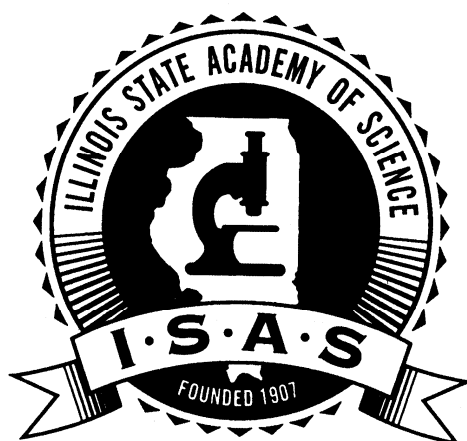


***TRANSACTIONS OF THE ILLINOIS  
STATE ACADEMY OF SCIENCE***

**Supplement to Volume 105**



**104<sup>th</sup> Annual Meeting  
March 30-31, 2012**

**Knox College  
Galesburg, Illinois**

**Illinois State Academy of Science  
Founded 1907  
Affiliated with the Illinois State Museum, Springfield**



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# SCHEDULE OF EVENTS

## Friday, March 30

- 11:00 – 5:30 **Registration** – Umbeck Science and Math Center
- 12:00 – 1:00 **ISAS Council Meeting (includes lunch)** – Seymour Union  
**Lunch on your own for other attendees (see Galesburg map)**
- 12:00 – 1:30 **Poster set-up** – Umbeck Science and Math Center
- 1:30 – 2:45 **Poster Session 1** (Presenters at odd numbered posters)
- 3:00 – 4:15 **Poster Session 2** (Presenters at even numbered posters)  
Light refreshments provided during poster sessions
- 4:30 – 6:30 **Mini-Symposium: Ecological Restoration and Conservation in Illinois – Past, Present, and Future Challenges** – Umbeck Science and Math Center, Room E117  
Stuart Allison, moderator; Roger Anderson, ISU; Angella Moorhouse, IDNR; Jack W. Walk, Science Director, Nature Conservancy; Jack Pizzo, President and Senior Ecologist, Pizzo & Associates
- 6:30 – 7:00 **Break**
- 7:00 – 8:30 **Banquet followed by Keynote Address by Dr. Stuart Allison** – Seymour Union  
Address open to public

## Saturday, March 31

- 7:00 – 8:00 **Breakfast** – Seymour Union
- 7:30 – 12:00 **Registration** – Umbeck Science and Math Center
- 8:00 – 9:00 **Oral Presentations** – Umbeck Science and Math Center
- 9:00 – 9:15 **Break**
- 9:15 – 10:30 **Oral Presentations** – Umbeck Science and Math Center
- 10:30 – 10:45 **Break**
- 10:45 – 12:30 **Oral Presentations followed by Division Meetings** – Umbeck Science and Math Center
- 12:30 – 1:30 **Buffet Lunch and Award Announcements** – Seymour Union

## KEYNOTE ADDRESS

**Stuart K. Allison**

*Ecological restoration and environmental change: Transforming ecosystems, transforming ourselves*



Stuart Allison is a native of western Illinois, where he now lives after following a circuitous path to gain his higher education. He earned a bachelor's degree in biology at the University of Puget Sound, a master's in oceanography at the University of Rhode Island and a Ph.D. in biology at the University of California, Berkeley. He did postdoctoral studies in ecology at Rutgers University. He has been at Knox College for 14 years where he is a professor in the biology department and director of the Green Oaks Field Research Station. He specializes in ecological restoration.

He recently completed a Fulbright Fellowship at Cranfield University, UK, in which he conducted a comparative study of ecological restoration practices worldwide with the objective of providing a framework which restorationists can use to plan and implement restoration work of both ecological and cultural value. His book, Ecological Restoration and Environmental Change (Earthscan/Taylor and Francis Publishers), is in production and will be out later this year.

Summary of Keynote Address: My seminar will begin by introducing my work and me to the ISAS community. I will summarize some of my past work that led me to develop the research project I carried out last year as a guest at Cranfield University funded by the Fulbright Commission. My goal was to produce a synthesis of the approaches to ecological restoration undertaken around the world with the objective of providing a better framework from which restorationists can plan and implement restoration work of both ecological and cultural value. By developing a better understanding of ecological restoration as it is practiced worldwide, I hoped to articulate the relationship between ecological value and human needs so that we can pursue a more global approach to planning and discussing restorations with all stakeholders. I performed a meta-analysis of restoration ecology papers published from 2006 to 2010 that provided a description of a restoration project. I also conducted an on-line survey of restorationists to determine their attitudes towards and goals for ecological restoration.

Today the development of novel ecosystems (ecosystems highly modified by local habitat destruction, the presence of non-native invasive species and the effects of global climate change) is causing restorationists to reassess what it means to do good ecological restoration. When ecological restoration was first practiced there was frequently a focus on re-establishing historic ecosystems (this was especially true in North America and Australia). Today restorationists are beginning to focus more on restoring biodiversity and valuable ecosystem functions. Some are even talking about future oriented restoration with a goal of planning restoration to match expected future conditions. Planning restoration projects has become a more contentious process due to changes in attitudes and approaches.

In the end, good ecological restoration practice must produce restoration projects that have both ecological value and human meaning. The more explicitly we address both properties, the more successful we will be as restorationists and the more benefit there will be for the entire planet as we work together to repair the damages that have resulted from some human activities and on-going environmental change.

## MINI-SYMPOSIUM

### *Ecological Restoration and Conservation in Illinois – Past, Present, and Future Challenges*

Television, newspapers, scientific journals and popular magazines report on climate change and its impact on our lives and ecosystems. The impetus for putting together this panel of scientists is to become better informed about the conservation and restoration activities undertaken by the governmental agencies, NGOs, academia, businesses and volunteers in Illinois. We have identified scientists from each of these areas to talk to us about their personal experiences in past restoration practices, current practices and future plans and challenges. Their biographical sketches follow.

#### **Roger Anderson**

Roger's Ph.D. degree is in Botany from University of Wisconsin-Madison (1968). He joined the Illinois State University faculty in 1976 where he is currently a Distinguished Professor Emeritus of Plant Ecology. Roger was the Director of the University of Wisconsin-Madison Arboretum from 1970-1973. His service to professional organizations includes membership on the Editorial Boards of Restoration Ecology (1993-present) and American Midland Naturalist (2010-present). He served two terms on the Illinois Nature Preserves Commission (1985-1990). Roger has authored 143 peer reviewed publications, and is a co-editor of "Savannas, Barrens, and Rock Outcrop Plant Communities of North America," Cambridge University Press. He has served as a member of the ISAS Council and the Board of the Midwest Great Lake Chapter of the Society for Ecological Restoration.

#### **Angella Moorhouse**

Angella Moorhouse received a BS in Biology from Western IL University in 1999 and a MS in biology/plant ecology from WIU in 2000. Since 1996 she has worked for the Illinois Nature Preserves Commission as a Natural Areas Protection Specialist. Her job coverage includes 15 counties in west-central Illinois. Prior professional experience includes working for the DNR at the Mason State Tree Nursery, the Fish & Wildlife Service at Illinois River Refuges in Havana and a short stint with the Illinois Natural History Survey. She specializes in plant ecology and cultural resource protection with a keen interest in the cultural and natural heritage protection of pioneer cemetery prairies and archaeological sites, hill prairie restoration, and the hosting of hill prairie conferences. She works extensively with private landowners, local municipalities, NGOs and volunteer groups doing management on high quality natural areas, especially on those areas protected within the Illinois Nature Preserves System. She and her husband Dan are active with the Illinois Audubon Society. They helped start and maintain the Western Prairie Audubon Chapter in Macomb. Angella serves on the board of the Illinois Native Plant Society and has been active in spring and Christmas Bird Counts since 1992, in Breeding Bird Surveys since 2006 and has been a compiler for 4 butterfly counts.

#### **Jack Pizzo**

Jack is the founding partner of Pizzo & Associates, Ltd. (founded in 1988) and serves as the President, Senior Ecologist, and Registered Landscape Architect. Jack's duties include directing the Management Team, marketing, speaking & education. Most importantly Jack serves as the ecological knowledge base for the company setting the philosophies, ethics, techniques and

principals that have made Pizzo & Associates, Ltd. the industry leader in Ecological Restoration. Jack is hands-on and has been involved in every project performed by Pizzo & Associates, Ltd. He has extensive experience in a multitude of ecosystems and project types. Jack is a 1984 graduate of the University of Illinois in Champaign with a Bachelor of Science in Ornamental Horticulture. He is affiliated with numerous restoration societies and has professional training in advanced fire burning, landscape architect, and wetlands.

### **Jeff Walk**

The Nature Conservancy in Illinois' Director of Science Jeff Walk has a longstanding loyalty to nature and Illinois' natural areas. A life-long Illinois resident, Jeff grew up on a family farm, where he developed a strong connection to land and water. Jeff joined the Conservancy in Illinois in 2007 as a conservation planner and was promoted to director of science in January 2010. Previously, he was a research scientist with the Illinois Natural History Survey and a professor of biology and environmental science at the University of Dubuque in Iowa. Jeff received his doctorate and master degrees from the University of Illinois at Urbana-Champaign. Jeff and a team of six authors recently published the book, *Illinois Birds: A Century of Change*, which uses information from bird surveys completed in the 1900s, 1950s and 2000s to document how Illinois birds and landscapes have or have not changed in the last 100 years. Repeated at the same locations, these surveys combined make up the oldest standardized survey in the United States. For their work on the book, Jeff and his co-authors received the 2010 Conservationist of the Year Award from the Illinois Audubon Society. As the Director of Science, Jeff oversees research and manages on-the-ground projects at Illinois Conservancy preserves. Through his involvement with local land trusts and other conservation agencies, Jeff finds joy in being a part of so many conversations that are guiding the direction of conservation in Illinois, from planning and strategy to measuring effectiveness.



## POSTER PRESENTATION SESSIONS

Poster presentations are Friday, March 30, in Umbeck Science and Math Center from 2:30 – 4:15 PM. Presenters can hang their posters up any time between Noon – 1:30 PM. Those students who are competing for awards and have been assigned an odd number should be at their posters from 1:30 – 2:45 PM to answer judges' questions. Students competing for awards with an even number assignment should be at their posters from 3:00 – 4:15 PM to speak with the judges. An asterisk (\*) indicates the presenters eligible for a Student Presentation Award.

### **Division: Botany**

**\*1. Determining the DNA content of a unique population of *Schoenoplectus hallii* in Howell County, MO**

Sutton, Alex, Smith, Marian, and Esselman, Elizabeth. Southern Illinois University Edwardsville, Edwardsville, IL.

**\*2. Foliar anatomy and ecological succession**

Hartnett, Michelle, Carlsward, Barbara, and Meiners, Scott. Eastern Illinois University, Charleston, IL.

**\*3. Standing crop and Pb availability in a tallgrass prairie restoration**

Bryson, Brooke, Krutsinger, Roxane, Martin, Samantha, Brugam, Richard, Kohn, Luci, and Schulz, Kurt. Southern Illinois University Edwardsville, Edwardsville, IL.

**\*4. Rising productivity through time in a tallgrass prairie restoration**

Krutsinger, Roxane, Brugam, Richard, and Schulz, Kurt. Southern Illinois University Edwardsville, Edwardsville, IL.

**\*5. Fourth year of study of biomass dynamics in an abandoned old field in Rock Island County, northwestern Illinois**

Scaggs, Allison and Dziadyk, Bohdan. Augustana College, Rock Island, IL.

**\*6. Germination of field-collected Japanese hops (*Humulus japonicus*, Cannabinaceae): lab techniques and between population variation**

Clark, Jonathan, Israelitt, David, and Schulz, Kurt. Southern Illinois University Edwardsville, Edwardsville, IL.

**\*7. Triclopyr (Tahoe 4E) versus glyphosate (Bullzeye) as effective foliar herbicides for eliminating Asiatic honeysuckle from forests**

Karrick, Megan and Schulz, Kurt. Southern Illinois University Edwardsville, Edwardsville, IL.

**\*8. Comparative foliar anatomy in *Kosteletzkya* (Malvaceae)**

Bland, Margaret, Carlsward, Barbara, and Meiners, Scott. Eastern Illinois University, Charleston, IL.

**\*9. A study on the arboreal flora and the environmental conditions in a bottomland forest site, Duck Creek Nature Trail, Silver Springs State Park, Kendall County, Illinois.**

Mestek, Gerry<sup>1,2</sup> and Beck, Hans<sup>1</sup>. <sup>1</sup>Aurora University, Aurora, IL. <sup>2</sup>Cowherd Middle School, Aurora, IL.

**Division: Cell, Molecular & Developmental Biology**

**10. The *Arabidopsis thaliana* (Brassicaceae) receptors, atToc132 and atToc120 do not represent the critical regulatory point in the biosynthesis of jasmonic acid**

Afitlhile, Meshack, Sprout, Danielle, Workman, Samantha, Musser, Sue-Hum, Golz, Michelle, and Kouassi, Gilles. Western Illinois University, Macomb, IL.

**\*11. Novel genetic transformation of three microalgae species for enhanced hydrocarbon production**

Robinson, Chelsey, K., Luker, John, and Luesse, Darron. Southern Illinois University Edwardsville, Edwardsville, IL.

**12. A heterozygous mutant of *Arabidopsis thaliana* (Brassicaceae), atToc132/120(+/-) accumulated reduced levels of linolenic acid when exposed to low temperatures**

Afitlhile, Meshack, Workman, Samantha, Sprout, Danielle, Dao, Khanh, Tracy, Kara, and Kouassi, Gilles. Western Illinois University, Macomb, IL.

**13. APKQYVRFamide, the first FMRFamide-related peptide identified from an oligochaete annelid**

Krajniak, Kevin G., Brauer, Cassandra, Kerstein, Kristopher, McCullough, Kyle and McCommas, Steven. Southern Illinois University Edwardsville, Edwardsville, IL.

**\*14. UVA induction of lysosomal membrane permeabilization in human leukemia cells, HL60**

Martens, Andrew J., Krajniak, Kevin, Worthington, Ronald, Hamad, Abdullatif, and Wanda, Paul E. Southern Illinois University Edwardsville, Edwardsville, IL.

**15. The effects of APKQYVRFamide on the body wall of *Lumbricus terrestris* (Lumbricidae)**

Kerstein, Kristopher W. and Krajniak, Kevin G. Southern Illinois University Edwardsville, Edwardsville, IL.

**16. Intracellular Ice Nucleation Protein Reduces Cryogenic Injury in Eukaryotic Cells**

Harder, Avril M.<sup>1</sup>, Chakraborty, Nilay<sup>2</sup>, and Menze, Michael A.<sup>1</sup> <sup>1</sup>Eastern Illinois University, Charleston, IL, <sup>2</sup>Center for Engineering in Medicine Harvard Medical School, Boston, MA.

**\*17. Identifying candidate genes involved in hepatic gene silencing in hepatoma cell variants**

Aylmer, Caitlin M., Kurkewich, Jeffrey, and Bulla, Gary A. Eastern Illinois University, Charleston, IL.

**\*18. Phase shift temperature as a marker for membrane fluidity increases during UV-induced apoptosis**

Robb, Dustin, Ansbro, Daniel, Shaw, Michael, and Wanda, Paul E. Southern Illinois University Edwardsville, Edwardsville, IL

**\*19. The effects of APKQYVRFamide on the isolated crop-gizzard of the earthworm *Lumbricus terrestris* (Lumbricidae)**

Brauer, Cassandra L. and Krajniak, Kevin G. Southern Illinois University Edwardsville, Edwardsville, IL.

**\*20. The effects of oxytocin and related peptides on the crop/gizzard of *Lumbricus terrestris* (Lumbricidae)**

Bone, Nathaniel B. and Krajniak, Kevin G. Southern Illinois University Edwardsville, Edwardsville, IL.

**\*21. Cloning of European honey bee (*Apis mellifera*, Apidae) odorant receptors predicted by the *A. mellifera* genome**

Kelsey, John C.<sup>1</sup>, Grimme, Steve J.<sup>1</sup>, Arnett, Clint<sup>1</sup>, Wanner, Kevin<sup>2</sup>, and MacAllister, Irene E.<sup>1</sup>  
<sup>1</sup>US Army Corps Engineer Research and Development Center Construction Engineering Research Laboratory, Champaign, IL, <sup>2</sup>Montana State University, Bozeman, MT.

**\*22. Diverse microRNAs in dictyostelid social amoebas**

Lu, Ya-Lin, DeMaria, Sara, Blackburn, Devon, and Jones-Rhoades, Matthew. Knox College, Galesburg, IL.

**\*23. Construction of a knock-out plasmid for mutational analysis in the mushroom-forming fungus *Schizophyllum commune* (Aphyllophorales)**

Hollaway, Andrea S., Moser, Casey L., and Fowler, Thomas J. Southern Illinois University Edwardsville, Edwardsville, IL.

**\*24. Identifying the function of a G $\beta$  Gene from the mushroom-forming fungus *Schizophyllum commune* (Aphyllophorales).**

Lim, Song, K. and Fowler, Thomas, J. Southern Illinois University Edwardsville, Edwardsville, IL.

**Division: Chemistry**

**\*25. Analysis of Melamine and Cyanuric acid by HPLC/Photodiode Array Detection Using Ionic Liquids as Mobile Phase Additives**

Shackelford, Jennifer F., Ahmad, Tariq Z., Thompson, A., Alhiji, Azhar S., and Ahmad, Tarab J. Western Illinois University, Macomb, IL.

**26. The Effect OF 1-Methyl, 3-Butylimidazolium Tetrafluoroborate BMIMBF<sub>4</sub> Ionic Liquid on The Retention Behavior of Nitroaromatics and Nitroanilines**

Redlinski, Bartlomiej, Utterback, Craig W., Sharp, Stephanie L., Heagy, Ashlie N., and Ahmad, Tarab J. Western Illinois University, Macomb, IL.

**\*27. Investigation of the Effect of Ionic Liquids as Mobile Phase Additives on the Separation of Basic Drugs**

Ahmad, T., Alhiji, Azhar S., Salam, Sahar A., and Ahmad, Tarab J. Western Illinois University, Macomb, IL.

**\*28. Effect of trehalose and sucralose on emulsion stability and controlled release of eicosapentaenoic acid encapsulated into a biopolymer matrix**

Chodavarapu, Naga P., Made Gowda, Netkal M., Boley, Mark M., Ahmad, Tarab, and Kouassi, Gilles K. Western Illinois University, Macomb, IL.

**\*29. Development of a convenient and pedagogically useful green oxidation protocol for wider adaptation in undergraduate laboratory curriculum**

Thamasetti, Abhilash A., Talluri, Sri H., Ries, Sahnique S., and Vinod, Thottumkara K. Western Illinois University, Macomb, IL.

**\*30. Screening Polyphenol Composition and Antioxidant Activity of Berries**

Kasarla, Deepak S. Afithile, Meshak, Made Gowda, Netkal M, Ahmad Tarab, and Kouassi, Gilles K. Western Illinois University, Macomb, IL.

**\*31. Effects of various dextrans on stability of controlled release of microencapsulated bioactive compounds**

Tamatam, Manassa, Gowda, Netkal M., Ahmad, Tarab, and Kouassi, Gilles M. Western Illinois University, Department of Chemistry, Macomb, IL.

**\*32. Synthesis of diol substrates for the investigation of selective oxidation of alcohols using water-soluble hypervalent iodine reagents**

Kupireddy, Nikhil, R., Gude, Harika C., and Vinod, Thottumkara K. Western Illinois University, Macomb, IL.

**\*33. Photodynamic therapy for prostate cancer**

Keesari, Bharadwaj and Fu-Giles, Patty K. Governors State University, University Park, IL.

**\*34. Synthesis of aminoallenes**

Nappa, Amanda M., and Brown, Benjamin M. Greenville College, Greenville, IL.

**\*35. Synthesis of tripeptides containing C-terminal L-lysinal and ornithinal thiosemicarbazone as potential cathepsin B inhibitors**

Kazipeta, K., Jin, J., Zhang, S., Wen, L., and McConnell, Rose M. Western Illinois University, Macomb, IL.

**\*36. Synthesis of novel cathepsin K inhibitors containing N-aromatic piperazine moiety**

Bommana, Rupesh R., Jin, J., Zhang, S., Wen, L., and McConnell, Rose M. Western Illinois University, Macomb, IL.

**\*37. Development of new selenium antioxidants**

Qarah, A., Jin, J., and Zhang, S., Western Illinois University, Macomb, IL.

**\*38. Progressive synthesis of a potential cathepsin K inhibitor**

Bongarala, V., Jin, J., Zhang, S., Wen, L., and McConnell, Rose M. Western Illinois University, Macomb, IL.

**\*39. Comparison of GC/FID, GC/ECD and GC/MS for determination of organochlorine pesticides in water**

Kunuru, Prashant G., Taylor, Mercedes M., and Guan, H., Western Illinois University, Macomb, IL.

**\*40. Evaluation of different solid phase sorbents for the extraction of benzodiazepines in water**

Nagabandi, S., Fitzgerald, Samantha M., Guan, H., Western Illinois University, Macomb, IL.

**\*41. Determination of aflatoxins b1, b2, g1 and g2 in corn products using disposable pipette extraction followed by HPLC analysis**

Fatima, A., Munster, Lisa A., Guan, H., Western Illinois University, Macomb, IL.

**\*42. Analysis of explosives in water using solid phase extraction and HPLC**

Taylor, Mercedes M., Stewart, Katelyn J., Bonnell, Lauren E., Guan, H., Western Illinois University, Macomb, IL.

**\*43. A chemical stability study of the N-terminal half of the Calcium binding domain of *NADPH oxidase 5***

Dickerson, Megan L., Tatro, Allison C., Reynolds, Nicole R., and Wei, C.-C., Southern Illinois University Edwardsville, Edwardsville, IL.

**\*44. Ethopropazine Complexes of Transition Metals: Antioxidant and Radical Scavenging Activities**

Debbeti, Varun; Ahmad, Tarab J., Kouassi, Gilles, K., Made Gowda, Netkal M. Western Illinois University, Macomb, IL.

**\*45. Metal-Promethazine Complexes: Synthesis and Characterization**

Manasani, Pavankumar, Ahmad, Tarab, J., Kouassi, Gilles, K., Made Gowda, Netkal M. Western Illinois University, Macomb, IL.

**46. Chemical vapor deposition of TiO<sub>2</sub>**

Harrison, Nicole L., and Flint, Edward B. Bradley University, Peoria, IL.

**Division: Earth Science**

**\*47. Hermosa Formation, Silverton, CO, sediment source area petrographic analysis**

Pourtabib, Kristina P. and Burns, Diane M. Eastern Illinois University, Charleston, IL.

## **Division: Environmental Science**

### **\*48. Effects of Prescribed Burning on Grassland Avifauna at Riverlands Migratory Bird Sanctuary**

Wood, Travis J.<sup>1</sup>, Essner, Richard L.<sup>1</sup>, Minchin, Peter R.<sup>1</sup> and Deutsch, Charlie.<sup>2</sup> <sup>1</sup>Southern Illinois University Edwardsville, Edwardsville, IL. <sup>2</sup>U.S. Army Corps of Engineers, West Alton, MO.<sup>2</sup>

### **\*49. Evaluating green roof coverage of various green roof establishment methods**

Buckles, Brittany<sup>1</sup>, Retzlaff, Bill<sup>1</sup>, Krutsinger, Roxane<sup>1</sup>, Jost, Vic<sup>2</sup>, Morgan, Susan<sup>1</sup> and Luckett, Kelly<sup>3</sup>. <sup>1</sup>Southern Illinois University Edwardsville, Edwardsville, IL. <sup>2</sup>Jost Greenhouses, Des Peres, MO. <sup>3</sup>Green Roof Blocks, Lake Saint Louis, MO.

### **\*50. Lead contamination of the biota of Horseshoe Lake, Madison, Co.**

Wilson, Matthew J., Brugam, Richard, B., Lin, Zhi Qing and Brunkow, Paul. Southern Illinois University Edwardsville, Edwardsville, IL.

### **\*51. The paleomicrobiology and geomicrobiology of the Dakhleh Oasis, Egypt with scanning electron microscopy**

Quesnell, Kathryn A., Adelsberger, Katherine and Dybas, Linda. Knox College, Galesburg, IL.

### **\*52. Storm water runoff of residential green roof systems**

Mosby, Katie<sup>1</sup>, Murphy, Dan<sup>1</sup>, Morgan, Susan<sup>1</sup>, Jost, Vic<sup>2</sup>, Luckett, Kelly<sup>3</sup> and Retzlaff, Bill<sup>1</sup>. <sup>1</sup>Southern Illinois University Edwardsville, Edwardsville, IL. <sup>2</sup>Jost Greenhouses, Des Peres, MO. <sup>3</sup>Green Roof Blocks, Lake Saint Louis, MO.

## **Division: Health Sciences**

### **53. Zyvox influences murine immune responses**

Hurt, Mariah, Wells-Kestur, Adrienne, Ruiz, Catherine, Robinson, Shonnece and Kitz, Dennis J. Southern Illinois University Edwardsville, Edwardsville, IL

### **\*54. The life expectancy of citizens in Kane County is significantly lower than citizens of Illinois of the United States**

Malmborg, Whitney A. and Beck, Hans T. Aurora University, Aurora, IL

### **\*55. The effects of Chloroquine and UV radiation on HL-60 cell line**

Wilm, Kyle R. and Wanda, Paul. Southern Illinois University Edwardsville, Edwardsville, IL

### **\*56. Effect of 8-cyclopentyltheophylline on heart rate in newborn rats**

Workman, Erika R. and McGilliard, Kip L. Eastern Illinois University, Charleston, IL

### **\*57. Effects of 8-cyclopentyltheophylline on respiration in newborn rats**

Albers, Christine E. and McGilliard, Kip L. Eastern Illinois University, Charleston, IL

### **Division: Microbiology**

**\*58. Phenotypic and genotypic characterization of *Escherichia coli* isolated from surface waters in Illinois and Missouri**

Janezic, Kristopher J., Hendricks, Eric W., Theisen, Alexandra N., Ferry, Blake, Roberts, Morgan E., Murphy, Samantha, Scott, Sarah M., Janiga, Brian A., Johnson, Tiffany, Hung, Kai F., and Daniel, Steven L. Eastern Illinois University, Charleston, IL.

**59. Growth and sucrase activity of *Leuconostoc* in defined growth media.**

Becker, Nick P., Holt, Scott M. and McAndrew, John. Western Illinois University, Macomb, IL

**60. Influence of culture conditions on hydrogen peroxide synthesis by *Lactobacillus jensenii***

Pohren, Adonica S. and Holt, Scott M. Western Illinois University, Macomb, IL

**61. Alternansucrase gene structure from *Leuconostoc* B-1498**

Holt, Scott M. Western Illinois University, Macomb, IL

**\*62. Antibiotic susceptibility testing of non-*Escherichia coli* thermotolerant coliforms (KEC) isolated from streams feeding into the Mississippi River in Hancock County, Illinois**

Pierre, Myrtha, and French, Wendell L. Western Illinois University, Macomb, IL

**63. Sequencing of *Salmonella* strains During Host Shift**

Brauer, Shari D., Swarm, Steven A. and Dunkley, Eugene A. Greenville College, Greenville, IL.

**64. Biofilm development: Many characters, different plots for *Staphylococcus aureus* and *Escherichia coli***

Blazina, Erin M., Pecherek, Aleksander W., Figus, Elizabeth, Floren, Elizabeth A., Keleher, Jason and Kavouras, Jerry H. Lewis University, Romeoville, IL

**\*65. Antibiotic susceptibility testing of *Escherichia coli* thermotolerant coliforms (KEC) isolated from streams that feed into the Mississippi River in Hancock County, Illinois.**

Parker, Morris L. Western Illinois University, Macomb, IL

### **Division: Physics, Mathematics & Astronomy**

**\*66. Arecibo calibrators for galactic observations**

Halbe, Daniel and Araya, Esteban, D, Western Illinois University, Macomb, IL, USA

**67. Variability of molecular masers in NGC 7538 IRS 1**

Ezerskyte, Edita and A., Araya, Esteban, D, Western Illinois University, Macomb, Illinois, USA

### **Division: Zoology**

**68. Ontogeny of body shape and diet in Freshwater Drum (*Aplodinotus grunniens*)**

Essner, Jr., Richard, L.<sup>1</sup>, Patel, Roma<sup>1</sup>, and Reilly, Stephen, M.<sup>2</sup><sup>1</sup>Southern Illinois University Edwardsville, Edwardsville, IL <sup>2</sup>Ohio University, Athens, OH.

**69. A Kinematic Comparison of Serpentine Locomotion in Snakes (Suborder: Serpentes)**

Bulla, Andrew, J., and Essner, Richard, L., Southern Illinois University Edwardsville, Edwardsville, IL.

**70. Morphological Variation of the Pectoral Girdle in Basal Anurans**

Wells, Ashley, and Essner, Jr., Richard, L., Southern Illinois University Edwardsville, Edwardsville, IL.

**\*71. Locomotor Behavior, Microhabitat Use, and Activity Patterns in the Cane Toad, *Bufo marinus*, (Anura: Bufonidae)**

McClenagan, Nicholas, D., and Essner, Jr., Richard, L., Southern Illinois University Edwardsville, Edwardsville, IL.

**\*72. Growth and Development of the Raccoon (*Procyon lotor*) Mandible**

Elting, Mitchell, and Kohn, Luci, Southern Illinois University Edwardsville, Edwardsville, IL.

**\*73. Scapula Growth and Development in Raccoons (*Procyon lotor*)**

Spung, Melanie, and Kohn, Luci. Southern Illinois University Edwardsville, Edwardsville, IL.

**\*74. Mussel Communities in the Sangamon River, IL**

Park, Tracey, J, Wildenberg, Amanda, J., Moody, Cassi, J, Laursen, Jeff, R, and Colombo, Robert, E. Eastern Illinois University, Charleston, IL.

**\*75. Individual recognition in the olive nerite snail *Neritina reclinata* (Neritopsina: Neritidae) as determined by clustering behavior**

Guinn, Amanda, Robertson, Marianne, and Watson, Casey, Millikin University, Decatur, IL

**\*76. Analysis of stride patterns in wolf spiders and fishing spiders**

Nichting, Brittany, and Brunkow, Paul, Southern Illinois University Edwardsville, Edwardsville, IL.

**\*77. Vibrational signal transmission in a grass versus an invasive plant: possible effects on wolf spider courtship?**

Lemenager, Kristi, and Brunkow, Paul, Southern Illinois University Edwardsville, Edwardsville, IL.

**78. Differences in hematocrit and body condition indices between Northern Cardinals and Indigo Buntings**

Hubble, Cody, N, and Wilcoxon, Travis E. Millikin University, Decatur, IL.

**79. Effects of Supplemental Feeding on Antioxidant Levels in Bird Species**

Hogan, Brianna, M, and Wilcoxon, Travis E. Millikin University, Decatur, IL.

**80. The effect of long-term antioxidant supplementation on survival and function of endogenous antioxidants**

Ridenbark, Tarah, Wessling, Ryan, and Williams, Jason. Southern Illinois University Edwardsville, Edwardsville, IL.



**\*81. The effect of repeated freezing on oxidative damage and survival in the freeze-tolerant goldenrod gall fly, *Eurosta solidaginis***

Doelling, Adam, R.W., and Williams, Jason. Southern Illinois University Edwardsville, Edwardsville, IL.

**82. Does cryoprotectant production influence bound water content in the freeze-tolerant goldenrod gall fly, *Eurosta solidaginis*?**

Griffis, Nicole, and Williams, Jason. Southern Illinois University Edwardsville, Edwardsville, IL.

**83. Patterns of bird-window collisions in an urban landscape**

Hager, Stephen, B<sup>1</sup>, Cosentino, Bradley, J<sup>2</sup>, McKay, Kelly, J<sup>3</sup>, Monson, Cathleen, D<sup>3</sup>, Zuurdeeg, Walter, M<sup>4</sup>, and Blevins, Brian, L, Pete<sup>5</sup>. <sup>1</sup>Augustana College, Rock Island, IL, <sup>2</sup>Department of Natural Resources and Environmental Sciences, University of Illinois, Urbana, IL, <sup>3</sup>BioEco Research and Monitoring Center, Hampton, IL, <sup>4</sup>Department of Geography, Western Illinois University, Moline, IL, <sup>5</sup>Peterson's Wild Bird Shop, Davenport, IA.

**84. Endocrine mechanisms of evolutionary changes in body size of closely related *Anolis* lizards**

Mueller, Eric, and Jennings, David, H. Southern Illinois University Edwardsville, Edwardsville, IL.

**85. Pelvic fin development in Mottled Sculpins (*Cottus bairdi*: Cottidae) and Slenderhead Darters (*Percina phoxocephala*: Percidae)**

Baggett, Ashlynn, and Jennings, David, H., Southern Illinois University Edwardsville, Edwardsville, IL.

**86. Comparative jaw muscle development and metamorphosis in tadpoles with divergent larval feeding strategies (planktivory vs. herbivory)**

Crowden-Headrick, Kristen, and Jennings, David, H., Southern Illinois University Edwardsville, Edwardsville, IL.

**87. Forensic Study: Species Identification Using Hair Microscopy**

Manjerovic, Mary Beth<sup>1</sup>, Green, Michelle, L.<sup>2</sup>, Mateus-Pinilla, Nohra<sup>1</sup>, and Novakofski, Jan<sup>2</sup>. <sup>1</sup>Illinois Natural History Survey, Champaign, IL, <sup>2</sup>Department of Animal Sciences, University of Illinois, Urbana, IL.

**\*88. Allometry in male aedeagus length and effect on copulation duration in *Anastrepha suspense* (Diptera: Tephritidae)**

Inboden, Taylor, J, Simon, Kimberly, Smith, Karli, Davies, Robert, Dust, Holly, J, and Fritz, Ann, H. Eastern Illinois University, Charleston, IL.

## ORAL PRESENTATION SESSIONS AT A GLANCE

	<b>Room E117</b>	<b>Room A112</b>	<b>Room A107</b>	<b>Room A210</b>	<b>Room D107</b>	<b>Room A106</b>
8:00 AM		Chemistry		Health/Micro		Zoology
8:15 AM	Botany	Chemistry	Cell Mol Dev	Health/Micro		Zoology
8:30 AM	Botany	Chemistry	Cell Mol Dev	Health/Micro		Zoology
8:45 AM	Botany	Chemistry	Cell Mol Dev	Health/Micro		Zoology
9:00 AM	<b>Break</b>	<b>Break</b>	<b>Break</b>	<b>Div. Meeting</b>		<b>Break</b>
9:15 AM	Botany	Chemistry	Cell Mol Dev		Phys Math Astro	Zoology
9:30 AM	Botany	Chemistry	Cell Mol Dev	Earth Sci	Phys Math Astro	Zoology
9:45 AM	Botany	Chemistry	Cell Mol Dev	Earth Sci	Phys Math Astro	Zoology
10:00 AM	Botany	Chemistry	Cell Mol Dev	Env Sci	CS	Zoology
10:15 AM	Botany	Chemistry	Cell Mol Dev	Env Sci	CS	Zoology
10:30 AM	<b>Break</b>	<b>Break</b>	<b>Break</b>	<b>Div. Meeting</b>	<b>Div. Meeting</b>	<b>Break</b>
10:45 AM	Botany	Chemistry	Cell Mol Dev	Env Sci	SMT Ed	Zoology
11:00 AM	Botany	Chemistry	Cell Mol Dev	Env Sci	SMT Ed	Zoology
11:15 AM	Botany	Chemistry	Cell Mol Dev	Env Sci	SMT Ed	Zoology
11:30 AM	Botany	Chemistry	Cell Mol Dev	Env Sci	SMT Ed	Zoology
11:45 AM	<b>Div. Meeting</b>	Chemistry	<b>Div. Meeting</b>	Env Sci	SMT Ed	Zoology
12:00 PM		Chemistry		<b>Div. Meeting</b>	<b>Div. Meeting</b>	Zoology
12:15 PM		Chemistry				Zoology

### Division Meeting Schedule

<b>Division</b>	<b>Time</b>	<b>Room</b>
Botany	11:45 AM	SMC E117
Cell, Molecular & Developmental Biology	11:45 AM	SMC A107
Chemistry	After lunch	Student Union
Computer Science	10:30 AM	SMC D107
Earth Science	10:30 AM	SMC A210
Environmental Science	12:00 PM	SMC A210
Health Sciences/Microbiology	9:00 AM	SMC A210
Physics, Mathematics, & Astronomy	10:30 AM	SMC B106
Science Math Technology Education	12:00 PM	SMC D107
Zoology	After lunch	Student Union

## ORAL PRESENTATION SESSIONS

Oral presentations are Saturday, March 31, in the Umbeck Science and Mathematics Center from 8:00 AM – 12:30 PM. Division business meetings will convene at the close of each session unless otherwise scheduled by the Division Chair. An asterisk (\*) indicates the presenters eligible for a Student Presentation Award.

### Division: Botany

SMC – Room E117

Session Moderator – Barbara Carlsward

- 8:15 AM     **1. Changes in tree species composition, abundance, and diversity in a remnant historic prairie grove in central Illinois, USA over thirty-four years**  
Anderson, Roger C. Illinois State University, Normal, IL.
- 8:30 AM     **\*2. Effects of shading, seed longevity, and soil mixes on germination of *Besseyia bullii* – a rare species in Illinois**  
Curtis, Marnelle<sup>1</sup> and Molano-Flores, Brenda<sup>2</sup>. <sup>1</sup>University of Illinois, Urbana, IL. <sup>2</sup>University of Illinois, Illinois Natural History Survey, Champaign, IL.
- 8:45 AM     **3. Final results of the reassessment of Category I Natural Areas**  
Schennum, Wayne E.<sup>1</sup>, Vogel, Randy L.<sup>1</sup>, Wilker, John<sup>2</sup>, and Wibbenmeyer, Joshua A.<sup>3</sup>. <sup>1</sup>Applied Ecological Services, West Dundee, IL. <sup>2</sup>Illinois Department of Natural Resources, Springfield, IL. <sup>3</sup>Applied Ecological Services, Glen Carbon, IL.
- 9:00 AM     **Break**
- 9:15 AM     **4. New tools for the analysis of community change with applications in conservation, management and restoration**  
Minchin, Peter R. Southern Illinois University Edwardsville, Edwardsville, IL.
- 9:30 AM     **\*5. Presence and intensity of pre-dispersal seed predation in response to habitat quality**  
Leja, Margaux<sup>1</sup>, Chi, Katherine<sup>1</sup>, and Molano-Flores, Brenda<sup>2</sup>. <sup>1</sup>University of Illinois, Urbana, IL. <sup>2</sup>University of Illinois, Illinois Natural History Survey, Champaign, IL.
- 9:45 AM     **\*6. Survival of *Platanthera holochila* (Orchidaceae) seedlings *in vitro* and following reintroduction in Hawaii**  
David, Shanna E.<sup>1</sup>, Oppenheimer, Hank<sup>2</sup>, Perlman, Steven P.<sup>3</sup>, Palomino, Anna<sup>4</sup>, and Zettler, Lawrence W.<sup>1</sup>. <sup>1</sup>Illinois College, Jacksonville, IL. <sup>2</sup>Plant Extinction Prevention Program, Maui, HI. <sup>3</sup>National Tropical Botanical Garden, Kauai, HI. <sup>4</sup>Olinda Rare Plant Facility, Maui, HI.
- 10:00 AM    **\*7. Response of floodplain forest communities to modified hydrology in Mississippi River Pool 24**  
Israelitt, David and Schulz, Kurt. Southern Illinois University Edwardsville, Edwardsville, IL.
- 10:15 AM    **\*8. Effects of habitat quality on floral morphology and reproductive output in the rare plant *Besseyia bullii* (Plantaginaceae)**  
Chavez, Samantha<sup>1</sup>, Collins, Michelle<sup>1</sup>, Chi, Katherine<sup>1</sup>, and Molano-Flores, Brenda<sup>2</sup>. <sup>1</sup>University of Illinois, Urbana, IL. <sup>2</sup>University of Illinois, Illinois Natural History Survey, Champaign, IL.
- 10:30 AM    **Break**

- 10:45 AM **\*9. Investigating the role of genetic diversity and pollination biology as potential causes for reproductive failure in *Asclepias lanuginosa***  
Kim, Eun Sun<sup>1</sup>, Zaya, David N.<sup>1</sup>, Fant, Jeremie B.<sup>2</sup>, and Ashley, Mary V.<sup>1</sup>.  
<sup>1</sup>University of Illinois Chicago, Chicago, IL. <sup>2</sup>Chicago Botanic Garden, Glencoe, IL.
- 11:00 AM **\*10. *Ex situ* conservation of threatened and endangered Illinois native species at the Whiteside Garden**  
Daugherty, Bradley M., Coons, Janice, Coutant, Nancy E, and Whiteside, Wesley C. Eastern Illinois University, Charleston, IL.
- 11:15 AM **11. Effects of microclimate on the reproductive biology of *Besseyia bullii* (Plantaginaceae), a rare plant**  
Robinson, Dana O.<sup>1</sup>, Chi, Katherine<sup>2</sup>, and Molano-Flores, Brenda<sup>2</sup>. <sup>1</sup>Knox College, Galesburg, IL. <sup>2</sup>University of Illinois, Illinois Natural History Survey, Champaign, IL.
- 11:30 AM **12. A critique the Floristic Quality Index (FQI)**  
Schulz, Kurt E. Southern Illinois University Edwardsville, Edwardsville, IL.
- 11:45 AM **Division Meeting**  
SMC Room E117

**Division: Cell, Molecular & Developmental Biology**

SMC – Room A107

Session Moderator – Tom Fowler

- 8:15 AM **\*1. Role of lipids and peroxynitrite in beta cell defects under chronic nutrient overload**  
Vernier, Stephanie B., Schober, Joseph, Neumann, William L., Wanda, Paul E. and Kwon, Guim. Southern Illinois University Edwardsville, Edwardsville, IL.
- 8:30 AM **\*2. Late embryogenesis abundant protein ameliorates inhibition of mitochondrial respiration**  
Marunde, Matthew R.<sup>1</sup>, Hand, Steven C.<sup>2</sup>, Li, Shumin<sup>2</sup> and Menze, Michael A.<sup>1</sup>  
<sup>1</sup>Eastern Illinois University, Charleston, IL, <sup>2</sup>Louisiana State University, Baton Rouge, LA.
- 8:45 AM **3. Identification of candidate genes driving liver function using whole genome microarrays**  
Estanda, Arnold B., and Bulla, Gary A. Eastern Illinois University, Charleston, IL.
- 9:00 AM **Break**
- 9:15 AM **\*4. Postglacial history of an Eastern North American aquatic insect, *Acroneuria frisoni* Stark & Brown (Plecoptera: Perlidae)**  
Pessino, Massimo<sup>1</sup>, Chabot, Ember T.<sup>1</sup>, Giordano, Rosanna<sup>2</sup> and DeWalt, R. Edward,<sup>1</sup>University of Illinois, Champaign, IL, <sup>2</sup>Illinois Natural History Survey, Champaign, IL.
- 9:30 AM **5. Evidence for an Sfi1p-like/centrin complex in *Vorticella convallaria* (Vorticellidae)**  
Konior, Katarzyna, McCutcheon, Suzanne M., and Buhse, Jr., Howard E. University of Illinois Chicago, Chicago, IL.

- 9:45 AM     **\*6. SR-135, a peroxyxynitrite decomposing catalyst, prevents weight gain and reduces fasting blood glucose levels in B6D2F1 mice fed with a high fat diet**  
Johns, Michael E., Rausaria, Smita, Kamadulski, Andrew, Neumann, William L., Wanda, Paul, and Kwon, Guim, Southern Illinois University Edwardsville, Edwardsville, IL.
- 10:00 AM     **\*7. The use of Mitotracker to determine the feeding preferences for the carnivorous macrostomal form of *Tetrahymena vorax* (Tetrahymenidae)**  
Dyrey, Grzegorz, Lee, Elizabeth K., Kutor, Alfreda S., Patel, Meera R., Zantout, Linda, and McCutcheon, Suzanne M. University of Illinois Chicago, Chicago, IL.
- 10:15 AM     **\*8. Protective mechanisms against water stress evaluated in insect cells**  
Anderson, John M.<sup>1</sup>, Harder, Avril M.<sup>1</sup>, Toner, Mehmet<sup>2</sup>, Chakraborty, Nilay N.<sup>2</sup>, and Menze, Michael A.<sup>1</sup> <sup>1</sup>Eastern Illinois University, Charleston, IL, <sup>2</sup>Center for Engineering in Medicine, Harvard Medical School, Boston, MA.
- 10:30 AM     **Break**
- 10:45 AM     **\*9. Life without water: intracellular expression of late embryogenesis abundant (LEA) protein increases dehydration tolerance of eukaryotic cells**  
Samarajeewa, Dilini A.<sup>1</sup>, Adikari, Thiruni<sup>1</sup>, Hand, Steven C.<sup>2</sup>, and Menze, Michael A.<sup>1</sup> <sup>1</sup>Eastern Illinois University, Charleston, IL, <sup>2</sup>Louisiana State University, Baton Rouge, LA.
- 11:00 AM     **\*10. The effects of acyl CoA:diacylglycerols acyltransferase 1 inhibitor on beta-cell function**  
Brenegan, Teryn V., Neumann, William L., I, Bhargav M., Vernier, Stephanie B., Wanda, Paul E. and Kwon, Guim. Southern Illinois University Edwardsville, Edwardsville, IL.
- 11:15 AM     **\*11. Transcriptome Analysis of UV-Irradiated *Dictyostelium discoideum* (Dictyosteliidae) through RNA Sequencing**  
Mulani, Shaunak and Jones-Rhoades, Matthew W. Knox College, Galesburg, IL.
- 11:30 AM     **\*12. Preservation of beta-cell function by peroxyxynitrite scavenger under chronic nutrient overload**  
Bhargav, Patel, Neumann, William L., Brenegan, Teryn V., Vernier, Stephanie B., Wanda, Paul E., and Kwon, Guim. Southern Illinois University Edwardsville, Edwardsville, IL.
- 11:45 AM     **Division Meeting**  
SMC Room A107

**Division: Chemistry**

SMC – Room A112

Session Moderator – T.K. Vinod

- 8:00AM     **\*1. Nano/Microencapsulation of *Piroxicam* into dual biopolymer matrices: Effect of pH, ionic strength, temperature, and water activity of encapsulation and release**  
Gogineni, Varalakshmi L., Boley, Mark M., Made Gowda, Netkal M., and Kouassi, Gilles K. Western Illinois University, Macomb, IL.
- 8:15 AM     **\*2. Investigation of syneresis and phase separation in emulsions and amorphous systems**  
Shashank, Akku, Made Gowda, Netkal M, Boley, Mark, M., Ahmad, Tarab, and Kouassi, Gilles K. Western Illinois University, Macomb, IL.

- 8:30 AM **\*3. A study of the stability of biopolymer-reinforced emulsion systems containing lipophilic bioactive ingredients**  
Tournear, Jennifer, Gogineni, Vara, L., and Kouassi, Gilles K. Western Illinois University, Macomb, IL.
- 8:45 AM **\*4. Investigation of the antioxidant activity of berry polyphenols in linoleic acid model**  
Diawara, Fatoumata, Afithile, Meshak, Made Gowda, Netkal M., and Kouassi, Gilles K. Western Illinois University, Macomb, IL.
- 9:00 AM **Break**
- 9:15 AM **\*5. Eco- and User-friendly procedure for oxidative cleavage of alkenes: Optimization and development of an undergraduate experiment**  
Norris, Brianna R., Kupireddy, Nikhil R., and Vinod, Thottumkara K. Western Illinois University, Macomb, IL.
- 9:30 AM **\*6. Iodine atom economic co-iodination of alkenes: Selective and differential functionalization of the two double bonds in dienes**  
Pandey, Sonali R., Medikonda, Tejaswini, and Vinod, Thottumkara K. Western Illinois University, Macomb, IL.
- 9:45 AM **\*7. New insights into an alternate mechanism for oxidation of alcohols using iodine (V) reagents**  
Madne, Kishor K., Raya, Balaram R., and Vinod, Thottumkara K. Western Illinois University, Macomb, IL.
- 10:00 AM **\*8. Using photoactivated nanoparticles as photodynamic therapeutic agent to treat prostate cancer**  
Madavarapu, Kamala B., and Fu-Giles, Patty K. Governors State University, University Park, IL.
- 10:15 AM **\*9. Photodynamic therapy for skin carcinomas**  
Sudershan, Nikhil B., and Fu-Giles, Patty K. Governors State University, University Park, IL, USA
- 10:30 AM **Break**
- 10:45 AM **\*10. Antioxidant and Radical Scavenging Activities of Transition Metal-Chlorpromazine Complexes**  
Naini, Yakub R., Gouru, Dayakar R., Ahmad, Tarab J., Kouassi, Gilles K.; Made Gowda, Netkal M. Western Illinois University, Macomb, IL.
- 11:00 AM **\*11. Transition Metal-Promazine Complexes: Antioxidant and Radical Scavenging Activities**  
Gouru, Dayakar R., Thakkalapally, Vishnuvardhan R., Ahmad, Tarab J., Kouassi, Gilles K., Made Gowda, Netkal, M. Western Illinois University, Macomb, IL.
- 11:15 AM **\*12. Kinetics of Pyridoxine Oxidation by Chloramine-T in Acid Solutions**  
Thakkalapally, Vishnuvardhan R., Gouru, Dayakar R., Ahmad, T., Kouassi, Gilles K., Terry, Ronald J., and Made Gowda, Netkal M. Western Illinois University, Macomb, IL.
- 11:30 AM **\*13. Emission spectra of metals from electrical arc, hollow cathode lamp, and flame sources**  
Brashler, Kyle and Flint, Edward B. Bradley University, Peoria, IL.
- 11:45 AM **14. Synthesis of coordination polymers**  
Alleman, Tyler, and Flint, Edward B. Bradley University, Peoria, IL.
- 12:00 AM **15. Coordination polymers: a rapidly expanding field of study**  
Kellogg, Avery, D., and Flint, Edward B. Bradley University, Peoria, IL.

12:15 AM **16. Terephthalate-based Coordination Polymers**  
Hinman, Jordan, J. and Flint, Edward B. Bradley University, Peoria, IL.  
**Division Meeting**  
To be held after lunch in the Seymour Union

**Division: Computer Science**

SMC – Room D107

Session Moderator – Jim McQuillan

10:00 AM **\*1. Enhancing the Levenshtein String Edit Distance algorithm to identify source code clones**  
Thurman, Jacob and Maskarinec, Martin. Western Illinois University, Macomb, IL.  
10:15 AM **\*2. Cache Management System for Deductive Database**  
Williams, Larry, S. and Maskarinec, Martin. Western Illinois University, Macomb, IL.  
10:30 AM **Division Meeting**  
SMC Room D107

**Division: Earth Science**

SMC – Room A210

Session Moderator – Jim Riley

9:30 AM **1. Effect of floodplain position on CRP tree growth, East Central Illinois**  
Gutowski, Vincent P. Eastern Illinois University, Charleston, IL.  
9:45 AM **2. Field investigation of three-dimensional flow structure and bed morphology at a low junction angle confluent meander bend**  
Riley, James D.<sup>1</sup> and Rhoads, Bruce L.<sup>2</sup> <sup>1</sup>Eastern Illinois University, Charleston, IL.  
<sup>2</sup>University of Illinois at Urbana-Champaign, Urbana, IL.  
10:30 AM **Division Meeting**  
SMC Room A210

**Division: Environmental Science**

SMC – Room A210

Session Moderator – Richard Brugam

10:00 AM **\*1. Tracing long-term environmental change in the Illinois River using fish collagen**  
Little, Kayla L., Brugam, Richard B., Kohn, Luci, Vogel, Gregory G. and Brunkow, Paul. Southern Illinois University Edwardsville, Edwardsville, IL.  
10:15 AM **2. Identifying the source of nitrogen to Horseshoe Lake, Madison County, IL using stable nitrogen isotopes**  
Brugam, Richard B., Karthic, Indu and Retzlaff, William A. Southern Illinois University Edwardsville, Edwardsville, IL.  
10:30 AM **Break**  
10:45 AM **\*3. Impact of anaerobic soil environment on the adsorption, desorption and degradation of [14C] Metolachlor**  
Kanissery, Ramdas<sup>1</sup> and Sims, Gerald K.<sup>2</sup> <sup>1</sup>University of Illinois Urbana Champaign, Urbana, IL. <sup>2</sup>USDA-ARS, Urbana, IL.

- 11:00 AM **\*4. The bioaccumulation and transport pathway of heavy metals in Granite City, Illinois**  
Martin, Samantha, Delmore, Stephanie, Wilson, Matthew, Brugam, Richard, Schulz, Kurt and Kohn, Luci. Southern Illinois University Edwardsville, Edwardsville, IL.
- 11:15 AM **5. Survey and habitat evaluation for Franklin's Ground Squirrel in Sangamon County, Illinois**  
Ting, Tih-Fen, McNamara, Joseph and Young, Christopher. University of Illinois at Springfield, Springfield, IL.
- 11:30 AM **\*6. Microbial Volatilization of Selenium by *Pseudomonas sp.* (STL-6) Isolated from the Soil- *Stanleya pinnata* System**  
Zhu, Yangyu<sup>1</sup>, Banuelos, G.S.<sup>2</sup> and Lin, Z.-Q.<sup>1</sup> <sup>1</sup>Southern Illinois University-Edwardsville, Edwardsville, IL. <sup>2</sup>USDA-ARS, Parlier, CA.
- 11:45 AM **7. The 20th century accumulation of organohalogenated compounds in Illinois river otters**  
Carpenter, Samantha K.<sup>1</sup>, Mateus-Pinilla, Nohra E.<sup>1</sup>, Singh, Kuldeep<sup>2</sup>, Lehner, Andreas<sup>3</sup>, Satterthwaite-Phillips, Damian<sup>1</sup>, Bluett, Robert D.<sup>4</sup>, Rivera, Nelda A.<sup>1</sup> and Novakofski, Jan<sup>5</sup>. <sup>1</sup>Illinois Natural History Survey, Champaign, IL. <sup>2</sup>College of Veterinary Medicine, Urbana, IL. <sup>3</sup>Diagnostic Center for Population and Animal Health, Michigan State University, Lansing, MI. <sup>4</sup>Illinois Department of Natural Resources, Springfield, IL. <sup>5</sup>Department of Animal Sciences, University of Illinois Urbana-Champaign, Champaign, IL.
- 12:00 PM **Division Meeting**  
SMC Room A210

### **Division: Health Sciences**

SMC – Room A210

Session Moderator – Vance McCracken

- 8:00 AM **\*1. The effect of depression on healing time of clavicle fractures**  
Thomas, Emily and Zelman, Mark E. Aurora University, Aurora, IL
- 8:15 AM **\*2. Using health science questionnaire to survey the influence of the internet on self diagnosis by college staff and students: cyberchondria affects healthcare decisions**  
Galloway, Jennifer A., Beck, Hans T. and Rudek, David J. Aurora University, Aurora, IL
- 8:30 AM **3. Bio-Gerontology for the pre-professional student**  
Lloyd, Johnny K. Aurora University, Aurora, IL
- 9:00 AM **Division Meeting**  
SMC Room A210

### **Division: Microbiology**

SMC – Room A210

Session Moderator – Vance McCracken

- 8:45 AM **\*1. Possible relationship between in vivo S-adenosyl-L-methionine hydrolase activity and quorum sensing in *Escherichia coli***  
Walworth, Grace and Hughes, Jeffrey A. Millikin University, Decatur, IL.



9:00 AM **Division Meeting**  
SMC Room A210

**Division: Physics, Mathematics & Astronomy**

SMC – Room D107

Session Moderator – Casey Watson

- 9:15 AM **\*1. Circle beyond center and radius: Apollonius definition of a circle**  
Koissi, Marie Claire and Liu, Shufang, Western Illinois University, Macomb, IL.
- 9:30 AM **2. Applications of fuzzy regression to insurance**  
Koissi, Marie Claire, Western Illinois University, Macomb, IL.
- 9:45 AM **\*3. Modeling formaldehyde maser variability with Easy Java Simulations**  
Carlson, Jeff, C. and Araya, Esteban, D., Western Illinois University, Macomb, Illinois.
- 10:30 AM **Division Meeting**  
SMC Room B106

**Division: Science, Mathematics, and Technology Education**

SMC – Room D107

Session Moderator – Kelly Barry

- 10:45 AM **1. Partnership and sustainability in science and math education: results from Aurora University's IMSP masters degree programs**  
Beck, Hans, Davis, Jane, and Othman, Saib. Aurora University, Aurora, IL.
- 11:00 AM **2. Re-designing the Human Body Systems**  
Cherif, Abour<sup>1</sup>, Jedlicka, Dianne<sup>2</sup> and Phillips, William<sup>3</sup>. <sup>1</sup> DeVry University, Addison, IL. <sup>2</sup> DeVry University, Frankfort, IL. <sup>3</sup> DeVry University, Arlington, VA.
- 11:15 AM **\*3. A study on the effect of using showcase portfolios as an assessment in upper level high school science courses**  
Scholle, Tiffany<sup>1,2</sup> and Beck, Hans<sup>1</sup>. <sup>1</sup> Aurora University, Aurora, IL. <sup>2</sup> Oswego East High School, Oswego, IL.
- 11:30 AM **4. The Science of the History of Fashion: from the Flintstones to the Jetsons**  
Jedlicka, Dianne<sup>1,2</sup>, Gaul, Emily<sup>1</sup>, Rowberg, Kathy<sup>3</sup>, and Widing, Robert<sup>4</sup>.  
<sup>1</sup> Columbia College Chicago, IL. <sup>2</sup> DeVry University, Frankfort, IL. <sup>3</sup> Purdue Calumet, Hammond, IN. <sup>4</sup> University of Illinois at Chicago, Chicago, IL.
- 11:45 AM **\*5. Improving ISAT Scores in science of at-risk students from low-income families by promoting vocabulary development to enhance science literacy**  
Mestek, Gerry<sup>1,2</sup> and Beck, Hans<sup>1</sup>. <sup>1</sup> Aurora University, Aurora, IL. <sup>2</sup> Cowherd Middle School, Aurora, IL.
- 12:00 PM **Division Meeting**  
SMC Room D107

**Division: Zoology**

SMC – Room A106

Session Moderator – David Duvernell

- 8:00 AM     **\*1. Cranial Morphology of Raccoon Subspecies (*Procyon lotor lotor* and *Procyon lotor hirtus*) in Illinois**  
Longfellow, Lindsay, and Kohn, Luci. Southern Illinois University Edwardsville, Edwardsville, IL.
- 8:15 AM     **\*2. Investigating Morphological Integration in Mandibles of Two Mustelid Species**  
Oster, Molly, Schorsch, Robert, and Kohn, Luci. Southern Illinois University Edwardsville, Edwardsville, IL.
- 8:30 AM     **3. Hydrologic effects on morphology in largescale stonerollers (*Campostoma oligolepis*)**  
Stoff, Brian, Matteson, Stephanie, and Brunkow, Paul, Southern Illinois University Edwardsville, Edwardsville, IL.
- 8:45 AM     **\*4. Movement patterns in two closely-related species of Topminnow in a Southern Illinois Contact Zone**  
Koepp, Kate, E, Miller, Patrick, M, Law, Tab, Rigg, Brian, and Duvernell, David, D. Southern Illinois University Edwardsville, Edwardsville, IL.
- 9:00 AM     **Break**
- 9:15 AM     **\*5. The influence of habitat continuity on genetic structure among populations of two closely related topminnow species**  
Scott, Jason, M, and Duvernell, David, D. Southern Illinois University Edwardsville, Edwardsville, IL.
- 9:30 AM     **6. Beta Diversity of Stoneflies (Plecoptera) in the Midwest**  
DeWalt, R.<sup>1</sup>, Edward, Pessino, Massimo<sup>1</sup>, Cao, Yong, Tweddale, Tari<sup>1</sup>, Hinz, Leon<sup>1</sup>, and Grubbs, Scott, A.<sup>2</sup>. <sup>1</sup>University of Illinois, Illinois Natural History Survey, Champaign, IL, <sup>2</sup>Western Kentucky University, Bowling Green, KY.
- 9:45 AM     **\*7. A survey of the insects inhabiting the Florida Panther National Wildlife Refuge, including first documentation of the Mexican Bromeliad Weevil, *Metamasius callizona* (Coleoptera: Curculionidae).**  
Ray, Haleigh, A.<sup>1</sup>, Zettler, Lawrence, W.<sup>1</sup>, and Richardson, Larry, W.<sup>2</sup>. <sup>1</sup>Illinois College, Jacksonville, IL, <sup>2</sup>Florida Panther National Wildlife Refuge, Naples, FL.
- 10:00 AM    **\*8. Occurrence of Boisduval Scale, *Diaspis boisduvalii* (Hemiptera: Diaspididae), on native epiphytic orchids in Collier Co., Florida, including Fakahatchee Strand State Preserve**  
McCormick, John, P.<sup>1</sup>, Ray, Haleigh, A.<sup>1</sup>, Stice, Andrew, L.<sup>1</sup>, Stocks, Ian<sup>2</sup>, and Zettler, Lawrence, W.<sup>1</sup>. <sup>1</sup>Illinois College, Jacksonville, IL, <sup>2</sup>DPI, Florida Department Agriculture & Consumer Services, Gainesville, FL.
- 10:15 AM    **\*9. Avian hemoparasites in Illinois and their effects on health**  
Annetti, Kendall, L, and Mateus-Pinilla, Nohra. Illinois Natural History Survey, Champaign, IL.
- 10:30 AM    **Break**
- 10:45 AM    **10. The effect of supplemental feeding on white blood cell populations in Northern Cardinals (*Cardinalis cardinalis*)**  
Huber, Sarah, J, and Wilcoxon, Travis, E. Millikin University, Decatur, IL.

- 11:00 AM **\*11. Analysis of avian communities in fragmented oak-hickory forest in southwestern Illinois**  
 French, Zachary, L, Richter, Lane, A, Minchin, Peter, R, and Essner, Richard, L.  
 Southern Illinois University Edwardsville, Edwardsville, IL.
- 11:15 AM **12. Summary and Results of the Milan Bottoms Bald Eagle Night Roost Survey Project**  
 Monson, Cathleen, D.<sup>1</sup>, McKay, Kelly, J.<sup>1</sup>, Bryant, Robert, R.<sup>1</sup>, Ritter, Brian, P.<sup>2</sup>,  
 Monson, Jason, L.<sup>1</sup>, Rothe, Jennifer, A.<sup>1</sup>. <sup>1</sup>BioEco Research and Monitoring  
 Center, Hampton, IL, <sup>2</sup>Eastern Iowa Community College, Davenport, IA.
- 11:30 AM **\*13. The effects of reflectivity on bird-window collisions at Millikin University in Decatur, Illinois**  
 DeCosse, Matthew, T, Martell, Eric, C, and Horn, David, J. Millikin University,  
 Decatur, IL.
- 11:45 AM **14. In the eye of the beholder: Visual mate choice lateralization in a polymorphic songbird, the Gouldian Finch (*Erythrura gouldiae*)**  
 Templeton, Jennifer<sup>1</sup>, Mountjoy, James<sup>1</sup>, Pryke, Sarah<sup>2</sup>, and Griffith, Simon<sup>2</sup>.  
<sup>1</sup>Knox College, Galesburg, IL, <sup>2</sup>University, Sydney, Australia.
- 12:00 PM **15. Scavenging throughout the life cycle of the jumping spider, *Phidippus audax* (Hentz) (Araneae, Salticidae)**  
 Vickers, Michael, E., Robertson, Marianne, W., and Watson, Casey, R., Millikin  
 University, Decatur, IL.
- 12:15 PM **\*16. A study of Sleep Traits in mutation accumulation lines of *Drosophila melanogaster***  
 Lyman, Rachel, A.<sup>1</sup>, Jones-Rhoades, Matthew<sup>1</sup>, Lyman, Richard, F.<sup>2</sup>, Harbison,  
 Susan, T.<sup>2</sup>, and Mackay, Trudy, F. C.<sup>2</sup>. <sup>1</sup>Knox College, Galesburg, IL, North  
 Carolina State University, Raleigh, NC.
- Division Meeting**  
 To be held after lunch in the Seymour Union

## POSTER PRESENTATION ABSTRACTS

An asterisk (\*) indicates the presenters eligible for a Student Presentation Award.

### **Division: Botany**

#### **\*1. Determining the DNA content of a unique population of *Schoenoplectus hallii* in Howell County, MO**

Sutton, Alex, Smith, Marian, and Esselman, Elizabeth. Southern Illinois University Edwardsville, Edwardsville, IL.

*Schoenoplectus hallii* is a rare wetland sedge that is restricted to wetland habitats of varying water fluctuations. Anthropogenic alterations to the habitat of *S. hallii* such as agricultural, developmental and recreational activities threatens the survival of this species. The distribution of *S. hallii* has been restricted to sites scattered throughout MO, IL, IN and KS. Most of these sites occur on privately owned land, where the species is not protected regardless of conservation status. This research will focus on a *S. hallii* population in Howell County, MO. Evidence has shown that population contains achenes that are larger than any other recorded *S. hallii* individuals. We hypothesize that this population will have a larger genome content and/or ploidy level than other populations of *S. hallii*. Preliminary flow cytometry data supports our hypothesis suggesting that the Howell county population may have a larger genome size than any other documented *S. hallii* plants. The unique DNA content of this population suggests it should be given higher conservation status.

#### **\*2. Foliar anatomy and ecological succession**

Hartnett, Michelle, Carlsward, Barbara, and Meiners, Scott. Eastern Illinois University, Charleston, IL.

The Buell-Small Succession Study is a long-term study documenting compositional changes during old field succession over the past 50 years at the Hutcheson Memorial Forest Center in Somerset, New Jersey. As a part of this study, we examined ten herbaceous species to determine correlations between leaf anatomy and life history traits. To examine leaf surfaces, adaxial and abaxial leaf clearings were made. Leaves were also embedded in paraffin and sectioned on a rotary microtome to examine internal structure. Stomatal density, trichome density, palisade thickness, and midrib thickness were measured and related to plant longevity as well as year of peak cover using correlation analyses. The ten species varied significantly in all leaf traits. Abaxial stomatal and adaxial trichome densities were negatively correlated ( $R = -0.62$ ;  $P = 0.077$ ), while adaxial and abaxial trichome densities were positively correlated ( $R = 0.90$ ;  $P = 0.0008$ ). There were no statistically significant correlations between stomatal density and either of the life history traits, suggesting that foliar surface features are not useful in predicting life history. However, midrib thickness was positively correlated with the year of peak cover ( $R = 0.64$ ;  $P = 0.044$ ), and palisade thickness was weakly negatively correlated with peak cover ( $R = -0.58$ ;  $P = 0.077$ ). In conclusion, foliar anatomical characteristics, especially mesophyll traits, seem to show correlations with plant ecological strategies.

### **\*3. Standing crop and Pb availability in a tallgrass prairie restoration**

Bryson, Brooke, Krutsinger, Roxane, Martin, Samantha, Brugam, Richard, Kohn, Luci, and Schulz, Kurt. Southern Illinois University Edwardsville, Edwardsville, IL.

The Metro East (Illinois, east of St. Louis, MO) has been an industrial center for the last 150 years. A major concern has been the long history of lead smelting, an industry which pollutes the landscape with heavy metal particles. As part of a larger study examining lead contamination of the local ecosystem, we determined peak standing crop for a tallgrass sand prairie restoration. Standing crop multiplied by tissue lead concentration can be used to estimate the biological availability of lead to herbivores. Standing crop was 6740 ( $\pm$  1210, 95% CI) kg/ha. This is comparable to values published for other Midwestern tallgrass prairies. Grass comprises only 23% of the biomass, as compared to 92% in another regional tallgrass restoration. A preliminary estimate of lead concentration in tissue is 3 ppm. This corresponds to ca. 0.02 kg / ha of lead available in above ground biomass. This value is quite low compared to some urban sites.

### **\*4. Rising productivity through time in a tallgrass prairie restoration**

Krutsinger, Roxane, Brugam, Richard, and Schulz, Kurt. Southern Illinois University Edwardsville, Edwardsville, IL.

Over the last decade, ecology students at Southern Illinois University Edwardsville have sampled peak above-ground biomass of a tallgrass prairie restoration on Campus. Although the focus of the exercise has been to evaluate the effect of a steep slope gradient (10%) on biomass production, the fairly long time series allows us to evaluate other properties of the prairie. Peak biomass production has varied greatly through time, ranging 6460 to 18,700 kg / ha. The lower value is far more typical of Midwestern tallgrass prairies. With the exception of 2009, standing crop has increased fairly smoothly over time ( $r = 0.82$ ,  $p < 0.004$ ). Standing crop is strongly correlated with increasing average June-August temperatures ( $r = 0.64$ ,  $p < 0.05$ ), but not with measures of rainfall during or before the growing season. Notably, standing crop decreases with higher elevation, consistent with the existence of a moisture gradient (partial  $r = -0.34$   $p < 0.0001$ ). The high proportion of C4 grasses in the prairie (ca. 90%) is concordant with increasing productivity in response to temperature.

### **\*5. Fourth year of study of biomass dynamics in an abandoned old field in Rock Island County, northwestern Illinois**

Scaggs, Allison and Dziadyk, Bohdan. Augustana College, Rock Island, IL.

For a fourth consecutive year net primary production was studied in an old field during the growing season of 2011. Abandoned after more than a decade of row cropping, the study area is a half hectare agricultural field contiguous with the Beling Ecological Preserve located near the Rock River in Rock Island County. In our continuing study, floristic structure and biomass production are being analyzed at three permanent study sites, each a different distance from the adjacent forest edge. Aboveground biomass production is estimated through the harvest method at two week intervals through the growing season (June – September). Site locations (distance from the forest edge) and estimates of the peak standing crop ( $\text{g/m}^2$ ) in years 2008/2009/2010/2011 are: SITE 1 - 2m (the wettest site) 258/502/420/613; SITE 2 – 20m, 345/424/445/628; SITE 3 – 40m (the driest site) 515/559/471/656. Year to year biomass variation appears to be a complex interaction of edaphic and other abiotic variables, rapid changes in floristic composition and highly variable seasonal flooding.

**\*6. Germination of field-collected Japanese hops (*Humulus japonicus*, Cannabinaceae): lab techniques and between population variation**

Clark, Jonathan, Israelitt, David, and Schulz, Kurt. Southern Illinois University Edwardsville, Edwardsville, IL.

Japanese hops (*Humulus japonicus*) is an aggressive invader of forest edge habitats, flood plains and riparian zones. Japanese hops easily outcompetes native vegetation. This experiment was conducted to determine germination rates for a later study of phenotypic plasticity in this invasive. We modified proven techniques used to germinate American hops (*Humulus lupulus*) test a method for cleaning and stratification. Seeds were collected from multiple plants within multiple sites in forest edge and floodplain habitats in Madison County, Illinois. Sanitized seeds were placed into plates containing damp sterilized sand and cold stratified at 4° C for 8 weeks. Plates were then transferred to a light table with a 14/10 light / dark cycle at 23°C. Chi-square tests were used to compare germination rates. Germination rate varied greatly (range 40-65%) and significantly (Chi-square = 10.45, df = 3, p < 0.02) between seeds collected at various locations. In addition, germination rates of seeds from the various locations fell significantly short of the 80% germination rate typical of domesticated hops (all p < 0.004). Varying germination rates between sites suggests either habitat or genetic controls on germination. The 50% average germination rate fell short of the 80% expected rate of *H. lupulus*. This may be caused by the seed sanitation and stratification technique, or may be typical of Japanese hops.

**\*7. Triclopyr (Tahoe 4E) versus glyphosate (Bullzye) as effective foliar herbicides for eliminating Asiatic honeysuckle from forests**

Karrick, Megan and Schulz, Kurt. Southern Illinois University Edwardsville, Edwardsville, IL.

The introduction of invasive species is problematic because they can displace previously established and valued species, change community function, and alter ecosystem properties. The invasive *Lonicera maackii* drastically alters the structure and diversity of native communities. At the Palisades Nature Preserve (Jersey County, IL) an invasion of these shrubs has begun, but there are areas that have not yet been colonized. Before the problem becomes too serious, action is being taken to protect the forest. Tahoe 4E (triclopyr) and Bullzye (glyphosate) herbicides were applied foliarly to honeysuckle shrubs along access trails in early and late summer of 2010. The shrubs were then assessed for survival in the spring of 2011. Tahoe killed more honeysuckle than the Bullzye, while the Bullzye tended to kill larger honeysuckle than Tahoe. Applications of these herbicides were more effective when made in August. These results should receive detailed consideration when deciding on an appropriate choice of herbicide. Bullzye is more effective on larger shrubs, however it will likely require more than one application, which may be detrimental to other organisms. Tahoe 4E is more costly than the Bullzye, although fewer applications would be needed to ensure shrub fatality.

**\*8. Comparative foliar anatomy in *Kosteletzkya* (Malvaceae)**

Bland, Margaret, Carlsward, Barbara, and Meiners, Scott. Eastern Illinois University, Charleston, IL.

*Kosteletzkya* is a herbaceous genus of Malvaceae related to *Hibiscus*. The 17 species of *Kosteletzkya* are pubescent with variously lobed leaves. Flowers resemble those of *Hibiscus* and range in color from white or yellow to pink. Fruits are capsular and dehiscent. Plants tend to grow in wetland habitats and geographically show a Gondwanan distribution, with about half in tropical America and half in tropical Africa. North America has one native species, *K.*

*pentocarpos* (formerly *K. virginica*), which occurs in coastal regions of the southeast. Species found in Africa commonly show polyploidy (mostly tetraploids with one hexaploid), while those in America are diploid ( $n = 19$ ). Our study focused on the foliar anatomy of diploid Neotropical species with comparisons to Paleotropical species. Leaf clearings were used to study surface anatomy and thin transverse sections for mesophyll anatomy. Observations were made with a Zeiss Axioskop compound microscope and images were captured using an OptixCam 3.3 megapixel digital camera. Measurements of leaf features were made using ImageJ and nested ANOVA analyses were used to compare measurements across multiple individuals of each species. Throughout the Neotropics, where there are only diploid species, the mesophyll thickness and guard cell dimensions were not significantly different from one another. However, guard cell dimensions were larger in African polyploid species than in American diploid species.

**\*9. A study on the arboreal flora and the environmental conditions in a bottomland forest site, Duck Creek Nature Trail, Silver Springs State Park, Kendall County, Illinois.**

Mestek, Gerry<sup>1,2</sup> and Beck, Hans<sup>1</sup>. <sup>1</sup>Aurora University, Aurora, IL. <sup>2</sup>Cowherd Middle School, Aurora, IL.

The arboreal flora of a bottomland forest site on the Duck Creek Nature Trail, Silver Springs State Park, was surveyed during the growing season of 2011. In addition to identifying the species diversity present, we counted all trees 10 cm dbh or greater within the 20 m x 50 m plot. Within in the 10 quadrats, we collected quantitative environmental data for each individual using Vernier temperature and light sensors. Soil temperatures as well as air temperatures and light intensity at 2 m above ground for each tree were recorded and tagged with GPS position. Trunk density ranged from 6 to 17 trees per quadrat. Statistical analysis of environmental data are correlated with the site. The understory flora data we collected in 2010 are evaluated with the 2011 environmental information. Low light levels and significantly cooler soil temperatures characterize this forest site.

**Division: Cell, Molecular & Developmental Biology**

**10. The *Arabidopsis thaliana* (Brassicaceae) receptors, atToc132 and atToc120 do not represent the critical regulatory point in the biosynthesis of jasmonic acid**

Afitlhile, Meshack, Sprout, Danielle, Workman, Samantha, Musser, Sue-Hum, Golz, Michelle, and Kouassi, Gilles. Western Illinois University, Macomb, IL.

The chloroplasts is an organelle in which the initial stages of jasmonic acid (JA) biosynthesis takes place, and the process is completed in the peroxisomes. Enzymes in the JA pathway are encoded by nuclear-localized genes, and pre-proteins are synthesized in the cytoplasm and imported into the chloroplasts or peroxisomes in a process that is facilitated by receptor complexes. The outer chloroplasts membrane has the atToc159 family of receptors, namely, atToc159, 132 and 120. The atToc159 receptor is specific for the import of light-induced proteins, while atToc132 and atToc120 are redundant receptors that import house-keeping proteins. In this study, we evaluated the ability of atToc132/120(+/-) mutant to accumulate mRNA for lipoxygenase-2 (LOX-2), allene oxide synthase (AOS), 12-oxo-phytodienoic acid reductase 3 (OPR3), plant defensin 1.2 (PDF1.2) and the repressor of JA responsive genes, JAZ1. The atToc132/120(+/-) mutant was null for atToc132 and heterozygous for atToc120. As expected, transcript levels for LOX-2, AOS and OPR3 were low in the unwounded leaves of wild type and atToc132/120(+/-) mutant. In the wounded leaves however, transcript levels were increased in both the mutant and wild type, and there was no significant difference between

wound-induced transcripts in the wild type and mutant. The jasmonate responsive gene, PDF1.2 was induced equally in both the wild type and mutant by wounding. The results of this study indicate that the mutant, just like wild type is capable of synthesizing jasmonic acid. We therefore conclude that atToc132 and atToc120 receptor complex does not represent a critical regulatory point in the import of enzymes that are required to initiate the JA pathway.

#### **\*11. Novel genetic transformation of three microalgae species for enhanced hydrocarbon production**

Robinson, Chelsey, K., Luker, John, and Luesse, Darron. Southern Illinois University Edwardsville, Edwardsville, IL.

The development of an alternative to fossil fuel sources has become an increasingly popular concern as our climate changes. Several species of microalgae have shown to produce hydrocarbons that can be converted to biofuel and for this reason are promising alternatives to fossil fuel sources. This work pursues the hypothesis that minor environmental and molecular changes can increase the hydrocarbon production found in the microalgae species, *Chlorella vulgaris*, *Scenedesmus obliquus*, and *Botryococcus braunii* so that they might be economic competitor to fossil fuel sources. Specifically, this work aims to determine if a specific photoreceptor, or a specific wavelength of light is used to modulate the hydrocarbon biosynthetic pathway. Growth conditions will be altered using specific light wavelengths to alter photoreceptor activation. If effective, certain light conditions may increase hydrocarbon accumulation without decreasing the overall photosynthetic light quality. Second, this work aims to use *Agrobacterium tumefaciens* to insert the promoter HSP70A RBCS2 in conjunction with paromomycin resistance into these three algae, resulting in a random mutation. These mutations will then be screened and selected for increased hydrocarbon production.

#### **12. A heterozygous mutant of *Arabidopsis thaliana* (Brassicaceae), atToc132/120(+/-) accumulated reduced levels of linolenic acid when exposed to low temperatures**

Afithile, Meshack, Workman, Samantha, Sprout, Danielle, Dao, Khanh, Tracy, Kara, and Kouassi, Gilles. Western Illinois University, Macomb, IL.

The chloroplast is the major site of lipid biosynthesis. The chloroplasts outer and inner membranes have translocons that facilitate the import of pre-proteins, which are synthesized in the cytoplasm. The imported proteins include enzymes that function in lipid biosynthesis and desaturation. In this study, we evaluated the ability of atToc132/120(+/-) mutant to accumulate polyunsaturated fatty acids when subjected to low temperatures. The atToc132/120(+/-) mutant was null for atToc132 and heterozygous for atToc120. It is well established that exposure of plants to low temperature favors the accumulation of polyunsaturated fatty acids, which help maintain membrane fluidity and allow plants to survive the cold. When grown at 22°C for 4 weeks and then incubated at 2°C for 24 hours, the accumulated amount of fatty acids in the mutant was comparable to that in the wild type. This indicates that lipid synthesizing enzymes were functional in the mutant, and the lack of a functional atToc132 had no adverse effect in lipid synthesis and desaturation. When incubated at 2°C for 5 days, the mutant accumulated high levels of 16:3, 18:0 and 18:1, and highly reduced levels of 18:3. The reduced levels of 18:3 could be indicative of the low activity of FAD8 enzyme, which converts 18:2 into 18:3. The increased level of 16:3 suggests that in the mutant, Fad5 activity was enhanced and palmitic acid (16:0) in monogalactosyldiacylglycerol was preferentially desaturated into hexadecatrienoic acid (16:3), presumably to compensate for the reduced levels of linolenic acid. The results of this study



indicate that the mutant, just like wild type had the full complement of enzymes, which are required in chloroplasts lipid synthesis and desaturation.

### **13. APKQYVRFamide, the first FMRFamide-related peptide identified from an oligochaete annelid**

Krajniak, Kevin G., Brauer, Cassandra, Kerstein, Kristopher, McCullough, Kyle and McCommas, Steven. Southern Illinois University Edwardsville, Edwardsville, IL.

FMRFamide is a neuropeptide that was first isolated from the cerebral ganglia of a bivalve mollusc. Since then many peptides with a sequence similar to FMRFamide have been isolated from many different invertebrate animals. In the phylum Annelida FMRFamide and other FMRFamide-related peptides (FaRPs) have been found in polychaetes and leeches. However so far no one has identified a FaRP from an earthworm. Many animal genomes have been sequenced and placed in public databases, including that of the earthworm, *Lumbricus rubellus*. Therefore we decided to examine whether any of the expressed sequence tags (ESTs) in Lumbribase, the *L. rubellus* database, contained any peptide sequences related to FMRFamide. Using the BLASTx program for translated nucleotide sequences we found an EST from the late cocoon stage that contained multiple copies of a sequence which, if cleaved at the basic residues and amidated would yield the peptide APKQYVRFamide. This peptide is similar in structure to two other predicted annelid peptides, PAKHYVRFamide from a leech and AGAYVRFamide from a polychaete. These three peptide sequences contain a tetrapeptide core of YVRFamide. Previously we have shown that FMRFamide regulates the motility of various regions of the earthworm digestive tract and body wall. We are currently examining the effects of APKQYVRFamide on these tissues.

### **\*14. UVA induction of lysosomal membrane permeabilization in human leukemia cells, HL60**

Martens, Andrew J., Krajniak, Kevin, Worthington, Ronald, Hamad, Abdullatif, and Wanda, Paul E. Southern Illinois University Edwardsville, Edwardsville, IL.

Recent data suggests that lysosomal alterations sensitize cancer cells to a cell death pathway involving lysosomal membrane permeabilization (LMP) and the release of cathepsins into the cytosol. This LMP cell death pathway may circumvent the traditional signaling routes of apoptosis by eliminating the necessity of pro-apoptotic proteins, which are commonly defective in cancer cells due to mutations. In this study UVA light-induced LMP was explored in a line of HL60 cells. UVA is thought to induce LMP through production of reactive oxygen species (ROS) which degrade and thus permeabilize the lysosomal membrane. HL60 cells were induced to cell death with specific energies of UVA exposure using two filtered ranges of light while two assays were utilized to examine lysosomal involvement. An Alexa Fluor 488 – annexin V conjugate and propidium iodide double staining technique was used to detect viability. Lysosome permeability was observed with the lysosomotropic, metachromatic dye acridine orange (AO). Fluorescence was recorded on an Accuri C6 flow cytometer for both assays. When compared to control groups, data indicates that UVA induces a dose-dependent, apoptotic cell death that appears to occur more effectively in cancer cells due to several key lysosomal differences.

## **15. The effects of APKQYVRFamide on the body wall of *Lumbricus terrestris* (Lumbricidae)**

Kerstein, Kristopher W. and Krajniak, Kevin G. Southern Illinois University Edwardsville, Edwardsville, IL.

Our lab synthesized APKQYVRFamide the first earthworm FMRFamide-related peptide based on a gene sequence in *L. rubellus*. Previous work has shown the FMRFamide modulates the spontaneous contractions of the body wall. Therefore, we chose to examine the effects of this earthworm peptide on isolated body wall. The 10-segment section of dorsal body wall tested is located anterior to the clitellum. A force transducer strung tissue bath recorded contractions or changes in amplitude and frequency. Analysis was completed using an Iworx and Labscribe. After a baseline of saline was established for five minutes, the peptide serial dilutions were added by increasing concentration from  $10^{-10}$  to  $10^{-5}$  M. The YVRFamide frequency decreased at a threshold of  $10^{-9}$  M. The YVRFamide amplitude increases at a threshold  $10^{-8}$  M. These results suggest that APKQYVRFamide may be involved in the controlled body wall contractions.

## **16. Intracellular Ice Nucleation Protein Reduces Cryogenic Injury in Eukaryotic Cells**

Harder, Avril M.<sup>1</sup>, Chakraborty, Nilay<sup>2</sup>, and Menze, Michael A.<sup>1</sup> <sup>1</sup>Eastern Illinois University, Charleston, IL, <sup>2</sup>Center for Engineering in Medicine Harvard Medical School, Boston, MA.

Exposure of isolated cells to subzero temperatures typically leads to a significant or complete loss of plasma membrane integrity and cell viability. The observed low viability is thought to be a result from the formation of intracellular ice when water crystallization occurs. Interestingly, some organisms induce extracellular ice formation through membrane-bound ice-nucleation proteins in order to structure extracellular ice in an arrangement that is conducive to cell survival. Wolber *et al.* (1986) first identified and isolated an ice-nucleation protein (PsINP) from *Pseudomonas syringae*. We hypothesize that intracellular expression of PsINP may promote controlled formation of ice-crystals and ameliorates freeze injury in ovarian cells (Sf-21) of the fall armyworm, *Spodoptera frugiperda*. PsINP is a highly repetitive protein composed of multiples of the amino acid motive SSLTAGYGSTQTAQ. We stably transfected a synthetic nucleotide sequence encoding for 279 amino acids that make up the central domain of PsINP into Sf-21 cells (Sf-21-PsINP). Sf-21-PsINP showed significantly increases in cell viability compared to wild-type Sf-21 cells following one freezing-thawing cycle. Wild-type cells retained  $60 \pm 3.3$  % cell membrane integrity, while  $72 \pm 3.4$  % of Sf-21-PsINP cells showed intact plasma membranes ( $n = 6$ ,  $p < 0.05$ ). Our result suggests that intracellular ice formation can be non-lethal, and in certain cases, its careful regulation may be beneficial to cell viability following freezing.

## **\*17. Identifying candidate genes involved in hepatic gene silencing in hepatoma cell variants**

Aylmer, Caitlin M., Kurkewich, Jeffrey, and Bulla, Gary A. Eastern Illinois University, Charleston, IL.

Genome-wide gene expression profiles were compared between rat hepatoma parental cells and four dedifferentiated variant cell lines that have lost liver function. Using expression profiles of parental and variant cell lines generated from Illumina bead microarray technology, expression ratios were generated to identify differentially expressed genes. This profiling strategy was used to identify candidate genes that may ultimately give insight into the mechanisms behind global hepatic gene expression. From the microarray ratios, we identified 268 genes repressed >5-fold

in 2 of the 4 variant cell lines, while 132 of these were found to be repressed in all four cell lines. These targets were then analyzed further using NCBI and Genecard bioinformatics information to determine those that are involved in signal transduction pathways and/or transcriptional activation. From this repressed set of genes, we identified numerous well-described indicators of hepatic function. Notably, fourteen candidate genes were identified by selection of their known or proposed function. Validation of candidate gene expression was then carried out using qPCR, which provided much more sensitive quantitation than did the microarrays. Candidate genes have been introduced into a variant cell line and hepatic gene rescue profiling is being done using qPCR for monitoring rescue of the hepatic phenotype.

**\*18. Phase shift temperature as a marker for membrane fluidity increases during UV-induced apoptosis**

Robb, Dustin, Ansbrosio, Daniel, Shaw, Michael, and Wanda, Paul E. Southern Illinois University Edwardsville, Edwardsville, IL

Cellular membrane fluidity increases following UV-induction of apoptosis. This fluidity increase has previously been documented in several labs, including our own. Future and concurrent experiments should help elucidate the pathway. Our current experiment utilizes a Bruker Electron Paramagnetic Spin Resonance Spectroscopy (EPR) to measure the spin correlation time of 5-Doxyl Stearic Acid, a nitroxide spin label integrated into HL60, Human Leukemia cells. The spin correlation time was measured over a range of temperatures to determine the phase shift, or gel-liquid transition, temperature of the membrane. Induction of apoptosis in these cells appears to cause a marked decrease in phase shift temperature denoting an increase in membrane fluidity. We gratefully acknowledge support from the Fraternal Order of Eagles –Granite City Aerie 1126.

**\*19. The effects of APKQYVRFamide on the isolated crop-gizzard of the earthworm *Lumbricus terrestris* (Lumbricidae)**

Brauer, Cassandra L. and Krajniak, Kevin G. Southern Illinois University Edwardsville, Edwardsville, IL.

The digestive tract of the earthworm *Lumbricus terrestris* responds to a variety of neurotransmitters including FMRFamide and its related peptides (FaRPs). Recently we identified the first earthworm FaRP, APKQYVRFamide, from the genes of *Lumbricus rubellus*. The goal of this project was to examine the effects of this peptide on the crop-gizzard of *L. terrestris*. In the experiment, the crop-gizzard of the worm was removed and placed into a bath filled with worm saline. All movements of the crop-gizzard were recorded with a Grass force transducer and were displayed on a computer using Iworx Labscribe 2. Increasing concentrations of APKQYVRFamide were added to the bath and adequate time was allowed for it to take effect. The resulting changes in contractions were used to create log-concentration response curves. APKQYVRFamide caused a concentration dependent decrease in contraction amplitude with a threshold of  $10^{-7}$  M. The peptide also caused a biphasic response in contraction rate with a decrease in rate at  $10^{-9}$  M and an increase at  $10^{-8}$  M. Thus it appears that APKQYVRFamide plays a role in controlling the motility of the earthworm crop-gizzard.

**\*20. The effects of oxytocin and related peptides on the crop/gizzard of *Lumbricus terrestris* (Lumbricidae)**

Bone, Nathaniel B. and Krajniak, Kevin G. Southern Illinois University Edwardsville, Edwardsville, IL.

Members of the Oxytocin/Vasopressin family of peptides are present in both vertebrates and invertebrates. While oxytocin and vasopressin are found in vertebrates, annetocin is found exclusively in annelids. Many of these peptides modulate the motility of smooth muscle. Several experiments have been performed on several species of Annelids regarding the effects of annetocin, oxytocin, and vasopressin. However, the effects of these peptides have yet to be determined in the earthworm *Lumbricus terrestris*. In this study we used isolated the crop-gizzard of *L. terrestris* to measure the effects of oxytocin. The crop-gizzard was removed from the animal, placed in a tissue bath, and connected to a force transducer. The responses to increasing concentrations of peptide were recording using a computer with an Iworx converter and Labscribe 2. Preliminary findings show that the oxytocin increased contraction rate with a threshold of  $10^{-8}$  M, and amplitude with a threshold between  $10^{-8}$  and  $10^{-7}$  M. The results obtained from the Arg-Vasopressin show that this peptide does not elicit a response when administered to the crop/gizzard. Other peptides in the oxytocin/vasopressin family are also being investigated for their effects on the crop/gizzard of the earthworm.

**\*21. Cloning of European honey bee (*Apis mellifera*, Apidae) odorant receptors predicted by the *A. mellifera* genome**

Kelsey, John C.<sup>1</sup>, Grimme, Steve J.<sup>1</sup>, Arnett, Clint<sup>1</sup>, Wanner, Kevin<sup>2</sup>, and MacAllister, Irene E.<sup>1</sup>  
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The European honey bee (*Apis mellifera*) is vital to the production of many agricultural products which rely on it for pollination. Within this role, the olfactory system of *A. mellifera* is crucial for sensing plant volatile organic compounds. Although sequencing of the honey bee genome was completed in 2006, genes coding for the odorant receptor (Or) proteins of *A. mellifera* have been predicted only as hypothetical proteins from the genomic sequence by homology with related insects. In this paper, we describe the cloning and sequence comparison of *A. mellifera* odorant receptor genes. The Or genes were PCR amplified from cDNA isolated from bee antennae. Amplicons were cloned and sequenced, and the nucleotides sequences compared to *A. mellifera* Or gene models. While most of the cloned Or genes agreed with the predicted Or models, several genes were identified in which previously unknown introns and cases of alternative splicing were observed. Our findings indicate that the Or gene models are largely correct and the encoded proteins are likely functional Ors.

**\*22. Diverse microRNAs in dictyostelid social amoebas**

Lu, Ya-Lin, DeMaria, Sara, Blackburn, Devon, and Jones-Rhoades, Matthew. Knox College, Galesburg, IL.

MicroRNAs (miRNAs) are a class of endogenous, small non-coding RNAs derived from stem-loop precursor RNAs by the action of Dicer-like proteins. MicroRNAs are important regulators of gene expression in both plants and animals, but have not been widely studied in other eukaryotes. We have used next generation sequencing to analyze the sets of small RNAs expressed in two species of dictyostelid social amoebas. We find that both *Dictyostelium discoideum* and *Dictyostelium purpureum* express small RNAs with patterns of expression

consistent with processing from stem-loop precursors, suggesting a mechanism of biogenesis similar to those of plant or animal miRNAs. In contrast to the evolutionary conservation observed for some plant and animal miRNAs, we see little evidence of conservation of miRNAs between the two *Dictyostelium* species. At this point, biological roles for the *Dictyostelium* miRNAs remain uncertain, although bioinformatic analysis suggests some potential to regulate protein coding genes and to interact with genomic regions that generate phased siRNAs.

**\*23. Construction of a knock-out plasmid for mutational analysis in the mushroom-forming fungus *Schizophyllum commune* (Aphyllophorales)**

Hollaway, Andrea S., Moser, Casey L., and Fowler, Thomas J. Southern Illinois University Edwardsville, Edwardsville, IL.

*Schizophyllum commune*, the split-gill mushroom, has around 15,000 different mating types. This vast number of mating specificities is attributed to just four genetic loci, two that contain genes encoding different pheromones and G protein-coupled receptors. The gene of interest in this study is an *S. commune* ortholog of Ste20pak, a p21-associated protein kinase that is known to be involved in the pheromone response pathway of *Saccharomyces cerevisiae* and may play a similar role in *Schizophyllum*. *ste20pak* is involved with the mitogen-activated protein (MAP) kinase cascade that leads to activation of transcription factors that regulate other genes involved in mating. It is hypothesized that the *S. commune ste20pak* gene is necessary for proper regulation of the mating pathway and either sterility or excessive mate signaling could result if the gene is successfully knocked-out. If the gene's function is essential within *S. commune*, a knock-out will result in death. The gene may not have a role in pheromone response and the process would remain unchanged. A plasmid was constructed to allow the *ste20pak* gene to be knocked out by its replacement with a *trp1* marker gene. DNA flanking the gene was transferred into a plasmid that carries the marker gene and a transformation of SKO2-14, a KU80-deficient strain that has a high proportion of homologous recombination (70%) compared to other strains (1-5%), was done. Using this new knock-out technology that is recently available in *S. commune* we should successfully delete *ste20pak* to allow a description of its phenotype.

**\*24. Identifying the function of a G $\beta$  Gene from the mushroom-forming fungus *Schizophyllum commune* (Aphyllophorales).**

Lim, Song, K. and Fowler, Thomas, J. Southern Illinois University Edwardsville, Edwardsville, IL.

In fungal cells, G protein-coupled receptors (GPCRs) play an important role in cell signaling pathways that regulate physiological processes. When signals such as pheromones bind to GPCRs in the plasma membrane, the receptor interacts with a cytoplasmic heterotrimeric G protein composed of G $\alpha$  and G $\beta$ -G $\gamma$  subunits, which in turn transmit the signal to effector molecules. Some fungi signal for their mates by this mechanism. Among different species, G $\beta$  subunits may act as negative regulators of G $\alpha$ , or to activate an effector. The roles of the G $\beta$  subunits of filamentous mushroom-forming fungus *Schizophyllum commune* remains unknown. Therefore, the objective of this research is to determine the signaling role of one G $\beta$  subunit (Protein ID 69726) of *S. commune*. We hypothesize that elimination of this G $\beta$  subunit by a gene knock-out will result in a defective mating response. Several attempts to knock out the gene were made and 28 transformants were generated that are positive for the transformation marker gene *trp1*. Based on a previous study, the rate homologous recombination to produce a gene deletion can be as high as 70% in *S. commune* (de Jong et al., 2010). PCR evidence suggests that the targeted gene has been affected when compared to the wild type strain. Additional transformants

are being generated and the evidence is being collected to test this transformant as a G $\beta$  knockout.

### **Division: Chemistry**

#### **\*25. Analysis of Melamine and Cyanuric acid by HPLC/Photodiode Array Detection Using Ionic Liquids as Mobile Phase Additives**

Shackelford, Jennifer F., Ahmad, Tariq Z., Thompson, A., Alhiji, Azhar S., and Ahmad, Tarab J. Western Illinois University, Macomb, IL.

Increased instances of processed food contaminated with melamine (Me) and cyanuric acid (Cy) has led to increased government regulation and required testing. Cy is a structural analog of Me and may be found as an impurity with Me. While Me and Cy are less toxic if they are ingested individually, Me forms a dangerous insoluble complex with Cy (1:1 complex) that leads to kidney's failure and possibly death. Therefore developing methods for the determination of these compounds is very important to guarantee food safety. Current methods for the analysis of melamine and cyanuric acid include GC-MS, (LC-MS) and HPLC. GC-MS requires derivatization which is labor intensive. LC-MS is an expensive technique and requires extensive cleanup for samples. Both HPLC and LCMS methods require the use of toxic volatile organic solvents. These solvents are harmful to the environment and to the human health. Additionally, the disposal of these solvents costs large amounts of money. Thus, eliminating organic solvents is very important to protect the environment, human health, and the economy. Currently, we are developing a method for the analysis of these compounds in which there is less or no use for organic solvents. These methods include using room temperature ionic liquids as mobile phase additives (RTILS). RTILS are recyclable, nonvolatile and nonflammable compounds which have the potential to replace organic solvents in HPLC analysis and in other methods like extractions and CE.

#### **26. The Effect OF 1-Methyl, 3-Butylimidazolium Tetrafluoroborate BMIMBF<sub>4</sub> Ionic Liquid on The Retention Behavior of Nitroaromatics and Nitroanilines**

Redlinski, Bartlomiej, Utterback, Craig W., Sharp, Stephanie L., Heagy, Ashlie N., and Ahmad, Tarab J. Western Illinois University, Macomb, IL.

The identification of explosives and their degradation products is important in forensic and environmental applications. Complete separation of these structurally similar compounds using reversed-phase liquid chromatography has proven to be a challenge. The 8330 EPA method for the trace analysis of explosives includes isocratic HPLC separations of 14 components using C18 columns. These separations typically take over 30 min and are unable to separate all the compounds and a second column is usually needed leading to an increase in the analysis time and sample handling complexity. These disadvantages have led to the search for alternative LC for the separation of explosives. Room temperature ionic liquids RTILs are salts with melting points at or close to room temperature. They are good solvents, highly polar, environmentally benign, nonvolatile, nonflammable, and stable in air or water. RTILs can be used to adjust the selectivity as well as to enhance the resolution by improving the peak shapes. In the present work we will investigate the effect of using BMIM salts as a mobile phase additives on the retention behavior, peak shapes and resolution of the nitroaromatic and nitroaniline compounds using two C18 reversed phase columns; prevail C18 and Grace smart C18.

**\*27. Investigation of the Effect of Ionic Liquids as Mobile Phase Additives on the Separation of Basic Drugs**

Ahmad, T., Alhiji, Azhar S., Salam, Sahar A., and Ahmad, Tarab J. Western Illinois University, Macomb, IL.

Room temperature ionic liquids (RTIL) are good solvents for both inorganic and organic materials, they are non-volatile, nonflammable, thermally stable, and recyclable solvents and they have some Particular properties in chemical reactions etc., currently they are being investigated widely as “green chemistry” solvents. Ionic liquids are used in reversed phase high performance liquid chromatography RP-HPLC as blockers for silanol activity and as mobile phase additives and as a replacement of organic modifiers. In HPLC, the addition of ionic liquids has great effects on the separation of the compounds. They decrease the band tailing, reduce band broadening and improve resolution. The objective of this work is to study the effect of 1-butyl 3-methyl imidazolium tetrafluoroborate BMIMBF<sub>4</sub> as a mobile phase additive on the retention and separation of Nortriptyline and Amitriptyline on reversed phase liquid chromatography. Different concentrations of BMIMBF<sub>4</sub> and different percentages of acetonitrile were used in the mobile phase. The effect of these experimental conditions on the retention factors and the asymmetry factors of the individual compounds and the resolution of mixtures of these compounds is investigated in this study.

**\*28. Effect of trehalose and sucralose on emulsion stability and controlled release of eicosapentaenoic acid encapsulated into a biopolymer matrix**

Chodavarapu, Naga P., Made Gowda, Netkal M., Boley, Mark M., Ahmad, Tarab, and Kouassi, Gilles K. Western Illinois University, Macomb, IL.

In the present study, eicosapentaenoic acid (EPA) was emulsified into whey protein lambda-carrageenan systems using power ultrasound, and the effects of adding either trehalose or sucralose, on the stability of these systems were investigated by monitoring the volume of aqueous, lipophilic, and solid layers separated from the initial homogeneous emulsion system. Aliquots of the systems were freeze dried and the glass transition temperature ( $T_g$ ) of the freeze-dried encapsulated EPA was determined using differential scanning calorimeter (DSC). Furthermore, the release of (EPA) from the freeze-dried systems was studied upon storage of the samples at various water activity conditions. The emulsion systems containing trehalose showed delayed phase separation compared to the one prepared with sucralose. This suggested that trehalose exhibited higher molecular interactions with *lambda*-carrageenan, possibly due the hydrogen bonding.  $T_g$  of trehalose- and sucralose- containing systems were 55°C and 50°C, respectively. Above  $a_w$  value of 0.444, the release of EPA increased with increasing  $a_w$  in both systems. A study of the combined effects of water activity and glass transition temperature on the release of EPA is under way to determine the conditions that pertain to the controlled release of encapsulated EPA. **Acknowledgement:** We thank the Western Illinois University Research Council for support.

**\*29. Development of a convenient and pedagogically useful green oxidation protocol for wider adaptation in undergraduate laboratory curriculum**

Thamasetti, Abhilash A., Talluri, Sri H., Ries, Sahnique S., and Vinod, Thottumkara K. Western Illinois University, Macomb, IL.

Use of well known reagents for the oxidation of different functional groups and the mechanism of such transformations are an important part of any sophomore organic chemistry curriculum.

Most, if not all, of the traditional oxidizing agents covered in an undergraduate lecture course are transition metal based reagents which are toxic and are also potential environmental pollutants. While the ease and efficiency (% yield) of the oxidation reactions using these reagents are highlighted during the lecture class, the deleterious health and environmental aspects of these reagents are often ignored or omitted in classroom discussions. A green oxidation procedure for oxidation of alcohols using catalytic amounts of in-situ generated o-iodoxybenzoic acid (IBX) in presence of Oxone as a stoichiometric oxidant is developed. Catalytic amount of commercially available 2-iodobenzoic acid is used as the organoiodine precursor for IBX in the reaction. This convenient procedure for the oxidation of alcohols, completed in a 2.5 h laboratory period, is carried out in aqueous solvent mixtures. Students are introduced to several pedagogically relevant green chemistry principles including the use of aqueous reaction medium, non-extractive product isolation procedure, and use of benign and catalytic reagents through this convenient oxidation experiment. Finally, this experiment also allow instructors to discuss the use of IBX and other hypervalent iodine reagents as benign alternatives to commonly used and frequently discussed transition metal based reagents.

### **\*30. Screening Polyphenol Composition and Antioxidant Activity of Berries**

Kasarla, Deepak S. Afithile, Meshak, Made Gowda, Netkal M, Ahmad Tarab, and Kouassi, Gilles K. Western Illinois University, Macomb, IL.

Polyphenols are secondary plant metabolites that exhibit protective effects against oxidation and degenerative diseases such as cancer and hypertension in humans. Polyphenols in plants, berries, and fruits are grouped into different classes, and each class contributes to the overall antioxidant activity. The objectives of this study are to investigate the phenolic composition of four varieties of berries namely blueberry (*Vaccinium corymbosum*), cranberry (*Vaccinium marocarpum*), blackberry (*Vaccinium consanguineum*), and grapes (*Vitis labrusca*) to investigate the phenolic composition of each berry, by class of polyphenols, to study the antioxidant activity using various in-vitro antioxidant assays including the free radical scavenging assay, hydroxyl radical scavenging assay, and superoxide dismutase scavenging assay, and to determine if a relationship exists between the phenolic composition and the antioxidant activity. The results of this study will be useful for assessing the functional properties of berries for in vivo studies.

**Acknowledgement:** We thank the Western Illinois University Research Council for support.

### **\*31. Effects of various dextrans on stability of controlled release of microencapsulated bioactive compounds**

Tamatam, Manassa, Gowda, Netkal M., Ahmad, Tarab, and Kouassi, Gilles M. Western Illinois University, Department of Chemistry, Macomb, IL.

Encapsulation refers to the process by which tiny particles or droplets are surrounded by a coating or embedded in a homogenous or heterogeneous matrix to protect many useful properties of molecules. In this study canola oil and piroxicam were encapsulated into multilayer biopolymer matrices consisting of dextrin, whey protein, and surfactants, using power ultrasound. The stability of the systems was evaluated by monitoring phase separation in the systems. The sizes of the particles were measured using atomic force microscopy and FlowCam technology, and factors that pertain to the controlled release of the encapsulated substances were investigated. After 30 days of storage of the samples at 4°C, no phase separation was observed, while the control emulsion containing no dextrin underwent phase separation after 72h. AFM and FlowCam images indicated that the particles were spherical, with sizes between 2 and 6 µm. A temperature of 60°C and a water activity value as low as 0.537 were found to be favorable for



partial release of oil and piroxicam, respectively. This study indicated that dextrans are excellent emulsion stabilizers and ideal carbohydrate matrices for encapsulation and controlled release of lipophilic substances.

**\*32. Synthesis of diol substrates for the investigation of selective oxidation of alcohols using water-soluble hypervalent iodine reagents**

Kupireddy, Nikhil, R., Gude, Harika C., and Vinod, Thottumkara K. Western Illinois University, Macomb, IL.

Recently reported water-soluble IBX derivatives have been shown to exhibit solvent dependent oxidation of different alcohol moieties. While the ease and selectivity of oxidation of alcohols using the new IBX derivatives parallel that of IBX in polar aprotic solvents, the selectivities observed in the oxidation of diol and triol substrates carrying benzylic, non-benzylic and homobenzylic alcohol moieties in aqueous solvent mixtures allude to an alternate oxidation mechanism. The observed selectivities are explained both using an alternate H-atom abstraction mechanism and correlated to the bond dissociation energies of the benzylic, homobenzylic and non-benzylic alpha C-H bonds involved in the initial H-atom abstraction step. We report here the synthesis of three diol substrates, that carry combinations of benzylic, non-benzylic and homobenzylic alcohol moieties, to be included in a substrate scope investigation currently underway to highlight the selective oxidation behavior of water-soluble IBX derivatives.

**\*33. Photodynamic therapy for prostate cancer**

Keesari, Bharadwaj and Fu-Giles, Patty K. Governors State University, University Park, IL.

The objective of this research is to utilize non-toxic, photoactive molecules to treat different stages of prostate cancer. According to The National Cancer Institute, African-American men have the highest risk of developing prostate cancer, and they have more than twice the mortality rate observed for other racial and ethnic groups. Photodynamic therapy (PDT) is a technique that uses the combination of light and nontoxic drugs to destroy specific targeted tumor cells. After the inactive, nontoxic drug is applied topically or injected, it localizes in tumor tissue and can only be activated by irradiation with certain wavelengths of light. When these photosensitive drugs are “switched on” by light, they can produce highly reactive intermediates. In this manner, the irradiation of tumors with low energy light can ultimately lead to the selective death of cancerous cells without affecting normal tissue. According to our data, phthlocyamine dyes are excellent potential photodynamic therapeutic agents due to they absorb low energy visible light and have the ability of conducting energy transfer with DNA. Their cytotoxicity toward humans has been well studied; however, their photophysical, photochemical, and photobiological characteristics have not yet being explored. In our study, their molecular and electronic structure, bonding, reactivity, photo- and cyto-toxicity, and the ability of binding to nucleic acids have been well characterized and tested on the malignant prostate cancerous cells in vitro.

**\*34. Synthesis of aminoallenes**

Nappa, Amanda M., and Brown, Benjamin M. Greenville College, Greenville, IL.

This research project was part of a collaboration with the Johnson Laboratory at Harvey Mudd College. The Johnson lab is currently working on intramolecular hydroamination reactions of aminoallenes. In cooperation with the Johnson group, we agreed to synthesize two substituted aminoallenes for use in the hydroamination reactions. We were able to successfully synthesize both aminoallenes in good yield through a five-step sequence. The structures of the

intermediates and final products were confirmed by NMR. This research project has laid the ground for further synthetic research projects at Greenville College as well as helped to establish a working relationship with Harvey Mudd College in Claremont, CA.

**\*35. Synthesis of tripeptides containing C-terminal L-lysinal and ornithinal thiosemicarbazone as potential cathepsin B inhibitors**

Kazipeta, K., Jin, J., Zhang, S., Wen, L., and McConnell, Rose M. Western Illinois University, Macomb, IL.

Cathepsins are proteases associated in the cell growth and regulation. In cancer cells, expression of cathepsin mRNA is very high and they cause cell motility leading to metastatic spread of cancer. Cathepsin B is a lysosomal cysteine protease. Cathepsin B has emerged as a prognostic indicator in several cancers such as breast cancer, lung cancer and colon cancer. Cathepsin-B facilitates the tumor progression by degrading the components of the basement membrane and extracellular matrix. Studies on cathepsin-B also revealed that the tumor progression is caused indirectly by the activation of some latent proteases. Cathepsin-B also has the activity of inhibiting the protein inhibitors of other proteases facilitating the metastatic spread of cancers. Inhibition of protease before it spreads is the safer way to control the cancerous growth. Tripeptides containing C-terminal aldehydes have been developed as new cathepsin B inhibitors. It was found some of these tripeptides showed the inhibition on cathepsin K as well. Described is the synthesis of tripeptides containing C-terminal L-lysinal and ornithinal semicarbazone. The inhibition data of these synthetic tripeptides on cathepsin B will be tested.

**\*36. Synthesis of novel cathepsin K inhibitors containing N-aromatic piperazine moiety**

Bommana, Rupesh R., Jin, J., Zhang, S., Wen, L., and McConnell, Rose M. Western Illinois University, Macomb, IL.

Cathepsins are globular lysosomal proteases. Initially cathepsins were described to have only intracellular lysosomal protease activity but later it was discovered that they also have extracellular functions. Cathepsins include enzymes such as serine proteases, aspartic proteases and cysteine proteases. Cathepsins have active-site cysteine residue. There are different types of cathepsins (B, H, L, S, C, K, O, F, V, X). Cathepsin K is a cysteine protease highly expressed in osteoclasts and plays a major role in bone resorption cycle. Deficiency of cathepsin K causes a hereditary bone disorder called pycnodysostosis. Various inhibitors are being synthesized to control the harmful effects of cathepsins. The main purpose of this project is to synthesize potential cathepsin K inhibitors. The target molecule contains an N-aromatic piperazine group along with cyclic ketone moiety that can bind at S3, S2, S1 sub sites and control the activity of cathepsin K. The target molecule is to be synthesized, characterized and the inhibition data will be tested.

**\*37. Development of new selenium antioxidants**

Qarah, A., Jin, J., and Zhang, S., Western Illinois University, Macomb, IL.

Selenium antioxidants are one of the important types of antioxidants. All antioxidants have a chemical element referred to as a “redox” potential, which is the measurement of their ability to be oxidized. Experiment evidence has shown that incorporation of silicon atom or Si-Si bond at the beta position of Se atom in organoselenium compounds will enhance the activities of these compounds by lowering the redox potential. This is due to the beta-silicon effect or beta-disilanyl effect. Here we report the design and synthesis of a series of new organoselenium

antioxidants with incorporation of silicon atom at the beta position. These new compounds are proposed to have lower redox potentials and therefore show more potent antioxidant activity compared to the currently available selenium antioxidants. Their antioxidant ability will be evaluated by testing their redox potentials and different antioxidant capacity assays such as hydroxyl radical scavenging assay, ferric-reducing antioxidant power assay, etc.

**\*38. Progressive synthesis of a potential cathepsin K inhibitor**

Bongarala, V., Jin, J., Zhang, S., Wen, L., and McConnell, Rose M. Western Illinois University, Macomb, IL.

Cathepsin K, a lysosomal cysteine protease, is expressed by the osteoclasts, which are responsible for the degradation of bone matrix during the process of bone remodeling and resorption. An imbalance between these two processes leads to a condition called as osteoporosis, which is generally observed in postmenopausal women and geriatric males. Inhibition of cathepsin K has been found to be important, in the treatment of Osteoporosis and other bone related disorders. Therefore in the recent past, cathepsin K has become a potential target site in the treatment of several bone related disorders. Currently, cathepsin K inhibitors like Odanacatib and Balicatib are being developed for the treatment of osteoporosis. On similar lines as Balicatib, the synthesis of 2-Methyl-2-[2-(4-oxo-2-thioxo-thiazolidin-3-yl)-acetylamino]-N-[4-(4-propyl-piperazin-1-yl)-phenyl]-propionamide is being carried. The starting material 1-(4-nitrophenyl piperazine) is subjected to alkylation, followed by reduction, protection, deprotection steps and finally coupling reaction to synthesize the target molecule. The synthesis of the target molecule is still in progress. Upon completion of synthesis, the proposed inhibitor will be assayed by several biochemical methods to study its ability, as a potential cathepsin K inhibitor.

**\*39. Comparison of GC/FID, GC/ECD and GC/MS for determination of organochlorine pesticides in water**

Kunuru, Prashant G., Taylor, Mercedes M., and Guan, H., Western Illinois University, Macomb, IL.

Organochlorine pesticides (OCPs) are lipophilic compounds that tend to bioaccumulate and are stored in fatty tissues and fluids such as breast milk, blood, and brain. Numerous studies have clearly linked organochlorine pesticides exposures to various diseases including cancer and Parkinson's disease. Water bodies often serve as a key receiver of harmful industrial and domestic pollutants emitted from industrial and domestic sources. Pesticides can often enter water through sewage plants, sewer overflows, surface water runoffs and leaching from agricultural applications or even through improper disposal. Regulatory and public concern over pesticide residues in water supplies has been increasing, and it is important to develop a reliable method for routine test of pesticides in water supplies.

Presented here is a novel solid-phase extraction technique using disposable pipette extraction (DPX) for determination of OCPs in water followed by gas chromatographic analysis. The purpose of the current study is to evaluate the suitability of GC/FID, GC/ECD and GC/MS, GC for OCPs analysis in water. Our study showed that GC/FID is not suitable for OCPs analysis in water due to its low sensitivity and poor selectivity. GC/ECD is the most sensitive method; however, it could be affected by background components. Therefore, GC/ECD analysis followed by GC/MS confirmation provided the necessary sensitivity and selectivity for determination of OCPs in water.

**\*40. Evaluation of different solid phase sorbents for the extraction of benzodiazepines in water**

Nagabandi, S., Fitzgerald, Samantha M., Guan, H., Western Illinois University, Macomb, IL.

Drug residues can be released to surface water and drinking water, and the concentration of drug residue in water can be used to back track drug use in communities. Benzodiazepines are prescribed in large quantities for a variety of conditions, such as anxiety and insomnia, in the United States today; however, there is insufficient removal at drinking water treatment plants due to high cost. As a result, benzodiazepines drugs are the latest group emerging that is receiving a considerable amount of attention. Since most drugs of abuse are present in wastewater influent at part per billion (ppb) levels, it is necessary to develop and validate a selective and robust solid phase extraction (SPE) method for determination of benzodiazepines in water.

The focus of the current project is to investigate a novel SPE method using disposable pipette extraction (DPX) for sample preparation. To achieve selective extraction of benzodiazepines in water, octadecylsilane, styrenedivinylbenzene, and weak anion exchange sorbents were studied. It was found that styrenedivinylbenzene, and weak anion exchange sorbents provided good accuracy for the targeted benzodiazepines compounds with recoveries between 70 and 90%, with relative standard deviations of the recoveries below 10%, which indicates a good accuracy and precision of the proposed method. However, and the recoveries were below 70% when octadecylsilane was employed.

**\*41. Determination of aflatoxins b1, b2, g1 and g2 in corn products using disposable pipette extraction followed by HPLC analysis**

Fatima, A., Munster, Lisa A., Guan, H., Western Illinois University, Macomb, IL.

Aflatoxins are cancer-causing toxins that are produced by the molds *Aspergillus flavus* and *Aspergillus parasiticus*. These molds grow on corn, peanuts, milo, rice, and many other grains and nuts under appropriate condition, but the risk of aflatoxin contamination is greater in corn. Traditional methods for extraction of aflatoxins B1, B2, G1 and G2, are based on immune-affinity sample cleanup followed by liquid chromatography (LC) or capillary electrophoresis (CE) analysis. These sample preparation methods, however, are expensive, require many steps, and increase analysis time. This paper presents the rapid and simple method for the determination of Aflatoxin B1, B2, G1 and G2 in corn products using Disposable Pipette Extraction (DPX) followed by High Performance Liquid Chromatography (HPLC) analysis. Disposable pipette extraction is a fairly new SPE technique, and DPX's intrinsic mixing capabilities provide unsurpassed extraction efficiencies and equilibration times. The DPX methodology presented here incorporates styrene divinyl benzene (SDVB) for reversed phase mechanisms, which provided satisfying accuracy and precision for extraction of aflatoxins in corn products. The chromatographic analysis of aflatoxins was accomplished using a C 18 column eluted with an isocratic mobile phase consisting of methanol, acetonitrile and water. The proposed method is rapid, simple and accurate for monitoring aflatoxins in corn products.

**\*42. Analysis of explosives in water using solid phase extraction and HPLC**

Taylor, Mercedes M., Stewart, Katelyn J., Bonnell, Lauren E., Guan, H., Western Illinois University, Macomb, IL.

Terroristic attacks, occurring throughout the world, frequently employ explosive materials to inflict harm and destruction to others. Due to the increasing demand for time-efficient forensic investigations, particularly organic explosive analysis, advancements are continually made to

ease sample preparation processes. Solid-phase extraction (SPE) has been the most popular sample preparation method for trace analysis such as explosives. Compared with traditional SPE technology, the disposable pipette extraction (DPX), described here, eliminates the need for a large sample volume and reduces the amount of organic solvent required for the extraction process. Therefore, concentration and reconstitution of the eluted analytes is no longer necessary, since a minimal amount of the elution solvent was used. Directly following the extraction, enriched samples were subjected to an instrumental analysis by means of high performance liquid chromatography with UV detection (HPLC-UV). After obtaining promising recovering using the DPX method for explosive-spiked water samples, a matrix match calibration study was performed used simulated lake water containing explosive contaminations. Promising recoveries and linearity displayed by all analytes resulted from the aqueous samples and a preliminary investigation was initiated to extract and analyze explosive residues present on fabric or cloth samples.

**\*43. A chemical stability study of the N-terminal half of the Calcium binding domain of NADPH oxidase 5**

Dickerson, Megan L., Tatro, Allison C., Reynolds, Nicole R., and Wei, C.-C., Southern Illinois University Edwardsville, Edwardsville, IL.

The non-phagocytic NADPH Oxidase 5 (NOX5) enzyme generates superoxide, which is critical for cells to function correctly. NOX5 contains a calcium binding domain (CaBD), in which its four EF-hands bind four Ca<sup>2+</sup> ions. The N- and C-terminal halves of CaBD (N-CaBD and C-CaBD) are structurally independent. Previously, we used IAEDANS-labeled CaBD and studied its chemical stability. Our results revealed that Ca<sup>2+</sup>-bound C-CaBD has a higher chemical stability, when compared to N-CaBD, with the value of the melting temperature (T<sub>m</sub>) equaling to 4.7 M guanidine hydrochloride (GdnHCl) while N-CaBD has a lower chemical stability with the value of T<sub>m</sub> equaling 2.5 M. However, because the dye was specifically labeled in the C-terminal half, the information regarding N-CaBD is not clear. Here we generate recombinant N-CaBD and its calcium-site removed mutants and separately study their chemical stability. The protein samples were incubated overnight in varying concentrations of GdnHCl ranging from 0.0 M to 6.0 M, in the presence of calcium and EDTA and their Trp fluorescence intensities and maxima emission wavelength were recorded. Our data revealed that the values of T<sub>m</sub> for apo N-CaBD and Ca<sup>2+</sup>-bound N-CaBD were ~4.2 and 4.7 M respectively, indicating that Ca<sup>2+</sup>-bound N-CaBD has a comparable chemical stability to Ca<sup>2+</sup>-bound C-CaBD. Thus, the lower binding affinity of N-CaBD is largely attributed to the smaller free energy difference between unfolded and folded states while the higher binding affinity of C-CaBD is mainly due to the large energy difference between unfolded and folded states

**\*44. Ethopropazine Complexes of Transition Metals: Antioxidant and Radical Scavenging Activities**

Debbeti, Varun; Ahmad, Tarab J., Kouassi, Gilles, K., Made Gowda, Netkal M. Western Illinois University, Macomb, IL.

Phenothiazines (PTZs) represent the tranquilizing agents that are used as antihistaminic and antipsychotic drugs. [1] N-Alkylaminophenothiazine derivatives (NAPTZs) such as ethopropazine hydrochloride (C<sub>19</sub>H<sub>24</sub>N<sub>2</sub>S • HCl or EPHCl) are some of the important members of this class. The first part of the present project is on the synthesis and characterization of transition metal complexes of the EPHCl ligand. Several transition metal complexes of the EPHCl ligand with metal salts, such as ZnBr<sub>2</sub>, CdBr<sub>2</sub>, CdI<sub>2</sub>, and HgBr<sub>2</sub>, have been synthesized

and characterized. The molecular formulations and structures of the complexes will be discussed. The second part of the project involves the evaluation of the new complexes for their antioxidant/free-radical scavenging activities using standard assays [2]. The experimental results will be presented and discussed. **Acknowledgement:** We thank the Western Illinois University Research Council for support.

[1] Snyder, S.H., 1976, Am. J. Psychiatry, 133, 197; [2] Chaitanya Lakshmi G., Ananda S., and Made Gowda N.M., 2009, Synthesis and Reactivity in Inorganic, Metal-Organic and Nano-Metal Chemistry, 39(8), 434-440, 2011.

#### **\*45. Metal-Promethazine Complexes: Synthesis and Characterization**

Manasani, Pavankumar, Ahmad, Tarab, J., Kouassi, Gilles, K., Made Gowda, Netkal M. Western Illinois University, Macomb, IL.

Phenothiazines (PTZs) including promethazine hydrochloride ( $C_{17}H_{20}N_2S.HCl$  or PMHCl) are tricyclic compounds, which find applications in medicine as antipsychotic and antihistaminic drugs and also as inodilators in the treatment of congestive heart failure [1]. In this project, several transition metal complexes of the PMHCl ligand with metal salts, such as  $ZnBr_2$ ,  $CdBr_2$ ,  $CdI_2$ , and  $HgBr_2$ , have been synthesized. Products have been characterized based on their elemental analysis and other analytical data. The molecular formulations and proposed structures of the complexes will be discussed. Furthermore, the evaluations of *in vitro* antioxidant/radical scavenging activities of the complexes have been performed using the following standard assays [2]: i) ferric ion reducing assay; ii) total antioxidant capacity assay; iii) hydroxyl radical scavenging assay; iv) superoxide radical scavenging assay; and v) nitric oxide radical scavenging assay. The results will be presented and discussed.

**Acknowledgement:** We thank the Western Illinois University Research Council for support.

[1] Snyder, S.H., 1976, Am. J. Psychiatry, 133, 197; [2] Chaitanya Lakshmi G., Ananda S., and Made Gowda N.M., 2009, Synthesis and Reactivity in Inorganic, Metal-Organic and Nano-Metal Chemistry, 39(8), 434-440.

#### **46. Chemical vapor deposition of $TiO_2$**

Harrison, Nicole L., and Flint, Edward B. Bradley University, Peoria, IL.

Thin films of titanium dioxide ( $TiO_2$ ) were produced on glass and silicon (111) substrates by chemical vapor deposition (CVD) from titanium isopropoxide and oxygen. The CVD substrates, arranged in a glass tube, were placed in a tube furnace, which was heated to an average temperature of  $450^\circ C$ . A small well of liquid titanium isopropoxide was attached to the furnace input nozzle, which was heated to about  $150^\circ C$ . Titanium isopropoxide was carried into the furnace by a stream of nitrogen gas (at a flow rate of about 3000 mL/min). An input stream of oxygen gas (at a flow rate of about 50 mL/min) mixed with the titanium isopropoxide/ $N_2$  mixture just before it entered the glass tube in the furnace. The reaction ran for about an hour. The temperature in the furnace and the resulting titanium deposition were not uniform along the length of the tube. Where the temperature is between the highest temperature,  $463^\circ C$ , and  $400^\circ C$  the  $TiO_2$  reacts on the substrates to form a  $TiO_2$  film with uneven thickness, which was visualized by the appearance of parabolic rainbows. Where the temperature drops below  $170^\circ C$  an opaque layer of white  $TiO_2$  powder was found. The powder was not bound to the substrates. In all other regions of the tube, no visible deposition was apparent. Deposition characteristics correlate strongly with temperature. UPS and XRD analysis will be presented.

## **Division: Earth Science**

### **\*47. Hermosa Formation, Silverton, CO, sediment source area petrographic analysis** Pourtabib, Kristina P. and Burns, Diane M. Eastern Illinois University, Charleston, IL.

The Pennsylvanian/Permian Hermosa Formation in southwestern Colorado is composed of arkosic sandstone, marine limestone, and shale that formed at a time when the depositional environments consisted of open-marine carbonate shelf and coastal plains. During the time of deposition, there were many tectonically active topographic highlands in the region, including the Ancestral Rockies to the west, the Uncompahgre and Emery Uplifts to the northwest, the San Luis Highlands to the southeast, and the Zuni-Defiance-Kaibab Uplifts to the southwest. Previous studies have attributed the source of the main sediment supply of the Hermosa Formation to the Ancestral Rockies. Because the area around the Hermosa Formation consisted of many different dynamic regional uplifts, it is possible that there were multiple source areas. By analyzing the sediment from the Hermosa Formation and determining the provenance, it will provide a better understanding of the paleogeographic evolution of this region.

The goal for this study is to analyze multiple field samples taken from the Hermosa Formation using the Gazzi-Dickinson point counting technique. Rock samples have been cut into billets and made into thin sections. After the samples have been analyzed, the results will be compared to a previous sediment source area study on the contemporaneous Casper Formation of southeastern Wyoming, where sediments were found to be derived from the Ancestral Rockies and a northeastern topographic highland.

## **Division: Environmental Science**

### **\*48. Effects of Prescribed Burning on Grassland Avifauna at Riverlands Migratory Bird Sanctuary**

Wood, Travis J.<sup>1</sup>, Essner, Richard L.<sup>1</sup>, Minchin, Peter R.<sup>1</sup> and Deutsch, Charlie.<sup>2</sup><sup>1</sup>Southern Illinois University Edwardsville, Edwardsville, IL. <sup>2</sup>U.S. Army Corps of Engineers, West Alton, MO.<sup>2</sup>

Native grasslands are disappearing at an alarming rate throughout North America. Grassland habitat has undergone significant degradation through fire suppression, overgrazing, and fragmentation. As suitable habitat has vanished many native grassland bird species have experienced pronounced population declines. As grassland bird populations continue to suffer declines the need for effective management of remaining grasslands becomes increasingly important. Prescribed burning is used to restore grassland ecosystems and promote self-sustaining populations of wildlife. Few studies have explored the long-term impact of frequent burning on grassland bird species. This study compared the correlations between grassland bird populations and vegetative communities based upon burn histories. Riverlands Migratory Bird Sanctuary (RMBS) contains 486 ha of protected wetland and prairie restoration sites. The grassland management area was divided into three study areas based upon time since burning: 1) 0-1 year; 2) 2-4 years; and 3)  $\geq 5$  years. Each burn category area contained 35, 50-m fixed-radius survey points. Point count surveys of grassland bird populations were conducted at the 105 randomized circular plots from June-August 2011. Vegetation surveys were conducted along 100-m transects at each of the survey plots. The use of prescribed fire at RMBS has generated a mosaic of habitat types in varying stages of succession and has contributed to a diverse avifauna. Those areas burned 2-4 year prior to sampling displayed the greatest total species richness.

**\*49. Evaluating green roof coverage of various green roof establishment methods**

Buckles, Brittany<sup>1</sup>, Retzlaff, Bill<sup>1</sup>, Krutsinger, Roxane<sup>1</sup>, Jost, Vic<sup>2</sup>, Morgan, Susan<sup>1</sup> and Luckett, Kelly<sup>3</sup>. <sup>1</sup>Southern Illinois University Edwardsville, Edwardsville, IL. <sup>2</sup>Jost Greenhouses, Des Peres, MO. <sup>3</sup>Green Roof Blocks, Lake Saint Louis, MO.

A recent study, established in 2010, evaluated the use of Sedum cuttings, Sedum 406 plugs, and a soil binder singly and in combination as sustainable green roof establishment methods on the Student Success Center's roof at Southern Illinois University of Edwardsville. Green roof areas that were treated only with cuttings and those treated with 406 plugs and Atlas Soil Lock had greater roof coverage than the untreated blocks and all other treatments in the initial establishment period (the first 18 months). In order to re-evaluate the longevity of the establishment treatments, the green roof coverage of the experimental plots was re-measured on Jan 5th 2012. Green Roof Blocks treated with cuttings and the Green Roof Blocks treated with 406 plugs with Atlas Soil Lock still have greater than 75% roof coverage by Sedum plants. These two treatments had significantly greater roof coverage than all the other treatments. It is clear that either using spring cuttings or applications of 406 plugs with a soil binding agent are viable methods to increase the plant roof coverage of green roof systems.

**\*50. Lead contamination of the biota of Horseshoe Lake, Madison, Co.**

Wilson, Matthew J., Brugam, Richard, B., Lin, Zhi Qing and Brunkow, Paul. Southern Illinois University Edwardsville, Edwardsville, IL.

Horseshoe Lake adjacent to Granite City is a 3, 000 year old ox bow, located near a site of a Lead (Pb) smelter. In recent studies by others have shown that Pb is excluded from higher trophic levels unlike organic pollutants. Therefore, the question could be asked, does the Pb bioaccumulate up the food chain in Horseshoe Lake? If Pb accumulates up a food web where in the food web is it most abundant? By the analysis of trophic levels in the lake food web it is possible to determine whether Pb is affecting the biota of the lake. We examined Pb concentrations in lake sediment, seston, zooplankton, and fish using ICP-MS. We used Cougar Lake on the SIUE campus. Our hypothesis is that organisms from Horseshoe Lake will have much higher lead concentrations than Cougar Lake. Our preliminary results show strong differences in sediment Pb between lakes (Horseshoe = 170 ppm Pb, Cougar = 16 ppm Pb) Chironomus, a benthic invertebrate present in both lakes shows a strong between-lake difference (Horseshoe= 12 ppm, Cougar = 5 ppm). This preliminary data seems to support our hypothesis. However, more data is needed from higher trophic level organisms.

**\*51. The paleomicrobiology and geomicrobiology of the Dakhleh Oasis, Egypt with scanning electron microscopy**

Quesnell, Kathryn A., Adelsberger, Katherine and Dybas, Linda. Knox College, Galesburg, IL.

Archaeological evidence of early humans found at the Dakhleh Oasis in Western Egypt implies that the Oasis may have been used by early hominids as a source of water while migrating out of Africa through Egypt. However, geologic evidence shows the presence of jarosite, which requires a pH of 1-3 to form. The potability of water is compromised when the pH becomes more acidic than 6.5, making water that is suitable for jarosite formation unsuitable for human consumption. However, certain types of microbial activity such as sulfur or iron oxidation can acidify water, meaning that there may have been periods of time where the pH of the water was and more accessible to humans. It is also possible that there may also have been localized microniches of acidity where the jarosite may have developed within the microbial mats. In this



study, ironstone from the Dakhleh Oasis in Egypt is examined under the Scanning Electron Microscope to discover evidence of microbially mediated jarosite formation.

**\*52. Storm water runoff of residential green roof systems**

Mosby, Katie<sup>1</sup>, Murphy, Dan<sup>1</sup>, Morgan, Susan<sup>1</sup>, Jost, Vic<sup>2</sup>, Lockett, Kelly<sup>3</sup> and Retzlaff, Bill<sup>1</sup>.

<sup>1</sup>Southern Illinois University Edwardsville, Edwardsville, IL. <sup>2</sup>Jost Greenhouses, Des Peres, MO.

<sup>3</sup>Green Roof Blocks, Lake Saint Louis, MO.

As human population increases so does environmental issues. Runoff is an escalating issue that has arisen from the substantial amount of impervious surfaces in developed areas. A popular resolution to manage runoff has become a green roof. To evaluate their runoff retention potential, eighteen residential green roof models were built at three different angles, 1°, 20° (5/12), and 40° (10/12). Nine of the roofs were shingled and represent a standard residential roof, and nine were also shingled and had a green roofs system installed. The roof models were divided into three sets of six and arranged in a completely randomized design. The green roofs were fitted and planted with a mixture of seven Sedum species including: *S. kamtschaticum*, *S. reflexum*, *S. sexangulare*, *S. album*, *S. spurium*, *S. floriferum*, and *S. immergrunchen*. Each roof system was equipped with gutters and barrels to collect the storm water runoff under each gutter. Measurements from each barrel were taken after each precipitation event and were compared to each roof model. During the initial project establishment period, green roof systems reduced the runoff by 42%. On December 16, 2011, during a saturated period, runoff of green roof systems was reduced by 40% while runoff of shingled roofs was reduced by 12%. Residential green roof systems show promise as a storm water management practice.

**Division: Health Sciences**

**53. Zyvox influences murine immune responses**

Hurt, Mariah, Wells-Kestur, Adrienne, Ruiz, Catherine, Robinson, Shonnece and Kitz, Dennis J. Southern Illinois University Edwardsville, Edwardsville, IL

The linezolid class antibacterial antibiotic Zyvox (Pfizer) is used to treat gram positive bacterial infections, of which many are drug resistant. Our studies were used to see if zyvox could enhance certain immune responses. With our assays, zyvox does not enhance neutrophil cidal activity for yeasts, but it does significantly enhance fungicidal activity by macrophages. Zyvox also significantly enhances T cell mediated DTH response to the contact sensitizing chemical dinitrofluorobenzene (Sigma). Zyvox's effect on organ clearance of intravenously administered yeasts from murine organs was less clear, with reductions in yeast CFU from liver, spleen and kidneys, but only yeast reductions in kidneys of zyvox treated animals were significant. Our findings support the hypothesis that zyvox may benefit host therapy by enhancing certain immune responses. Funded in part by the Max Baer Heart Fund, Fraternal Order of Eagles and the LS-AMP Research Scholar's program, NSF.

**\*54. The life expectancy of citizens in Kane County is significantly lower than citizens of Illinois of the United States**

Malmborg, Whitney A. and Beck, Hans T. Aurora University, Aurora, IL

Life expectancy in the U.S. has increased dramatically from 47 yr at the beginning of the 20th C to 77 yr currently. However, do citizens of Kane County have significantly different life expectancies from those of Illinois and the U.S.? I used demographic methods to compile and

calculate life tables for men and women. I obtained age and gender information from interment data in Kane County for a total of 1, 000 individual records. This retrospective study addressed whether life expectancy in Kane County is significantly different than life expectancy in Illinois, and the U.S. The Illinois life expectancy is currently 76.4 yr, and my calculation of Kane County life expectancy was 71.12 yr. I found that there is a significant difference in life expectancy of citizens in Kane County compared to Illinois, living 5.28 yr less than the average citizens of Illinois. U.S. life expectancy is currently 78.24 yr, and in Kane County, life expectancy was 71.12 yr. I found that there is a significant difference in life expectancy of citizens in Kane County compared to the U.S. as a whole, living 7.12 yr less than the average citizens of the U.S. In my study, I also addressed other questions with regard to comparisons of gender and pre- and post- Great Depression life expectancies. I found a general pattern of males, on average, living 2.2 yr longer than women pre- Great Depression, yet post-Great Depression, women, on average, living 3.98 yr longer than men, as well as a pattern of significantly more infant deaths pre-Great Depression, than post-Great Depression.

**\*55. The effects of Chloroquine and UV radiation on HL-60 cell line**

Wilm, Kyle R. and Wanda, Paul. Southern Illinois University Edwardsville, Edwardsville, IL

Cancer is one of medicine's greatest adversaries. In the past, cancer treatments have hinged on the ability to destroy vast numbers of cells, often harming healthy cells in the process. Unlike some of these earlier treatments, the future of cancer treatment relies on new and innovative ways of approaching treatment of cancer. Each and every patient has a unique biological system with a unique cancer. Modern medicine has been forced to affront this problem head on. More modern approaches have focused on correcting dysfunctional cellular processes. The apoptosis pathway has been front and center in this quest. HL-60 has a deletion mutation in the genetic code for protein 53. P-53 detects and facilitates the repair of DNA and may even initiate apoptosis and mutations can arise from environmental toxins, genetics and even some viruses. Today, HL-60 treatment focuses on alternative treatment to circumvent p-53 activity. For better or worse, efforts are hindered by the human body's mandate to survive, leading to such results as multi-drug resistance. Dr. Wanda has attempted to attack an often overlooked organelle, the lysosome. These digestive organelles can be lysed, an activity normally performed in apoptosis, through the use of UV radiation. This temperature-dependent approach could be enhanced through the addition of an anti-malarial drug, Chloroquine. Chloroquine is slightly basic and naturally stores in the lysosome. The HL-60 line has enlarged and unstable lysosomes. This leads to an unusually large amount of reactive Chloroquine being stored.

**\*56. Effect of 8-cyclopentyltheophylline on heart rate in newborn rats**

Workman, Erika R. and McGilliard, Kip L. Eastern Illinois University, Charleston, IL

Infant apnea is treated with methylxanthines, such as caffeine or theophylline, due to their respiratory stimulant effects. These drugs also cause general stimulation of the central nervous system and the heart, both undesirable side effects in premature infants. The methylxanthines are thought to act by antagonizing adenosine receptors. A related compound, 8-cyclopentyltheophylline (CPT), is a potent antagonist of adenosine A1 receptors. Our hypothesis was that CPT in low doses would cause an increase in heart rate. In this study, the effect of (CPT) on the heart rate of newborn rats was examined. The electrocardiogram (ECG) was recorded in rats ranging in age from 4 to 7 days using a set of 5 mini-electrodes attached to the ventral skin surface of the rat. After a 10-min initial recording period, treatment rats were injected subcutaneously with either 320, 640, 1280, or 2560 µg/kg of CPT, while control rats

were injected with 0.9% NaCl. ECG was recorded continuously for one hour after drug and heart rate was determined from this recording at 5 min intervals. Mean heart rate remained within 10% of baseline in control rats. None of the doses of CPT had a significant effect on the heart rate. The dosage of CPT was taken to the limit of its solubility. In conclusion, CPT did not stimulate heart rate in the predicted dose range. These data, in combination with previous studies in our laboratory, suggest that cardiostimulation by xanthine analogs may involve antagonism of adenosine A1 receptors in combination with other receptor interactions.

**\*57. Effects of 8-cyclopentyltheophylline on respiration in newborn rats**

Albers, Christine E. and McGilliard, Kip L. Eastern Illinois University, Charleston, IL

Neonatal apnea, a temporary cessation of breathing in newborns, is commonly treated by methylxanthines, such as caffeine or theophylline. The methylxanthines are known to stimulate respiration in infants who are at risk of apnea, but they also cause unwanted side effects, such as central nervous system stimulation and cardiostimulation. The methylxanthines are thought to act by antagonizing adenosine receptors. A related drug, 8-cyclopentyltheophylline (CPT), is a potent antagonist of adenosine A1 receptors. My hypothesis is that CPT in low doses would stimulate breathing in newborn rats. The effects of CPT on respiration were tested in 4- to 7-day-old rats. Each rat was placed in a heated body plethysmograph, and its respiratory rate and volume were measured using a flow transducer, pneumotachograph, and PowerLab data acquisition system. After a 10-min control period, each rat was given a subcutaneous dose of CPT (80, 160, 320, 640, or 1280 µg/kg) or saline. Respiration was then recorded continuously for one hour, and comparisons were made at 5-min intervals. Minute ventilation (VE), tidal volume (VT), respiratory rate (f), and mean inspiratory flow (MIF) decreased after saline treatment. These values did not show significant change in the lower doses of CPT (80, 160, 320 µg/kg). However, higher doses of CPT (640 and 1280 µg/kg) showed increases in VE, f, VT, and MIF. The increase in VE appears to be primarily due to an increase in f. It is concluded that CPT stimulates respiration by antagonism of adenosine A1 receptors.

**Division: Microbiology**

**\*58. Phenotypic and genotypic characterization of *Escherichia coli* isolated from surface waters in Illinois and Missouri**

Janezic, Kristopher J., Hendricks, Eric W., Theisen, Alexandra N., Ferry, Blake, Roberts, Morgan E., Murphy, Samantha, Scott, Sarah M., Janiga, Brian A., Johnson, Tiffany, Hung, Kai F., and Daniel, Steven L. Eastern Illinois University, Charleston, IL.

A common member of the intestinal microbiota in humans and animals is *Escherichia coli*. Based on the presence of virulence factors, *E. coli* can be potentially pathogenic. The focus of this study was to isolate *E. coli* from surface waters in Illinois and Missouri and determine phenotypic and genotypic diversity among isolates. Water samples positive for fecal coliforms based on the Colisure test were streaked directly onto EMB agar (37°C) or transferred to EC broth (44.5°C). EC broth cultures producing gas were then streaked onto EMB agar. Forty-five isolates were identified as *E. coli* using API 20E and Enterotube II, and some phenotypic variation was observed in metabolism and fermentation. Antibiotic susceptibility was also determined using the Kirby-Bauer Method. Differential responses to 10 antimicrobial agents were seen with 14, 9, 5, and 2 of the isolates resistant to cephalothin, triple sulfonamide, ampicillin, and tetracycline, respectively. All of the isolates were susceptible or intermediate to amoxicillin, ciprofloxacin, polymyxin B, gentamicin, imipenem, and nalidixic acid. Genotypic

variation was assessed through multiplex Polymerase Chain Reaction for five genes: *stx<sub>1</sub>* and *stx<sub>2</sub>* [shiga toxin], *eaeA* [intimin]; *hlyA* [enterohemolysin]; and *uidA* [ $\beta$ -D-glucuronidase]. Genotypic variation was observed with two of the isolates possessing the virulence gene (*eaeA*) for intimin. These findings increase our knowledge of the diversity of *E. coli* which will help in the assessment of this organism and its role in human health.

#### **59. Growth and sucrose activity of *Leuconostoc* in defined growth media.**

Becker, Nick P., Holt, Scott M. and McAndrew, John. Western Illinois University, Macomb, IL

Sucrases from *Leuconostoc* make commercially important polymers like dextran. Sucrase expression in *Leuconostoc* has been determined using complex growth media. Chemically defined growth media, however, is desirable for consistent results. The goal was to compare growth and sucrase activity when *Leuconostoc* was grown on defined media. Cultures were cultivated in complex and defined media with either glucose or sucrose. Growth was measured using Abs and sucrase was assessed by detection of activity in SDS-PAGE gels. For glucose, four strains showed higher growth and four strains showed lower growth on the defined vs. the complex. For sucrose media, six strains grew higher on the defined and two grew higher on the complex. Sucrase was comparable for strains grown on the defined vs. the complex. Differences were detected in the number of sucrase bands that appeared in the gels. No sucrase band was detected when strain B-742 was grown on defined-glucose but a band was observed when grown on the complex-glucose. For strain B-1355, three sucrase bands were detected when grown on complex-sucrose, however, only two bands were observed when grown on defined-sucrose. Results indicate that growth of *Leuconostoc* on complex versus defined was comparable but strain-dependent. Sucrase was also comparable but a few differences in the number of enzyme bands were observed due to components in the complex media.

#### **60. Influence of culture conditions on hydrogen peroxide synthesis by *Lactobacillus jensenii***

Pohren, Adonica S. and Holt, Scott M. Western Illinois University, Macomb, IL

*Lactobacillus jensenii* can produce H<sub>2</sub>O<sub>2</sub> to inhibit pathogenic vaginal microbes. The goal was to determine how conditions such as glucose, pH, temp., and growth influence H<sub>2</sub>O<sub>2</sub> by *L. jensenii*. Cultures were resuspended in buffer and exposed to different culture conditions. An assay was used to measure H<sub>2</sub>O<sub>2</sub> after cell exposure to each condition. H<sub>2</sub>O<sub>2</sub> from *L. jensenii* was lowest at the highest glucose concentration tested indicating that H<sub>2</sub>O<sub>2</sub> may be effective against competition when carbon is limited. The highest rates of H<sub>2</sub>O<sub>2</sub> were observed at mid-range levels of glucose. H<sub>2</sub>O<sub>2</sub> was higher at neutral pH and lower at acidic pH levels. Higher H<sub>2</sub>O<sub>2</sub> at neutral pH may be an antibacterial response to competition from other microbes which occurs during a vaginal infection. The lower H<sub>2</sub>O<sub>2</sub> observed at acidic pH levels may represent a mechanism Lacto. uses to conserve energy, because the acidic environment itself would inhibit the growth of pathogenic microbes. A lower rate of H<sub>2</sub>O<sub>2</sub> occurred at 30°C, the lowest temperature tested, than at all other temperatures. Peak rates of H<sub>2</sub>O<sub>2</sub> occurred at the two highest temperatures tested, indicating that increased temperature enhances H<sub>2</sub>O<sub>2</sub>. *L. jensenii* produced higher H<sub>2</sub>O<sub>2</sub> during early log growth when nutrients are in excess and when cells are focused on primary metabolism. This research indicates that many factors can influence H<sub>2</sub>O<sub>2</sub> by *L. jensenii*.

### **61. Alternansucrase gene structure from *Leuconostoc* B-1498**

Holt, Scott M. Western Illinois University, Macomb, IL

Alternansucrase (ASR) from *Leuconostoc* can make the polymer alternan. Structural information for asr is lacking as only two asr genes have been sequenced. The goal was to sequence and analyze asr from Leuc. B- 1498 to help understand structural characteristics. B-1498 asr was amplified by PCR and cloned into a TOPO vector. asr was sequenced using Sanger and ABI methods. B-1498 asr sequence was analyzed by BLAST, ORF Finder, and ClustalW2. Results indicated that asr is 6174 nt long with putative start, RBS, -10, -35, and stop sites identified. The B-1498 asr gene has 99% and 97% identity with Leuc. KM20 asr and Leuc. B-1355 asr. B-1498 asr gene shows a closer identity to the KM20 asr gene than the B-1355 asr gene. The B-1498 asr gene encodes a 2057 aa protein with a mass of 228, 798 Da. B-1498 ASR possesses similar aa domain structure associated with glucansucrases but with distinctive features associated with known asr genes. Distinctive ASR features include three N-terminal repeats, a single C-terminal A repeat, and seven APY repeats. Alignment among other asr genes shows a high degree of aa conservation, however, there are less conserved regions within the catalytic core. The less conserved regions within the catalytic domain may provide insight into why B-1498 ASR and B-1355 ASR make different proportions of links in alternan.

### **\*62. Antibiotic susceptibility testing of non-*Escherichia coli* thermotolerant coliforms (KEC) isolated from streams feeding into the Mississippi River in Hancock County, Illinois**

Pierre, Myrtha, and French, Wendell L. Western Illinois University, Macomb, IL

Fecal pollution is determined by the presence of thermotolerant coliform bacteria in water (Crenshaw, 2011). Thomas Crenshaw and Dr. Wendell French conducted a recent study on the degree of fecal pollution in natural water streams feeding into the Mississippi River in Hancock County, Illinois. Over a period of three months, they collected different samples of water aseptically to prevent sample contamination, from seven streams that flow into the Mississippi River. The samples were filtrated using the membrane filtration technique and placed on CHROMagarECC (ECC) and incubated at both 41°C and 44.5°C to determine the optimum growth temperature of thermotolerant coliforms (Crenshaw, 2011; Alonso et al., 1999). Since the degree of susceptibility of microorganisms vary in between species and strains (Tortora et al., 2007), it is important that antibiotic susceptibility tests be conducted on the isolates from the Mississippi River. We will use different types of antibiotics, each with different modes of action and different spectrums of activity. The objective of our study is to determine the level of sensitivity/resistance as well as multidrug resistance amongst the different strains of non-*E. coli* isolated from the previous study. We will use the reference strain of *E. coli* (ATCC8739) as a negative control for comparison.

### **63. Sequencing of *Salmonella* strains During Host Shift**

Brauer, Shari D., Swarm, Steven A. and Dunkley, Eugene A. Greenville College, Greenville, Illinois

Despite the amount of research that has already been undertaken in regards to the genetics of *Salmonella*, the mechanisms triggering its virulence, pathogenesis, host specificity, and genome reduction are not fully understood. This research will endeavor to enable scientists and researchers to more fully understand the evolution of host specificity by comparing the genome of an American strain in comparison to a NTS Sub-Sahara African strain which is pathogenic in AIDS patients. In addition, we look to compare the genomes of strains of *Salmonella*

*Typhimurium* obtained from canine fecal samples, highlighting possible sources for future increases in *Salmonella* virulence in humans by documenting the evolutionary changes occurring as the host specificity shifts.

**64. Biofilm development: Many characters, different plots for *Staphylococcus aureus* and *Escherichia coli***

Blazina, Erin M., Pecherek, Aleksander W., Figus, Elizabeth, Floren, Elizabeth A., Keleher, Jason and Kavouras, Jerry H. Lewis University, Romeoville, IL

*Staphylococcus aureus* and *Escherichia coli* are leading causes of hospital-acquired infections and form biofilms on many surfaces, which serves as a protective barrier for the bacteria. The hypothesis is that environmental factors play an important role in the development of biofilms. In this study, cell arrangements and densities within films were examined. *S. aureus* and *E. coli* biofilms were developed in glass and polystyrene Petri dishes at 28° C and 37° C for 1 or 24 hours using log phase cultures. Cells were fixed and stained with crystal violet. Thirty random fields of view were examined in each dish using light microscopy. Cell arrangements were categorized as individuals, or in clusters of two, three, four, and five or more. The number of cells were determined in each field of view. *S. aureus* and *E. coli* biofilms developed at 28°C displayed a predominantly clustered cell arrangement (P<0.05, ANOVA), whereas the same biofilms developed at 37°C comprised mostly of individual cells (P<0.05, ANOVA). Cell densities within *S. aureus* biofilms decreased over 24 hours, whereas densities within *E. coli* biofilms increased over 24 hours (P<0.05, ANOVA). This indicates that temperature and surface chemistry play a significant role in the arrangement of cells and cell densities within biofilms during development, which ultimately can influence the mature biofilm architecture, and *S. aureus* and *E. coli* biofilms develop over time using different mechanisms.

**\*65. Antibiotic susceptibility testing of *Escherichia coli* thermotolerant coliforms (KEC) isolated from streams that feed into the Mississippi River in Hancock County, Illinois.**  
Parker, Morris L. Western Illinois University, Macomb, IL

The number of thermotolerant coliform bacteria present in water determines fecal pollution. During a three month period (June 2010-August 2010) Dr. Wendell French and Thomas Crenshaw collected 54 samples from eight different streams that all feed into the Mississippi. These samples were aseptically collected from the eight streams sites labeled A-G. These samples were serially diluted to a 10<sup>5</sup> and then vacuumed filtered onto Whatman membrane filter paper. After filtration, these membranes were placed on CHROMager ECC and placed into incubator at 41°C OR 45°C. After a 24-hour incubation period, the cultures were removed and enumerated. This was done to determine the optimum growth temperature of the thermotolerant coliforms (Crenshaw, 2011; Alonso et al., 1999) Since the degree of susceptibility of microorganism vary in between species and strains (Tortora et al., 2007). It is important that the isolates collected from the Mississippi be tested with antibody susceptibility test. The main objective of our study is to determine the level of sensitivity/resistance as well as multidrug resistance among the different strains of *E. coli* isolated from a previous study of this experiment. The reference strain of *E. coli* (ATC8739) will be used as a negative control for comparison.

## **Division: Physics, Mathematics & Astronomy**

### **\*66. Arecibo calibrators for galactic observations**

Halbe, Daniel and Araya, Esteban, D, Western Illinois University, Macomb, IL, USA

In radio astronomy, all science projects require observations of calibrators to check pointing performance and sensitivity. The calibrators must be small with respect to the beam of the telescope, and bright enough to be detectable within a few seconds. The 305m Arecibo Telescope is the largest single dish telescope in the world, and it has mostly been used for observations at 1 GHz. Receivers developed and installed in the last decade enable observations at higher frequencies (5 GHz and above), but the standard list of calibrators provided by the observatory is optimized for 1 GHz observations where the beam of the telescope is large. The goal of this project is to obtain a sub-sample of calibrators from the standard Arecibo list that are suitable for galactic studies at 5 GHz. We selected all calibrators within 10 degrees from the galactic plane, and based on their flux density obtained from the VLA calibration manual, and morphology from NVSS and NRAO-VLA archive images, we classified the calibrators as good, marginal, and unsuitable for 5 GHz galactic observations. We found that, out of the 66 calibrators in the original list, only four are ideal for galactic observations with Arecibo at 5 GHz.

### **67. Variability of molecular masers in NGC 7538 IRS 1**

Ezerskyte, Edita and A., Araya, Esteban, D, Western Illinois University, Macomb, Illinois, USA

Molecular masers are commonly found in star forming regions. Some molecular masers are widespread, such as water masers, while others are rare. Formaldehyde masers are an example of rare molecular masers. They were first detected toward the massive star forming region NGC 7538 IRS1. We used the Green Bank Telescope (GBT) between 2008 and 2011 to monitor several maser species including H<sub>2</sub>CO and H<sub>2</sub>O. The H<sub>2</sub>CO maser in this region has two velocity components. Observations of these components over the last three decades have shown a possible correlated variability, with a time-delay of ~14 years. Our new observations support such a correlated variability. The time-scale of the variability and angular separation of the maser components are consistent with a shock front propagating between the maser regions causing changes in the maser gains. If this model is correct, we would expect to see changes in the linewidth and peak velocity of the masers, similar to those observed in H<sub>2</sub>O masers, which are known to originate in shocked gas regions. We present further analysis of our data to investigate the degree of variability of line width and peak velocity of H<sub>2</sub>CO masers in NGC 7538 IRS1.

## **Division: Zoology**

### **68. Ontogeny of body shape and diet in Freshwater Drum (*Aplodinotus grunniens*)**

Essner, Jr., Richard, L.<sup>1</sup>, Patel, Roma<sup>1</sup>, and Reilly, Stephen, M.<sup>2</sup><sup>1</sup>Southern Illinois University Edwardsville, Edwardsville, IL <sup>2</sup>Ohio University, Athens, OH.

Ontogenetic changes in body shape were studied in Freshwater Drum *Aplodinotus grunniens*, using geometric morphometrics. We examined a single cross-sectional sample of juveniles, sub-adults and adults collected from the Ohio River near Racine, OH. Eleven landmarks on lateral profiles of fish were digitized and body shape was compared using relative warp analysis. Significant allometric growth was identified between four relative warp axes and centroid size. Several of the shape changes characterizing growth in *A. grunniens* appear to be functionally

related to feeding. Gut content analysis was consistent with other research that found a dietary shift from soft-bodied prey (e.g., copepods, chironomids) in smaller individuals to hard-bodied prey (e.g., fish) in larger individuals. Key shape changes that correspond to a shift in diet to larger and harder prey types include a more anteriorly positioned mouth, more expansive gape and increased body depth.

#### **69. A Kinematic Comparison of Serpentine Locomotion in Snakes (Suborder: Serpentes)**

Bulla, Andrew, J., and Essner, Richard, L., Southern Illinois University Edwardsville, Edwardsville, IL.

Locomotion presents a unique challenge for snakes, the majority of which reside terrestrially and must travel without the benefit of legs. Snakes are a diverse and highly successful group; however, little is known regarding the evolution of their unique locomotion, nor how locomotor kinematics vary phylogenetically. This research seeks to compare serpentine locomotion among representative species from three snake families (Pythonidae, Boidae, and Colubridae) that span the snake phylogeny. A total of 6 individuals per species will be filmed with high-speed video as they move across an arena. Landmarks placed along the dorsal mid-line of the body will be digitized in order to generate a suite of angular and timing variables that will be compared statistically.

#### **70. Morphological Variation of the Pectoral Girdle in Basal Anurans**

Wells, Ashley, and Essner, Jr., Richard, L., Southern Illinois University Edwardsville, Edwardsville, IL.

Frogs are model organisms for biologists, especially for those interested in examining the relationships between form and function as it relates to locomotion. To date, the majority of anuran functional morphological research has focused on the hind limbs. However, the pectoral girdle exhibits substantial morphological variation that may be key to elucidating the anuran locomotor form-function complex. Frogs exhibit two basic types of pectoral girdles, firmisternal and arciferal. The firmisternal condition is characterized by fusion of epicoracoid cartilages along the ventral midline, allowing no movement; whereas, the arciferal condition is characterized by overlapping epicoracoid cartilages that allow for a large degree of movement in the horizontal plane. Previous research concluded that the two conditions evolved independently multiple times and found no apparent link between morphology and locomotion. The goal of this research is to use recent phylogenetic and morphological data to gain novel insight into the evolution of the anuran pectoral girdle within a group comprising the most basal anuran taxa (Ascaphidae, Leiopelmatidae, Bombinatoridae, and Discoglossidae).

#### **\*71. Locomotor Behavior, Microhabitat Use, and Activity Patterns in the Cane Toad, *Bufo marinus*, (Anura: Bufonidae)**

McClenagan, Nicholas, D., and Essner, Jr., Richard, L., Southern Illinois University Edwardsville, Edwardsville, IL.

The goal of ecomorphology is elucidating the relationship between organismal form and function in an ecological context. Frogs are an ideal system for understanding such relationships since form-function linkages, especially with respect to locomotion, are relatively well understood. Unfortunately, for the majority of anuran taxa, ecological context and relevance are lacking. Instead, biologists have generally grouped frogs into broad, poorly defined ecological categories such as aquatic, semi-aquatic, terrestrial. Descriptions of locomotor behavior are equally



problematic, consisting of terms such as hopper, jumper, burrower, with little more than anecdotal evidence supporting them. The goal of our research is to conduct an ecomorphological analysis of locomotor behavior and microhabitat use across an array of taxa, spanning the anuran phylogeny. Here we report data for the Cane Toad, *Bufo marinus*.

**\*72. Growth and Development of the Raccoon (*Procyon lotor*) Mandible**

Elting, Mitchell, and Kohn, Luci, Southern Illinois University Edwardsville, Edwardsville, IL.

The mandible includes several functional regions, including regions of muscle attachments for chewing and regions associated with dentition. Derived from two different types of tissue, these functional and developmental features must be accommodated during mandible growth. We test for difference in growth patterns in functional and developmental regions in the raccoon (*Procyon lotor*) mandible. A sample of 136 raccoon mandibles representing immature through adult raccoons were photographed, and 18 two-dimensional landmarks were digitized. Lengths between landmarks were calculated to represent dimensions of the ramus, body and alveolar regions. Developmental stage was determined by dental development, and postcranial development where available. We test for significant allometric growth, and for similarity of growth patterns between ages during development. Significant growth patterns provide additional insight into development of the raccoon mandible. Loan of samples from the Illinois State Museum and Illinois Natural History Survey are gratefully acknowledged.

**\*73. Scapula Growth and Development in Raccoons (*Procyon lotor*)**

Spung, Melanie, and Kohn, Luci. Southern Illinois University Edwardsville, Edwardsville, IL.

The scapula is formed from two distinct developmental tissues, and functions in movement of the upper limb and stabilizing the upper limb during movement. Scapula growth must accommodate these functional and developmental differences. This study tests for growth patterns in the raccoon (*Procyon lotor*) scapula in a developmental series representing both immature and mature individuals. Right scapulae from 110 individuals were photographed in a standard position, the locations of 19 landmarks were recorded, and dimensions representing the functional and developmental regions were calculated. Developmental stage was determined by amount of postcranial and cranial development. We test for significant allometric growth and similarity of growth patterns between developmental stages. Significant ontogenetic changes represent functional and developmental patterns. Loan of samples from the Illinois State Museum and Illinois Natural History Survey are gratefully acknowledged.

**\*74. Mussel Communities in the Sangamon River, IL**

Park, Tracey, J, Wildenberg, Amanda, J., Moody, Cassi, J, Laursen, Jeff, R, and Colombo, Robert, E. Eastern Illinois University, Charleston, IL.

Mussel communities have shown sensitivity to multiple abiotic factors and can provide insight into the health of a river's ecosystem. In this study we assessed mussel assemblages along the Sangamon River in Decatur, Illinois. Sites were chosen along a 12 mile stretch of river below the Lake Decatur dam. We conducted mussel surveys consisting of four-man hour hand searches and substrate sieving at 7 sites in summer 2011. The most common species were *Amblema plicata* (105), *Truncilla donaciformis* (38), *Leptodea fragilis* (31), and *Potamilus ohiensis* (21). The average catch per unit effort (CPUE) was 8.36/hour for hand searches and 0.16/m<sup>2</sup> for sieves. Species richness was 14. Mussel species are present below the dam but vary in composition.

**\*75. Individual recognition in the olive nerite snail *Neritina reclivata* (Neritopsina: Neritidae) as determined by clustering behavior**

Guinn, Amanda, Robertson, Marianne, and Watson, Casey, Millikin University, Decatur, IL

A wide variety of animals have the capability of kin recognition but few studies, especially among snails, focus on individual recognition. Recognition can be adaptive when considering things such as helping rear young, reducing aggression, avoiding inbreeding, securing resources, and choosing mates. I tested the ability of the olive nerite snail (*Neritina reclivata*) to discriminate between unfamiliar and familiar individuals by observing the individuals with which a snail formed clusters with. The control group was a set of 15 snails that stayed together in the same tank throughout the experiment. For the experimental groups, I placed 5 familiarized snails of the same color into tanks with unfamiliar snails of a different color. I did this to create three configurations, I: 15 color 1, 0 color 2; II: 10 color 1, 5 color 2; III: 5 color 1, 10 color 2. I formed all possible combinations using three different colors (purple, green, and orange) and repeated the entire process twice. I used the control group to observe the snails' homogeneous clustering behavior, i.e., when they were not introduced to unfamiliar snails or territories. This set a benchmark for expectations of clustering in the experimental groups. My results showed evidence of individual recognition in *N. reclivata*. Five out of seven clusters (on average) during a given phase had excessive amounts of minority colored snails. This indicates that, when placed in a new territory with novel individuals, snails tend to form clusters with familiar individuals.

**\*76. Analysis of stride patterns in wolf spiders and fishing spiders**

Nichting, Brittany, and Brunkow, Paul, Southern Illinois University Edwardsville, Edwardsville, IL.

While both fishing spiders and wolf spiders utilize a double quadruped gait while on land, fishing spiders shift to a simultaneous rowing gait when on water. This difference in gait is interpreted as an important adaptation that allowed for more efficient exploitation of water surfaces. However, few if any studies have examined fine-scale variation in gait patterns in these spiders. The present study represents a preliminary analysis of how gaits differ between fishing and wolf spiders. We filmed spiders (*Dolomedes triton*, *D. tenebrosus*, and *Hogna helluo*) moving on water and on a dry surface at 240 frames/second, and analyzed gait amplitude and timing. *D. triton* took longer to complete strides on both water and land than both *D. tenebrosus* and *H. helluo*, and *D. triton* also generally displayed a higher total amplitude (maximal angle between legs). *D. tenebrosus*, which has relatively shorter legs compared to *D. triton*, was more similar to *H. helluo* than to the congeneric *D. triton* in stride characteristics. All spiders showed a lengthening of stride and an increase in amplitude when on water compared to on land, perhaps reflecting the physical interaction between legs and the walking surface.

**\*77. Vibrational signal transmission in a grass versus an invasive plant: possible effects on wolf spider courtship?**

Lemenager, Kristi, and Brunkow, Paul, Southern Illinois University Edwardsville, Edwardsville, IL.

Rabid wolf spiders (*Rabidosa rabida*) are native to mixed grasslands throughout Illinois. Males court females on grass blades and leaf surfaces by using substrate-borne signals produced through stridulating organs in the pedipalps and abdomen. These signals are essential to preventing predation of males by the females. However, native grass communities are being invaded by *Lespedeza cuneata* throughout Illinois. This Asian plant has a very different

structure from grass, in terms of both growth form and stem material. Wolf spiders can be found in stands of Lespedeza, and the physical structure of Lespedeza may alter how courtship signals are perceived by females. The present project is a preliminary comparison of how well grass and Lespedeza transmit vibrational signals along their surfaces. We generated pure tones at frequencies between 100 and 2000 Hz, and measured signal strength at 10, 20, 30, and 40 cm away using a phonograph needle and sonogram software. Distance did not significantly affect signal transmission in either species. However, there was a significant interaction effect between species and frequency on signal transmission: low frequencies < 500 Hz were transmitted differentially by grass versus Lespedeza. Major components of spider courtship signals utilize this range of frequencies; thus, invasion of grass communities by Lespedeza may affect courtship success in wolf spiders even if it does not affect access to food or refuges.

### **78. Differences in hematocrit and body condition indices between Northern Cardinals and Indigo Buntings**

Hubble, Cody, N, and Wilcoxon, Travis E. Millikin University, Decatur, IL.

Hematocrit is defined as the percentage of the volume of whole blood that is made up of red blood cells and can be used to evaluate the health of individual birds. Body condition indices such as fat score and structural size to mass ratios are also ways to assess the health of birds. We studied Northern Cardinals and Indigo Buntings at 6 sites near Decatur, Illinois from 1 April 2011 to 11 November 2011. Different species and males and females are known to have different physiological demands associated with reproduction. We predicted that Indigo Buntings would have the greater hematocrit and better body condition than the Northern Cardinals in the study and that the male resident songbirds will have a greater overall hematocrit than the female resident songbirds. We found that there were differences in hematocrit between the species of birds but that hematocrit varied less by season and sex of the birds. Understanding differences in individual condition among songbirds help us discover how these animals allocate nutritional resources at different times of the year

### **79. Effects of Supplemental Feeding on Antioxidant Levels in Bird Species**

Hogan, Brianna, M, and Wilcoxon, Travis E. Millikin University, Decatur, IL.

Antioxidants are essential to the health of vertebrates through their protection from free-radical damage. We hypothesized that there would be a difference between birds that were fed supplemental food versus those that were not given supplement with consideration to antioxidant levels. We tested this hypothesis by capturing birds at sites with supplemental food and sites without feeders. Specifically, we examined antioxidant levels in white-breasted nuthatches, black-capped chickadees, and northern cardinals. We found that total antioxidant capacity did increase over time at control sites; however there was a significant effect of supplemental food on total antioxidant capacity after birds at the feeder sites had received supplemental food for more than two months.

### **80. The effect of long-term antioxidant supplementation on survival and function of endogenous antioxidants**

Ridenbark, Tarah, Wessling, Ryan, and Williams, Jason. Southern Illinois University Edwardsville, Edwardsville, IL.

Supplementing antioxidants through diet can reduce oxidative stress and even extend life in many animals. However, the effect of long term supplementation on levels of and effectiveness

of endogenously produced antioxidants is unknown. The purpose of this study was to determine (1) if supplementation with the antioxidant thioproline increased lifespan in the fruit fly, *Drosophila melanogaster*, and (2) if life-long supplementation reduces endogenous levels of antioxidants and/or their effectiveness. Longevity was enhanced in flies supplemented with 0.3% (wt./vol.) thioproline as time until 80% mortality was 7 d longer in these animals compared to control individuals (averaging 67 d). However, flies supplemented with 0.7% thioproline had substantially shorter life spans, reaching 80% mortality at 25 d of adult age. To assess the effectiveness of endogenous antioxidants, animals were briefly starved prior to determining rates of mortality after a 24 h exposure to paraquat, a potent oxidative stress inducer. At 60% of average lifespan, few animals supplemented with 0.3% thioproline survived the paraquat exposure (only 16.7%) compared to controls (45% survival) or even those supplemented with 0.7% thioproline (85% survival). Taken together, these results indicate 0.7% thioproline supplementation reduces longevity of flies independent of oxidative stress, while 0.3% thioproline supplementation increases longevity but limits the flies' ability to utilize endogenous antioxidants.

**\*81. The effect of repeated freezing on oxidative damage and survival in the freeze-tolerant goldenrod gall fly, *Eurosta solidaginis***

Doelling, Adam, R.W., and Williams, Jason. Southern Illinois University Edwardsville, Edwardsville, IL.

Most studies assess insect freeze tolerance by examining survival after a single, low temperature exposure. However, overwintering animals likely experience multiple freezing events and are potentially subject to a variety of stresses, such as the formation of reactive oxygen species as reperfusion of oxygen occurs post-thaw. To determine if multiple freezing events reduce survival and influence factors associated with oxidative stress, we measured eclosion rates, levels of oxidative damage to macromolecules, and antioxidant capacity of larvae subjected to either 0 (control), 5, 10, 20, or 30 artificial diurnal freezes. Eclosion rates were similar for controls and animals experiencing only 5 freeze cycles (averaging 62.5%), but survival was reduced in groups subjected to 10, 20, or 30 freezing episodes (33.3%, 16.7%, and 8.3%, respectively). In contrast, oxidative damage to lipids (malondialdehyde levels) and protein (advanced oxidation protein product levels) were only higher in animals subjected to 30 freeze cycles ( $159 \pm 34.63 \mu\text{mol TMOP} \cdot \text{ng protein}^{-1}$  and  $19241.41 \pm 1463.34 \text{ mmol Chloramine-T} \cdot \text{ng protein}^{-1}$ , respectively) compared to others which averaged  $50.16 \pm 8.91 \mu\text{mol TMOP} \cdot \text{ng protein}^{-1}$  and  $12086.56 \pm 1172.84 \text{ mmol Chloramine-T} \cdot \text{ng protein}^{-1}$ . Interestingly, no difference in antioxidant capacity (an animal's ability to mitigate reactive oxygen species) was observed between groups, with values ranging from 14-22.05 mmol Trolox  $\cdot \text{ng protein}^{-1}$ . In summary, the number of freezing events may dramatically increase oxidative stress and reduce survival in overwintering insects.

**82. Does cryoprotectant production influence bound water content in the freeze-tolerant goldenrod gall fly, *Eurosta solidaginis*?**

Griffis, Nicole, and Williams, Jason. Southern Illinois University Edwardsville, Edwardsville, IL.

Most freeze tolerant insects enhance survival to low temperature by producing high concentrations of cryoprotectants. These solutes enhance survival by reducing cellular osmotic dehydration during freezing. However, recent data suggest that cryoprotectants may also enhance freeze tolerance by increasing intracellular bound water content. Properties of bound

water differ from bulk water in that its close association with subcellular structures prevents it from freezing. To determine if cryoprotectant production is correlated with bound water content and increased freeze tolerance, we measured seasonal changes in all three parameters in *Eurosta solidaginis*, the goldenrod gall fly. Gall flies typically double the concentration of their cryoprotectants (sorbitol and glycerol) from the fall to winter which was reflected in increased freeze tolerance. Only 25% of November collected larvae responded to tactile stimulation 48h after being removed from a diurnal exposure to -30°C. By contrast, 95% of larvae responded when exposed to the same stress in December or January. Increases in cold tolerance were not reflected in changes in bound water content as levels of non-freezable water averaged  $23.7 \pm 1.6\%$  in all larvae regardless of collection date. Interestingly, January collected animals subjected to room temperature for four days prior to analysis had a trend of increased bound water content compared to other groups ( $28.6 \pm 2.0\%$ ), indicating that the room-temperature induced conversion of sorbitol back into glycogen may increase non-freezable water levels.

### **83. Patterns of bird-window collisions in an urban landscape**

Hager, Stephen, B<sup>1</sup>, Cosentino, Bradley, J<sup>2</sup>, McKay, Kelly, J<sup>3</sup>, Monson, Cathleen, D<sup>3</sup>, Zuurdeeg, Walter, M<sup>4</sup>, and Blevins, Brian, L, Pete<sup>5</sup>. <sup>1</sup>Augustana College, Rock Island, IL, <sup>2</sup>Department of Natural Resources and Environmental Sciences, University of Illinois, Urbana, IL, <sup>3</sup>BioEco Research and Monitoring Center, Hampton, IL, <sup>4</sup>Department of Geography, Western Illinois University, Moline, IL, <sup>5</sup>Peterson's Wild Bird Shop, Davenport, IA.

Collisions with windows may represent an important source of mortality for urban birds. However, the proximate drivers influencing collision risk are not well understood and no study has examined spatiotemporal variation in mortality in an urban setting. We studied the environmental and structural factors believed to influence collisions in an urban landscape. A stratified random sample of 20 buildings allowed us to assess mortality in multiple land cover settings for a year. For each building and season, we conducted 21 daily surveys for carcasses and nine point count surveys to estimate abundance and diversity of live birds. Multiple regression models were constructed with different combinations of predictor variables to explain variation in the number of collisions. Mortality was (1) highest in the non-winter seasons relative to winter, (2) observed at 50% of the buildings, (3) documented in 21 species (46 total carcasses), and (4) highest in hatch-year juveniles relative to adults. The top two models explaining variation in mortality included window area and diversity, and all carcasses were located at large structures displaying high levels of glass (e.g., commercial buildings) in forested habitat. Models including open habitat and abundance were not competitive. Our work suggests that bird-window collisions vary in time and space in urban landscapes, and that the magnitude of mortality may be lower than current estimates.

### **84. Endocrine mechanisms of evolutionary changes in body size of closely related Anolis lizards**

Mueller, Eric, and Jennings, David, H. Southern Illinois University Edwardsville, Edwardsville, IL.

Body size in vertebrates is largely regulated by the actions of pituitary growth hormone (GH) and insulin-like growth factors (IGFs), and adult body size within a species is positively correlated with circulating levels of both hormones. Similar comparisons between species have only been reported for distantly related taxa and the relationship between GH / IGF levels in closely related taxa has yet to be reported. The current work uses exogenous GH and IGF-I treatment to alter growth patterns and determine how hormone levels contribute to differences in

morphological traits among closely related species of Anolis lizards. Initial studies of *Anolis carolinensis* and *A. sagrei* indicate that in addition to differences in snout-vent length, the two species differ in tail length and limb length. We predict that if changes in the endocrine regulation of growth are responsible for differences in body size, experimental manipulations will cause the smaller *A. sagrei* to more closely resemble *A. carolinensis*. Similar manipulations in *A. carolinensis* should also alter growth patterns and result in individuals that resemble even larger species of Anole (e.g., *A. equestris*). Understanding how hormones control growth in closely related species can be used to develop general models about mechanisms regulating evolutionary changes in body size. Mechanistic approaches using hormone manipulations can also be used to separate the direct consequences of changes in body size from changes that occur subsequent to the evolution of body size.

### **85. Pelvic fin development in Mottled Sculpins (*Cottus bairdi*: Cottidae) and Slenderhead Darters (*Percina phoxocephala*: Percidae)**

Baggett, Ashlynn, and Jennings, David, H., Southern Illinois University Edwardsville, Edwardsville, IL.

Mottled Sculpins (*Cottus bairdi*) and Slenderhead darters (*Percina phoxocephala*) are two species of fish found in very similar habitats. Both *C. bairdi* and *P. phoxocephala* are bottom dwelling fish commonly found in relatively fast flowing rivers and streams. To maintain their position in the current, both fishes have specialized morphological features that help anchor them to the substrate. In particular, the two species develop relatively large pelvic fins compared to their body size. The current study quantified morphological changes in fin dimensions across a range of body sizes in each species. Preliminary results indicate that while both species exhibit enlarged pelvic fins, each species grows pelvic fins in different ways. *C. bairdi* pelvic fins grow rapidly along the base of the fin, where it attaches to the body, and along the top. The ventral portion of *C. bairdi* pelvic fins grow at a slower rate compared to the rest of the fin. In contrast, *P. phoxocephala* pelvic fins grow at the same rate along the base, top and bottom. The functional significance of these different growth patterns (if any) with respect to ecological variables such as stream flow rate is unknown. The next step is to determine if water velocity affects the pattern or extent of pelvic fin growth and the ability of growing fishes to maintain their position on the stream bottom.

### **86. Comparative jaw muscle development and metamorphosis in tadpoles with divergent larval feeding strategies (planktivory vs. herbivory)**

Crowden-Headrick, Kristen, and Jennings, David, H., Southern Illinois University Edwardsville, Edwardsville, IL.

Most frogs undergo a two-stage pattern of development where they first develop into an herbivorous, aquatic tadpole before metamorphosing into a carnivorous, terrestrial adult frog. Herbivorous tadpoles often develop elaborate keratinized beaks and denticles to collect food and an elongated, coiled gut for processing. Tadpole mouth-parts are supported by several cartilage elements and associated muscles. The objective of the current study is to compare development and metamorphosis of tadpoles with the ancestral, herbivorous, type of tadpole (Fowler's toad: *Bufo fowleri*) with tadpoles that feed on plankton (Eastern Narrowmouth toads: *Gastrophryne carolinensis*). Preliminary studies use standard histology and immunohistochemistry of muscle myosin to document the initial formation and arrangement of jaw musculature in *B. fowleri*. Similar techniques will be used to document jaw development in a developmental series of *G. carolinensis* collected later this year. We predict that the initial formation and arrangement of

muscles associated with the jaw of herbivorous tadpoles will be reduced in *G. carolinensis*, and that the musculature of the tadpole mouth will shift to accommodate planktivorous feeding.

### **87. Forensic Study: Species Identification Using Hair Microscopy**

Manjerovic, Mary Beth<sup>1</sup>, Green, Michelle, L.<sup>2</sup>, Mateus-Pinilla, Nohra<sup>1</sup>, and Novakofski, Jan<sup>2</sup>.

<sup>1</sup>Illinois Natural History Survey, Champaign, IL, <sup>2</sup>Department of Animal Sciences, University of Illinois, Urbana, IL.

Animal forensic science is increasing in popularity causing a cross-over of techniques from human crime scene investigations to animal. Poaching of white-tailed deer is a major economic and environmental concern in Illinois and forensic techniques can be used for identification of illegally harvested species. The objective of this study was to determine whether species level identifications could be made with the exclusive use of hair morphology. We compared hairs from white-tailed deer (*Odocoileus virginianus*) to other common wildlife and domestic species found throughout Illinois. We viewed and photographed guard hairs using both an EVOS fl inverted digital microscope and Nikon Diaphot inverted compound microscope. The hair shaft is composed of three parts: the cuticle, cortex, and medulla. We used the cuticle and medulla scale pattern and diameter across guard hairs to determine if guard hair patterns are distinctive enough to distinguish among species. Cuticle and medulla analysis discriminated between white-tailed deer and most other species (e.g. rabbit, squirrel, human) but unsurprisingly revealed similarity with other cervids. We further discriminated between samples with measured diameter across the guard hair to reveal that the white-tailed deer could be identified with reasonable certainty amongst those species it resembled in morphological pattern. Further construction of mammalian hair database would be useful not only for forensic science but also for investigations of endangered or illegal foreign species smuggling, animal theft, and animal cruelty cases.

### **\*88. Allometry in male aedeagus length and effect on copulation duration in *Anastrepha suspensa* (Diptera: Tephritidae)**

Inboden, Taylor, J, Simon, Kimberly, Smith, Karli, Davies, Robert, Dust, Holly, J, and Fritz, Ann, H. Eastern Illinois University, Charleston, IL.

The Caribbean Fruit Fly (*Anastrepha suspensa*) is a pest species that causes economic damage in cultivated crops and are controlled by disrupting fertile copulations. During copulation, male insects transfer sperm as well as fluids containing proteins through a long cuticular aedeagus and distophallus. The hypothesis proposed was whether aedeagus length varied in a non-linear relationship to overall body size, and copulation duration. Male body size was determined by measuring each male's wing from the alular notch to the wing margin (as is a standard measure for Tephritidae). Male wing length ranged from 3.83 mm to 5.01 mm, with an average of 4.22 mm and a standard deviation of 0.19 mm. Most male's wing size were from 4.01 mm to 4.30 mm (64%, n= 53). Male aedeagus length was measured by carefully dissecting the male reproductive tract, and separating the male aedeagus and distophallus from other reproductive tract structures. The aedeagus was treated to allow mounting in slide media, by soaking in 60 % acetic acid for 72 hours, followed by immersion in cellosolve for an additional 72 hours. Each aedeagus was mounted in Euparal mounting medium on standard microscope slide with a coverslip affixed. After mounting, slides were cured in an oven at 26oC for 5 days, prior to examination. Slides were photographed and measured with Image J software. Male aedeagus size ranged from 1.39 mm to 1.59 mm. Mean aedeagus size was 1.49 mm, with a standard deviation of 0.043 mm. Fifty-five percent of males had an aedeagus length of 1.49 mm-1.53 mm (n=38). Copulation time was measured.

# ORAL PRESENTATION ABSTRACTS

An asterisk (\*) indicates the presenters eligible for a Student Presentation Award.

## Division: Botany

### **1. Changes in tree species composition, abundance, and diversity in a remnant historic prairie grove in central Illinois, USA over thirty-four years**

Anderson, Roger C. Illinois State University, Normal, IL.

Historic Midwest oak woodland and savannahs have undergone changes resulting from fire suppression and subsequent invasion by shade-tolerant mesophytes, Dutch elm disease, and white-tailed deer browsing. I studied changes in tree species composition and diversity over 34 years in the 12 ha Thaddeus Stubblefield Grove Nature Preserve, which is part of the 342 ha Funks Grove in McLean County, IL. The study site currently supports a closed canopy forest dominated by sugar maple. However, when this study was initiated, scattered large (120-180 cm dbh) living and dead open-grown burr oaks provided evidence of a more open historic forest. Government Land Office records (1820) indicate oaks dominated the historic vegetation with a combined Importance Value (IV) of 43.2; IV for all species sums to 100. Historic tree density was 28 trees/ha compared to current densities of 275 trees/ha. American elm (IV = 29) was the leading species in the 1977 sample. However, by 1984 Dutch elm disease had caused a rapid decline in American elm (IV = 1.6) and sugar maple (IV = 46). In the past 25-30 years, browsing by white-tailed deer diminished seedlings of most tree species, except for paw paw, an unbrowsed species, which has increased in abundance. Samples taken in 1984, 1994, and 2011 showed that the relative density of sugar maple seedlings declined sharply over time and was 69%, 26%, and 0% for the three samples, respectively. In contrast, relative density of paw paw was 24%, 52%, and 92% for the same years.

### **\*2. Effects of shading, seed longevity, and soil mixes on germination of *Besseyia bullii* – a rare species in Illinois**

Curtis, Marnelle<sup>1</sup> and Molano-Flores, Brenda<sup>2</sup>. <sup>1</sup>University of Illinois, Urbana, IL. <sup>2</sup>University of Illinois, Illinois Natural History Survey, Champaign, IL.

Many rare plants are disappearing due to habitat destruction and/or habitat quality degradation. To improve the odds for these rare plants to persist a good understanding of seed ecology is crucial for the conservation and management of these species. The purpose of this study was to examine the effects of shading, seed longevity and soil mixes on seed germination for the rare Midwestern endemic *Besseyia bullii* (Eaton) Rydb. (Plantaginaceae; kittentail). Seed germination studies were conducted in a greenhouse environment utilizing seeds from eight populations from Illinois collected in 2008, 2009, 2010. Seed germination was affected by shading, seed longevity and soil mix. The results from these studies suggest that *Besseyia bullii* may be shade tolerant, seed viability lessens with age, and it requires a special germinating soil mix to germinate. The information generated by this study can provide guidelines for better seed storage and germination protocols for use in in situ conservation for this rare plant.



### **3. Final results of the reassessment of Category I Natural Areas**

Schennum, Wayne E.<sup>1</sup>, Vogel, Randy L.<sup>1</sup>, Wilker, John<sup>2</sup>, and Wibbenmeyer, Joshua A.<sup>3</sup>.

<sup>1</sup>Applied Ecological Services, West Dundee, IL. <sup>2</sup>Illinois Department of Natural Resources, Springfield, IL. <sup>3</sup>Applied Ecological Services, Glen Carbon, IL.

The recently completed Illinois Natural Areas Inventory (INAI) Cat. I Reassessment project was the first attempt to reevaluate the condition of Illinois' vegetation remnants resembling their presettlement condition. These areas were first discovered and described in 1977 by the Illinois Department of Natural Resources' (IDNR) landmark study; additional areas were added from 1979 to 2007. From 2008 - 2011, ecologists from Applied Ecological Services conducted the reassessment for IDNR, collecting data digitally; included were plant species lists with relative abundances, descriptions of community quality, records of endangered species, and community mapping. A total of 529 sites, containing 715 original high quality natural communities were evaluated; 560, or 79%, were found to have retained or increased their original quality, while 155, or 21% decreased in quality. The resource rich regions, such as the Coastal Plain and Northeastern Morainal Divisions, have been the target of considerable management and protection efforts, and so have maintained or increased their species diversity and structural integrity. Overall, well-managed sites, those which have prescribed burning and brush removal programs, exotic species and deer control, water table maintenance & restoration, and buffer from suburban development, still exhibit much of their presettlement character.

### **4. New tools for the analysis of community change with applications in conservation, management and restoration**

Minchin, Peter R. Southern Illinois University Edwardsville, Edwardsville, IL.

Patterns of community change can be visualized by plotting trajectories in ordinations of community data from repeated sampling of permanent plots or from chronosequences but statistical tools for testing hypotheses about apparent patterns are currently lacking. I present a general framework for hypothesis testing based on random permutation of data within trajectories. An appropriate statistic is first calculated from the trajectories of plots within the ordination. Statistics have been designed to test a variety of hypotheses about rates or directions of community change. These include testing for differences between control and treatment groups in rates or directions of change, testing that changes are aligned with a hypothesized direction and testing for convergence or divergence of community composition over time. The null hypothesis of no systematic change in community composition is then simulated by randomly permuting the data for each species within each trajectory, repeating the ordination on the permuted data and recalculating the statistics. This is done many times and a frequency distribution for the statistic under the null hypothesis is generated empirically, allowing P-values to be computed for the hypothesis of interest. Experiments using simulated community data with known structure show that the new methods are effective in detecting trends and patterns built into the data. I demonstrate the utility of these methods in several case studies.

### **\*5. Presence and intensity of pre-dispersal seed predation in response to habitat quality**

Leja, Margaux<sup>1</sup>, Chi, Katherine<sup>1</sup>, and Molano-Flores, Brenda<sup>2</sup>. <sup>1</sup>University of Illinois, Urbana, IL. <sup>2</sup>University of Illinois, Illinois Natural History Survey, Champaign, IL.

Pre-dispersal seed predation (PDSP) may be an important indicator of differences in habitat quality between populations. Pre-dispersal seed predation among populations can be influenced by several environmental factors, including habitat light levels (i.e., shading), which is indicative

of the type and quality of the habitat. In this study, we examined how PDSP by Dipterans varies among populations of *Besseyia bullii*, a rare Midwestern plant. In particular, we examined if PDSP is related to different habitat shading levels. In 2010 and 2011, 15 populations were sampled across the range of *Besseyia bullii* (7 open, 3 semi-shaded, 5 shaded). Pre-dispersal seed predation was determined by examining 20 infructescences from each population and recording the amount of damaged fruit on each infructescence. When PDSP was present in a population, either about half of the fruit was damaged or almost none was damaged. In addition, PDSP was observed more frequently in open habitats than in shaded habitats. Pre-dispersal seed predation differences among habitats may be related to Dipteran population size, density, or habitat requirements. Variation in PDSP among different populations may be indicative of differences in habitat quality, as changes to the environment may reduce the amount of suitable habitat available to Dipteran seed predators.

#### **\*6. Survival of *Platanthera holochila* (Orchidaceae) seedlings *in vitro* and following reintroduction in Hawaii**

David, Shanna E.<sup>1</sup>, Oppenheimer, Hank<sup>2</sup>, Perlman, Steven P.<sup>3</sup>, Palomino, Anna<sup>4</sup>, and Zettler, Lawrence W.<sup>1</sup>. <sup>1</sup>Illinois College, Jacksonville, IL. <sup>2</sup>Plant Extinction Prevention Program, Maui, HI. <sup>3</sup>National Tropical Botanical Garden, Kauai, HI. <sup>4</sup>Olinda Rare Plant Facility, Maui, HI.

*Platanthera holochila* is the rarest of three orchids endemic to Hawaii. In early 2011, only 33 individuals of this U.S. Federally endangered species remained in the wild, all restricted to Kauai, Maui, and Molokai. In 2002, a project was initiated to cultivate this species from seed. Various techniques were employed for this purpose ranging from *in situ* seed baiting, to *in vitro* germination. Using acidified asymbiotic medium P723, 200+ leaf-bearing seedlings were acquired *in vitro* 3.1 years after sowing. In March 2011, 85 of the largest seedlings were deflasked and promptly flown to Hawaii. Eight seedlings were reintroduced on Kauai, nine on Molokai, and the majority (47) taken to a rare plant facility on Maui for further development. As of January 2012, 28 of 47 were confirmed as alive on Maui, two on Kauai, and two on Molokai. Additional seedlings may still be alive on Kauai and Molokai given that this census was carried out during seasonal dormancy. In early February 2012, 26 additional seedlings were deflasked on the mainland and taken to Maui to augment the initial reintroduction. Given that seedling survival rates for terrestrial orchids are typically low (ca. 10%) without mycorrhizal fungi, these results are expected. Efforts are continuing to recover Hawaiian mycorrhizal fungi for eventual use in symbiotic germination experiments which might improve seedling survival.

#### **\*7. Response of floodplain forest communities to modified hydrology in Mississippi River Pool 24**

Israelitt, David and Schulz, Kurt. Southern Illinois University Edwardsville, Edwardsville, IL.

The Great Flood of 1993 was a catastrophic flood that inundated Midwest urban and agricultural lands for weeks, and resulted in combined damages estimated at \$15 billion. In addition, areas of natural floodplain forests were seriously affected. Modifications in river hydrology, because of long-term flood control structures (i.e., levees) and navigation dams, may be responsible for differences in forest recovery patterns after the 1993 flood. This study intended to quantify differing patterns in forest community recovery to varying pool hydrology after the 1993 flood and (2) describe the differential responses of species in relation to the various hydrological differences. Forest survey, river level (1993-2011), and elevation data were integrated using a GIS. River level and elevation data were used to calculate inundation at survey sites. Initial analyses revealed basal area responded positively to mean maximum inundation depth ( $p <$

0.02), but H' diversity and evenness were negatively correlated (both  $p < 0.02$ ). Species richness (s) was not related mean maximum inundation depth ( $p = 0.87$ ). This suggests that the Pool 24 floodplain forest communities differ in species dominance patterns as a result of their position within the hydrologic gradient between locks and dams.

**\*8. Effects of habitat quality on floral morphology and reproductive output in the rare plant *Besseyia bullii* (Plantaginaceae)**

Chavez, Samantha<sup>1</sup>, Collins, Michelle<sup>1</sup>, Chi, Katherine<sup>1</sup>, and Molano-Flores, Brenda<sup>2</sup>.

<sup>1</sup>University of Illinois, Urbana, IL. <sup>2</sup>University of Illinois, Illinois Natural History Survey, Champaign, IL.

The decline of many rare plant species has been linked to changes in the quality of their habitat. For example, woody encroachment decreases light availability affecting plant development and reproduction. In this study we examined the consequence of woody encroachment, in particular shading, on reproductive morphology and reproductive output of *Besseyia bullii*. *Besseyia bullii* is a rare perennial forb that has been declining as the result of habitat loss due to development and woody encroachment. In 2010 and 2011, twenty-five populations were visited across the range of the species. Each population was assigned to one of three categories: shaded, semi-shaded, and open. At each site, twenty infructescences were collected at random to determine fruit and seed set. In addition, the following inflorescence morphometrics were measured: floral density and inflorescence height. Results indicate that shading as the result of woody encroachment does have adverse effects on inflorescence morphology and reproductive success. The results from this study suggest that habitat management is needed to improve population viability and fitness for *Besseyia bullii*.

**\*9. Investigating the role of genetic diversity and pollination biology as potential causes for reproductive failure in *Asclepias lanuginosa***

Kim, Eun Sun<sup>1</sup>, Zaya, David N.<sup>1</sup>, Fant, Jeremie B.<sup>2</sup>, and Ashley, Mary V.<sup>1</sup>. <sup>1</sup>University of Illinois Chicago, Chicago, IL. <sup>2</sup>Chicago Botanic Garden, Glencoe, IL.

Woolly milkweed (*Asclepias lanuginosa*) is a native perennial prairie herb which is a state-listed endangered species in Illinois, and a threatened species in Wisconsin and Iowa. In Illinois, only a handful of highly fragmented populations remain. Existing populations have flowering individuals, but they do not set seed. We tested two possible explanations for the lack of sexual reproduction in Illinois populations, low genetic diversity and a lack of effective pollinators. We used nuclear microsatellite DNA markers to compare genetic diversity and clonal structure between the small Illinois populations and larger Wisconsin populations where fruit-set was observed in the recent past. Low genetic diversity and a high degree of clonal reproduction were observed in both Illinois and Wisconsin populations. The pollinator observation conducted at one Illinois population suggests that there may be a reduced number of effective pollinators, hindering gene flow between the clonal patches. We will conduct further genetic analyses to compare genetic diversity of Illinois and Wisconsin populations to sexually reproducing populations in Iowa and Minnesota. We will also compare data on genetic diversity and pollinator observations to a common co-occurring congener, *Asclepias viridiflora*. Depending on the upcoming results, recommendations for a recovery plan may include transplanting individuals or seeds between Illinois populations, introducing seeds or individuals from out-of-state populations, or defining steps to maintain healthy pollinator populations.

### **\*10. *Ex situ* conservation of threatened and endangered Illinois native species at the Whiteside Garden**

Daugherty, Bradley M., Coons, Janice, Coutant, Nancy E, and Whiteside, Wesley C. Eastern Illinois University, Charleston, IL.

*Ex situ* conservation is the strategy of creating a refuge of living material outside of their natural habitat. Dr. Wesley Whiteside, a professor emeritus of Eastern Illinois University, has transformed 5 acres of farm land into a diverse botanical garden. Plant images, surveys, and consultation with Dr. Whiteside have come together to develop an inventory of the plants at the Whiteside Garden and some of their fundamental attributes. By cross referencing the Whiteside Garden inventory with the February 2011 Checklist of Endangered and Threatened Animals and Plants of Illinois, a list of endangered and threatened native species of Illinois located at the Whiteside Garden was developed. Taxonomical information, habitat, geographical origin and range, habit, flowering season, flower color, fruit type, source of plant material, availability, soil characteristics, cultural methods, GPS location and relevant history was recorded. Forty-one endangered and 8 threatened Illinois native plant species covering 29 families have been identified at the Whiteside Garden. Thirty five herbaceous and 14 woody species are represented. In the wild, these 49 species are recorded in 67 Illinois counties and a variety of habitat types. Having identified and recorded the presence and history of the threatened and endangered Illinois native species facilitates their use in research, education, outreach, and restoration and offers a platform upon which their usefulness can be improved.

### **11. Effects of microclimate on the reproductive biology of *Besseyia bullii* (Plantaginaceae), a rare plant**

Robinson, Dana O.<sup>1</sup>, Chi, Katherine<sup>2</sup>, and Molano-Flores, Brenda<sup>2</sup>. <sup>1</sup>Knox College, Galesburg, IL. <sup>2</sup>University of Illinois, Illinois Natural History Survey, Champaign, IL.

We studied populations of *Besseyia bullii*, a rare prairie perennial, at seven sites across northern Illinois. Anecdotal evidence suggests that *B. bullii* is sensitive to microclimatic changes associated with woody encroachment, a conservation issue attributed to fire prevention. This study determined whether two aspects of woody encroachment, increased shade and decreased pollinator visitation, affected *Besseyia bullii*'s reproductive success. We assessed the effect of shading by comparing fruit set and seed set among individuals in shaded, partially shaded, and open environments. We studied the potential effect of pollinator limitation by covering 10 individuals at each site with insect exclosures before flowers opened. We also collected and 10 open-pollinated individuals (i.e., uncaged plants) per site. Both fruit set and seed set were lower in shaded than in open or semi-shaded habitats, and were much lower in caged than in uncaged plants. These results suggest that woody encroachment into *Besseyia bullii*'s habitat is detrimental to this rare species.

### **12. A critique the Floristic Quality Index (FQI)**

Schulz, Kurt E. Southern Illinois University Edwardsville, Edwardsville, IL.

The Floristic Quality Index (FQI) and its local variants now appear regularly in the management and ecological literature. I suggest that the assumptions and mathematics of FQI require closer scrutiny to support its continued use. Particular problems include: 1) the need for internally consistent criteria to assign coefficients of conservatism (CC); 2) assumptions concerning the composition of high quality communities (especially as they concern natural disturbance patterns); 3) a finely graded scale for CC values which implies precision that may not exist; 4)

the intentional absence of species abundance data; and 5) a mathematical formulation which progressively down-weights individual species “quality” of as overall species richness increases. I suggest more informative and familiar alternatives to the FQI.

### **Division: Cell, Molecular & Developmental Biology**

#### **\*1. Role of lipids and peroxy nitrite in beta cell defects under chronic nutrient overload**

Vernier, Stephanie B., Schober, Joseph, Neumann, William L., Wanda, Paul E. and Kwon, Guim. Southern Illinois University Edwardsville, Edwardsville, IL.

Obesity is one of the leading causes of type 2 diabetes mellitus (T2DM). Elevated levels of nutrients in obesity have been associated with insulin resistance and insulin-secreting beta cell defects. The specific mechanisms how high nutrients cause beta cell defects, however, are unknown. Using two pharmacological agents, BN-99 and SRI-135, that block triglyceride (TG) biosynthesis and decompose peroxy nitrite, respectively, we studied the role of lipids and peroxy nitrite in beta cell defects in rat and human islets. Under conditions of nutrient overload, lipid droplet formation, distortion of the islet architecture, and a reduction in insulin content were observed in both rat and human islets. A significant intra-islet cell expansion was observed in rat but not in human islets. BN-99, an inhibitor of Acyl CoA:diacylglycerol acyltransferase 1 (DGAT1) that catalyzes the conversion of diacylglycerols to TG, blocked lipid droplet formation in both rat and human islets. BN-99 preserved islet architecture and insulin content under nutrient overload in human islets but not in rat islets. SRI-135, a peroxy nitrite decomposing catalyst, preserved islet architecture and insulin content in both rat and human islets. SRI-135 also blocked lipid droplet formation under these conditions with yet unknown mechanisms. In conclusion, BN-99 and SRI-135 preserved beta cell function under nutrient overload, suggesting that lipids and peroxy nitrite are potential toxic molecules that cause beta cell defects.

#### **\*2. Late embryogenesis abundant protein ameliorates inhibition of mitochondrial respiration**

Marunde, Matthew R.<sup>1</sup>, Hand, Steven C.<sup>2</sup>, Li, Shumin<sup>2</sup> and Menze, Michael A.<sup>1</sup> <sup>1</sup>Eastern Illinois University, Charleston, IL, <sup>2</sup>Louisiana State University, Baton Rouge, LA.

Some animals survive nearly complete loss of cellular water. Mechanisms that govern anhydrobiosis involve the accumulation of highly hydrophilic macromolecules, such as late embryogenesis abundant (LEA) proteins. Warner et al. (2009) first reported group 1 LEA proteins in *Artemia franciscana* embryos, which were localized within the cytoplasm or the mitochondrion. We designed primers based on NCBI sequence ACX81198 to amplify cDNA from *A. franciscana*. Two variants encoding for proteins of 181 (LEA1.1) and 197 (LEA1.3) amino-acid lengths were cloned and expressed in *Drosophila melanogaster* cells (Kc167). Confocal microscopy revealed a construct composed of green fluorescence protein (GFP) and LEA1.3 accumulates in the mitochondria (LEA1.3-GFP), while LEA1.1-GFP was predominantly found in the cytoplasm. No significant difference in routine respiration was observed among Kc167 controls and cell lines that stably expressed LEA1.3, LEA1.3-GFP, or LEA1.1-GFP ( $17.7 \pm 1.3$  pmol O<sub>2</sub>·s<sup>-1</sup>·10<sup>-6</sup> cells n=9 ±SD). After inducing maximum flux through the electron transport system (ETS<sub>max</sub>) Kc167 control cells showed significantly higher ETS<sub>max</sub> values compared to Kc167-LEA1.3. No difference in ETS<sub>max</sub> values were observed among cell lines exposed to 500 mM sucrose. However, at 500 mM sucrose Kc167-LEA1.3 cells exhibited significantly lower state 4 respiration compared to controls, suggesting reduced proton leak across the inner mitochondrial membrane. Our results indicate that expression of LEA1.3

ameliorates reductions of mitochondrial functions under water stress conditions (NSF-IOS-0920254).

### **3. Identification of candidate genes driving liver function using whole genome microarrays**

Estanda, Arnold B., and Bulla, Gary A. Eastern Illinois University, Charleston, IL.

Hepatocyte nuclear factors (HNFs) are known to play an important role in mammalian liver development. However, genetic networks that establish liver identity are unclear. Through whole-genome microarray analysis, transcriptional pathways related to liver function have been analyzed by comparing expression profiles of dedifferentiated hepatocyte “variant” cells with their hepatoma parental cells. Four hepatoma variant cell lines were analyzed using triplicate microarrays. Reproducibility of the microarray and normalization of variability between triplicate samples was considered by extracting RNA from each cell line on different days. Microarray gene expression variation of housekeeping genes,  $\beta$ -actin and GAPDH showed less than a two-fold difference between all cell lines. False positive gene expression was assessed, averaging expression units within each triplicate cell line microarray. From the ~21, 000 genes analyzed by the microarrays, ~350 genes were found to be repressed >5 fold in at least two of the variant cell and 132 of those genes were repressed in all four hepatoma variants. Many of these genes have been previously identified as liver-specific genes. Importantly, we identified 26 “candidate” genes that encode proteins involved in transcriptional pathways. Candidate genes identified include several transcription factors known to drive liver function and several other functions previously implicated. These include CREB3L3, CREG1, DPPA4, HHEX, IGFBP1, ONECUT1, and MDK. Introduction of these transcription factors into variant cells are being tested.

### **\*4. Postglacial history of an Eastern North American aquatic insect, *Acroneuria frisoni* Stark & Brown (Plecoptera: Perlidae)**

Pessino, Massimo<sup>1</sup>, Chabot, Ember T. <sup>1</sup>, Giordano, Rosanna<sup>2</sup> and DeWalt, R. Edward,  
<sup>1</sup>University of Illinois, Champaign, IL, <sup>2</sup>Illinois Natural History Survey, Champaign, IL.

The Illinoian and Wisconsinan glacial episodes deeply influenced the distribution and genetic structure of most North American animals and plants. In this study, the demographic history of the stonefly *A. frisoni* was analyzed using variation in the mitochondrial gene cytochrome oxidase I. Results indicated that populations survived in glacial refugia located in the southern states west of the Appalachians through the Cumberland Plateau in Kentucky and Tennessee and in the Ozark Mountains of Missouri and Arkansas. Western and central Tennessee populations were most responsible for the repopulation of the Midwest, while Eastern Tennessee populations appear to have mostly recolonized the Northern Appalachian through one or more bottleneck events. Ozark populations have been largely isolated since before the last glacial episodes. Knowledge of the present genetic makeup of *A. frisoni* populations is the basic step toward assessing the species' conservation needs and is fundamental for predicting its capacity of coping with natural or human induced environmental changes.

### **5. Evidence for an Sfi1p-like/centrin complex in *Vorticella convallaria* (Vorticellidae)**

Konior, Katarzyna, McCutcheon, Suzanne M., and Buhse, Jr., Howard E. University of Illinois Chicago, Chicago, IL.

*Vorticella convallaria* possesses a calcium-responsive 3-5 nm contractile cytoskeletal system called myonemes and spasmonemes. The myonemes and spasmonemes initiate contraction of the

cell body and the stalk, respectively. In *Paramecium*, the calcium-triggered contractile cytoskeleton is mainly composed of two proteins, Sfi1-like and centrin. Sfi1 and Sfi1-like proteins are large molecular weight proteins that form the backbone of the 3-5 nm filaments. The Sfi1 proteins bind numerous tandemly arranged centrin proteins. Centrins are calcium binding proteins and act as calcium-sensors. In the presence of calcium, centrin proteins undergo a conformational change that causes associated Sfi1 protein to fold initiating contraction. Using FITC-tagged human Sfi1 and anti-centrin antibodies in *Vorticella*, we show that they bind to oral structures, the ciliary wreath and the transition zone between the cell body and the stalk. These two antibodies also bind the spasmoneme. The application of microgram quantities of anti spasmin/ centrin or anti-hSfi1 antibodies to glycerol extracted stalks models prevents stalk contraction. When these antibodies are removed by washing, stalk elongation occurs. Taken together these data strongly implicate the role of centrin and centrin-binding protein complex (Sfi1) governing spasmonemal contraction and relaxation in *Vorticella*.

**\*6. SR-135, a peroxynitrite decomposing catalyst, prevents weight gain and reduces fasting blood glucose levels in B6D2F1 mice fed with a high fat diet**

Johns, Michael E., Rausaria, Smita, Kamadulski, Andrew, Neumann, William L., Wanda, Paul, and Kwon, Guim, Southern Illinois University Edwardsville, Edwardsville, IL.

Peroxynitrite has been recently implicated in the pathogenesis of type 2 diabetes. Chemical catalysts that destroy peroxynitrite, therefore, may have therapeutic value for treating type 2 diabetes. We have recently reported a new class of Mn(III)-bis(hydroxyphenyl)dipyrromethene peroxynitrite decomposition catalysts. From this class, SR-135 was shown to have potent peroxynitrite reducing catalytic activity. Herein we show that SR-135 inhibited lipid droplet formation and prevented the loss of insulin content caused by nutrient overload in a concentration-dependent manner (0.1-10 micromM) in rat and human primary beta-cells. To confirm these findings in an in vivo obesity-induced diabetes model, 6 week old B6D2F1 mice were fed with a lean- or a high fat-diet (HFD) for 6 weeks and were monitored for bodyweights and fasting blood glucose levels. After 6 weeks, the average bodyweights and fasting blood glucose levels of HFD-fed mice were 10 g and 20 mg/dL higher than those of lean diet-fed mice, respectively. Daily intra-peritoneal injection of SR-135 (5 mg/kg) for 7 days significantly reduced the body weight ( $36.9 \pm 1.4$  vs.  $32.3 \pm 1.0$ ) and fasting blood glucose levels ( $158 \pm 8.7$  vs.  $109 \pm 3.4$ ) of HFD-fed B6D2F1 mice (n=6). Vehicle-treated HFD-fed mice also showed a slight decrease in bodyweights and fasting blood glucose levels but substantially less than SR-135 treated mice. In conclusion, SR-135 may provide a therapeutic intervention for type 2 diabetes.

**\*7. The use of Mitotracker to determine the feeding preferences for the carnivorous macrostomal form of *Tetrahymena vorax* (Tetrahymenidae)**

Dyrey, Grzegorz, Lee, Elizabeth K., Kutor, Alfreda S., Patel, Meera R., Zantout, Linda, and McCutcheon, Suzanne M. University of Illinois Chicago, Chicago, IL.

The polymorphic species, *Tetrahymena vorax*, exhibits two major phenotypes: microstomes and macrostomes. Microstomal cells feed exclusively on bacteria and our competitors of *T. thermophila* for this resource. The macrostomal form feeds carnivorously on larger prey organisms including *T. thermophila*. However, macrostomes are capable of feeding cannibalistically on untransformed microstomal cells. Transformation to the macrostomal phenotype is caused by a signal called stomatin released by *T. thermophila*. In nature, it has been suggested that when bacteria become scarce and in the presence of larger numbers of *T. thermophila* cells, *T. vorax* differentiates into the macrostomal cell type in response to increasing

amounts of stomatin. In order to determine the feeding preference of the macrostomal form, either untransformed microstomal cells or *T. thermophila* cells, we intend to differentially mark these species with a long lasting *in vivo* dye called Mitotracker™ (Molecular Probes). The dye forms a thiol-reactive-linkage with mitochondrial proteins, becoming trapped within the mitochondria and fluorescing either red or green depending on the conjugated dye and excitatory wavelength. It should allow us to determine the feeding preference of macrostomal cells by labeling non-transformed microstomes and *T. thermophila* cells with different colored dyes and feeding them to macrostomes.

#### **\*8. Protective mechanisms against water stress evaluated in insect cells**

Anderson, John M.<sup>1</sup>, Harder, Avril M.<sup>1</sup>, Toner, Mehmet<sup>2</sup>, Chakraborty, Nilay N.<sup>2</sup>, and Menze, Michael A.<sup>1</sup> <sup>1</sup>Eastern Illinois University, Charleston, IL, <sup>2</sup>Center for Engineering in Medicine, Harvard Medical School, Boston, MA.

We utilized three different water-stress models (controlled-rate freezing, spin-drying, and desiccation) to investigate the impact of intracellular trehalose on membrane integrity in a *Spodoptera frugiperda* cell line (Sf-21), this insect species does not tolerate severe desiccation. To facilitate trehalose uptake a nucleotide sequence encoding for a trehalose transporter (GenBank: BT003466) was stably transfected into Sf-21 cells (Sf-21-TRET). Expression of a TRET and GFP construct in *Drosophila melanogaster* cells (Kc167) confirmed successful plasma membrane insertion of the transporter. Sf-21-TRET cells were incubated for 3 h at 27°C in a hyperosmotic buffer containing 200 mM trehalose (~470 mOsm). After incubation 43 ± 3.7% (n=5, ±SE) of control Sf-21 cells showed compromised membranes while Sf-21-TRET cells maintained significantly higher numbers of cells with intact membranes [76±5.4% (n=5, ±SE, P<0.05)]. However, Sf-21 and Sf-21-TRET cells frozen in this buffer at 1°C • min-1 showed no significant difference in membrane integrity after thawing (60±3.3% control vs. 60±2.8% Sf-21-TRET; n=3; ±SE). After incubation in standard culture media supplemented with 400 mM trehalose for 3 hours, severe water stress was applied by spin-drying (moisture content ~0.2 gH<sub>2</sub>O/gdw). Spin-drying caused 100% loss of membrane integrity in control Sf-21 cells, whereas Sf-21-TRET cells membrane integrity was comparable to non-dried control cells 48 hours after rehydration. Intracellular trehalose appears to aid in the maintenance of membrane integrity during water stress (CFR-EIU-2010).

#### **\*9. Life without water: intracellular expression of late embryogenesis abundant (LEA) protein increases dehydration tolerance of eukaryotic cells**

Samarajeewa, Dilini A.<sup>1</sup>, Adikari, Thiruni<sup>1</sup>, Hand, Steven C.<sup>2</sup>, and Menze, Michael A.<sup>1</sup> <sup>1</sup>Eastern Illinois University, Charleston, IL, <sup>2</sup>Louisiana State University, Baton Rouge, LA.

Many desiccation tolerant organisms including embryos of the brine shrimp *Artemia franciscana* respond to water stress by intracellular accumulation of sugars such as trehalose and larger macromolecules such as Late Embryogenesis Abundant (LEA) proteins. Both molecules may work together to confer cellular protection during severe water loss in eukaryotic cells. We used cells from the fruit fly *Drosophila melanogaster* (Kc167), a species that lacks significant dehydration tolerance, as our model. Kc167 cells were stably transfected with a gene encoding a 197 amino-acid length mitochondrial localized Group 1 LEA protein (Kc167-LEA1.3). Convective drying experiments were conducted for Kc167 and Kc167-LEA 1.3 cells in presence and absence of 200 mM extracellular trehalose. Kc167 cells dried without trehalose showed a gradual decline in cell viability and no viable cells were found at moisture contents below 0.75 gH<sub>2</sub>O/gDW. A significant increase in cell viability was observed in presence of 200 mM



trehalose and Kc167 cells could be desiccated to 0.50 gH<sub>2</sub>O/gDW. The moisture content at which complete loss of cell viability was observed for Kc167-LEA1.3 cells in presence of 200 mM trehalose was extremely low with 0.20 gH<sub>2</sub>O/gDW. This result demonstrates that expression of a mitochondrial targeted LEA protein provides protection from desiccation injury in cells from organisms which lack naturally occurring desiccation tolerance, such as the fruit fly *D. melanogaster* (NSF-IOS-0920254).

**\*10. The effects of acyl CoA:diacylglycerols acyltransferase 1 inhibitor on beta-cell function**

Brenegan, Teryn V., Neumann, William L., I, Bhargav M., Vernier, Stephanie B., Wanda, Paul E. and Kwon, Guim. Southern Illinois University Edwardsville, Edwardsville, IL.

Type 2 diabetes mellitus (T2DM) has become an epidemic in the developed countries around the world. High levels of glucose and free fatty acids (FFAs) in obesity have been associated with both insulin resistance and beta-cell defects. Ectopic lipid accumulation in beta-cells under nutrient overload is thought to cause lipotoxicity that impairs beta-cell function and reduces beta-cell mass. To study the role of lipid accumulation in beta-cell defects, we synthesized an inhibitor of acyl CoA:diacylglycerol acyltransferase 1 (DGAT1), the enzyme that catalyzes the conversion of diacylglycerol to triacylglycerol, and studied its effect on lipid accumulation and beta-cell function in rat islets. Treatment of dispersed rat islet cells with elevated glucose (25 mM) and free fatty acids (FFAs, 500  $\mu$ M, oleate: palmitate=1:1 v/v) for 4 days markedly increased lipid accumulation and islet cell expansion, and reduced insulin content. BN-99, a DGAT1 inhibitor, inhibited lipid accumulation in a concentration-dependent manner ranged in 0.01-1  $\mu$ M in both rat and human beta-cells. BN-99, however, had no significant effect on the reduction of insulin content and islet cell expansion caused by excess nutrients. These results indicate that blocking lipid accumulation alone is not sufficient to preserve beta-cell function under nutrient overload.

**\*11. Transcriptome Analysis of UV-Irradiated *Dictyostelium discoideum* (Dictyosteliidae) through RNA Sequencing**

Mulani, Shaunak and Jones-Rhoades, Matthew W. Knox College, Galesburg, IL.

All life forms require DNA repair mechanisms to maintain the integrity of their genetic material. The cellular slime mold *Dictyostelium discoideum* has been known to be particularly resistant to DNA damage caused by ultraviolet radiation and other mutagens. I am interested in understanding the genetic basis of this enhanced DNA repair system. Specifically, I am using high-throughput cDNA sequencing to measure the sets of genes induced and repressed by exposure to UV light in *Dictyostelium*. In identifying a sublethal dose of irradiation, *Dictyostelium* cells have shown resilience to stressing, mutagenic conditions with >80% viability at 100 J/m<sup>2</sup>. I have been monitoring expression of a small set of known UV-responsive genes in order to establish an ideal protocol for UV exposure. Preliminary results have indicated an induction of the repB gene, a gene involved in nucleotide excision repair, in response to 100 J/m<sup>2</sup> of UV irradiation. Using this UV-treatment and comparing to a control, I have followed established protocols (Parikh *et al* 2010) to generate cDNA libraries to send for Illumina sequencing. I have successfully created adapter-ligated cDNA libraries, and small-scale sequencing has shown the presence of rRNA contamination. Samples have been sent for large-scale Illumina sequencing, and data analysis of the transcriptome will begin after those results have been received. I hope to address the question of whether DNA repair in *Dictyostelium*

primarily involves genes homologous to DNA repair pathways studied in other organisms, or if it possesses novel DNA repair pathways not yet studied.

**\*12. Preservation of beta-cell function by peroxynitrite scavenger under chronic nutrient overload**

Bhargav, Patel, Neumann, William L., Brenegan, Teryn V., Vernier, Stephanie B., Wanda, Paul E., and Kwon, Guim. Southern Illinois University Edwardsville, Edwardsville, IL.

Persistently high levels of glucose and free fatty acids (FFAs) are thought to cause insulin resistance and beta-cell defects, leading to Type 2 diabetes mellitus (T2DM). Recent studies indicate that peroxynitrite production under nutrient overload is implicated in the pathogenesis of T2DM. Targeting peroxynitrite, therefore, may provide a novel approach to treating T2DM. To this end, we studied the effects peroxynitrite scavenger SRI-135, Manganese (III) complexes of Bis(hydroxyphenyl) dipyrromethenes, on rat and human beta-cell function under nutrient overload. Treatment of dispersed rat or human islet cells with elevated glucose (25mM) and free fatty acids (FFAs, 500 microM, oleate: palimiate=1:1 v/v) for 4 days resulted in significant increase in lipid droplet accumulation and reduction in insulin content. SRI-135 prevented the loss of insulin content caused by excess nutrients in a concentration-dependent manner ranged in  $1^{-10}$  microM in both rat and human beta-cells. Furthermore, SRI-135 inhibited lipid droplet accumulation in a concentration-dependent manner with yet unknown mechanisms. Peroxynitrite scavengers such as SRI-135 may provide a new approach to treat T2DM.

**Division: Chemistry**

**\*1. Nano/Microencapsulation of *Piroxicam* into dual biopolymer matrices: Effect of pH, ionic strength, temperature, and water activity of encapsulation and release**

Gogineni, Varalakshmi L., Boley, Mark M., Made Gowda, Netkal M., and Kouassi, Gilles K. Western Illinois University, Macomb, IL.

Piroxicam is a derivative of the oxicam group which includes non-steroidal anti-inflammatory drugs. Piroxicam is poorly soluble in hydrophobic media. This limitation reduces its absorption into the intestinal mucosa. In this study, piroxicam was encapsulated into a matrix system containing  $\beta$ -cyclodextrin, whey protein, and *kappa*-carrageenan using power ultrasound. The effects of various amounts of Tween 20 and pH of the coating matrix on the encapsulation efficiency (EE) of piroxicam were investigated. Furthermore, the effect of water activity ( $a_w$ ) on the release profile of piroxicam was studied. The sizes of the capsules were determined using atomic force microscopy (AFM) and the glass transition ( $T_g$ ) of the coating matrix was determined using differential scanning calorimeter (DSC). The sizes of the particles were in the nano and micro regimes. EE of piroxicam was pH sensitive and adding Tween 20 to the system improved the EE. Below  $a_w$  value of 0.444, no piroxicam was released. Above  $a_w$  value of 0.537, gradual release of piroxicam occurred. Water activity and temperature altered the structure of the capsules, allowing the release of the encapsulated piroxicam. The results of this study can be used to improve the solubility and adsorption of poorly soluble drugs. **Acknowledgement:** We thank the Western Illinois University Research Council for support.

## **\*2. Investigation of syneresis and phase separation in emulsions and amorphous systems**

Shashank, Akku, Made Gowda, Netkal M, Boley, Mark, M., Ahmad, Tarab, and Kouassi, Gilles K. Western Illinois University, Macomb, IL.

Syneresis in biopolymer structures is essentially controlled by thermodynamic factors, and is regarded as phase separation. In some cases, syneresis is due to the sudden removal of hydrophilic macromolecules from a mixture. As result, bonds between hydrophobic sites start to form because the water molecules in the micelles leave the structure. In this study, the effects of various biopolymers including *kappa*-carrageenan, *iota*-carrageen, *lambda*-carrageenan, guar gum, sodium alginate and cyclodextrin were investigated for their ability to stabilize oil-in water emulsions against time-dependent syneresis. Duplicate emulsions, each containing one of the aforementioned biopolymers, were prepared using power ultrasound and stored at 4°C in 100 ml graduated burettes. At time intervals of 24h, the volume of each separated phase (water, oil, and solid) was recorded. The rate of occurrence of syneresis in the emulsions was related to the amount of separated water. A ranking of the biopolymers made on the basis of their ability to retard syneresis was established. Cyclodextrin was the most effective biopolymer, followed by guar gum, *kappa*-carrageenan, *iota*-carrageenan, *lambda*-carrageenan, and sodium alginate. Further study is under way to explore possible relationship between the viscosity and turbidity of each polymer with its ability to stabilize the emulsions. The results of this study are important for formulation and processing of food and drug systems susceptible to phase separation.

**Acknowledgement:** We thank the Western Illinois University Research Council for support.

## **\*3. A study of the stability of biopolymer-reinforced emulsion systems containing lipophilic bioactive ingredients**

Tournear, Jennifer, Gogineni, Vara, L., and Kouassi, Gilles K. Western Illinois University, Macomb, IL.

Many food, pharmaceutical, and industrial systems exist in the form of oil-in water emulsions. The stability of oil-in-water emulsions is a major concern in product formulation due to differences in hydrophobicity of the components of the systems. In this project, oil-in water emulsions containing bioactive compounds were prepared using power ultrasound, and the effects of various biopolymers (hydrocolloids) on the stability of these emulsions were investigated. Each biopolymer used carries a specific and unique structure that determines the type of interactions it can exhibit in the emulsion. Insights in these interactions are useful for nano- and/or micro encapsulation of bioactive compounds having limited solubility in water. It was found that *kappa*- and *lambda*-carrageenan exhibited very good stabilizing effects. Furthermore, adding minute amounts of maltodextrin-MD100 improved the stability of all the emulsions, regardless of the hydrocolloid present. A study of water sorption isotherms of freeze-dried biopolymers containing oil-in water emulsions is under way to elucidate the role of water on the physical state and functionality of biopolymers in emulsions. **Acknowledgement:** We thank the Western Illinois University Research Council for support.

## **\*4. Investigation of the antioxidant activity of berry polyphenols in linoleic acid model**

Diawara, Fatoumata, Afithile, Meshak, Made Gowda, Netkal M., and Kouassi, Gilles K. Western Illinois University, Macomb, IL.

Polyphenols such as phenolic acids and flavonoids are widely distributed in fruits and berries. They are secondary plant metabolites characterized by phenylbenzopyran in their chemical structure. These compounds represent diverse groups and are classified on the basis of hydroxyl

substitutions on the heterocyclic benzopyran ring. Flavonoids are intensively studied because of their health benefits in humans. In this study, the total phenolics (TP), total flavonols (TF), and total anthocyanins (TA) contents of blueberries, cranberries blackberries, and grapes were investigated using spectroscopic methods. The antioxidant activity of each type of berry was measured from berry extracts using various assays, including, the conjugated diene hydroperoxides assay, the thiobarbituric acid reactive assay, the superoxide dismutase assay, and the total antioxidant capacity assay. The relationship of the total antioxidant capacity (TEAC) with TP, TF, and TA was evaluated. A positive correlation was obtained between TEAC and TA. A poor correlation was found between TEAC and TP, and TEAC and TF. The data suggest that the anthocyanin contents significantly contributed to the antioxidant potential of the berries. A study is under way to elucidate possible relationship of the antioxidant activity measured from all four assays, with the phenolic composition of the berries. **Acknowledgement:** We thank the Western Illinois University Research Council for support.

**\*5. Eco- and User-friendly procedure for oxidative cleavage of alkenes: Optimization and development of an undergraduate experiment**

Norris, Brianna R., Kupireddy, Nikhil R., and Vinod, Thottumkara K. Western Illinois University, Macomb, IL.

Oxidative cleavage of alkenes is a synthetically important transformation emphasized during the first term of a sophomore undergraduate organic chemistry curriculum. The practical difficulties with the ozonolysis procedure makes it an inconvenient experiment for undergraduate students to carry out. We have recently described a facile and operationally convenient catalytic procedure for oxidative cleavage of alkenes. In situ formed [hydroxy(4-carboxyphenyl)iodonium]ion, from the oxidation of 4-iodobenzoic acid, has been shown to facilitate the cleavage of a variety of alkenes in presence of Oxone as a co-oxidant. Optimization of this convenient procedure using 1-phenyl-1-cyclohexene as a prototypical substrate to develop a useful undergraduate experiment is described.

**\*6. Iodine atom economic co-iodination of alkenes: Selective and differential functionalization of the two double bonds in dienes**

Pandey, Sonali R., Medikonda, Tejaswini, and Vinod, Thottumkara K. Western Illinois University, Macomb, IL.

In-situ generation of acetyl hypoiodite, and trifluoroacetyl hypoiodite from the oxidation of elemental iodine using (diacetoxyiodo)benzene (DAIB) and bis(trifluoroacetoxy)iodobenzene (BTI) respectively and the subsequent use of these hypoiodite reagents in co-iodination of alkenes is reported. The observed 100% iodine atom economy in the reaction is mechanistically justified and unequivocally demonstrated by <sup>1</sup>H NMR investigation. Synthetic utility of this new procedure for the co-iodination of alkenes is highlighted by the use of a diverse array of nucleophilic components in the reaction for rapid assembly substituted alkanes from alkenes. Selective co-iodination of the electron rich double bond in dienes is observed when acetyl hypoiodite is the electrophilic iodine source in the reaction, while the use of trifluoroacetyl hypoiodite results in exhaustive functionalization of both double bonds in dienes. Careful choice of the hypervalent iodine oxidants and the nucleophilic components in the reaction allows for selective and sequential functionalization of the two double bonds of dienes.

**\*7. New insights into an alternate mechanism for oxidation of alcohols using iodine (V) reagents**

Madne, Kishor K., Raya, Balaram R., and Vinod, Thottumkara K. Western Illinois University, Macomb, IL.

Hypervalent Iodine (V) reagents, o-iodoxybenzoic acid (IBX) prominent among them, have become reagents of choice for a wide range of selective oxidative transformations in synthetic organic chemistry. The currently accepted mechanism of oxidation of alcohols by IBX in polar aprotic solvents is the well-established ligand exchange mechanism. We have recently reported the synthesis of three new water-soluble IBX derivatives as user-friendly substitutes for the DMSO soluble parent reagent, IBX. While the ease and selectivity of oxidation of alcohols using the new IBX derivative parallel that of IBX in polar aprotic solvents, the selectivities observed in the oxidation of diol and triol substrates carrying benzylic, non-benzylic and homobenzylic alcohol moieties in aqueous solvent mixtures allude to an alternate oxidation mechanism. The observed selectivities are explained both using an alternate H-atom abstraction mechanism and correlated to the bond dissociation energies of the benzylic, homobenzylic and non-benzylic C-H bonds involved in the initial H-atom abstraction step.

**\*8. Using photoactivated nanoparticles as photodynamic therapeutic agent to treat prostate cancer**

Madavarapu, Kamala B., and Fu-Giles, Patty K. Governors State University, University Park, IL.

The purpose of this study is to develop nanoparticulate drug-carrying systems that are capable of directly delivering photodynamic agents to treat different stages of prostate cancer. Cancer is one of the major disease-specific and ethnically disparate healthcare problems in the US. According to The National Cancer Institute, African-American men have the highest risk of developing prostate cancer, and they have more than twice the mortality rate observed for other racial and ethnic groups. Photodynamic therapy (PDT) is a technique that uses the combination of light and nontoxic drugs to destroy specific targeted tumor cells. After the inactive, nontoxic drug is applied topically or injected, it localizes in tumor tissue and can only be activated by irradiation with certain wavelengths of light. When these photosensitive drugs are “switched on” by light, they can produce highly reactive intermediates. In this manner, the irradiation of tumors with low energy light can ultimately lead to the selective death of cancerous cells without affecting normal tissue. Owing to most photosensitizers are not water soluble, nanoemulsion formulations have been developed to promote drug delivery. Studies have shown that using a nanoemulsion as a carrier for biomedical applications can improve efficacy in solubilizing, protecting, and targeting drugs for specified organ, tissue, and cell delivery. We anticipate such an approach can greatly advance current cancer diagnostics and treatments.

**\*9. Photodynamic therapy for skin carcinomas**

Sudershan, Nikhil B., and Fu-Giles, Patty K. Governors State University, University Park, IL, USA

The objective of this research is to utilize existing non-toxic, photoactive molecules to treat skin carcinomas. Skin cancer is the most prevalent of all types of cancers. It is estimated that more than 1 million Americans develop skin cancer every year. Recently photodynamic therapy has received a great deal of attention owing to the ability of the technique to target tumor tissue selectively. Photodynamic therapy (PDT) is a technique that uses the combination of light and nontoxic drugs to destroy specific targeted tumor cells. After the inactive, nontoxic drug is

applied topically or injected, it localizes in tumor tissue and can only be activated by irradiation with certain wavelengths of light. When are photoactivated, these drugs can produce highly reactive intermediates. In this manner, the irradiation of tumors with low energy light can ultimately lead to the selective death of cancerous cells without affecting normal tissue. It has been discovered recently that malignant cancerous cells often have over-expressed vitamin receptors on its surface. Among many tumor-specific overexpressed vitamin receptors, biotin (vitamin B2) and cobalamin (vitamin B12) are specifically overexpressed on melanomas. Both biotin and B12 are photoactive vitamins; they absorb visible light and have the ability of conducting energy transfer with DNA. Therefore, in this study, we have explored the possibilities of biotin and B12 as potential PDT agents.

#### **\*10. Antioxidant and Radical Scavenging Activities of Transition Metal-Chlorpromazine Complexes**

Naini, Yakub R., Gouuru, Dayakar R., Ahmad, Tarab J., Kouassi, Gilles K.; Made Gowda, Netkal M. Western Illinois University, Macomb, IL.

Chlorpromazine (CP) is one of the N-alkyl phenothiazine (NPTZ) derivatives, which finds extensive applications in the field of medicine as antipsychotic, anxiolytic, antiemetic and inodilation drugs [1]. It has been proved that metal complexes of phenothiazines exhibit good biological functions [2]. Because of its importance, CP has been used as ligand in the synthesis of complexes of transition metal ions such as Zn(II), Cd(II) and Hg(II). Four transition metal complexes have been synthesized and characterized based on elemental analysis, molar conductivity, magnetic susceptibility, and spectroscopic data. The tentative formulae and the structures of complexes have been proposed. Furthermore, the evaluations of *in vitro* antioxidant/free-radical scavenging activities of each complex, in comparison to the positive control, butylated hydroxyanisole (BHA), have been performed using five standard assays [2]. The available results will be presented and discussed. **Acknowledgement:** We thank the Western Illinois University Research Council for support.

[1] Snyder, S.H., 1976, Am. J. Psychiatry, 133, 197; [2] Chaitanya Lakshmi G., Ananda S., and Made Gowda N.M., 2009, Synthesis and Reactivity in Inorganic, Metal-Organic and Nano-Metal Chemistry, 39(8), 434.

#### **\*11. Transition Metal-Promazine Complexes: Antioxidant and Radical Scavenging Activities**

Gouuru, Dayakar R., Thakkalapally, Vishnuvardhan R., Ahmad, Tarab J., Kouassi, Gilles K., Made Gowda, Netkal, M. Western Illinois University, Macomb, IL.

Phenothiazines are tricyclic compounds which are used in medicine as neuroleptic, antipsychotic, antihistaminic, and inodilation drugs [1]. N-alkylaminophenothiazine (NAPTZ) derivatives, such as promazine hydrochloride ( $C_{17}H_{20}N_2S.HCl$  or PHCl), are prominent members of this class of drugs. Some NAPTZs have an electron-withdrawing group such as a halogen or  $CF_3$  in position-2. In this project, we have studied the synthesis, purification, and characterization of four PMHCl complexes of transition metal halides, such as  $ZnBr_2$ ,  $CdI_2$ ,  $CdBr_2$ , and  $HgBr_2$ . The new metal-PHCl complexes have been characterized based on their analytical results such as the melting point, elemental analysis, magnetic susceptibility, and molar conductance, IR, NMR, and mass spectral data. Additionally, these complexes have been evaluated *in vitro* for their antioxidant/free-radical scavenging activities using five standard

assays [2]. The available results will be presented and discussed. **Acknowledgement:** We thank the Western Illinois University Research Council for support.

[1] Snyder, S.H., 1976, Am. J. Psychiatry, 133, 197; [2] Chaitanya Lakshmi G., Ananda S., and Made Gowda N.M., 2009, Synthesis and Reactivity in Inorganic, Metal-Organic and Nano-Metal Chemistry, 39(8), 434-440, 2011.

#### **\*12. Kinetics of Pyridoxine Oxidation by Chloramine-T in Acid Solutions**

Thakkalapally, Vishnuvardhan R., Gouru, Dayakar R., Ahmad, T., Kouassi, Gilles K., Terry, Ronald J., and Made Gowda, Netkal M. Western Illinois University, Macomb, IL.

In the present project, the Ru(III) catalyzed oxidation of pyridoxine (Py) by chloramines-T (CAT) in acid solutions, under pseudo-first-order conditions of  $[CAT] \gg [Py]$ , has been spectrophotometrically monitored at a constant temperature. The experimental rate law for the reaction is,  $rate = k_1 [Py][CAT]^x [H+]^y [Ru(III)]^z$ , where x, y and z are fractional orders. Additionally, the effects on the rate of adding the reduction product, p-toluenesulfonamide (pts) and varying the ionic strength and the solvent dielectric constant are negligible. Activation parameters, namely,  $E_a$ ,  $\Delta S^\ddagger$ ,  $\Delta H^\ddagger$ , and  $\Delta G^\ddagger$ , have been evaluated using Arrhenius and Eyring plots based on the effect of temperature. A suitable mechanism consistent with the experimental kinetic data and a derived rate law will be presented. **Acknowledgement:** We thank the Western Illinois University Research Council for support.

#### **\*13. Emission spectra of metals from electrical arc, hollow cathode lamp, and flame sources**

Brashler, Kyle and Flint, Edward B. Bradley University, Peoria, IL.

An Ocean Optics microspectrometer with a fiber-optic probe has been used to collect emission spectra from over 20 different metals from three different sources. The Vreeland Arc Spectrograph is an instrument designed for visual identification of metals from their arc spectra. Collection of the spectra with the Ocean Optics system allows easier and more accurate identification of the metal being analyzed. Comparison of the spectra collected from the arc excitation to those from hollow cathode lamps aids in the identification of the important peaks. Introduction of aqueous samples into a Bunsen-burner flame allows the identification of alkali and alkaline earth metals, but the flame is not hot enough to excite most transition metals.

#### **14. Synthesis of coordination polymers**

Alleman, Tyler, and Flint, Edward B. Bradley University, Peoria, IL.

The tetrameric copperoxohalide cluster  $Cu_4OCl_6$  coordinates bases to each copper center on the surface of the cluster. Each copper atom has trigonal-bipyramidal structure, and the bases form a tetrahedral arrangement in space. Copper(II) chloride was reacted with various nitrogen based heterocyclic organic compounds in methano to make compounds containing this cluster. The products were categorized into three groups: polymers (pyrazine, 4, 4'-bipyridine, piperazine, DABCO), monomers (pyridine, piperidine, 2-methylpyridine, 4-cyanopyridine), and compounds ( $Py_2CuCl_2$ ). The products varied in color (green, blue, brown) and consistency (brittle solid, powder, crystalline). The difference between the monomers and polymers is the number of linker atoms on the ligands. Polymers have two linker atoms while the monomers only have one. Solubility, infrared spectra, thermal stability, and magnetic susceptibility data were collected for all products.  $Cu_4OCl_6(Pyrazine)_2$  and  $Cu_4OCl_6(4, 4'-bipyridine)_2$  are thought to be coordination

polymers based on the changes in the infrared spectrum between the products and the reactants, insolubility in common solvents, stability to greater than 400° C.

### **15. Coordination polymers: a rapidly expanding field of study**

Kellogg, Avery, D., and Flint, Edward B. Bradley University, Peoria, IL.

The field of coordination polymers is expanding at a rapid pace due to interest in their numerous applications, such as gas storage and purification. Our current focus is on the synthesis of a 2D honeycomb coordination polymer using cobalt metal, acetyl acetone, and 2,4,6-tris(4-pyridyl)-1,3,5-triazine. Qualitative visual assessment of products and Fourier-transform infrared spectroscopy (FT-IR) results indicate two products are formed. While both products show similar structure via FT-IR, they have different degrees of symmetry. Longer synthesis time yields proportionately larger quantities of a green coordination polymer product, which has a higher ordered structure than its more readily formed orange counterpart. It is hypothesized that the orange product is a one dimensional structure that, on further heating, converts to a two dimensional green form. Future work includes further product identification, examination of potential applications, and exploration of other reaction solvents, ligands, and metal centers to produce additional high order coordination polymers.

### **16. Terephthalate-based Coordination Polymers**

Hinman, Jordan, J. and Flint, Edward B. Bradley University, Peoria, IL.

Terephthalate (the dianion of 1,4-benzenedicarboxylic acid) is a commonly used linking molecule in coordination polymers and metal-organic frameworks. Our research has focused on its use with different metal 'hubs'. The synthesis of coordination polymers with terephthalate linking iron trimers was attempted first. While the materials produced by this synthesis were insoluble and showed peaks in the infrared from both ligands and complex, reproducible results were not possible. To gain experience synthesizing and characterizing coordination polymers the zinc-terephthalate metal-organic framework MOF-5 was made and characterized. Spectra matched literature values, indicating successful synthesis of this MOF. Different thermal and solution conditions were investigated toward the aim of growing single crystals suitable for X-Ray analysis.

### **Division: Computer Science**

#### **\*1. Enhancing the Levenshtein String Edit Distance algorithm to identify source code clones**

Thurman, Jacob and Maskarinec, Martin. Western Illinois University, Macomb, IL.

It is possible for two pieces of computer program source code to be superficially different, but functionally identical. Two such pieces of source code are known as "clones." These clones commonly occur when a student has taken academically inappropriate measures in order to complete a programming problem. In short, plagiarism produces clones. The Levenshtein String Edit Distance algorithm (V.I. Levenshtein, 1965) is a means of comparing two strings of text in order to find the minimum number of steps required to transform one string into the other using a small set of allowed character operations: deletion, insertion, and replacement. We adapted Levenshtein distance to compare two pieces of source code, with the hypothesis that a smaller edit distance is more likely to indicate a pair of clones. First, we implemented a method of tokenizing each of the source codes in order to translate them into a form suited to comparison



using the Levenshtein algorithm. Second, we created two enhancements to the Levenshtein algorithm that improve the correlation by adding additional edit operations to those already permitted: 1. large-scale replacement of one token with another, and 2. swapping of two sub-sequences of tokens. Finally, in imminent research, the "enhanced" algorithm will be compared to the original Levenshtein algorithm with the hypothesis that the enhanced algorithm will more accurately identify clones.

## **\*2. Cache Management System for Deductive Database**

Williams, Larry, S. and Maskarinec, Martin. Western Illinois University, Macomb, IL.

Our paper will illustrate what to do when a query is executed, or sented thought the calculation plan. It will also illustrate what the Cache Management System should do when the cache is full. Once the query goes thought the calculation plan, it then passes the results to the Cache Management System. The Cache Management System will then decide if the query should be cached or not. The Cache Management System will also have to decide what should be removed for the cache if the cache is full. The paper will also illustrate the how to calculate the Decalculation cost.

## **Division: Earth Science**

### **1. Effect of floodplain position on CRP tree growth, East Central Illinois**

Gutowski, Vincent P. Eastern Illinois University, Charleston, IL.

Seventeen acres of agricultural land on the North and South side of Kickapoo Creek, Coles County, Illinois, were converted from farmland to a CRP Reforestation Project in 2002. Although a large diversity of trees was recommended to be planted, availability of seedlings restricted the number of species actually planted. Over the last decade, additional species were planted and seedlings of beneficial and nuisance trees have begun to grow in the reforestation area. Vegetation transects were conducted between 2004 and 2011 to determine the vigor and survivability of the originally planted trees. Results show, of the original trees planted, Bald Cypress have been the most successful, Black Walnut, subsequently planted from local nuts, has also done quite well. Occasional Sycamore, Cottonwood, Ash and Hickory are found near source trees. Box Elder is rapidly becoming the most ubiquitous nuisance tree in the plots. Assuming temperature, rainfall and flooding are approximately the same over the reforestation sites, the current size and composition of the trees appears to be affected by location on the floodplain. Sandy areas near levees contain the largest trees and the highest number of Box Elder, while lower floodplain elevations and clay-rich areas have slowed the growth of all species. Tree height in the South field, typically a sandy loam area, averages approximately 5 feet. Trees growing on the silt loam and clay loam in the North field, average approximately 2 feet in height.

### **2. Field investigation of three-dimensional flow structure and bed morphology at a low junction angle confluent meander bend**

Riley, James D.<sup>1</sup> and Rhoads, Bruce L.<sup>2</sup> <sup>1</sup>Eastern Illinois University, Charleston, IL. <sup>2</sup>University of Illinois at Urbana-Champaign, Urbana, IL.

An underlying assumption of previous experimental and theoretical models of confluence dynamics has been that converging rivers have straight channels with angular configurations. However, natural channels, particularly those of meandering rivers, curve and bend. This

property and observation of channel curvature at natural junctions have led to the hypothesis that natural river confluences tend to occur on the concave outer bank of meander bends. The resulting confluence planform, referred to as a confluent meander bend, was observed over a century ago but has received little scientific attention. This paper examines field data collected on three-dimensional (3D) flow structure and bed morphology at the junction of the Wabash and Vermilion Rivers, a confluent meander bend located in west central Indiana. Measurements of 3D velocity components were obtained with an acoustic Doppler current profiler (ADCP) for two flow events with different momentum flux ratios. Channel bathymetry was also resolved from the four-beam configuration of the ADCP. Analysis of the velocity data reveals the presence of a well-defined shear layer between the converging flows, zones of flow separation and stagnation, and secondary circulation in the main channel. These flow structures actively respond to differences in momentum flux ratio, yet the bed morphology of the confluence remains generally consistent and void of scour that is typically found at other tributary junctions. Observed flow structure and bed morphology are compared to a conceptual model of confluent meander bend dynamics.

### **Division: Environmental Science**

#### **\*1. Tracing long-term environmental change in the Illinois River using fish collagen**

Little, Kayla L., Brugam, Richard B., Kohn, Luci, Vogel, Gregory G. and Brunkow, Paul. Southern Illinois University Edwardsville, Edwardsville, IL.

There have been many human-caused alterations to the Illinois River which have significantly changed the life histories of the fish and added pollution sources that could appear in the fishes. My hypothesis is that changes in the  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  isotopes between pre-historic and modern fishes will show the differences in where the fish foraged and their trophic level in the River food chain. It is likely that these changed with human modification of the river. Stable isotopes of nitrogen and carbon vary with food source in fishes. Prehistoric Native American middens contain fish that represent a baseline for modern fish communities, which can be used to determine changes in the river. We have used the isotopic composition of both modern and prehistoric fish to understand changes in fish in the River. The bone collagen was analyzed in order to reduce the chances of contamination in our samples. My results show little change in fish life history, but large increases in  $^{15}\text{N}$  found nitrogen pollution of the river.

#### **2. Identifying the source of nitrogen to Horseshoe Lake, Madison County, IL using stable nitrogen isotopes**

Brugam, Richard B., Karthic, Indu and Retzlaff, William A. Southern Illinois University Edwardsville, Edwardsville, IL.

Coke is an important fuel for the steel industry whose production results in large amounts of ammonia gas. As an air pollution control strategy, the ammonia gas is dissolved in wash water and released into local surface water resulting in increased nitrogen loading. We expect this effluent to be highly enriched in  $^{15}\text{N}$  because of ammonia volatilization during the gas washing step. Horseshoe Lake, Madison County, is located adjacent to a steel mill with an active coking operation. The lake receives treated effluent from the mill. We examined nitrogen isotopes in lake surface sediment cores, phytoplankton and zooplankton in the lake. We found an increase in sediment  $\delta^{15}\text{N}$  since 1910. The surface sediment in the lake basin near the nitrogen effluent is also marked with high  $\delta^{15}\text{N}$  values. Likewise, modern phytoplankton ( $\delta^{15}\text{N}=14.4\pm 3.0\text{‰}$ ) and zooplankton ( $\delta^{15}\text{N} = 14.1\pm 2.0\text{‰}$ ) are similarly marked. Source analysis of sediment cores using

reciprocal plots shows three sources to the lake. One represents the watershed soils ( $5.3 \pm 0.3\%$ ). Another, active before 1910, has a  $\delta^{15}\text{N}$  value of  $-0.4 \pm 0.4\%$  – probably representing nitrogen fixation by cyanobacteria. The third source has a  $\delta^{15}\text{N}$  value of  $+20.8 \pm 1.7\%$  – probably representing the coking effluent. Our results suggest that the current coking plant effluent represents a significant fraction of the fixed nitrogen available to the lake biota.

### **\*3. Impact of anaerobic soil environment on the adsorption, desorption and degradation of [14C] Metolachlor**

Kanissery, Ramdas<sup>1</sup> and Sims, Gerald K.<sup>2</sup> <sup>1</sup>University of Illinois Urbana Champaign, Urbana, IL.  
<sup>2</sup>USDA-ARS, Urbana, IL.

Adsorption and desorption characteristics of herbicide pollutants in the soil serve as strong determinant factor for the degradation, bioavailability and henceforth their bioremediation in the contaminated soils. Although there have been extensive information on the adsorption and desorption of the herbicide [14C] Metolachlor under aerobic soil conditions, such properties under strict anaerobic soil environment have not been investigated adequately. The present study is addressed to unravel the ambiguity coupled with the influence of anaerobic soil environment on the adsorption, desorption and degradation of the herbicide [14C] Metolachlor in soils with different properties. The persistence of anaerobic soil regime significantly reduced the adsorption and consequently enhanced the desorption of the herbicide from the experimental soils as evident from the respective Freundlich parameters. However, the extent of such effects were correlated to the organic matter content and other soil properties. Furthermore, anaerobic soil redox also enhanced the degradation of the herbicide in the experimental microcosms.

### **\*4. The bioaccumulation and transport pathway of heavy metals in Granite City, Illinois**

Martin, Samantha, Delmore, Stephanie, Wilson, Matthew, Brugam, Richard, Schulz, Kurt and Kohn, Luci. Southern Illinois University Edwardsville, Edwardsville, IL.

The goal of this study was to evaluate if lead deposition has occurred in Horseshoe Lake State Park prairie soil in Granite City, Illinois and whether it has exhibited bioaccumulation within the existing food chain. Due to the operation of a large lead smelter for over a century near the park, unregulated disposal of industrial waste has caused subsequent heavy metal pollution in the surrounding area. The existence of lead in the soil introduces the possibility of pollutant uptake by terrestrial organisms which may lead to bioaccumulation in the both plant and invertebrate tissues. To evaluate the lead levels within the ecosystem, soil, plants, and invertebrates from Horseshoe Lake prairie were tested to determine lead content. As a control, soil, plants, and invertebrates were tested from Cougar Lake grassland and SIUE prairie in Edwardsville, Illinois. The samples were processed using acid digestion method EPA 3050B, and inductively coupled plasma mass spectrometry (ICP-MS) was used to determine the lead concentrations in the processed samples. Soil lead levels are higher at Horseshoe Lake than at the control site, and plant lead content does not reflect soil lead levels. Consideration of lead bioaccumulation in this Horseshoe Lake ecosystem is crucial, since many animals are a part of the potentially contaminated ecosystem, and could suffer negative health effects due to heavy metal exposure.

## **5. Survey and habitat evaluation for Franklin's Ground Squirrel in Sangamon County, Illinois**

Ting, Tih-Fen, McNamara, Joseph and Young, Christopher. University of Illinois at Springfield, Springfield, IL.

Franklin's Ground Squirrel (*Poliocitellus franklinii*) listed as a state-threatened species is declining in Illinois and adjacent states. Such decline is commonly thought due to habitat loss and fragmentation, especially in the southern portion of its range. Sangamon County sits at the southern edge of the range for *P. franklinii*. Although *P. franklinii* is known to occur in dense grassland or prairie habitat, its specific habitat requirements are not well understood. Moreover, the effects of habitat fragmentation on *P. franklinii* remain largely unanswered. Between late June and mid-August 2011, we surveyed *P. franklinii* along a former railroad bed in Sangamon County, Illinois, where the first sighting of *P. franklinii* was confirmed just a year ago. In total, 23 individuals were trapped along a 29-mile stretch of the railroad bed within the county. We collected information on microhabitat and analyzed the surrounding landscape configuration where the presence of *P. franklinii* was confirmed. We will further assess the condition and suitability of the former railroad bed for sustaining the colonies of *P. franklinii*.

## **\*6. Microbial Volatilization of Selenium by *Pseudomonas* sp. (STL-6) Isolated from the Soil- *Stanleya pinnata* System**

Zhu, Yangyu<sup>1</sup>, Banuelos, G.S.<sup>2</sup> and Lin, Z.-Q.<sup>1</sup> <sup>1</sup>Southern Illinois University-Edwardsville, Edwardsville, IL. <sup>2</sup>USDA-ARS, Parlier, CA.

Soil Selenium (Se) pollution is one of the major environmental problems in the western U.S. because of its significant ecotoxicological effects on wildlife. Prince's Plume (*Stanleya pinnata*) has been identified as a Se hyperaccumulator species that accumulates over 0.1% Se in plant tissues from soil. Although high rates of Se volatilization were observed in the Prince's Plume field, few studies have been conducted to better understand roles of soil microbes in Se volatilization from the soil-plant system. The objective of this research was to isolate and identify soil bacteria that associated with Prince's Plume and have great ability of volatilizing Se. A total of 30 bacteria strains were isolated from the top and rhizosphere soils, based on their morphological characteristics. Rates of Se volatilization of the isolated soil bacteria were determined, and *Pseudomonas* sp. (STL-6) was identified as the best soil bacteria strain that volatilized 7.66 µg Se per day in 200 ml culture solution treated with 10 mg Se L<sup>-1</sup>. The Se mass balance recovery rate was 99.6%. Microbial Se volatilization by *Pseudomonas* sp. (STL-6) increased from 3.06 µg to 8.45 µg Se per day in 200 ml culture solution, while the Se treatment changed from 5 to 15 mg L<sup>-1</sup>. The identified bacterium needs to be further characterized in order to be used for Se bioremediation under field conditions.

## **7. The 20th century accumulation of organohalogenated compounds in Illinois river otters**

Carpenter, Samantha K.<sup>1</sup>, Mateus-Pinilla, Nohra E.<sup>1</sup>, Singh, Kuldeep<sup>2</sup>, Lehner, Andreas<sup>3</sup>, Satterthwaite-Phillips, Damian<sup>1</sup>, Bluett, Robert D.<sup>4</sup>, Rivera, Nelda A.<sup>1</sup> and Novakofski, Jan<sup>5</sup>.  
<sup>1</sup>Illinois Natural History Survey, Champaign, IL. <sup>2</sup>College of Veterinary Medicine, Urbana, IL.  
<sup>3</sup>Diagnostic Center for Population and Animal Health, Michigan State University, Lansing, MI.  
<sup>4</sup>Illinois Department of Natural Resources, Springfield, IL. <sup>5</sup>Department of Animal Sciences, University of Illinois Urbana-Champaign, Champaign, IL.

Organohalogenated compounds (OHCs), including polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), and organochlorine pesticides (OCPs), are of global

concern because of their environmental persistence, bioaccumulative potential, and deleterious effects on wildlife and humans. The North American river otter (*Lontra canadensis*) is a top-trophic predator in the aquatic ecosystem of Illinois and therefore is vulnerable to the bioaccumulation of OHCs. We analyzed concentrations of OHCs in livers of 23 river otters salvaged by the Illinois Department of Natural Resources from 2009 to 2011. Our objectives were to: 1) determine the concentrations of 20 OHCs in livers of river otters collected in Illinois during 2009-2011, 2) determine sex and age-dependent distribution of OHCs, and 3) compare current results to reported concentrations in 1984-1989 of four OHCs in Illinois river otters. We anticipated lower OHC concentrations compared to those reported 20-25 years ago in Illinois. The highest concentrations of OHCs were PCBs, dieldrin, and 4, 4'-DDE. Mean PCB concentrations were significantly higher in males than females ( $p = 0.04$ ). Mean concentrations of dieldrin ( $653 \mu\text{g kg}^{-1}$  wet wt) were greater than those detected from 1986 to 1989 ( $340 \mu\text{g kg}^{-1}$  wet wt;  $p < 0.05$ ) and mean concentrations of HE ( $30 \mu\text{g kg}^{-1}$  wet wt) were lower ( $50 \mu\text{g kg}^{-1}$  wet wt;  $p < 0.05$ ). Our results highlight the need for a more thorough understanding of contaminant accumulations by river otters across different watersheds of Illinois.

### **Division: Health Sciences**

#### **\*1. The effect of depression on healing time of clavicle fractures**

Thomas, Emily and Zelman, Mark E. Aurora University, Aurora, IL

The goal of this project was to determine the effect of depression on a patient's return to their daily activities after sustaining a clavicle fracture. Little has been published on the relationship between fracture healing and depression. However, numerous studies have demonstrated that elevated cortisol levels in the blood that coincide with depression often affect bone mineral density in several different areas of the body. In addition, several studies found that patients suffering from depression were diagnosed with osteoporosis at a significantly higher rate than those who did not have depression. The population comprised patients who had completed the study, "A Multicenter, Prospective, Randomized Trial of Non-Operative Versus Operative Treatment for High-Energy Midshaft Clavicle Fractures" conducted at the Indiana University School of Medicine. Definitions were set for "depressed" and "healed" patients. Charts were examined and analyzed for the indicators of depression and for time to fracture healing. For statistical purposes, a two-tailed t-test and an ANCOVA analysis were run, and found that depression did significantly affect a patient's time to recovery ( $p = 0.049$ ). These data suggest that the relationship between fracture healing and depression should be further explored in a prospective study with a larger patient population.

#### **\*2. Using health science questionnaire to survey the influence of the internet on self diagnosis by college staff and students: cyberchondria affects healthcare decisions**

Galloway, Jennifer A., Beck, Hans T. and Rudek, David J. Aurora University, Aurora, IL

Cyberchondria, a recent phenomenon where people are self diagnosing illness or diseases without professional medical consultation using the internet, was investigated on a university campus using a locally designed health science questionnaire. Our survey results found that internet medical websites do influence self diagnosis among college staff and students.

### **3. Bio-Gerontology for the pre-professional student**

Lloyd, Johnny K. Aurora University, Aurora, IL

Bio-Gerontology, a course involving the biology of aging provides an opportunity for the pre-health professional student to be exposed to the geriatric population. Individuals are living longer and the “baby boomers” are quickly approaching the “golden years.” As a person ages so does the need for health care. Aging, which leads to gradual changes in body composition, involves structural and functional losses at the cellular, tissue, and organ system levels. Chronic medical conditions such as hypertension, arthritis, stroke, and heart disease have been associated with the aging process. Health care providers need to distinguish pathophysiological conditions from “normal aging” of the human body. Students in the course interact and observe elders at a local long-term care facility weekly and also organize and implement a group activity with various games for the residents. As a Sioux Proverb states, “As you go through life, act in such a way as to not deprive others of happiness. Avoid giving sorrow to your fellow man, but to the contrary, see that you give him joy as often as you can.” Selective student’s reflections of their experiences with the residents along with action photographs will be presented.

#### **Division: Microbiology**

##### **\*1. Possible relationship between in vivo S-adenosyl-L-methionine hydrolase activity and quorum sensing in *Escherichia coli***

Walworth, Grace and Hughes, Jeffrey A. Millikin University, Decatur, IL.

Recent literature has documented the existence inter-bacterial communication molecules called autoinducers in the form of N-actyl homoserine lactones that mediate a process called quorum sensing. By using quorum sensing, bacteria are able to aggregate together to form a biofilm that allows them to perform activities that single cells cannot conduct. In previous work, cells transformed with an expression vector containing the coliphage T3 SAM hydrolase (SAMase) gene aggregated into clumps distributed throughout the medium. We have demonstrated that these do not appear related to capsule formation or entanglement of cell filaments, both of which are induced by SAMase expression. The biochemical pathways related to SAM production and SAMase activity could be responsible for high amounts of homoserine lactone being dumped into the medium and possibly serving as an autoinducer. This research suggests that the SAMase activity is responsible for cell clumping that may be due to release of a soluble factor, the presence of which is the subject of current experiments.

#### **Division: Physics, Mathematics & Astronomy**

##### **\*1. Circle beyond center and radius: Apollonius definition of a circle**

Koissi, Marie Claire and Liu, Shufang, Western Illinois University, Macomb, IL.

The aim of this presentation is twofold. First, we review the construction of a circle through harmonic division of a segment, as suggested by Apollonius of Perga. We extend the definition to orthogonal circles. Secondly, we present a formula that links the radius in the standard definition of a circle to the ratio term in Apollonius circle.

## **2. Applications of fuzzy regression to insurance**

Koissi, Marie Claire, Western Illinois University, Macomb, IL.

Fuzzy regressions differ from standard regressions in their interpretation of the errors. In ordinary regression, the random errors, which are due to the residuals, are assumed to be Gaussian. While in fuzzy regression, the errors are viewed as fuzziness of the model structure and do not need to be normal. In this work, we will present some aspects of fuzzy regression and focus on a few applications in actuarial sciences.

## **\*3. Modeling formaldehyde maser variability with Easy Java Simulations**

Carlson, Jeff, C. and Araya, Esteban, D., Western Illinois University, Macomb, Illinois.

Formaldehyde (H<sub>2</sub>CO) masers are a rare astrophysical phenomenon associated exclusively with massive star forming regions. Of particular interest, due to its predictable variability, is the H<sub>2</sub>CO maser in the star forming region IRAS 18566+0408. We developed a simple set of geometrical models to explain the observed variability by translational or rotational motion of idealized maser regions. We utilized the cross-platform Easy Java Simulations (EJS) to quickly develop and test our model. The benefit of using EJS for our initial simulation work was that it allowed for rapid prototyping, as well as rejection, of hypothetical models. Using a point-and-click interface, we were able to add windows to display graphs, data and 3D visualizations that would have been unnecessarily time-consuming to implement with a traditional programming language.

## **Division: Science, Mathematics & Technology Education**

### **1. Partnership and sustainability in science and math education: results from Aurora University's IMSP masters degree programs**

Beck, Hans, Davis, Jane, and Othman, Saib. Aurora University, Aurora, IL.

Aurora University is midway through the final year of its Illinois Mathematics and Science Partnership grant, focusing on sustainability and dissemination of the gains made in teacher leadership, teacher content knowledge, and student test score improvement. Throughout the partnering districts, cohort members who have received Master's Degrees in Teacher Leadership in Mathematics, Life Science, and Elementary Math and Science Education have made significant improvements in their own content knowledge and teacher leadership skills, including endorsement in Teacher Leadership. Their students have achieved higher scores on standardized tests in mathematics and science. The partnership includes high need school districts, the Illinois Math and Science Academy, Packer Engineering's Foundation for Problem Based Learning, the Robert Crown Center for Health Education, and SciTech Hands on Museum. The collaborative partnership itself has been evaluated and has been found to be transformative in every area. At this time, teams of cohort teachers are disseminating their content expertise and honing their androgogy skills by holding workshops for their fellow teachers across the districts. These include content instruction, technology and manipulative demonstrations and check out for classroom use, and continuing education credit. The partnership has expanded to include more districts and community entities, and the collaborative process of improving mathematics and science education continues to expand and change the nature of Aurora University.

## **2. Re-designing the Human Body Systems**

Cherif, Abour<sup>1</sup>, Jedlicka, Dianne<sup>2</sup> and Phillips, William<sup>3</sup>. <sup>1</sup>DeVry University, Addison, IL. <sup>2</sup>DeVry University, Frankfort, IL. <sup>3</sup>DeVry University, Arlington, VA.

The Human Body is a remarkable biological machine that is supported and maintained by well-structured and interdependent body systems and their organs. Evolution has worked on humans for hundreds of thousands of years, yet the current pace of technological and social change have exposed possible human frailties and this in turn raises the question of whether or not nature's work could be improved upon. In this learning activity the students study morphological and anatomical structures and the physiological functions of the human body systems and their respective organs and parts. Then the students select their own favorite system or organ to re-design in order to optimize the efficiency of the anatomical structural, physiological function, and/or the ecstatic and functional morphology. Through group work and interaction (student groups compete for an "in-house" very prestigious Patent Award), students actively engage in the learning process to understand the role of design in the efficiency and functionality of the human body system, to retain the new information, and to apply what has been learned in different situations

### **\*3. A study on the effect of using showcase portfolios as an assessment in upper level high school science courses**

Scholle, Tiffany<sup>1,2</sup> and Beck, Hans<sup>1</sup>. <sup>1</sup>Aurora University, Aurora, IL. <sup>2</sup>Oswego East High School, Oswego, IL.

A study on the effect of using showcase portfolios as an assessment in upper level high school science courses was performed over the course of a full school year. The showcase portfolio and grading rubric was developed so that students would have control over what they were being assessed on as well as have the opportunity to show what was learned during a curricular unit as opposed to what was not learned. Participants were sophomores, juniors, and seniors enrolled in Chemistry, Honors Chemistry, and Forensics classes at a suburban high school. Grades on common unit exams, semester totals, and final exams were compared for two groups of students: the treatment group that used portfolio assessments and the control group that did not. Additionally, levels of comprehension were compared on the unit and final exams as those were set up with questions on three levels of Bloom's taxonomy per topic studied. A statistically significant increase in overall grades and comprehension of material was seen within the treatment group of students in all courses.

### **4. The Science of the History of Fashion: from the Flintstones to the Jetsons**

Jedlicka, Dianne<sup>1,2</sup>, Gaul, Emily<sup>1</sup>, Rowberg, Kathy<sup>3</sup>, and Widing, Robert<sup>4</sup>. <sup>1</sup>Columbia College Chicago, IL. <sup>2</sup>DeVry University, Frankfort, IL. <sup>3</sup>Purdue Calumet, Hammond, IN. <sup>4</sup>University of Illinois at Chicago, Chicago, IL.

Material Science can include the ability to date ancient textiles based on fiber types and dyes used. An overview of human innovation can be extrapolated by examining the fibers chosen, weaves employed, and dyes used, almost like an evolutionary sequence of events. The identification of dye origins and evaluation of the innovations that humans have applied to fabrics and to dyeing techniques allow for a glimpse into the past of fashion science. After a historical review of human garment design and materials, a lab activity will be presented. This activity/lab demonstrates the practicality and use of the scientific method as a discovery tool.



Dyes available regionally and historically will be used to re-enact possible scenarios used by these early materials scientists.

**\*5. Improving ISAT Scores in science of at-risk students from low-income families by promoting vocabulary development to enhance science literacy**

Mestek, Gerry <sup>1,2</sup> and Beck, Hans<sup>1</sup>. <sup>1</sup>Aurora University, Aurora, IL. <sup>2</sup>Cowherd Middle School, Aurora, IL.

In a two-year study of teaching methods for science comprehension, a design was implemented to focus on the effect on learning science vocabulary and content. The targeted audience was a middle school class comprised of 90 seventh grade students from low-income Hispanic and African American community. These students demonstrate low achievement in science literacy, and the cause was presumed to be impacted by problems that related to reading weaknesses in both content vocabulary and comprehension of scientific related topics. These students lack sufficient content vocabulary to enable them to be articulate in their discussion of science. It was presumed, also, that by increasing vocabulary, test scores as well as ISAT scores (Illinois Standards Assessment Test) would improve. By understanding and using reading strategies, students can acquire knowledge that will be made evident in classroom assessments. Using several selected CRISS (CReating, Independence through Student owned Strategies) an increase was seen. Three student groups were measured. By alternating Frayer Model, flash cards and concept maps activities, students were introduced to methods of vocabulary acquisition. Pre- and Post-tests were administered to assist in determining individual growth. The corroboration of evidence had supported the relationship between vocabulary and reading comprehension. The predictive power of the Pretest provided guidelines to addressing existing literacy deficiencies.

**Division: Zoology**

**\*1. Cranial Morphology of Raccoon Subspecies (*Procyon lotor lotor* and *Procyon lotor hirtus*) in Illinois**

Longfellow, Lindsay, and Kohn, Luci. Southern Illinois University Edwardsville, Edwardsville, IL.

Two subspecies of raccoon (*Procyon lotor lotor* and *P. l. hirtus*) have been identified in Illinois, based primarily on geographic location. Morphological distinctions between these two subspecies, however, have not been well defined. Biogeographic differences based on the effects of glaciation may explain the current subspecies differences seen today. We evaluated the morphological variation between the two different subspecies populations to test for significant differences between them. We examined 44 dimensions representing the skull, oral facial and braincase regions on 64 raccoon skulls. Data were adjusted for size differences, and tested for morphological differences between the two subspecies populations using analysis of variance and multivariate analysis of variance. Significant results provide support for differences between the subspecies due to their historic and biogeographic background. Loan of samples from the Illinois State Museum, Illinois Natural History Survey and Field Museum of Natural History are gratefully acknowledged.

## **\*2. Investigating Morphological Integration in Mandibles of Two Mustelid Species**

Oster, Molly, Schorsch, Robert, and Kohn, Luci. Southern Illinois University Edwardsville, Edwardsville, IL.

The vertebrate mandible undergoes a complex, modular development, however it is a functionally integrated structure. As the only movable bone of the skull, the mandible's primary functions are chewing, gnawing, and food ingestion. The physical stress on the bone resulting from these actions, as well as the presence or absence of teeth in particular regions strongly influences mandible morphology, since bones remodel in response to mechanical forces. The resulting morphological variation may be observed over varying periods of time, from change within an individual to enduring evolutionary change. We test for differences in mandible form between *Mustela frenata* and *Neovison vison*, members of the same genera with different diets. Morphological integration aids in the understanding of the relationship amongst multiple morphological traits, by revealing their interdependence. This study will examine 22 two-dimensional landmarks on photographs of 41 *M. frenata* and 131 *N. vison* mandibles were used to calculate 40 distances representative of the mandibular body, alveolar region, and ramus dimensions. Analysis of variance was used to test for differences between the mandibles, and morphological integration was estimated within functional regions. Significant integration reflects functional and genetic differences. This study aids in understanding the evolution of a developmentally complex structure. Loan of samples from the Illinois State Museum and Illinois Natural History Survey are gratefully acknowledged.

## **3. Hydrologic effects on morphology in largescale stonerollers (*Camptostoma oligolepis*)**

Stoff, Brian, Matteson, Stephanie, and Brunkow, Paul, Southern Illinois University Edwardsville, Edwardsville, IL.

Patterns of intraspecific morphological variation among populations can be a product of phenotypic plasticity or local adaptation. Partitioning out the interaction between habitat and morphology is important since differences in performance-based morphology can eventually lead to phylogenetic diversification. The hydraulic gradient presented by streams and rivers, with high variability in discharge in headwaters versus low variability in discharge in downstream sites, presents a valuable opportunity to examine site-specific, potentially performance-based morphological variation. We sampled largescale stonerollers, a bottom dwelling fish that occupies streams throughout the Midwest, from seven sites throughout the 138 mile long Big River in east-central Missouri. Photographs were taken of each individual fish with a high resolution digital camera, and 13 landmarks were digitized on each specimen. Geometric morphometrics was used to describe shape differences from the headwaters to the lower reaches of the river. Our findings revealed a highly significant anterior shift in dorsal, pelvic, and anal fin insertions on the body from upstream to downstream sites. Thus, this region of the body may be important in determining accommodation to hydraulic demands. Future research should focus on how this morphological feature affects swimming performance, and on whether these differences are due to phenotypic plasticity or local selection pressures.

#### **\*4. Movement patterns in two closely-related species of Topminnow in a Southern Illinois Contact Zone**

Koepp, Kate, E, Miller, Patrick, M, Law, Tab, Rigg, Brian, and Duvernell, David, D. Southern Illinois University Edwardsville, Edwardsville, IL.

Individual movement dynamics can influence species interactions in contact zones between closely related species. The purpose of this research was to determine if observed movements of two species of Topminnow (*Fundulus olivaceus* and *F. notatus*) in a contact zone are influenced by individual sex, species and overall abundance. Fish were marked and fin clips collected for genotyping along a 2.2 km reach of Prairie Creek in southern Illinois. In total 254 fish were marked, including 153 females and 101 males. Genotyping efforts confirmed the species identity of 92 *F. olivaceus* individuals (38 males 54 females) and 137 *F. notatus* individuals (62 males, 75 females). Several re-sampling expeditions were carried out to recapture marked fish and note their new location in the stream. ANOVA demonstrated that movement rates differed significantly by species ( $P < 0.001$ ) and by region ( $P < 0.001$ ) but not by sex ( $p = 0.225$ ). There was also a significant interaction effect between species and region ( $P = 0.004$ ). *F. olivaceus* exhibited greater movement overall and was numerically less abundant in both the upper and lower reaches. This supports the hypothesis that the less abundant species exhibited greater movement. This work was supported in part by the LSAMP Research Scholar's Program NSF/HRD 0904024, the NGRREC summer internship program and NSF DEB 0716985.

#### **\*5. The influence of habitat continuity on genetic structure among populations of two closely related topminnow species**

Scott, Jason, M, and Duvernell, David, D. Southern Illinois University Edwardsville, Edwardsville, IL.

The Blackstripe Topminnow (*Fundulus notatus*) and the Blackspotted Topminnow (*F. olivaceus*) are two closely related species that exhibit similar ecological niches and overlapping ranges. Within drainages where both species occur, *F. olivaceus* is typically isolated in headwater habitats, while *F. notatus* is found along the margins of larger river habitats lower in the water shed. As a result, these species are ideally suited for studies investigating the impact of habitat distribution on movement and genetic structure. Along a 70 km stretch of the Saline River in southern Illinois, we genotyped 328 fish at seven microsatellite loci to test the hypothesis that *F. notatus* populations separated solely by distance would be more genetically similar than populations of *F. olivaceus* separated by equivalent distances, but isolated in multiple headwater tributaries. Estimates of *Fst* were significantly greater for *F. olivaceus* populations than for *F. notatus* populations at equivalent distances, and a comparison of isolation by distance plots for each species provided evidence that genetic structure was greater among *F. olivaceus* than *F. notatus* populations.

#### **6. Beta Diversity of Stoneflies (Plecoptera) in the Midwest**

DeWalt, R.<sup>1</sup>, Edward, Pessino, Massimo<sup>1</sup>, Cao, Yong, Tweddale, Tari<sup>1</sup>, Hinz, Leon<sup>1</sup>, and Grubbs, Scott, A.<sup>2</sup>. <sup>1</sup>University of Illinois, Illinois Natural History Survey, Champaign, IL, <sup>2</sup>Western Kentucky University, Bowling Green, KY.

Museum records and new collections were used to analyze diversity patterns for stoneflies across IL, IN, MI, OH, ONT, and WI. Ohio was the most diverse state with 103 species, its unglaciated Allegheny Plateau serving as conduit for Appalachian species into the state. Diversity declined with increasing longitude and latitude. Unglaciated regions were most diverse overall. "Driftless

areas" of IL and WI held disjunct populations of several whose nearest populations were in the unglaciated Ozark Mountains and in the southern half of IL, IN, and OH.

**\*7. A survey of the insects inhabiting the Florida Panther National Wildlife Refuge, including first documentation of the Mexican Bromeliad Weevil, *Metamasius callizona* (Coleoptera: Curculionidae).**

Ray, Haleigh, A.<sup>1</sup>, Zettler, Lawrence, W.<sup>1</sup>, and Richardson, Larry, W.<sup>2</sup>. <sup>1</sup>Illinois College, Jacksonville, IL, <sup>2</sup>Florida Panther National Wildlife Refuge, Naples, FL.

Located in remote Collier County, the 10, 684 hectare Florida Panther National Wildlife Refuge (FPNWR) was established in 1989 to protect the endangered Florida Panther (*Puma concolor coryi*) and its habitat. Many types of natural communities are present within the refuge ranging from hardwood (tropical) hammocks, wet prairies, and swamps that collectively harbor considerable plant and animal diversity, including 27 species of orchids. Many native ecosystems in Florida have been invaded by exotic species in recent years necessitating biological surveys that document the existing flora and fauna. We present the first insect survey of the FPNWR carried out during a three year period (2009-2011). Black light, hand net, and malaise trap methods were used to collect insects. After capture, specimens were identified to genus and/or family level, and preserved using standard entomological protocols. All specimens were deposited into the Illinois College Insect Museum for future reference. A total of 78 insect families within 14 orders were acquired. Two exotics were collected that pose a threat to native epiphytic plants in the FPNWR: Mexican bromeliad weevil, *Metamasius callizona*, and the armored scales (Hemiptera: Diaspididae), namely *Diaspis boisduvalii* - a major pest of cultivated orchids. Also collected was Carter's sphinx, *Protambulyx carteri* (Lepidoptera: Sphingidae), a native moth whose larva feeds primarily on Brazilian pepper – an invasive exotic shrub established throughout South Florida.

**\*8. Occurrence of Boisduval Scale, *Diaspis boisduvalii* (Hemiptera: Diaspididae), on native epiphytic orchids in Collier Co., Florida, including Fakahatchee Strand State Preserve**

McCormick, John, P.<sup>1</sup>, Ray, Haleigh, A.<sup>1</sup>, Stice, Andrew, L.<sup>1</sup>, Stocks, Ian<sup>2</sup>, and Zettler, Lawrence, W.<sup>1</sup>. <sup>1</sup>Illinois College, Jacksonville, IL, <sup>2</sup>DPI, Florida Department Agriculture & Consumer Services, Gainesville, FL.

We present the results of a field study conducted in 2011 to assess native epiphytic orchids in South Florida for infestations of armored scales (Hemiptera: Coccoidea: Diaspididae). A total of 1, 726 orchids in 10 taxa were surveyed at seven locations at three sites. Boisduval scale, *Diaspis boisduvalii* Signoret, was detected on 2.3% of the orchids from six of the ten orchid species, and was present at all three primary sites surveyed. *Prosthechea cochleata* and *Epidendrum amphistomum* (Asparagales: Orchidaceae) appeared to be most vulnerable to this scale, with infection totals of 5.8% and 2.1%, respectively. Of 44 scales from the 39 orchids, 27% hosted hymenopteran parasitoids in various stages of development. The presence of *D. boisduvalii* adds an additional burden to state-endangered orchid populations and indicates that resource managers may need to expand management approaches to include plant-parasitic insect control.

**\*9. Avian hemoparasites in Illinois and their effects on health**

Annetti, Kendall, L, and Mateus-Pinilla, Nohra. Illinois Natural History Survey, Champaign, IL.

Blood parasites are found in wild birds nearly worldwide but published surveys have not been conducted in Illinois since 1957. There has been a limited focus in the literature on upland game

and waterfowl species in the state, both of which are important to Illinois economy through hunting license sales. Additionally, avian hematozoa are thought to induce physiological stress in the individual, leading to decreased reproduction and health. To determine this, many studies have only compared body condition score with infected and non-infected individuals, but very few have tried to compare clinical health parameters from blood with infection. Therefore, the objectives of this study are (1) to assess basic health parameters (white blood cell counts, packed cell volume, glucose, hemoglobin and fecal cortisol) between infected and non-infected upland game and waterfowl and (2) to determine the type, prevalence, density and intensity of hematozoa under natural conditions.

#### **10. The effect of supplemental feeding on white blood cell populations in Northern Cardinals (*Cardinalis cardinalis*)**

Huber, Sarah, J, and Wilcoxon, Travis, E. Millikin University, Decatur, IL.

The purpose of this study was to observe the health condition of Northern Cardinals (*Cardinalis cardinalis*) throughout seasonal changes as well as examine the impact of supplemental food on their condition. Specifically, we observed heterophil to lymphocyte ratios, a measure previously shown to reflect stress physiology and immune condition in birds. The Northern Cardinal is a species that stays in Central Illinois year-round; therefore we tracked cardinals throughout a full annual cycle of seasonal changes. We predicted that there would be a lower heterophil to lymphocyte ratio in the presence of supplemental food. We captured cardinals in mist nets, took body measurements and a small blood sample, from which we made a blood smear fixed to a microscope slide with methanol for each bird captured. Smears were later stained and white blood cells were counted to determine the ratio of heterophils to lymphocytes in each sample. Overall, this study demonstrates how variation in food availability influences stress and immune physiology of free-living birds.

#### **\*11. Analysis of avian communities in fragmented oak-hickory forest in southwestern Illinois**

French, Zachary, L, Richter, Lane, A, Minchin, Peter, R, and Essner, Richard, L. Southern Illinois University Edwardsville, Edwardsville, IL.

Habitat fragmentation is tied to population declines and extinctions of many bird species. Our objectives were to assess avian communities in three oak-hickory forest fragments in southwestern Illinois and to develop predictive habitat models. The survey was conducted at 130 randomized plots in two forest patches on the campus of Southern Illinois University Edwardsville and in the adjacent Bohm Woods State Nature Preserve. Fixed-distance point-counts and audio recordings (25 m radius for 10 minutes) were taken eight times per plot in May-July, 2008 and May-August, 2010. Plots were also assessed for habitat factors, including counts of standing dead trees and fallen logs, canopy height, canopy openness, distance to forest edge, successional age, median tree diameter, topographic position, understory cover, and forest composition (summarized as the three axes of a NMDS ordination of vegetation data). Density estimates of each bird species, Shannon Diversity index and species richness were calculated for each plot. Indicator species analysis was used to determine which bird species characterized the forest fragments and groups derived by clustering of vegetation data. Logistic regression models were developed for the probability of occurrence of each species as a function of habitat variables. We recorded a total of 94 species, including the state threatened Cerulean Warbler, Bell's Vireo and Northern Harrier. The habitat models developed in this study will inform management of forest fragments in the region.

## **12. Summary and Results of the Milan Bottoms Bald Eagle Night Roost Survey Project**

Monson, Cathleen, D.<sup>1</sup>, McKay, Kelly, J.<sup>1</sup>, Bryant, Robert, R.<sup>1</sup>, Ritter, Brian, P.<sup>2</sup>, Monson, Jason, L.<sup>1</sup>, Rothe, Jennifer, A.<sup>1</sup>. <sup>1</sup>BioEco Research and Monitoring Center, Hampton, IL, <sup>2</sup>Eastern Iowa Community College, Davenport, IA.

Human development and activities continue to increase and encroach on the floodplain habitats of the Upper Mississippi River. For example, economic development is occurring immediately adjacent to the Milan Bottoms Complex in Rock Island County, Illinois. Evidence suggests that this area functions as a major night roost location for wintering Bald eagles (*Haliaeetus leucocephalus*). Therefore we conducted a standardized night roost survey here during three consecutive winters (2005-2008), in order to document the importance of this site to wintering eagles. Each week, one evening and one morning survey were carried out from early December through late March (17 weeks). In 2005-2006, a total of 10,386 observations were recorded of eagles entering or exiting the night roost. Of these, 32% were adults, 36% were immatures, and 32% were unaged. In contrast, only 2,553 eagle observations were reported in 2006-2007, including 44% adults, 32% immatures, and 24% unaged. Eagle numbers increased in 2007-2008 to 6,957 observations. Among these, 39% were adults, 27% were immatures, and the remaining 34% were unaged. During the first three years of this project, the majority of night roosting eagle observations occurred in December and January, with steadily decreasing numbers in February and March, respectively. The upstream end of Milan Bottoms (i.e. the widest track of floodplain forest habitat appears to be the most heavily utilized portion of the study area for night roosting purposes.

## **\*13. The effects of reflectivity on bird-window collisions at Millikin University in Decatur, Illinois**

DeCosse, Matthew, T, Martell, Eric, C, and Horn, David, J. Millikin University, Decatur, IL.

Bird-window collisions are a result of birds not being able to recognize panes of glass as clear or reflective barriers, as well as their lack of ability to differentiate their reflections from those of other birds. We examined the role reflectivity plays in the number of collisions that occur at Millikin University in Decatur, Illinois. Ninety-six windows were measured for reflectivity at six different buildings (eight north-facing and eight south-facing on each building) located on Millikin's campus. To measure reflectivity of the window, we took 25 measures of reflectivity using a Vernier light sensor and compared it to the reflectivity off a mirror placed in front of the window. We found no significant differences in reflectivity between north and south-facing windows. A significant difference in reflectivity was found among buildings. At the four buildings that are most susceptible to collisions the relative reflectivity (the ratio of reflectivity off the window over the reflectivity off the mirror) was lower (0.72-0.75), compared to the two buildings with the least number of collisions (0.99 and 1.03). Given the large differences in the number of collisions at buildings with low reflectivity values, other factors such as landscape around buildings may play a key role in bird-window collisions.

## **14. In the eye of the beholder: Visual mate choice lateralization in a polymorphic songbird, the Gouldian Finch (*Erythrura gouldiae*)**

Templeton, Jennifer<sup>1</sup>, Mountjoy, James<sup>1</sup>, Pryke, Sarah<sup>2</sup>, and Griffith, Simon<sup>2</sup>. <sup>1</sup>Knox College, Galesburg, IL, <sup>2</sup>University, Sydney, Australia.

Birds choose mates on the basis of color, song, and body size, but little is known about the cognitive mechanisms underlying these mating decisions. Recent reports that immediate early

gene expression associated with courtship behavior is lateralized in the left optic tectum of zebra finches (*Taeniopygia guttata*) suggest that visual mate choice itself may be lateralized. To evaluate this hypothesis we tested Gouldian finches (*Erythrura gouldiae*), which exhibit strong, adaptive visual preferences for mates of their own head-color (red or black), in a mate-choice apparatus under three eye conditions: left-monocular, right-monocular, and binocular. We discovered that male preference for females of the same head color is so strongly lateralized in the right eye / left hemisphere system that if the right eye is unavailable, males are unable to respond discriminatively, not only to males and females of the same head color, but also to the strikingly dissimilar female morphs. Song was consistent with these lateralized mate preferences; black males sang more to black females when using their right eye than when using their left. Beauty, therefore, is in the right eye of the beholder for these colorful songbirds, providing the first demonstration of visual mate choice lateralization in any animal.

### **15. Scavenging throughout the life cycle of the jumping spider, *Phidippus audax* (Hentz) (Araneae, Salticidae)**

Vickers, Michael, E., Robertson, Marianne, W., and Watson, Casey, R., Millikin University, Decatur, IL.

*Phidippus audax* (Hentz), a common jumping spider found in the United States, is a visual predator that uses its highly developed eyesight to detect and actively forage for prey. We demonstrate that *P. audax* can survive throughout its life cycle as a scavenger. We separated 600 spiderlings into eight treatments examining all combinations of three different variables: live versus dead prey, substrate present versus substrate absent, and large versus small arenas. Over the course of the study, we recorded survival rates, instar durations, and carapace widths. Our results indicate that *P. audax* can survive solely on a diet of dead prey, but at significantly greater mortality and with longer instar durations. Scavenging spiders, however, exhibited no significant difference in carapace widths when compared to predators. Choice tests conducted on adults indicate that spiders raised as both predators and scavengers are more likely to choose live prey than dead prey.

### **\*16. A study of Sleep Traits in mutation accumulation lines of *Drosophila melanogaster***

Lyman, Rachel, A.<sup>1</sup>, Jones-Rhoades, Matthew<sup>1</sup>, Lyman, Richard, F.<sup>2</sup>, Harbison, Susan, T.<sup>2</sup>, and Mackay, Trudy, F. C.<sup>2</sup>. <sup>1</sup>Knox College, Galesburg, IL, North Carolina State University, Raleigh, NC.

To provide a better understanding the rate at which complex traits such as behavior can change in small, inbred populations, we constructed a set of 25 mutation accumulation (MA) lines from an inbred line of *Drosophila melanogaster*. The MA lines were maintained in small mass matings of 10 males and 10 females per generation at a standard population density with discrete generations. We measured MA lines at generation 41 and 61 for five aspects of sleep behavior using the *Drosophila* Activity Monitor (DAM). We found variation between the lines in terms of the number of bouts of sleep, the total time spent sleeping, and the amount of activity while awake. The variation seen might be the result of newly acquired mutations.

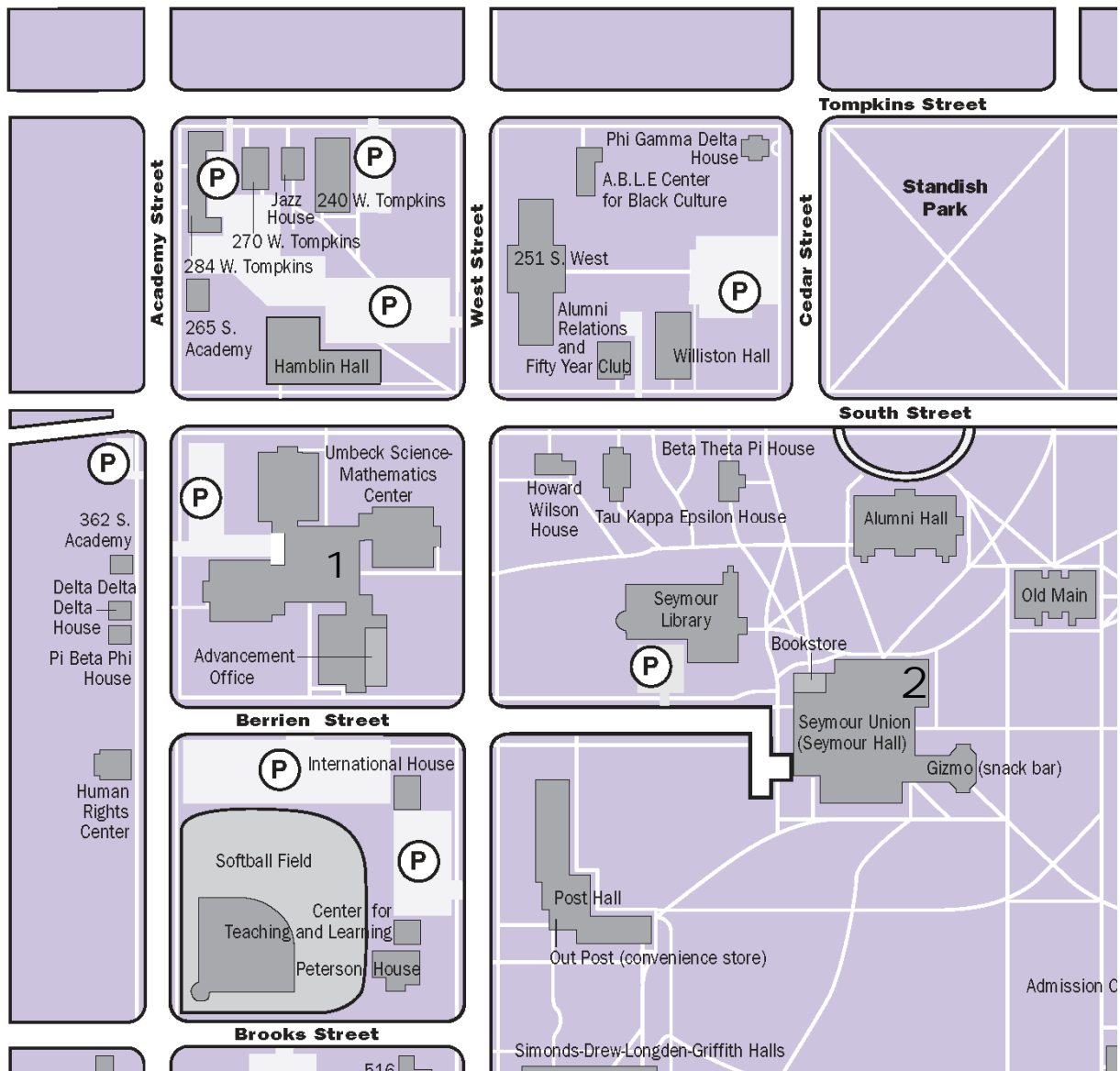
# KNOX COLLEGE CAMPUS MAP

**Conference Buildings:**

1. **Umbeck Science-Mathematics Center (SMC):** Registration, Poster Session, Mini-Symposium, Oral Presentations and Division Meetings
2. **Seymour Union:** Council Meeting, Banquet, Breakfast, Lunch, and Award Announcements

**Parking:**

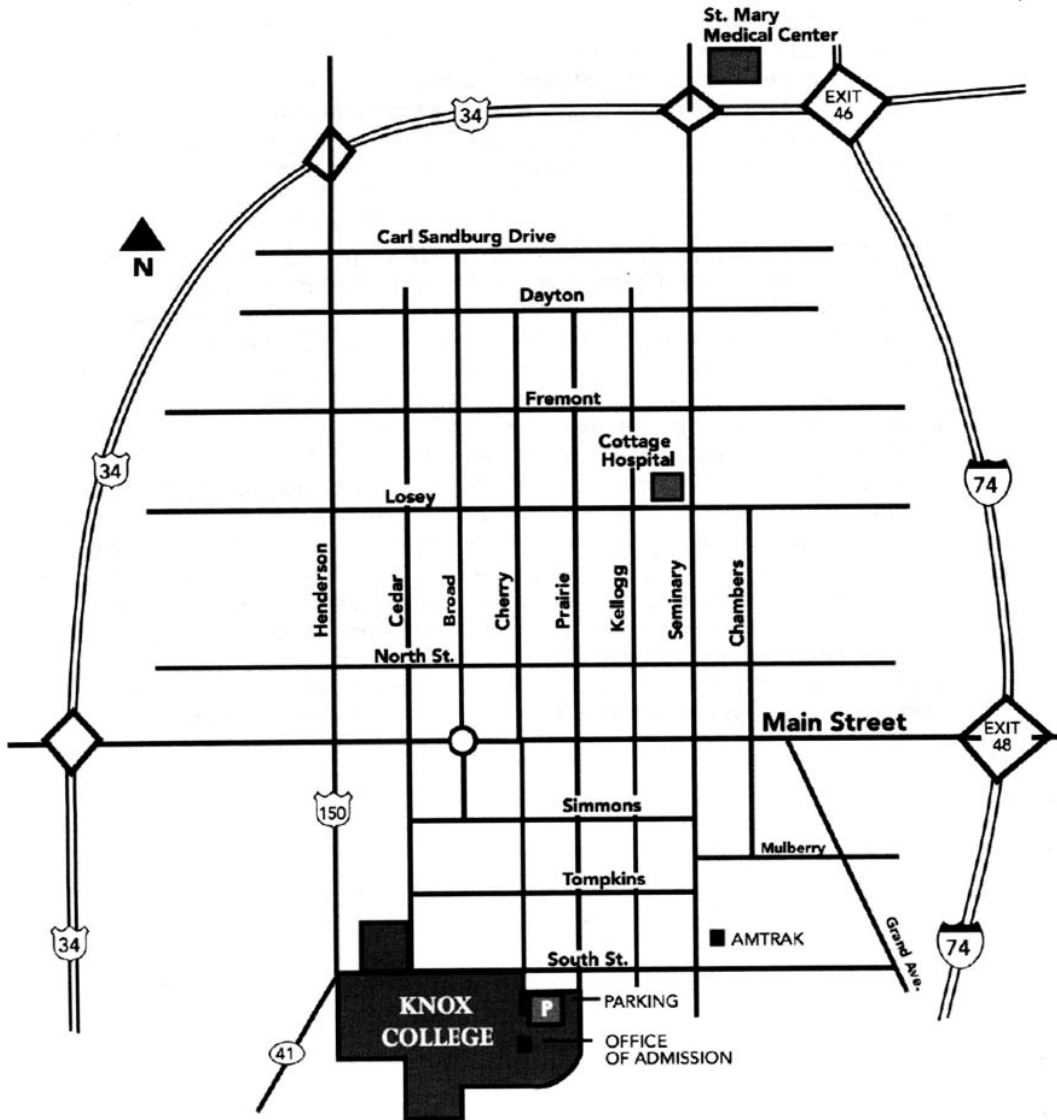
Parking is free on the west side of campus on the streets and adjacent parking lots (even those marked permit only). If you receive a campus parking ticket, please see Linda Dybas.





# GALESBURG MAP

There are a number of local restaurants within walking distance of campus in the downtown area on Cherry, Main and Seminary Streets. A variety of chain restaurants can be found on Henderson Street north of Main Street.



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## FELLOWS OF THE ILLINOIS STATE ACADEMY OF SCIENCE

<b>Year</b>	<b>Fellow</b>	<b>Area</b>
1984	Richard G. Bjorklund	Zoology
1984	Donald R. Dickerson	Geology
1984	Norman R. Farnsworth	Pharmacology
1984	James E. House	Chemistry
1984	Harold M. Kaplan	Physiology
1984	Richard C. Keating	Botany
1984	James E. King	Paleobotany
1984	Willard D. Klimstra	Zoology
1984	William M. Lewis	Zoology
1984	Robert H. Mohlenbrock	Botany
1984	Lambertus H. Princen	Chemistry
1984	David G. Rands	Chemistry
1985	Robert C. Duty	Chemistry
1986	Ronald A. Browning	Physiology
1986	Richard L. Leary	Geology
1986	David S. Seigler	Botany
1988	Roger C. Anderson	Botany
1988	John E. Ebinger	Botany
1990	Amrik Dhaliwal	Biology
1990	Leon Gershbein	Chemistry
1990	John W. Reeves	Biology
1991	Geoffrey A. Cordell	Chemistry
1991	George H. Fraunfelter	Geology
1992	Joseph E. Lambert	Chemistry
1992	R. Bruce McMillan	Anthropology
1993	Stanley A. Changnon	Geology
1995	Billy Geer	Biology
1995	Lawrence C. Matten	Botany
1996	Herbert L. Monoson	Botany
1996	Paul P. Sipiera	Geology
1996	Marian Smith	Botany
1998	Andrzej Bartke	Zoology
1999	Bonnie W. Styles	Anthropology
1999	Michael A. Goodrich	Zoology
2001	Howard E. Buhse, Jr.	Cell, Molecular, and Developmental Biology
2001	Ralph Troll	Biology
2002	Walter J. Sundberg	Botany
2003	Laurence E. Crofutt	Bacteriology
2003	Nektal M. Made Gowda	Chemistry
2004	James Rastorfer	Environmental Science
2005	William McClain	Botany
2008	Janice M. Coons	Botany
2008	Richard B. Brugam	Environmental Science
2010	Andrew S. Meethven	Botany

# In Memoriam

## Billy Wayne Geer

Clara A. Abbott Professor Emeritus of Biology, Knox College  
Fellow of the Illinois State Academy of Science, elected 1995



**July 6, 1935 - February 24, 2012**

Bill was graduated from Northwest Missouri State University in 1957 and completed a master's degree from the University of Nebraska in 1960, followed by a Ph.D. in genetics from the University of California, Davis. He joined the Knox faculty in 1963. Along with his Knox position he held a joint appointment as Professor of Pharmacology at Rush Medical College from 1979-1984. Bill successfully obtained external, peer reviewed funding, much of it from the National Science Foundation and National Institutes of Health, continuously from 1967-1998, when he retired. The funding allowed him to equip and maintain a first class research laboratory. In all, he produced over 100 refereed publications including a number co-authored with Knox students and colleagues. His early work on the genetics of reproduction of *Drosophila melanogaster* is considered a classic. His research on the dietary and genetic control of alcohol metabolism in fruit flies received research grants from the National Institute on Alcohol Abuse and Alcoholism. Geer emphasized the importance of research in the liberal arts science curriculum -- half of the students who worked in his lab as Knox undergraduates went on to medical school, and another one-third completed graduate or professional degrees. Without a doubt, Bill's greatest impact on the scholarly activities of Knox College is the inspirational example he set for the synergy of research and teaching.

Among Geer's many honors were an honorary doctorate from Knox College in 2009, a 1995 Shannon Award from the National Institutes of Health, **1995 election as a Fellow of the Illinois State Academy of Science**, 1991 Alumni Citation for Excellence from the University of California at Davis, 1990 Illinois Professor of the Year Award from the Council for Advancement and Support of Education, 1986 Burlington Northern Foundation Faculty Achievement Award, and a 1985 Fulbright Senior Research Fellowship for study at Monash University in Australia. In addition, Geer held visiting appointments at Cold Spring Harbor Laboratory, Oregon State University, Utah State University, University of Calgary in Canada, and Monash University in Australia.

## ACKNOWLEDGMENTS

Planning for the Annual Meeting of the Illinois State Academy of Science requires the assistance of a very large number of individuals who spend countless hours preparing for what we hope will be a successful event. The 104th Annual Meeting at Knox College was no exception, and we would like to thank everyone for their assistance. We would especially like to thank the President of the ISAS, Paul Brunkow, and the Executive Secretary, Robyn Myers, and Roger Anderson for their assistance in the various phases of planning the meeting. We would also like to thank the ISAS Division Chairs for their efforts in putting together the scientific program and for judging the poster and oral presentations given by a very talented group of students. The staff at Knox College: Facilities Services, Dining Services, Audio Visual Services, faculty who have relocated to accommodate our meeting and the administration who enthusiastically invited us to Knox College – we can't thank you enough. We thank the Galesburg Convention and Visitors Bureau for their donation of conference welcome packets. Finally, and most importantly, we thank the attendees, presenters, and our panel and keynote speakers

Sincerely,  
Linda Dybas and Mary Jane Shoyer  
Co-Vice Presidents, 2012 Annual Meeting



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