enhances Insulin Sensitivity in High Fat Diet-fed B6D2F1 Mice

*Nehal Malik, Michael Johns, Guim Kwon [SIUE School of Pharmacy]

Peroxynitrite has been implicated in b-cell defects and insulin resistance associated with obesity-mediated diabetes. SR-110, an orally active peroxynitrite decomposing catalyst, was synthesized and its effectiveness assessed as an anti-diabetic agent in diet-induced diabetes animal model. B6D2F1 mice (6 weeks old) were fed with a lean or a high fat diet (HFD) for 3 months. Mice on a HFD gained weight at a faster rate and showed significantly higher fasting blood glucose levels as compared to mice on a lean diet. HFD-fed mice were divided into 3 groups (n=8 per group): control, vehicle, and SR-110-treated group. HFD-fed mice treated with 10mg/kg SR-110 per orally daily for 2 weeks significantly reduced fasting blood glucose levels and had enhanced obesity-induced glucose tolerance compared to control HFD-fed or the HFD-fed vehicle group. Moreover, SR-110 treated HFD-fed mice showed reduced plasma insulin levels compared to the control groups, suggesting that SR-110 treatment enhanced insulin sensitivity. Western blot analysis of liver samples isolated from mice indicated that SR-110 significantly lowered basal levels of Akt activity but enhanced insulin-stimulated Akt activity similar to those in the liver samples from lean diet fed mice, supporting the findings that SR-110 enhanced insulin sensitivity in the peripheral tissues. Taken together, these results suggest that peroxynitrite decomposing catalysts may prevent and/or reverse insulin resistance caused by obesity.

9:40am Grad F2442

Metabolic Effects of SR-135, a Peroxynitrite Decomposition Catalyst, on Human ß-cell Function and Survival under Chronic Nutrient Overload

*Michael Johns, [1]Guim Kwon, [1]William Neumann, [1]Smita Rausarita, [1]Eliwaza Naomi Msengi, [1]Maryam Imani-Nejad, [1]Harry Zollars [Southern Illinois University Edwardsville, [1]SIUE School of Pharmacy]

Peroxynitrite is a highly reactive byproduct of mitochondrial metabolism and can damage insulin-secreting ß-cells by oxidation of protein, lipid, and DNA. Therefore, therapeutic agents that catalytically reduce peroxynitrite may be beneficial in treating type 2 diabetes mellitus (T2DM). One such agent, SR-135, a Mn(III) bis(dydroxyphenyl)-dipyrromethene complex, catalyzes the reduction of peroxynitrite through a 2-electron mechanism, converting it to an inactive molecule, nitrate. Our recent studies have shown that SR-135 effectively improved the symptoms in diet-induced diabetic mice. In vitro studies on isolated human islets demonstrated that SR-135 reduced ectopic lipid accumulation and preserved insulin content under nutrient overload. In the present study, we further studied the effects of SR-135 on human ß-cell metabolism and survival. Human pancreatic islets were obtained from the Integrated Islet Distribution Program (IIDP) and cultured for four days under intermediate (10 mM glucose + 240 uM FFAs) and high nutrient (25 mM glucose + 500 uM FFAs) conditions to simulate different levels of metabolic stress. Some islets were co-cultured with either SR-135 or a control drug, SRB. After treatment, islets were frozen in

freezing medium, sectioned (10 um thickness), and immunostained with various primary and secondary antibodies. Laser confocal microscopy was used to determine nitrotyrosine content, caspase-mediated apoptosis, mitochondrial density, and ß-cell proliferation. SR-135 significantly reduced nitrotyrosine levels and prevented caspase-dependent apoptosis, but had no effect on mitochondrial density or ß-cell proliferation as compared to control high nutrient and SRB conditions. Taken together, these studies suggest that peroxynitrite decomposition catalysts may preserve ß-cell function and survival under nutrient overload associated with obesity.

Chemistry (Room F2445)

9:00am F2445

Incorporating Powder X-ray Diffraction in Undergraduate Chemistry Research

*Mark Zelman, Jennifer Cain, Samantha Wokosin, Scott Naughton, Ronald Egyir, Jianhua Zhang [Aurora University]

Powder X-ray diffraction (XRD) is a powerful instrument in characterizing various materials. It has wide applications both in scientific research and industry. In this presentation, its principle and applications will be introduced. Also presented will be our research in preparing the mixed anion network that will be analyzed by PXRD. Our research focus on the studies on the synthesis of compounds with molybdenum oxo-chloride molecular $[Mo^{VI}O_mCl_n]^{6-2m-n}$ anions and various alkali cations frameworks. The synthesis, crystal growth, property characterization will be discussed.

9:20am Undergrad F2445

Examination of the Factors Associated with the Intrinsic Instability of Hollow Gold Nanoshells

*Brian Kane [Millikin University]

Hollow gold nanoshells (HAuNS) are currently being studied as potential components for anti-cancer treatments. This study focused on the thermal and electrolyte stability of HAuNS. The HAuNSs surface plasma resonance peak changes drastically at 37 °C. The magnitude of the blue-shift is size-, concentration-, temperature-, and time-dependent. Larger HAuNSs demonstrated greater stability than smaller shells. HAuNSs also aggregate faster in greater ionic strength solutions; however, the rate of aggregation is electrolyte-specific. Adding chemical species like PEG, BSA, or a combination of the two reduces hollow gold nanoshell instability.

9:40am Undergrad F2445

Synthetic Efforts to Prepare the Anti-Cancer Agent Xenitorin A via a Proposed, Asymmetric, Stereoselective Rauhut-Currier Reaction/Aldol Condensation

*Jacob Dander, Brent Chandler [Illinois College]

Xenitorins A-F were isolated in 2002 from the Formosan soft coral *Xenia puerto-galerae*. Xenitorin A demonstrated potent cytotoxicity against A549 (lung) cancer cells with an ED50 of 0.79 mg/mL. Despite its potency as an anticancer agent and relative scarcity, a successful synthesis of this valuable compound has not been reported. We hope to provide access to this molecule and its relatives in order to understand and improve its potency. We believe through the utilization of a cysteine-based catalyst, we can develop a catalytic, asymmetric Rauhut-Currier reaction, which would provide an advanced starting material for the eventual synthesis of xenitorin A. The development of this methodology would provide the chemical community with a new procedure for the synthesis of enantio-enriched cycloenone products. Our work thus far has focused on the preparation of an acyclic diene, dione precursor upon which we may test our proposed Rauhut-Currier transformation. This talk will outline initial synthetic attempts to prepare the acyclic precursors upon which our proposed tandem Rauhut-Currier/Aldol condensation will be performed.

Computer Science (Room F2445)

10:00am Grad F2445

Virtual Reality as a Teaching Tool for those with Autism and Developmental Disabilities

*James Munger, Justin Ehrlich [Western Illinois University]

It is now estimated that 1 in 50 children are afflicted with Autism Spectrum Disorder (ASD), so it is more important than ever to find effective treatments. Some of the most promising treatments involve Virtual Reality (VR), with its high level of immersion, to simulate and teach social skills in Virtual Environments (VE). One of the most immersive technologies available, the head mounted display (HMD), was recently advanced as the next generation of the device was released. In the past head-mounted displays had poor viewing angles, and were cumbersome, which caused the HMDs to be rejected by the community to treat those with developmental disabilities. The new HMDs fix these problems and are poised as a perfect platform for next generation interventions, but first researchers must determine if individuals with ASD will accept the use of the new HMD. Unfortunately the research is nonexistent when it comes to studying this generation of HMDs, therefore the purpose of this research is to answer two questions: to what extent do those with ASD or with general developmental disabilities accept and follow instructions using the HMD and to what extent do these individuals feel presence, induced by the device, while using the HMD when compared to neurotypicals. To answer these questions, a between-group study was conducted between those with ASD and those who are neurotypicals. The ages of the subjects ranged between 6-11 and were selected from a local school. A virtual environment was developed in which subjects were required to perform simple tasks such as recognizing objects and maneuvering in an environment. Scores were recorded based on the ability to complete the tasks within the virtual environment successfully as well as their acceptance of the HMD itself. This work reports the findings and to what extent individuals with ASD accept follow instructions using the new HMD and to what extent those with ASD report presence when compared to neurotypicals.

10:20am F2445

Identifying Correlations among Data in a Software Repository

*Chunying Zhao [Western Illinois University]

Software has become increasingly large and complex in the last decade. In addition to the source code itself, lots of information/data is generated during a software development process, such as design models, revision history, debugging logs, communication between developers, and error/bugs reports. Such information provides clues about where the errors/bugs come from, how they are fixed, and the pattern that a team collaborates. Lessons learned from this can help improve future project development. Therefore, discovering relationships among source code, design models, bugs, developer communications, and logs is necessary. To achieve this, this paper proposes a three-level mapping to locate the traceability between bugs, source code, design models, revision history, and developer communication. We use bugs as the start point. The first-level mapping is from the bug to the source code and its design model (e.g. UML class diagram). In this mapping, we can identify whether the bug

is caused by design phase or coding phase. The second-level mapping is from the source code or its design model to developer's revision history related to the bugging model. In this mapping, we can identify who and when the bugs are fixed. The third-level mapping is from revision history to developer's communication logs. In this level, we can identify what the team structure is and how the team collaborates to correct the bugs. From the three-level mapping, we can find out the major factors affecting software quality.

10:40am Grad F2445

Topological Implications of Negative Curvature for Biological and Social Networks

*Nasim Mobasheri, [1]Reka Albert, Bhaskar Dasgupta [University of Illinois at Chicago; [1]Pennsylvania State University]

Network measures that reflect the most salient properties of complex large-scale networks are in high demand in the network research community. We adapt a combinatorial measure of negative curvature (also called hyperbolicity) to parameterized finite networks, and show that a variety of biological and social networks are hyperbolic. This hyperbolicity property has strong implications on the higher-order connectivity and other topological properties of these networks. Specifically, we derive and prove bounds on the distance among shortest or approximately shortest paths in hyperbolic networks. We describe two implications of these bounds to cross-talk in biological networks, and to the existence of central, influential neighborhoods in both biological and social networks.

Engineering & Technology (Room F2445)

11:00am
F2445

Implementation of the Bond Energy Analysis Algorithm for Identifying Machine Cells and Defining Part Families through Microsoft Excel

*Rafael Obregon [Western Illinois University]

The definition of part families and the formation of machine cells are crucial aspects for the design of cellular manufacturing layouts. Manual and computerized methods for grouping parts and identifying machine cells have been developed and are widely used in industry. A number of these methods are centered on array-based cluster analysis techniques. Within the array-based clustering classification, the Bond Energy Analysis (BEA) algorithm is among the simplest, and easiest to implement. The purpose of this study is to present the main concepts of applying BEA to machine cell and part family grouping, and its implementation using MS Excel.

11:20am
F2445

Numerical Simulations for Various Syngas Fuels Using Trapped Vortex Combustor

*Khaled Zbeeb [Western Illinois University]

This paper presents results on the combustion of syngas fuel in a two-after-body trapped vortex combustor. The use of hydrogen fuels such as syngas fuel can be very helpful in increasing engine performance as well as decreasing emissions. The two-after-body trapped vortex combustor was selected because of its optimized geometry that creates two cavities which in turn help in combusting most of the fuel before it exits the combustor. Next generation turbine for power plants and aerospace applications will require high efficiency gas turbines with higher operating conditions (higher combustor pressures and firing temperatures). This increase in gas turbine operating conditions and firing temperature will tend to increase NO_x emissions. The trapped vortex combustor maintains a vortex of burning fuel and air in a chamber adjacent to the main burner ports. It is always desirable to have an efficient fuel to combust and produce power. However, most efficient fuels do not produce clean emissions. The main task of this study is to optimize the selection of a fuel based on its performance and emissions. Moreover, the aim of this study was to establish correlation graphs for the performance and emissions for the TVC combustor for various types of fuels with different compositions and heat of combustion values. Methane, hydrogen, and 10 different syngas fuels were analyzed in this study. In order to establish valid CFD simulations for these types of fuel, a validation for the CFD model of the TVC combustor was performed. The flame temperature, the flow field, and species concentrations inside the vortex trapped combustor were obtained. Several syngas fuels with different fuel compositions (H_2, CO, CH_4, CO_2, N_2, and H_2O) and lower heating values were tested in this study. The effects of H_2/CO ratio and the mass fraction of each constituent of syngas fuels and hydrogen-methane fuel mixtures on the combustion and emissions performances were investigated.

Environmental Science (Room F1622)

9:20am F1622 **Undergrad** **Impact of Soil Compaction in a Northern Hardwood Forest of the Upper Peninsula of Michigan**

*Wendy Leonard, John Yunger [Governors State University]

Mining can significantly alter presettlement vegetation in the United States. These effects can be attributed to not only the removal of rock and soil, but the accompanying impacts of towns, roads, water divergence, and timber removal. There was extensive copper mining between 1850 and 1950 in the Keweenaw Peninsula of northern Michigan. Some towns that rapidly developed have now been abandoned for approximately 100 years. Seven abandoned mines and their associated towns were identified. Areas close to a known mining site but with no evidence of mining relics were deemed non-mining areas. Data was collected on tree species composition, tree density, and tree size using point quarter sampling analyses on two size classes of trees located within mine sites, their adjoining non mining sites, and an old growth preserve. Soil compaction was also determined at all points. Mining locations were defined by landmarks indicative of related activity such as old buildings, piping, and stamp mill rock piles in addition to archival pictures. Soil compaction was significantly higher in mining sites than non-mining sites ($\bar{x}$ = 1.42 kg/cm^2) and ($\bar{x}$ = 1.20 kg/cm^2) as compared to levels in an old growth preserve ($\bar{x}$ =0.59 kg/cm^2). Neither total tree density nor overall DBH were significantly different among sites. Fifteen different species were found across all areas. There was extensive variation in species composition among the three treatment areas. Different growth rates among the species, particularly early succession species, may account for the lack of difference in tree size and density. Soil compaction of forest habitat may be attributed to mining and logging activity; heavy machinery, wagons, and domestic animals causing the compaction. Further research may provide insights into the relation of soil compaction on forest regrowth.

9:40am F1622 **Grad** **The Effects of Predator Cues on Vertical Foraging hHbits in the White-footed Mouse (*Peromyscus leucopus*)**

*Caitlin Stark [Governors State University]

Predation risk can have a strong influence foraging behavior. The white-footed mouse (*Peromyscus leucopus*) is an arboreal, omnivorous mammal and may change where it forages based on the type of predators present. For instance, if there is a ground predator such as a coyote, *P. leucopus* may decide to forage in trees as opposed to on the ground; if there is an aerial predator such as an owl, *P. leucopus* may stay closer to cover to forage. To explore this theory, giving-up densities (GUDs) were measured by using foraging trays mounted on trees in an oak woods . Trays were positioned at ground level, 3-m above ground, and 6-m above ground on 20 oak trees. Each tray contained 10 g of millet seed and 2 L of sand. Predator cues included coyote urine and owl pellets and each predator treatment was performed once during each season during the new moon phases. There was no significant difference between foraging heights during owl pellet trials, or between seasons during the owl trials. A significant difference was found between scent and day; day, season and scent; and foraging heights during the coyote

foraging trials. *Peromyscus leucopus* foraged more at the base of the trees than at 3 m and 6 m. Coyote scent and height was slightly different with *P. leucopus* foraging more at trees with coyote scent. Foraging at trees could be safer for *P. leucopus* because of their ability to climb or hide in hollows to escape ground predators. *Peromyscus leucopus* foraged more at the base of trees with owl pellets. This behavior was unexpected, but could be that owl pellets are not perceived as a risk that an owl will be near. Owl pellets could possibly be seen as a potential calcium source similar to shed antlers.

10:00am Grad F1622

Avian Habitat Use in a Chronosequence of Bottomland Hardwood Forest Restoration Sites

*Paul Le, Richard Essner, Jr., Lindley Ballen, Peter Minchin [Southern Illinois University Edwardsville]

Before European settlement in the Mississippi Alluvial Valley, bottomland hardwood forests dominated land cover and acted as an essential migratory corridor for millions of neotropical songbirds. Human expansion has drastically changed the landscape, which has resulted in diminished biodiversity and ecosystem structure and function. The alarming rate of degradation has led to the development of the field of restoration ecology, which seeks to reestablish original ecosystem services important to humans and wildlife. Birds are believed to be excellent indicators of environmental health, and interactions with their habitat can provide meaningful insight to restoration design and implementation. In order to assess restoration effectiveness, we compared avian richness, diversity, and density within a chronosequence of nine restored sites and two reference sites and will create predictive habitat models. The results of our research will provide wildlife agencies and refuges appropriate recommendations of where to concentrate monetary resources toward restoration planning and management. Our data utilizes point counts for bird presence and quadrat and belt sampling for vegetation. We hypothesize that as the age since restoration increases, avian species diversity will be higher due to increasing structural and vegetative complexity. Additionally, we hypothesize that prairie avifauna will be significant indicator species for restoration sites that are below 10 years of age. Alternatively, forest avifauna will be significant indicator species for restoration sites that are greater than 20 years of age.

10:20am Undergrad F1622

Bee, Butterfly, and Plant Species Diversity in Northeastern Illinois Tallgrass Prairie Restorations

*Neal Jankowski, Mary Carrington [Governors State University]

Pollinators not only are essential for production of a substantial portion of the world's food supply, but also provide key ecosystem services in natural ecosystems. In the Midwestern United States tallgrass prairies likely function as refugia for many native pollinator species; however, less than 1% of the original area of tallgrass prairie remains. Tallgrass prairie restoration is increasingly practiced to increase the extent of this natural ecosystem. Characterization of relationships among plant and pollinator species is needed to better understand and gauge the success of tallgrass prairie restorations. In this study the hypothesis that plant species diversity is positively linked with pollinator species diversity was

tested in ten tallgrass prairie restorations in northeastern Illinois. During July and August 2013 we quantified number of species of plants, bees, and butterflies along two 100-m transects in each prairie restoration. We then conducted separate correlation analyses for plant species diversity vs. bee species diversity, plant species diversity vs. butterfly species diversity, and plant species diversity vs. all pollinator (bees and butterflies combined) diversity. Unexpectedly, plant species diversity was negatively correlated with bee species diversity. Further analysis showed that the proportion of honeybees (*Apis mellifera*) at sites was positively correlated with plant species diversity and had a strongly negative correlation with native bee species diversity. While the main hypothesis of this study was refuted, results of the study demonstrate a relationship exists between plant species diversity and bee species diversity and there is evidence for competition between honey bees and native bees.

10:40am Grad F1622 **Evaluation of Methods for Short Term Stabilization of Road Construction Sites in Illinois**

*Irene Weber, Mark Grinter, Susan Morgan, William Retzlaff, Peter Minchin [Southern Illinois University Edwardsville]

When road construction sites are inactive for several months, establishment of temporary vegetation cover is required to stabilize soils and prevent erosion. Currently the Illinois Department of Transportation prescribes seeding with a perennial rye and oats mixture regardless of date or location within Illinois. The purpose of this research is to evaluate the effectiveness of the currently prescribed method against alternative combinations of different seed mixes, soil preparation, and mulching methods. We are performing experiments at four locations across Illinois, with seeding occurring at each site four times throughout the year. Climatic variation across Illinois suggests a need for different specifications among regions. Factorial combinations of ten seed mixes by two soil preparation methods by three mulching treatments are being tested, with three randomized blocks per planting at each site. Vegetation height is measured at two month intervals and vegetation cover is determined both visually and using analysis of digital photographs in Adobe Photoshop. Preliminary results from the fall 2012 seeding suggest that the current specification is inferior to other tested methods. Annual rye performs best in southern Illinois while cold weather grains (winter wheat, cereal rye, and barley) perform better in northern Illinois. Mulching with straw mat facilitates the best vegetative cover and minimizes seed predation. The soil preparation methods tested have equivalent effects on vegetation establishment. The experiments will continue until spring 2014 and results are expected to lead to modifications of the temporary stabilization specifications for Illinois.

11:00am Undergrad F1622 **The Effects of Time on the Abundance of Four Plant Species and their Effects on the Abundance of Butterflies and Bees in Prairie Restorations**

*Gloria Robertson, Mary Carrington [Governors State University]

The restoration of prairies and their pollinator communities is crucial due to the loss of 99% of tallgrass prairies within the United States. This study was conducted to determine if a relationship between time, bee abundance, butterfly abundance, and abundance of four species of plants (*Eryngium yuccifolium*, *Monarda fistulosa*,

Ratibida pinnata, and *Silphium integrifolium*) could be determined and then potentially applied to restoration efforts for bees and butterflies. Studies have shown that different conservation strategies are necessary for bees than for butterflies. It was hypothesized that the prevalence of the four plant species would increase with time, and that an increase in the prevalence of bees and butterflies would correlate with an increase in the prevalence of the four plant species. Ten restoration sites consisting of five younger sites and five older sites were studied. T-tests were used to analyze the plant data, and correlations were used to analyze the relationships between plant abundance and bee and butterfly abundance. *Monarda fistulosa* was the only species with a statistically significant difference in abundance between the younger sites and older sites. The abundance of *Monarda fistulosa* did not have statistically significant correlations with either bee abundance or butterfly abundance. Both hypotheses were rejected and it was concluded that none of the four plant species could be used for the specific purpose of increasing the abundance of both bees and butterflies at prairie restoration sites.

11:20am Undergrad F1622

Observed Effects of Warm Season Perennial Grass Agriculture on Resident Mammal Species

*David Leimbach, Gregg J. Marcello [Millikin University]

This study focused on the observed impact of switching from a corn / soybean agricultural rotation to the planting of warm season perennial grasses for use in biomass agriculture and the subsequent effects on resident mammal populations. We trapped two parcels of land planted in warm season perennial grasses between September 2011 and October 2013 in order to obtain a census of the mammal populations residing upon the property and to determine the impact (if any) of the change in agriculture. During the first year of the study, a seemingly inhospitable (urban) agricultural area revealed a diverse population of inhabitants. The second year of trapping resulted in the capture of 2 new species (total of 8 species captured) and the noticeable absence of 1 species; a distinct shift in mammal populations had been observed. There was a direct correlation between the population increase of *Peromyscus maniculatus* during 2012 and the decline in the population of *Peromyscus leucopus*. When a Chi-square test was run ($P<0.05$), the hypothesis of competitive exclusion appeared to be supported. In the third year, population numbers of *Peromyscus maniculatus* had also plummeted. It is our position that warm season perennial grass agriculture had an adverse effect on *Peromyscus* species, while other mammals were unaffected.

Health Science (Room F2442)

10:00am Grad F2442

The Effects of Theophylline and 8-Cyclopentyltheophylline on the Respiratory Response to Carbon Dioxide in Neonatal Rats

*Christine Albers, Kip McGilliard [Eastern Illinois University]

Premature infants are often plagued with respiration problems ranging from periodic breathing to apnea. Methylxanthines, such as theophylline (THEO) and caffeine, are commonly used for the prevention of apnea in infants. This study sought to compare the respiratory effects of THEO and 8-cyclopentyltheophylline (CPT) in combination with the respiratory stimulant effects of carbon dioxide (CO_2) inhalation. Various doses of THEO and CPT were injected into neonatal rats while performing CO_2-response tests. The interaction of the drugs and CO_2 was observed over a 45-minute period. Each rat was placed into a body plethysmograph connected by tubing to a flow transducer and a pneumotachograph. A 5-min control period of normal breathing was followed by a CO_2-response test involving exposure to increasing percentages of CO_2 ranging from 1 to 6% delivered at 2-min intervals. After injection of THEO (10, 20, 40mg/kg), CPT (320, 640, 1280ug/kg), or saline, this same procedure was repeated at 15-min intervals until the 45-min period concluded. CO_2 exposure produced a consistent increase in minute ventilation (VE), tidal volume (VT), and mean inspiratory flow (MIF), but not in respiratory rate. Although there was not an overall significant difference between doses of THEO, the highest dose (40mg/kg) showed significant increases in VE, VT, and MIF when paired with 5-6% CO_2. The dose of 10mg/kg of THEO also showed increases in VE and VT at the higher CO_2 percentages. In contrast, CPT showed no significant increases in respiration at any dose. THEO produced a more significant increase in the respiratory response to CO_2 than CPT, even though CPT is the more potent form of the drug and also has a higher affinity for adenosine A1 receptors. In conclusion, the highest dose of THEO produced a significant increase in the ventilatory response to CO_2, while CPT did not affect the CO_2 response in the dose range tested.

10:20am Grad F2442

Small Integrin-binding Ligand N-linked Glycoproteins (SIBLINGs) are Overexpressed in Cancer States

*Samantha Hamilton, Jennifer Yu, Asha Eapen, Anita Joy [Southern Illinois University Edwardsville]

Salivary gland carcinomas constitute a rare but deadly group of head and neck cancers, but timely diagnosis is often delayed due to inherent variability in etiology, heterogeneity, and histopathological characterization. SIBLINGs are a family of secreted glycophosphoproteins that include bone sialoprotein (BSP), dentin matrix protein-1 (DMP-1), dentin sialophosphoprotein (DSPP), osteopontin (OPN), and matrix extracellular phosphoglycoprotein (MEPE). SIBLINGs were first discovered in bone and teeth, and were considered to be exclusively expressed in mineralized tissue. In addition to mineralized tissue, SIBLINGs have now been shown to have variable expression in normal, non-mineralized tissue and in cancers. However, there have been no studies evaluating SIBLING expression in human salivary gland cancers. Our study tested the hypothesis that SIBLINGs, specifically, BSP, DMP1, DSPP, and OPN, would be significantly overexpressed in

human salivary gland cancers. Normal and malignant human salivary gland tissue obtained from the NDRI were processed using routine immunohistochemistry techniques to evaluate localization of BSP, DMP1, DSPP, and OPN. Normal salivary gland cell line (HSG) and submaxillary salivary gland cancer cell line (HTB-41) were propagated using routine cell culture techniques. Western blot was used to quantify and compare SIBLING protein expression levels in HSG and HTB-41 cells. Immunohistochemistry and western blot showed increased expression of SIBLINGs in human salivary gland cancers. Our studies confirm that SIBLING proteins are selectively expressed in human salivary gland cancer. Future studies will evaluate gene expression of SIBLINGs.

10:40am Grad F2442

Matrix-mediated Differentiation of Human Mesenchymal Stem Cells

*Jennifer Yu, Samantha Hamilton, Asha Eapen, Anita Joy| [Southern Illinois University Edwardsville]

One of the major limitations in tissue engineering is the inability to adequately vascularize tissue. Numerous studies are ongoing to evaluate potential strategies to enhance vascularization during treatment of bone defects and trauma. Our interest is in the field of regenerative endodontics, and we are studying strategies to enhance vascularization of dental pulp tissue following endodontic procedures. We sought to exploit the differentiation capacity of human mesenchymal stem cells (hMSCs) when exposed to the extracellular matrix of endothelial cells. Cell-based differentiation of multipotent hMSCs into endothelial lineage could potentially be used for in vivo formation of blood vessels. Two cell lines, namely hMSCs and a microvascular endothelial cell line, µVEC, were cultured using optimal cell culture conditions. Endothelial cell specific markers were evaluated using immunofluorescence techniques, to study the matrix influence of µVECs on hMSCs at 4 and 24 hours. Protein and mRNA expression levels of endothelial cell markers were also evaluated on the differentiated hMSCs at 4 and 24 hours. hMSCs exposed to endothelial extracellular matrix expressed endothelial cell specific markers at both transcriptional and translational levels. The differentiation potential of hMSCs into an endothelial lineage, under the influence of endothelial extracellular matrix was clearly evident.

Microbiology (Room F2442)

11:00am Grad F2442

Elucidating a Defined Medium for the Archaeal Acidophile, "*Ferroplasma acidarmanu*" strain fer1

*Yudong Qu, Caitlin M. Greene, Kai F. Hung [Eastern Illinois University]

"Ferroplasma acidarmanus" strain fer1 (fer1) is an archaeal microaerophilic acidophile (pH 0-3) with a chemolithotrophic metabolism. As an efficient consumer of sulfate, fer1 plays an important role in the biogeochemical process of pyrite dissolution at acidic sites. Confirming the genomic predictions of metabolic gene functions in this organism requires functional assays, which cannot be carried out until a defined medium is obtained. The objective of the current study is to replace the 0.1% (w/v) yeast extract component in the growth medium, mfer, with defined components for carbon, nitrogen, and vitamin needs. Possible sources for carbon (glucose, short-chain carbon compounds, organic acid mixture), nitrogen (alanine, ammonia, nitrate, casamino acids), and vitamins (10 vitamins) have been tested in different combinations for their ability to support growth. Various growth conditions, including different culture volumes and gas compositions in the headspace, were also tested. Triple serial passages (1/100 dilution) were carried out to eliminate carry-over effects. Growth was monitored by optical density (520 nm), visual inspection, and most-probable number estimation, as appropriate. Multiple independent trials with at least 2 repeats of each trial will be conducted for statistical analyses. Preliminary results showed that organic acids inhibited growth of fer1 while addition of either 0.1% or 0.01% (w/v) glucose did not improve growth of fer1 based optical density assessment. Elucidation of a defined medium to support growth of fer1 continues and comparisons between different methods of quantifying growth in fer1 are being investigated. Discovering a defined medium will enable research into the metabolic capacities of fer1, which will enhance our understanding of how extremophiles exist at the boundaries of life and raise the accuracy of bioinformatics predictions.

Science Education (Room F2442)

11:20am
F2442

Past, Present, and Future Applications of Audio-Visual Aids in Teaching Science

*John Lloyd [Aurora University]

Audio-Visual aids have been involved with the teaching of science for decades from the 35 mm film projector to DVDs /videos on-line today. In the late 50s and 60s, the Bell Laboratory Science Series (films) featuring Dr. Frank C. Baxter introduced various scientific topics such as weather, cosmic rays, the sun, DNA, and blood in the circulatory system to young minds. In the late 60s, the Sci-Fi film, "Fantastic Voyage" gave students the opportunity to travel through the human body exploring the heart, lungs, and the immune system. Today, many professors/instructors show films in class to engage the student with the subject material (introduce, review, reflect, stimulate discussion, and emphasize a specific concept). The films may have been purchased as a DVD or down-loaded from a Youtube website or recorded from a television program. The future of audio-visual aids may be here already. Since 2006, McGraw-Hill's Anatomy & Physiology Revealed (APR) CD-ROM /DVD, an interactive cadaver dissection has been implemented in the teaching of anatomy & physiology to pre-health professional (mainly nursing) students. APR allows students to peel away layers of tissues on their computer screens to reveal more than 5,000 anatomical structures from the various physiological systems of the body. APR also has animations, histology, imaging, and quizzes and lab practicals. Films and videos that have been used in various health science courses will be discussed and how the APR has been applied in the teaching of anatomy & physiology in the lab will be demonstrated.

Zoology (occurring simultaneously Rooms D2441 & D2444)

9:00am D2441 **Grad**

Using Deuterium and GIS Tools to Estimate Geographic Extents of Source Populations of Tree Bats Killed in a Central Illinois Wind Farm

*Rachael Van Essen, Angelo Capparella [Illinois State University]

Bats are killed at an astonishing rate by wind facilities - an estimated 600,000 nationwide in 2012. Approximately 75% of these bats are of three species, the Eastern Red (*Lasiurus borealis*), Hoary (*Lasiurus cinereus*), and Silver-haired (*Lasionycteris noctivagans*). While the number seems large, we have little understanding of the impact of this high mortality on these species' population persistence, in part because we have poor knowledge of their breeding sites and migration pathways. The use of stable isotopes in body tissues to determine both summer range and migration pathways of animals is an increasingly successful method for elucidating geographic patterns. In my research, I focus on the Eastern Red and Hoary bats using the method of deuterium isotope ratio (δD) analysis in a novel way through combining ecological niche modeling (GARP: Genetic Algorithm for Rule-set Prediction) with a web-based isotope modeling program (Isomap: Isoscapes Modeling, Analysis, and Prediction). My goal is to determine whether the bats being killed at an Illinois wind facility are coming from a large portion of their summer geographic range or from only a small segment. This will serve to help understand autumn migration patterns through central Illinois in terms of their northern extents. It will also be an important stepping stone toward understanding population and long-term impacts that the high mortality suffered at wind facilities will have on these two species.

9:20am D2441 **Undergrad**

Kissing Bugs (Reduviidae) - Vector of Chagas' disease - in San Luis, Costa Rica, and a Technique to Facilitate Feeding in Captivity for Sampling

*Gabrielle Kuhn, Kayla M. Koli, Lawrence W. Zettler [Illinois College]

Kissing bugs, found throughout Central and South America, are well-known vectors of *Trypanosoma cruzi* - the protozoan that causes American trypanosomiasis or Chagas' disease. According to the CDC, travelers to Costa Rica are at extremely low risk of developing the disease. Nevertheless, we sampled 20 families in San Luis (near Monteverde) in March 2014 for their familiarity with this insect in and around homes. All of the families reported seeing the bug - commonly referred to as "chinche" - and 19 of the 20 families allowed their properties to be searched for the insects. Three live specimens were obtained from one of the local's properties, and two additional bugs were collected on the University of Georgia - Costa Rica (UGA) campus nearby. To determine if these bugs harbored *T. cruzi* in bloody excrement (frass), the lower portion of the insect's abdomen was manually compressed but to no avail, suggesting that the insects had not fed prior. We then provided the bugs with fresh beef liver which served as a bloodmeal, and the insects began to feed on the liver almost immediately. After 24 hours, frass samples were obtained from engorged bugs. The samples were placed directly on microscope slides - one sample in saline solution and a second sample in ethanol solution for staining purposes. Upon viewing the samples in saline solution under microscopy, numerous swift-moving, serpentine organisms were prevalent in three of the bugs. These organisms matched published

descriptions for trypanosomes (*T. cruzi*) suggesting that these bugs could potentially serve as vectors of Chagas' disease in the Monteverde region of Costa Rica.

9:40am **Undergrad** **Male Mate Choice and Personality in Zebra Finches**
D2441
*James Lichtenstein [Knox College]
The study of animal personality examines consistent individual differences in behavior across time and context. These differences have been found to have implications for a wide range of ecological processes including sexual selection. For example, female Zebra Finches have been found to pick mates based on their apparent exploratory behavior, with high exploratory females preferring high exploratory males. However this phenomenon has not yet been studied in males. In order to investigate how males might select mates in respect to consistent differences in behavior we measured the exploratory behavior of male Zebra Finches in a novel environment test. We then examined the mating preferences of these males in a two choice apparatus after observing the apparent exploratory behavior of two females (high vs. low). Then in order to examine how female and male preferences differ with respect to aggressive behavior, we used a similar experimental design to examine the mating preferences of males for high and low aggressive females. The results of these experiments will be discussed.

10:00am **Survival and Movement Patterns of Franklin's Ground Squirrels in an**
D2441 **Agriculture-dominated Landscape**
*Tih-Fen Ting [University of Illinois at Springfield]
As the only species in the genus *Poliocitellus*, Franklin's ground squirrel (*Poliocitellus franklinii*) is declining in much of the central United States and is considered endangered, threatened, or a species of concern in many Midwestern states. Declines in Franklin's ground squirrel populations in the Midwest have been widely attributed to loss and fragmentation of tallgrass prairie or savanna habitat due to intensive agricultural practices. Nowadays Franklin's ground squirrels are frequently found along roadside or railroad right-of-ways when these areas are no longer in use. To study its population dynamics and movement patters in the agriculture-dominated landscape, Franklin's ground squirrel has been surveyed along a 38-mile stretch of an abandoned railroad corridor in central Illinois since 2011. Individuals of ground squirrels were live-trapped and tagged with passive integrated transponders (PIT) since 2012. Juveniles have been collared for radio telemetry since 2013. The densities of Franklin's ground squirrels, for both adults and juveniles, decreased sharply at most of the sites from 2012 to 2013. The drought in the latter half of the 2012 season and the unusually wet spring in 2013 might have contributed to the observed declines. Together the results from PIT-tagging and radio telemetry indicate that Franklin's ground squirrels, particularly males, were capable of moving or dispersing for a distance (e.g., 10 km) longer than those reported in the published literature. However, not all juvenile males dispersed along the linear right-of-way habitat. All collared juvenile males in 2013 dispersed from their natal sites along the corridor and traveled through the adjoining agricultural fields. No survivor was located through the dispersal events. It appears that agricultural fields, especially soybean fields,

pose as ecological traps for dispersing Franklin's ground squirrels.

10:00am Grad D2444 **Effects of an Invasive Plant on Wolf Spider Movement**

*Kristi Lemenager, Paul Brunkow [Southern Illinois University Edwardsville]

Rabid wolf spiders, *Rabidosa rabida* and *R. punctulat*a, are native to mixed grasslands throughout the Midwest. However, native grass communities are being invaded by *Lespedeza cuneata* throughout Illinois. The three dimensional structure of this Asian invasive plant varies greatly from grass, in terms of both growth form and stem material. *Rabidosa* wolf spiders can be found in stands of *Lespedeza*, and the physical structure of *Lespedez*a may alter *Rabidosa* movement as they travel through this invasive plant substrate. The present project tested possible effects of *Lespedeza* invasion on *Rabidosa* movement in terms of how fast they move and how often they move. We set up two aquaria, one with *Lespedeza* and the other with grass. Movement trials were recorded using time-lapse photography overnight between 2000 h and 0400 h. To identify the location of the *Rabidosa* in each photograph, LED lights were used to briefly fluoresce a mixture of talcum powder and fluorescent powder dusted on each spider. *Rabidosa* exhibited significantly greater average velocity, maximum velocity, and overall activity level in *Lespedeza* than in grass. These results indicate that *Lespedeza* may significantly alter the role of *Rabidosa* as the top predators in plant communities into which *Lespedeza* invades. Future studies will include field surveys of *Rabidosa* relationships with insect prey in grassland communities compared to those grassland communities invaded by *Lespedeza*. Further effects of *Lespedeza* invasion might include altered communication between individual *Rabidosa* via transmission of substrate-borne seismic signals.

10:20am Grad D2441 **A Comparison of Aquatic and Terrestrial Landing in Leiopelmatid and Lalagobatrachian Frogs**

*Jamay Michael, Rick Essner [Southern Illinois University Edwardsville]

Terrestrial jumping in frogs generally involves rapid hindlimb extension and loss of forelimb contact followed by mid-flight limb recovery. During landing, forelimbs make initial contact with the substrate, forming a pivot that helps with stabilization and support. Simultaneously, hindlimbs are rotated under the body so that the frog is in position to initiate another jump. Frogs of the family Leiopelmatidae (Tailed Frogs and New Zealand Frogs) differ from this general terrestrial condition by their exclusive use of "bellyflop" landings, with delayed hindlimb recovery. These frogs diverged from all other extant frogs (Lalagobatrachia) as long ago as 200 mybp. Anuran jumping is thought to have evolved in a riparian context, with the earliest frogs leaping into water to flee terrestrial predators. Thus, the bellyflop landing of leiopelmatids, which appears to be an aquatic diving behavior, may provide insight into the ancestral condition. We compared aquatic and terrestrial landing in a leiopelmatid, the Rocky Mountain Tailed Frog, *Ascaphus montanus*, and a basal lalagobatrachian, the Fire-bellied Toad, *Bombina orientalis*. Frogs were filmed with high-speed video at 250 fps (n=6 individuals per species) jumping from a platform into water. Three-dimensional kinematic analysis indicated that aquatic landing behavior was generally similar to terrestrial landing behavior, with *A. montanus* exhibiting

delayed limb recovery and *B. orientalis* exhibiting mid-flight limb recovery regardless of context.

10:20am Undergrad D2444 **Prevalence and Health Impacts of Avian Pox and Conjunctivitis in a Community of Wild Birds**

*Elizabeth Wrobel, Travis E. Wilcoxen, David J. Horn [Millikin University]

Pathogens are known to have a strong influence on fitness of wild birds. A well-known dynamic of disease ecology is the link between increased population density and increased pathogen prevalence and birds often gather at bird feeders in large densities. We used a population of free-living birds to assess pathogen prevalence among birds at sites with bird feeders, sites without bird feeders, and at sites with a history of bird feeding where the feeders had been removed. We tested for the presence of two different pathogens that can have a serious impact on the overall health of birds: the pathogenic bacteria, *Mycoplasma gallisepticum* (a causative agent of conjunctivitis) and *Avipoxvirus* (the causative agent of avian pox). In addition to the comparisons of sites with different bird feeding history, the prevalence of these diseases was compared among birds of different age, sex, and species to determine demographic distribution of the pathogens. To estimate the impact of these diseases on host health, we also examined immune and physiological profiles of each bird. Overall, this study reveals important, previously unknown disease dynamics associated with bird feeding activities in a community of free-living birds.

10:40am Undergrad D2444 **Impacts of West Nile Virus on Songbird Immune Function and Antioxidant Capacity in Central Illinois**

*Sarah Plants, Travis E. WIlcoxen [Millikin University]

Studies of West Nile Virus have been prevalent in avian, equine, and human health literature for approximately the past 15 years. Over that time, much research has been completed to facilitate understanding of the nature by which this disease is spread, identification of hosts and reservoirs, and the mechanisms by which hosts succumb to the disease and subsequently die. What remains poorly understood is immune and physiological mechanisms that promote survival of infection with the virus in natural populations. We captured birds before, during, and after a West Nile Virus outbreak in Central Illinois to determine the physiological costs associated with surviving with the West Nile Virus in known free-living hosts. By comparing three species, Northern Cardinal (*Cardinalis cardinalis*), Downy Woodpecker (*Picoides pubescens*), and House Finch (*Carpodacus mexicanus*), and using multiple physiological metrics, our study revealed significant differences in the body condition of Northern Cardinals that had antibodies to West Nile Virus and those that did not have antibodies to West Nile Virus, and differences in innate immune function and total antioxidant capacity among individuals of all three species with and without antibodies to West Nile Virus. West Nile Virus antibodies were also more prevalent among Northern Cardinals than either of the other two species. Taken together, our findings show variation in prevalence in a free-living population of birds, phenotypic qualities of birds that survive the virus, and potential costs associated with carrying the virus

11:00am D2444 **Undergrad** **Structurally Based Plumage Coloration as an Honest Signal for Individual Quality in Indigo Buntings (*Passerina cyanea*)**

*Spencer Hudson, Travis E. WIlcoxen [Millikin University]

Bright plumage coloration is seemingly favored by females of avian species with regard to sexual selection. This particular secondary sexual characteristic has been previously tested and supported to be an honest signal of individual quality among passerines with pigment-based coloration (i.e. yellows and reds). In contrast, structural plumage coloration (i.e. blues) exhibited by birds such as Indigo Buntings (*Passerina cyanea*), have received minimal research on relationships between plumage color intensity and aspects of physiological function. Using free-living Indigo Buntings as a study species, we compared UV color intensity to innate immune responses, antioxidant capacity, stress physiology, and plasma calcium levels. We have derived profiles of individual quality to determine whether variation in structural coloration does indeed reflect variation in physiological condition, and further, if it may serve as an honest signal for sexual selection in Indigo Buntings.

11:20am D2444 **Undergrad** **Changes in Innate Immune Function while Facing an Acute Stressor in Gray Catbirds (*Dumetella carolinensis*)**

*Mariah Schoonover, Travis WIlcoxen [Millikin University]

There are many studies of the effect of stress on the immune system in many different species, however, these studies have shown stressors to be either immunoenhancing or immunosuppressive, depending on the context and time course of the stressor. We used free-living Gray Catbirds (*Dumatella carolinensis*) to examine whether changes in avian innate immunocompetence during a 30-minute stress response are different between the original blood sampling location (the brachial vein of a wing) at time of initial capture and at 30 minutes post-capture compared to the opposite wing with a blood sample only taken at 30 minutes to determine if immunological responses to an acute stressor are different between a local wound site and other areas of the body. We used an in vitro *Escherichia coli* killing ability assay to assess immune function with samples taken from each time point and each wing. Samples taken from the initially sampled wing after 30 minutes showed significantly greater *E. coli* killing ability than the initial sample from that wing. Conversely, there was no difference in *E. coli* killing between the initial sample and the 30-minute sample from the opposite wing. Together, these findings suggest that the birds can mount an increased immune response while dealing with a stressor; however, the enhanced immunocompetence is likely restricted to a potential infection site or wound.