TRANSACTIONS OF THE ILLINOIS STATE ACADEMY OF SCIENCE

Supplement to Volume 103

102nd Annual Meeting
April 9-10, 2010

Millikin University
Decatur, Illinois

Illinois State Academy of Science
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SCHEDULE OF EVENTS

Friday, April 9

11:00 – 5:30	**Registration** – East Lobby of Leighty-Tabor Science Center
11:00 – 1:00	**ISAS Council Meeting (includes lunch)** – Lindsay Schaub room in Richards Treat University Center
11:00 – 3:00	**Poster Set-up** – Kirkland Fine Arts Center
12:00	**Lunch (on your own)**
1:00 – 3:00	**Graduate School/Career Fair** – Lower Level of Richards Treat University Center
3:00 – 3:15	**Break**
3:15 – 5:15	**Poster Session** – Kirkland Fine Arts Center
5:15 – 5:30	**Break**
5:30 – 7:30	**Banquet/Keynote Address: Mark Matlock** – Lower Level of Richards Treat University Center
7:30 – 7:45	**Break**
7:45 – 9:15	**Star Gazing** – Requarth Observatory in Leighty-Tabor Science Center
Overnight	Decatur Conference Center, Millikin University, or other arrangements

Saturday, April 10

7:00 – 8:00	**Breakfast** – Lower Level of Richards Treat University Center
7:30 – 12:00	**Registration** – East Lobby of Leighty-Tabor Science Center
8:00 – 9:00	**Oral Presentations** – Leighty-Tabor Science Center, Pilling Chapel, Shilling Hall
9:00 – 9:15	**Break**
9:15 – 10:30	**Oral Presentations** – Leighty-Tabor Science Center, Pilling Chapel, Shilling Hall
10:30 – 10:45	**Break**
10:45 – 12:00	**Oral Presentations** – Leighty-Tabor Science Center, Pilling Chapel, Shilling Hall
12:00	**Division Meetings** – Leighty-Tabor Science Center, Pilling Chapel, Shilling Hall
12:30 – 2:00	**Lunch/ISAS Business Meeting/Keynote Address: Robert Finley** – Lower Level of Richards Treat University Center
2:00 – 2:15	**Award Announcements** – Lower Level of Richards Treat University Center
2:15	**102nd Annual ISAS Meeting Adjourned**

KEYNOTE ADDRESSES

Mark Matlock

Providing Renewable Resources via Agriculture

Mark Matlock is senior vice president for the ADM Research Division where he directs food ingredient research. Mark joined ADM in 1980 as an analytical chemist and has held positions as manager of process development; laboratory manager of ADM BioProducts; and director of food applications. Mark received a Bachelor of Science degree in chemistry from Millikin University in 1976 and a Master of Science degree in polymer chemistry from the University of Akron in 1987. Mark is author or co-author of seven U.S. patents, two of which relate to an analytical instrument (OSI) that measures the oxidative stability of vegetable oils. He has conducted research that has led to new soy protein isolates for ADM. He has managed research efforts that led to the introduction of trans free fats for margarines and shortenings via a novel enzymatic rearrangement technology. Also, he was elected president of the American Oil Chemists' Society for 2003-2004 and in May 2007, he was awarded AOCS Fellow status by their governing board.

Summary of Keynote Address: Agriculture is capable of providing renewable resources that can be transformed into a wide range of products for food, feed, fuel and industrial chemicals. Growing food and feed requirements have consistently been supplied by agriculture through steadily improving yields from the same unit of land. The same agricultural processing operations used to produce hundreds of ingredients for food and animal feed also provide us the ability and scale to efficiently produce clean, renewable fuels. In addition, new bio-based industrial chemicals can have advantages over petrochemicals such as lower toxicity, biodegradability, and new functionality. As our petroleum based resources become more challenged, opportunity is created for renewable bio-based resources to help fill the gap.

Robert Finley

The Illinois Basin-Decatur Sequestration Test Site: A Leading-Edge Test of Geological Carbon Sequestration in the U.S.

Robert J. Finley is the Director of the Advanced Energy Technology Initiative at the Illinois State Geological Survey, Institute of Natural Resource Sustainability, at the University of Illinois, Champaign, Illinois. He joined the Illinois Survey in February 2000 after serving as Associate Director at the Bureau of Economic Geology, The University of Texas at Austin. Rob's area of specialization is fossil energy resources and carbon sequestration. His work has ranged from large-scale resource assessment, addressing hydrocarbon resources at national and state scales, to evaluation of specific fields and reservoirs for coal, oil, and natural gas. He is currently heading a major project on carbon sequestration in the Illinois Basin, the Midwest Geological Sequestration Consortium, aimed at researching carbon sequestration as a potential response to global climate change. Rob has served on committees of the National Petroleum Council, the American Association of Petroleum Geologists, the National Research Council, the Stanford Energy Modeling Forum, and the U.S. Potential Gas Committee. Rob holds a Ph.D. in geology from the University of South Carolina; he is currently also an Adjunct Professor in the Department of Geology, University of Illinois at Urbana-Champaign.

Summary of Keynote Address: After assessments of the geological carbon sequestration capacity of the Illinois Basin that began in 2003, the Midwest Geological Sequestration Consortium (MGSC) selected a test site for geological sequestration at Decatur, Illinois in 2007. In 2009, an injection well was drilled to a depth of 7,230 ft at the Archer Daniels Midland (ADM) agricultural products processing facility in Decatur, and ADM will begin supplying 1,000 tonnes per day of carbon dioxide for injection beginning in early 2011. Before injection, a 3D seismic survey will be acquired, processed, and interpreted (winter-spring 2010), and a second 7,000 ft well will be drilled (summer-fall 2010) for pressure and fluid sampling before and during injection. Injection is expected to take up to three years with 1 million tonnes total volume to be injected. The well is the first Class I Nonhazardous injection well permitted in the U.S. for testing geological sequestration at the deployment scale.

Carbon dioxide in a supercritical state will be injected into the Cambrian-age Mount Simon Sandstone, the lowermost sedimentary unit in the Illinois Basin. The Mount Simon is about 1,650 ft thick at the site and is overlain by 300 ft of shale, siltstone and tight limestone of the Eau Claire Formation which forms the reservoir seal. Favorable porosity and permeability were found in the Mount Simon, and initial injection will take place into 55 ft of perforations opened at the base of the formation. The Mount Simon was probably deposited as a bed-load (braided) fluvial system and is therefore sand-rich, but internal reservoir quality variations do exist and will serve as baffles to the buoyant movement of the carbon dioxide, based on initial reservoir modeling. An extensive environmental monitoring program is currently in place around the site to gather baseline data. Monitoring will continue during injection and for at least two years beyond injection.

POSTER PRESENTATION SESSIONS

Poster presentations are Friday, April 9 in Kirkland Fine Arts Center from 3:15 – 5:15 PM. Presenters can hang their posters up any time between 11:00 AM – 3:00 PM. Those students who are competing for awards should be at their posters from 3:15 – 5:15 PM to answer judges' questions. An asterisk (*) indicates the presenters eligible for a Student Presentation Award.

Division: Agriculture

1. Varietal Information Program for Soybeans—Disease and pest evaluations
Slaminko, Tara L.[1], Bowen, C. Roger[2] and Hartman, Glen L.[1,2] [1]University of Illinois at Urbana-Champaign, Urbana, IL. [2]USDA Agricultural Research Service, Urbana, IL.

*** 2. Detection of mRNA by reverse transcription-PCR as an indicator of specificity and viability in *Phakopsora pachyrhizi***
Vittal, Ramya[1], Haudenshield, James S.[2] and Hartman, Glen L.[1,2] [1]University of Illinois at Urbana-Champaign, Urbana, IL. [2]USDA Agricultural Research Service, Urbana, IL.

*** 3. Effect of male accessory gland extract on female copulation characteristics, *Anastrepha suspensa* (Diptera: Tephritidae)**
Lewis, Wesley R., Seelhoeffer, Lara B., Dust, Holly J. and Fritz, Ann H. Eastern Illinois University, Charleston, IL.

*** 4. Phytotoxic evaluation of nootkatone formulations and components**
Wetterauer, Alyssa M.[1] and Behle, Robert W.[2] [1]Eureka College, Washington, IL. [2]USDA-ARS-NCAUR, Peoria, IL.

*** 5. Public beliefs and attitudes concerning wind farms in Central Illinois**
Theron, Sophie, Winter, Randy J., Spaulding, Aslihan D. and Loomis, David G. Illinois State University, Normal, IL.

Division: Anthropology & Archaeology

*** 1. Investigation of Dietary Texture During the Archaic-Woodland Transition at the Carrier Mills Archaeological District (Saline County, Illinois)**
Forsythe, Lauren A.[1], Forsythe, Elliott C.[1], Gamza, Tammy R.[1], and Prowse, Tracy L.[2] [1]Southern Illinois University Carbondale, Carbondale, IL. [2]McMaster University, Hamilton, Ontario, Canada.

Division: Botany

1. Biomass production during two years of succession in an old field in Rock Island County, Illinois
Liva, Robert and Dziadyk, Bohdan. Department of Biology, Augustana College, Rock Island, IL.

*** 2. Examination of hybridization relationships between *Schoenoplectus hallii* and *S. saximontanus* (Cyperaceae) using ISSR markers**
Stapay, Tara[1], Smith, Marian[1], McKenzie, Paul[2] and Esselman, Elizabeth[1]. [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]U.S. Fish and Wildlife Service, Columbus, MO.

*** 3. The floristic quality index (FQI) as a tool to examine the regenerative capabilities of a previously disturbed field in Illinois**
Spagnolo, Sara, Bryant, Carol and Esselman, Elizabeth. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 4. Burning system to collect water soluble compounds from the smoke of plant materials**
Finn, Daniel J., Prosser, Stephanie D., Coons, Janice M., Coutant, Nancy E. and Lawrence, Barbara A. Eastern Illinois University, Charleston, IL.

*** 5. Influence of smoke solutions on the germination of twenty prairie plant species**
Ervin, Stefanie L., Daugherty, Bradley M., Coutant, Nancy E. and Coons, Janice M. Eastern Illinois University, Charleston, IL.

*** 6. Efficacy of glyphosate injection to eradicate *Ailanthus altissima* (Simaroubaceae)**
Wright, Jessica, Harroun, David, Schulz, Kurt, Reese, Nathan, Dugan, Erin, Tripp, Tim, McDonald, Erica and Hall, Melissa. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 7. A cautionary tale: ineffective stump treatments increase *Ailanthus* (Simaroubaceae) density six-fold**
Reese, Nathan, Wright, Jessica and Schulz, Kurt. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 8. Natural canopy gap formation facilitates Asiatic honeysuckle invasion of an old growth forest**
Wright, Jessica and Schulz, Kurt. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 9. Comparing edge and interior population contributions to the seed rain of invasive bush honeysuckle (*Lonicera maackii*, Caprifoliaceae)**
Hall, Melissa and Schulz, Kurt. Southern Illinois University Edwardsville, Edwardsville, IL.

10. Predictors of the diversity of the spring ephemeral community in a fragmented landscape
Laquet, Jennifer and Minchin, Peter R. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 11. A quantitative assessment of the effectiveness of buffer zones in conserving the core forest habitat in oak-hickory forest fragments**
Fritzgerald, Adam and Minchin, Peter R. Southern Illinois University Edwardsville, Edwardsville, IL.

12. Invasion potential of golden rain tree in bluff forests of the Mississippi River
Browning, Roberta, Minchin, Peter R. and Retzlaff, William A. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 13. Comparison of control of two spotted spider mites, *Tetranychus urticae* Koch (Arachnida: Acari: Tetranychidae), in greenhouse grown *Glycine max* (soybeans) using neem oil and predatory mites, *Phytoseiulus persimilis***
Pantoja, Gerald A. and Parrish, Judy Damery. Millikin University, Decatur, IL.

*** 14. Ethylene stimulates the *in vitro* germination of *Schoenoplectus hallii*, a native wetland sedge**
Miller, Brandon and Barry, Kelly J. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 15. *In vitro* propagation of *Desmantus illinoensis*, a native perennial of agricultural interest**
Mulherin, Craig and Barry, Kelly J. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 16. PCR amplification of endomycorrhizal fungal DNA from *Trillium recurvatum* roots**
Nichols, Bethanne, Peddicord, Layton, Fowler, Thomas and Barry, Kelly J. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 17. ISSR marker diversity in *S. hallii* (Cyperaceae) populations of Illinois**
Archdale, Emmaline L., Stapay, Tara, Esselman, Elizabeth, Mckenzie, P. and Smith, Marian. Southern Illinois University Edwardsville, Edwardsville, IL.

Division: Cell, Molecular & Developmental Biology

*** 1. Three amino acid positions cooperatively determine *Schizophyllum commune* (Aphyllophorales) pheromones' specificity for Bα receptors**
Springer, Kate M. and Fowler, Thomas J. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 2. 5-Hydroxytryptamine's effect on each region of *Lumbricus terrestris'* (Lumbricidae) digestive tract**
Neal, Michael W. and Krajniak, Kevin G. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 3. Effect of temperature and caspase inhibitors on UVB irradiation induction of apoptosis in human leukemia cells, HL60**
Gniadek, Jamie, Brenegan, Teryn V., Ahmadian, Fatemeh, Chambers, Andre S. and Wanda, Paul E. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 4. Atg1 positively regulates synapse formation**
Beatty, Derek, McKeown, Cassandra and Liebl, Faith L. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 5. Mutations in *Drosophila* (Drosophilidae) postsynaptic density homologs affect glutamate receptors at the neuromuscular junction**
Ferguson, Matt, Davis, Dustin and Liebl, Faith L. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 6. Kismet affects transcription of glutamate receptor subunits**
Spencer, Lauren and Liebl, Faith L. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 7. Analysis of gene silencing in mammalian cell hybrids**
Dust, Audra J. Eastern Illinois University, Charleston, IL.

*** 8. Where's Ypt11p? Expression and purification studies**
Westemeyer, B. Augustana College, Rock Island, IL.

*** 9. Role of liver-specific transcription factor-binding on gene expression**
Allen, Kerstin K. and Bulla, Gary A. Eastern Illinois University, Charleston, IL.

*** 10. Analysis of phosphorylation levels in wild type and Pez-overexpressing *Drosophila melanogaster* (Diptera Drosophilidae)**
Spelde, Audrey E. Millikin University, Decatur, IL.

*** 11. Taurine supplemented diet confers life span extension in adult *Drosophila melanogaster* (Drosophilidae) and arrests development in eggs**
Habib, Ishtiaq, Talon, Brian, Shirkey, Stephanie, Milne, Alexander and Smith, Lee Ann. Benedictine University, Lisle, IL.

*** 12. *In silico* inquiry into the structure-function relationship of MDM20 protein in *Saccharomyces cerevisiae* (Saccharomycetaceae), baker's yeast**
Liva, Robert B., Crawford, Patrick and Singer, Jason. Augustana College, Rock Island, IL.

*** 13. Physiological effects of Met-enkephalin on the gizzard of the earthworm, *Lumbricus terrestris* (Haplotaxida/Lumbricidae)**
Rapp, John D. and Krajniak, Kevin G. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 14. Analysis of protein expression differences in MCF-7 breast cancer and U-2 OS osteocarcinoma cells due to exposure with varied concentrations of acetochlor and chlorpyrifos**
Rich, Jessica D. and Schultz-Norton, Jennifer R. Millikin University, Decatur, IL.

*** 15. FMRRamide receptors in the intestine of the Earthworm *Lumbricus Terrestris***
Miller, Tyler and Krajniak, Kevin. Southern Illinois University Edwardsville, Edwardsville, IL.

Division: Chemistry

*** 1. Impact of fermentation on the total phenolic and antioxidant activity of cocoa bean polyphenols**
Nottoli, Katheryn and Kouassi, Gilles K. Western Illinois University, Macomb, IL.

*** 2. New cathepsin B inhibitors**
Inapudi, Kalyani, Kadasala, Naveen Reddy, Jin, Jin, Zhang, Shaozhang and McConnell, Rose. Western Illinois University, Macomb, IL.

*** 3. New cathepsin D inhibitors with hydroxyethyl amine isosteres**
Kadasala, Naveen Reddy, Ambati, Rama Krishna, Koneru, Lunita Nagini, Zhang, Shaozhong, Jin, Jin and McConnell, Rose. Western Illinois University, Macomb, IL.

*** 4. Synthesis of potential new cathepsin K inhibitor**
Yarlagadda, Karthika, Saichek, Nicholas, Ambati, Rama Krishna, Vinod, Thottumkara K., Jin, Jin and McConnell, Rose. Western Illinois University, Macomb, IL.

*** 5. Rapid assembly of multi-functionalized alkanes by co-halogenation of alkene precursors**
Kistammagiri Nalla, Madhumitha R., Saraf, Swetha V. and Vinod, Thottumkara K. Western Illinois University, Macomb, IL.

*** 6. Demonstration of solvent dependant oxidation behavior of water-soluble *o*-iodoxybenzoic acid (IBX) derivatives**
Raya, Balaram, Jajam, Savithri and Vinod, Thottumkara K. Western Illinois University, Macomb, IL.

*** 7. Ruthenium(III) catalyzed kinetics and mechanism of indigo carmine oxidation by manganese(III) in sulfuric acid medium**
Cholkar, Kishore, Poloju, Sridhar, Akita, Vikram and Made Gowda, Netkal. Western Illinois University, Macomb, IL.

*** 8. Synthesis and antioxidant activities of some transition metal complexes of pyridoxine**
Puram, Swetha[1], Kaur, Devinder[1], Chaitanya, Lakshmi G.[2], Ananda, S.[2] and Made Gowda, Netkal M.[1] [1]Western Illinois University, Macomb, IL. [2] University of Mysore, Mysore 570 006, India.

*** 9. Investigation of the retention behavior and separation of explosives on reversed phase liquid chromatography using 1-octyl-3-methylaimmadazolium salt (OMIM) as mobile phase additive**
Sharp, Stephanie and Heagy, Ashlie. Western Illinois University, Macomb, IL.

*** 10. The quantitative determination of capsaicin in hot sauce and the development of a case study for an analytical chemistry lab**
Bruno, Carrie. Millikin University, Decatur, IL.

*** 11. Do water treatment processes remove pharmaceuticals from the water?**
Holthaus, Zach. Millikin University, Decatur, IL.

*** 12. Monofunctionalization of diols for the synthesis of new cylindrical supramolecular hosts**
Makineni, Anupama. Eastern Illinois University, Charleston, IL.

*** 13. Characterizing sodium chloride crystallized in the presence of sodium ferrocyanide with powder x-ray diffraction and scanning electron microscopy**
Elkins, Sarah C. and Wiediger, Susan D. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 14. Replacing cadmium carbonate as the primary compound in analytical lab**
Wolfe, Eric B. Millikin University, Decatur, IL.

*** 15. Conformational states and kinetics of the calcium binding domain of NADPH oxidase 5**
Levek, Kelli, Boyle, Tiffany Rose, Wetherell, Kristen, Motl, Nicole and Wei, Chin-Chuan. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 16. Synthesis of cinnamaldehyde semicarbazones to explore their photochromicity**
Fortin, Stacy M., Murray, Kenzi M., Wysocki, Thomas J. and Treadwell, Edward M. Eastern Illinois University, Charleston, IL.

*** 17. Domain-domain and protein-protein interactions in NADPH oxidase 5**
Reynolds, Nicole R., Wetherell, Kristen, Motl, Nicole, Dixon, Robert and Wei, Chin-Chuan. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 18. Study of the retention behavior and separation of explosives on reversed phase liquid chromatography using 1 butyl 3-methylaimmadazolium salt (BMIM) as mobile phase additives**
Heagy, Ashlie and Sharp, Stephanie. Western Illinois University, Macomb, IL.

*** 19. Development of a Disposable Pipette Extraction (DPX) Method for the Trace Analysis of Common Propellant Powder Stabilizers in Gunshot Residue**
Lamb, Seth, Daughenbaugh, Timothy and Guan, Hongxia. Western Illinois University, Macomb, IL.

*** 20. Effect of catechin on stability of nanoencapsulated vitamin K**
Teriveedhi, Vinod K. and Kouassi, Gilles K. Western Illinois University, Macomb, IL.

Division: Environmental Science

*** 1. Degradation of Metolachlor in Drummer soil under different environmental conditions**
Kanissery, Ramdas G.[1] and Sims, Gerald K.[2] [1]Department of Natural Resources and Environmental Sciences, University of Illinois at Urbana-Champaign, Urbana, IL. [2]USDA-Agricultural Research Service, Urbana, IL.

*** 2. Active and reserve soil acidity as influenced by N-fertilization and irrigation**
Pedigo, Trent M., McConnell, J. Scott, Altfillisch, Chad J., Nicioli, Stephanie M., Ribory, Karen E. and Sheppard, Donald R. Western Illinois University, Macomb, IL.

*** 3. Dynamics of soil nitrate-nitrogen distribution as influenced by long-term nitrogen fertilization and irrigation**
Altfillisch, Chad J., McConnell, J. Scott, Nicioli, Stephanie M., Pedigo, Trent M., Ribory, Karen E. and Sheppard, Donald R. Western Illinois University, Macomb, IL.

*** 4. Comparisons of organic carbon content of native prairies and conventionally tilled soils in Illinois**
Ribory, Karen E., McConnell, J. Scott, Altfillisch, Chad J., Nicioli, Stephanie M., Pedigo, Trent M. and Sheppard, Donald R. Western Illinois University, Macomb, IL.

*** 5. Phytoplankton assessment of the Calumet and Little Calumet Rivers with an emphasis on seasonal changes and nutrient relationships**
Bertucci, Angela M., Potluri, Devi Prasad V., Bell, Timothy J. and Richter, Robert C. Chicago State University, Chicago, IL.

*** 6. Stable Isotopes of Nitrogen and Carbon in Collagen from Modern and Archeological Animal Bone from the Illinois River Valley**
Little, Kayla, Brugam, Richard B., Holt, Julie Z., Kohn, Luci and Vogel, Gregory. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 7. Evaluating Storm Water Runoff of Green Roofs with Varying Growth Medium and Species Composition**
Hilligoss-Volkmann, E.[1], Jost, V.[2], Luckett, K.[3], Morgan, S.[1], Celik, S.[1] and Retzlaff, W.[1] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]Jost Greenhouses. [3]Green Roof Blocks.

*** 8. The effect of duckweed removal on the biogeochemistry of an urban riparian marsh**
Craig, Matthew E. and Lepore, Jessie A. Augustana College, Rock Island, IL.

*** 9. Evaluating the environmental benefits of green wall systems**
Ostendorf, M.[1], Thompson, K.[1], Woolbright, M.[2], Morgan, S.[1], Celik, S.[1] and Retzlaff, W.[1] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]Green Wall Ventures, LLC.

*** 10. Evaluating the thermal performance of residential green roof systems**
Murphy, D.[1], Ferando, B.[1], Luckett, K.[2], Morgan, S.[1], Celik, S.[1] and Retzlaff, W.[1] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]Green Roof Blocks.

*** 11. Invasive Weed Species on a Midwestern Green Roof**
Greeling, B.[1], Krutsinger, R.[1], Jost, V.[2], Luckett, K.[3], Morgan, S.[1] and Retzlaff, W.[1] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]Jost Greenhouses. [3]Green Roof Blocks.

*** 12. Evaluation of Aboveground Weed Biomass on a Midwestern Green Roof**
Krutsinger, R.[1], Greeling, B.[1], Jost, V.[2], Luckett, K.[3], Morgan, S.[1] and Retzlaff, W.[1] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]Jost Greenhouses. [3]Green Roof Blocks.

*** 13. Storm Water Retention of Green Roof Models Planted with Mixed Sedum Plugs**
Kelleher, J.[1], Jost, V.[2], Luckett, K.[3], Morgan, S.[1], Celik, S.[1] and Retzlaff, W.[1] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]Jost Greenhouses. [3]Green Roof Blocks.

*** 14. Evaluation of Inquiries about the UIS Environmental Studies Online Master's Degree Program**
Killam, Lenore, Wei, Hung-Lung and Ruez, Jr., Dennis R. University of Illinois at Springfield, Springfield, IL.

Division: Health Sciences

*** 1. Respiratory effects of 8-cyclopentyl-1.3-dipropylxanthine in newborn rats**
Marcelin, Alain C. and McGilliard, Kip L. Eastern Illinois University, Charleston, IL.

*** 2. Small molecule analogues of schizozygane indoline alkaloid as potential antimicrobial agents**
Schwarm, Sam, Nieto, Marcelo, Mercado, Reesa and McCracken, Vance J. Southern Illinois University Edwardsville, Edwardsville, IL.

Division: Microbiology

*** 1. Utilization of bioelements and carbohydrates in an acidophilic consortium comprising of suspected nitrogen fixer**
Khan, Mohammed A. W. and Hung, Kai F. Eastern Illinois University, Charleston, IL.

*** 2. Using PCR amplification to investigate nitrogen fixation in a novel acidophilic community**
Flowers, Samantha L. and Hung, Kai F. Eastern Illinois University, Charleston, IL.

*** 3. Investigating the nitrogen fixing capacity of an acidophilic microbial community using PCR**
Janezic, Kristopher J. and Hung, Kai F. Eastern Illinois University, Charleston, IL.

*** 4. A mutant *E. coli* strain that can outcompete wildtype in a rich medium**
Barrett, Kimber and McCommas, Steven. Southern Illinois University Edwardsville, Edwardsville, Illinois.

*** 5. Colon cancer occurrence and dietary fiber: Example of a mutant strain of *E. coli***
Williams, Simone and McCommas, Steven. Southern Illinois University Edwardsville, Edwardsville, Illinois.

*** 6. *E. coli* strain MG1655 growth in complete medium compared to mutant strain KR4**
Stehlin, Courtney and McCommas, Steven. Southern Illinois University Edwardsville, Edwardsville, Illinois.

***7. Competition of wild-type *E. coli* strain, MG1655, and mutant JS15**
Wu, Precious and McCommas, Steven. Southern Illinois University Edwardsville, Edwardsville, Illinois.

*** 8. Evaluation of potential antimicrobial effects of heterocyclic compounds on microbial growth**
Mercado, Reesa D., McCracken, Vance J. and Nieto, Marcelo J. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 9. Competing *E. coli* mutant strain LB9 and wild type strain MG1655**
Garcia, Maria and McCommas, Steven. Southern Illinois University Edwardsville, Edwardsville, Illinois.

*** 10. Supplementation of high-fat diet with hyperimmunized egg decreases inflammation in diet-induced obese mice**
Castre, Erin M. and McCracken, Vance J. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 11. Effects of hyperimmunized egg on intestinal microbial populations in diet-induced obese mice**
Ansteatt, Kristin A. and McCracken, Vance J. Southern Illinois University Edwardsville, Edwardsville, IL.

12. The *Meiothermus ruber* (Thermales, Thermaceae) Genome Analysis Project – an authentic research experience for undergraduates in microbial genome analysis
Scott, Lori R.[1], Ghrist, Angela C. [2], Westemeyer, Blaine[1], Petersen, Max[1], Edison, Kristina[1], Sieg, Alex[1], Allibone, Kevin[1], Baumgartner, Angela[1], Curtis, Troy[1], Geison, Elizabeth[1], Lehpamer, Nicole[1], Sollenberger, Ryan[1], and Oldfather, Nicole[2]. [1]Augustana College, Rock Island, IL. [2]Scott Community College EICCD, Bettendorf, IA.

*** 13. Competition between wildtype *E. coli* (MG1655) and a mutant strain (WRL2) derived from it**
Weekley, Heather and McCommas, Steven. Southern Illinois University Edwardsville, Edwardsville, Illinois.

*** 14. Determining the nutritional requirements of the bile acid-metabolizing gut bacteria *Clostridium hylemonae* and *Clostridium hiranonis***
Huckaba, J'nai K. and Daniel, Steven L. Eastern Illinois University, Charleston, IL.

*** 15. Common herbs and household items tested for antimicrobial properties**
Ohrlund, Joel V. Millikin University, Decatur, IL

Division: Physics, Mathematics & Astronomy

1. Detailed Computer Modeling of the Gas Law of Real Gases by Molecular Dynamics Simulation
Zou, Jie and Chastain, Michael. Eastern Illinois University, Charleston, IL.

Division: Zoology

*** 1. Avian community succession in bottomland forest restoration sites in the Upper Mississippi Alluvial Valley**
Harster, L., Minchin, P. R. and Essner, R. L. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 2. Effects of Flooding on a Contact Zone Between Two Closely Related Killifish Species**
Gafford, A., Schoeneck, B. and Duvernell, D. D. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 3. Genetic study of hybridization and introgression between two topminnow species in an artificial stream system**
Anciulis, N.[1], Schaefer, J. F.[2] and Duvernell, D. D.[1] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]University of Southern Mississippi, Hattiesburg, MS.

*** 4. Marine vertebrates from the Upper Cretaceous in southeastern Colorado**
Nagrodski, M.[1], Shimada, K.[1] and Schumacher, B.[2] [1]DePaul University, Chicago, IL. [2]USDA Forest Service, La Junta, CO.

5. Fossils of Illinois' Meekest: Ice age Rodents and Rabbits
Ruez, Jr., D. R. University of Illinois at Springfield, Springfield, IL.

*** 6. Morphometric Analysis of Mandible Form in Family Mustelidae**
Jones, M. and Kohn, L. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 7. Physics versus phylogeny in the North American sunfishes**
Miller, K., Hubbs, M. and Brunkow, P. Southern Illinois University Edwardsville, Edwardsville, IL.

*** 8. Using insects to explore diversity and ecological connections: an assessment of student learning and interest**
Malone, K. B. and Fritz, A. H. Eastern Illinois University, Charleston, IL.

*** 9. Test of the monophyly of the subfamilies Perlinae and Acroneuriinae (Plecoptera: Perlidae Latreille 1802)**
Pessino, M.[1], Giordano, R.[2], Cameron, S. A.[1], and DeWalt, R. E.[2] [1]University of Illinois, Urbana, IL. [2]Illinois Natural History Survey, Champaign, IL.

10. Revision of the aquatic true bugs (Insect: Heteroptera) of the Crato Formation, northeastern Brazil
Tinerella, P. P. and Heads, S. W. Illinois Natural History Survey, Champaign, IL.

*** 11. The effects of weather conditions on avian mortality at three television towers in central Illinois**
Lundstrom, L. A., Huschen, M. S., Gibson, J. A. and Horn, D. J. Millikin University, Decatur, IL.

*** 12. Japanese Beetle (Coleoptera) Distributions in Soybean Fields**
Sara, S. A., Boersma, E. and Switzer, P. V. Eastern Illinois University, Charleston, IL.

13. The biology and phenology of an outbreak of Pine False Webworm (PFW), *Acantholyda erythrocephala* (L) (Hymenoptera: Pamphiliidae), in Central Illinois
Staples, J. K.[1] and Whitman, D. W.[2] [1]University of Southern Maine, Gorham, ME. [2]Illinois State University, Normal, IL.

*** 14. Population trends of southern sea otters (*Enhydra lutris*) along a four mile stretch of coast in Big Sur, California**
Crane, N. L.[1], Mahoney, T. R.[2] and Dybas, L. K.[2] [1]Wildlands Studies Program, Santa Cruz, CA. [2]Knox College, Galesburg, IL.

*** 15. The effects of circadian rhythm on the olfactory learning and recall ability of the common house cricket, *Acheta domesticus* (Insecta: Orthoptera)**
McDaniel, C. L., Robertson, M. and Watson, C. Millikin University, Decatur, IL.

16. Freezing at a mild subzero temperature enhances survival of the gall fly, *Eurosta solidaginis*, to subsequent low temperature exposures
Haskell, S., Roberts, V., and Williams, J. Southern Illinois University Edwardsville, Edwardsville, IL.

17. Divergent embryological development in two closely related lubber grasshopper species (Family Romaleidae)
Stauffer, T. W. and Whitman, D. W. Illinois State University, Normal, IL.

*** 18. Effects of shell orientation on drag experienced by *Elimia pototsiensis***
Miller, S. and Brunkow, P. Southern Illinois University Edwardsville, Edwardsville, IL.

19. Phenotypic plasticity in reproduction in the Eastern Lubber Grasshopper
Luong, M. H. and Whitman, D. Illinois State University, Normal, IL.

*** 20. Evaluating operant conditioning using positive reinforcement in the millipede *Orthoporus texicolens* (Diplopoda: Spirostreptida)**
Rigdon, B., Robertson, M. and Watson, C. Millikin University, Decatur, IL.

*** 21. Even a bad dog has its day. Domestic dog (*Canis familiaris*) behavior and its effect on human attachment**
Stoune, J. A. and Thorn, J. M. Knox College, Galesburg, IL.

22. High temperature eliminates microsporidia pathogens from an insect host
Johny, S., Omer, A., Newgent, W., Elmer, K., Stoerger, R. and Whitman, D. Illinois State University, Normal, IL.

*** 23. The Ticks of Illinois (Arachnida: Acari: Ixodida): A WWW Online Resource for Identification, Distribution, Biology, and Epidemiological Associations**
Jana, R. L., Tinerella, P. P., and Mateus-Pinilla, N. Illinois Natural History Survey, Champaign, IL.

*** 24. Using Negative Reinforcement to Test Spatial Learning and Memory in the Orange Baboon Tarantula, *Pterinochilus murinus* (Araneae: Theraphosidae)**
Jesek, S. M., Robertson, M. W. and Watson, C. R. Millikin University, Decatur, IL.

ORAL PRESENTATION SESSIONS AT A GLANCE

	LTSC 001	LTSC 115	LTSC 208	Shilling 317	Pilling Chapel
8:00 AM	Botany				Zoology
8:15 AM	Botany	Chemistry			Zoology
8:30 AM	Botany	Chemistry		Health	Zoology
8:45 AM	Botany	Chemistry		Health	Zoology
9:00 AM	**Break**	**Break**	**Break**	**Break**	**Break**
9:15 AM	Botany	Chemistry		Microbiology	Zoology
9:30 AM	Botany	Chemistry	Cell Biology	Microbiology	Zoology
9:45 AM	Botany	Chemistry	Cell Biology	Microbiology	Zoology
10:00 AM	Botany	Chemistry	Cell Biology	Microbiology	Zoology
10:15 AM	Botany	Chemistry	Cell Biology		Zoology
10:30 AM	**Break**	**Break**	**Break**	**Break**	**Break**
10:45 AM	Botany	Engineering	Cell Biology	Environmental	Zoology
11:00 AM	Botany	Engineering	Cell Biology	Environmental	Zoology
11:15 AM	Botany	Physics	Cell Biology	Environmental	Zoology
11:30 AM	Botany	Physics	Cell Biology	Environmental	Zoology
11:45 AM	Botany	Physics	Cell Biology	Environmental	Zoology
12:00 PM	**Div. Meeting**	**Div. Meeting**	**Div. Meeting**	**Div. Meeting**	**Div. Meeting**

Division Meeting Schedule

Classroom	**Division**
LTSC 213	Agriculture
LTSC 221	Anthropology & Archaeology
LTSC 001	Botany
LTSC 208	Cell, Molecular & Developmental Biology
LTSC 115	Chemistry
LTSC 209	Engineering & Technology/Physics, Mathematics, & Astronomy
Shilling Hall 317	Environmental Science
LTSC 117	Health Sciences/Microbiology
Pilling Chapel	Zoology

Room Key

LTSC – Leighty-Tabor Science Center

ORAL PRESENTATION SESSIONS

Oral presentations are Saturday, April 10 in Leighty-Tabor Science Center, Pilling Chapel, and Shilling Hall from 8:00 AM – 12:00 PM. An asterisk (*) indicates the presenters eligible for a Student Presentation Award.

Division: Botany
Leighty-Tabor Science Center – Room 001
Session Moderator – Barbara Carlsward

8:00 AM *** 1. Can seed banks assist prairie restorations?**
Zylka, Jason[1], Molano-Flores, Brenda[2] and Whelan, Christopher[2]. [1]University of Illinois at Urbana-Champaign, Urbana, IL. [2]Illinois Natural History Survey, Champaign, IL.

8:15 AM *** 2. Determining zinc nutrition and toxicity for oogenesis of the brown algae *Macrocystis integrifolia* and *Saccharina japonica***
Hunt, Hayley C. and Lewis, Raymond J. Wheaton College, Wheaton, IL.

8:30 AM *** 3. Development of scientific investigation skills among pre-service teachers**
Jacobs, K. A. and Koziarski, R. Chicago State University, Chicago, IL.

8:45 AM *** 4. Agar to seedling establishment of the federally endangered Hawaiian endemic, *Platanthera holochila* (Orchidaceae) *in vitro***
Yates, Ashley D.[1], Zettler, Lawrence W.[1], Perlman, Steve[2] and Oppenheimer, Hank.[3] [1]Illinois College, Jacksonville, IL. [2]National Tropical Botanical Garden, Kauai, HI. [3]Plant Extinction Prevention Program, University of Hawaii, HI.

9:00 AM **Break**

9:15 AM *** 5. Floral fragrance composition of the ghost orchid, *Dendrophylax lindenii* (Lindley) Bentham ex Rolfe (Orchidaceae)**
Smith, Jaclyn M.[1], Sadler, James J.[1], Zettler, Lawrence W.[1], Alborn, Hans T.[2] and Richardson, Larry W.[3] [1]Illinois College, Jacksonville, IL. [2]United States Department of Agriculture, Gainesville, FL. [3]Florida Panther National Wildlife Refuge, Naples, FL.

9:30 AM *** 6. *In vitro* seedling development of the Florida clamshell orchid, *Prosthechea cochleata* (L.) W.E. Higgins var. *triandra* (Ames) W.E. Higgins, on three different asymbiotic media**
Zimmerman, Clare C.[1], Zettler, Lawrence W.[1] and Richardson, Larry W.[2] [1]Illinois College, Jacksonville, IL. [2]Florida Panther National Wildlife Refuge, Naples, FL.

9:45 AM **7. Branch growth architecture in the hyper-shade tolerant shrub, *Dirca palustris* (Thymelaeaceae)**
Schulz, Kurt and Harroun, David. Southern Illinois University Edwardsville, Edwardsville, IL.

10:00 AM *** 8. Gender differences in the reproductive ecology of *Lobelia spicata* L. (Campanulaceae), a gynodioecious prairie species**
Ruffatto, Danielle Marie[1] and Molano-Flores, Brenda[2]. [1]University of Illinois at Champaign, Champaign, IL. [2]Illinois Natural History Survey, Champaign, IL.

10:15 AM **9. Effects of white-tailed deer on the early growth and survival of bottomland hardwood tree species in restoration sites**
McGuire, Ben and Minchin, Peter R. Southern Illinois University Edwardsville, Edwardsville, IL.

10:30 AM **Break**

10:45 AM **10. Invasive oriental bittersweet vines (*Celastrus orbiculatus*) are marketed as native American bittersweet (*C. scandens*) by Midwestern vendors**
Zaya, David N.[1], Ashley, Mary V.[1], Leicht-Young, Stacey A.[2] and Pavlovic, Noel B.[2] [1]University of Illinois at Chicago, Chicago, IL. [2]U.S. Geological Survey, Great Lakes Science Center, Porter, IN.

11:00 AM **11. Effect of removal of garlic mustard (*Alliaria petiolata*, Brassicaeae) on arbuscular mycorrhizal fungi (AMF) inoculum potential in forest soils**
Anderson, Roger C.[1], Anderson, Mary Rebecca[1], Bauer, Jonathan T.[2], Slater, Mitchell[1], Herold, Jamie[1] and Borowicz, Victoria[1]. [1]Illinois State University, Normal, IL. [2]Indiana University, Bloomington, IN.

11:15 AM **12. The effects of varying atmospheric conditions on soybean (*Glycine max*) cell biology**
Miller, Kristin L.[1], Dybas, Linda K.[1] and Ewy, Robert G.[2] [1]Knox College, Galesburg, IL. [2]State University of New York at Potsdam, Potsdam, NY.

11:30 AM **13. Diaspore morphometrics and self-burial in *Hesperostipa spartea* from different soil types**
Molano-Flores, Brenda. Illinois Natural History Survey, Champaign, IL.

11:45 AM **14. Does nonlinear rescaling of axes in detrended correspondence analysis (DCA) produce ecologically meaningful measures of beta diversity?**
Minchin, Peter R.[1] and Oksanen, Jari[2]. [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]University of Oulu, Oulu, Finland.

12:00 PM **Division Meeting**
Leighty-Tabor Science Center – Room 001

Division: Cell, Molecular & Developmental Biology
Leighty-Tabor Science Center – Room 208
Session Moderator – Tom Fowler

9:30 AM *** 1. Response to constitutive pheromone receptor activity is observable following site-directed mutagenesis in *Schizophyllum commune* (Aphyllophorales)**
Settlemoir, Emily and Fowler, Thomas J. Southern Illinois University Edwardsville, Edwardsville, IL.

9:45 AM *** 2. Isolate-specific encapsidation of soybean dwarf virus subgenomic RNAs**
Thekke Veetil, Thanuja[1] and Domier, Leslie L.[2] [1]Department of Natural Resources and Environmental Sciences. [2]USDA-ARS, University of Illinois at Urbana-Champaign, Urbana, IL.

10:00 AM *** 3. Relating Dr. Jekyll and Mr. Hyde transmogrification and intraguild predation to *Tetrahymena* (Tetrahymenidae)**
Orlando, Paul[1], Buhse, Jr., Howard E.[1], Brown, Joel S.[1], Knudtson, Tegan[1], Naim, Marriam[1], Abufarha, Najeeb[1], Orlof, Rozalia[1], and Whelan, Christopher J.[2] [1]University of Illinois at Chicago, Chicago, IL. [2]University of Illinois at Urbana-Champaign, Urbana, IL.

10:15 AM *** 4. The study of a heat shock protein, GrpE, in the scope of fluorescence spectroscopy**
Nagata, Akina. Knox College, Galesburg, IL.

10:30 AM **Break**

10:45 AM **5. Characteristics of two active transposable elements and related sequences within the *Schizophyllum commune* (Aphyllophorales) genome, strain 4-8**
Fowler, Thomas J. Southern Illinois University Edwardsville, Edwardsville, IL.

11:00 AM *** 6. Construction of a *tpsA* knockout strain of *Fusarium verticillioides* (Hypocreales)**
Boudreau, Beth A.[1], McQuade, Kristi L.[1] and Larson, Troy M.[2] [1]Bradley University, Peoria, IL. [2]USDA, Peoria, IL.

11:15 AM *** 7. Probing the stability and folding/unfolding pathway of the tetrameric protein GrpE 1-112**
Kurian, Sarah T. Knox College, Galesburg, IL.

11:30 AM *** 8. A model of the mechanism of Centrin/Spasmin-based contractility in *Vorticella convallaria* (Sessilida)**
Konior, Katarzyna, McCutcheon, Suzanne and Buhse, Howard. University of Illinois at Chicago, Chicago, IL.

11:45 AM *** 9. Consequences of sleep fragmentation induced circadian clock gene disruption in peripheral tissues of mice (Murinae)**
Jaeger, Cassie D.[1] and Tischkau, Shelly[2]. [1]Millikin University, Decatur, IL. [2]Southern Illinois University School of Medicine, Springfield, IL.

12:00 **Division Meeting**
Leighty-Tabor Science Center – Room 208

Division: Chemistry
Leighty-Tabor Science Center – Room 115
Session Moderator – Dean Campbell

8:15AM *** 1. Selective introduction of alpha-beta unsaturation in diketones**
McDonald, William and Vinod, Thottumkara K. Western Illinois University, Macomb, IL.

8:30 AM *** 2. Design of a new tool for macrocyclic synthesis**
Norris, Brianna and Vinod, Thottumkara K. Western Illinois University, Macomb, IL.

8:45 AM *** 3. Separation of chiral D and L-valine by high performance liquid chromatography**
Orech, Tara K. and Welch, Lawrence. Knox College, Galesburg, IL.

9:00 AM **Break**

9:15 AM *** 4. Synthesis of 1,1-dimethoxybutan-2-one by ether extraction and a Grignard reaction with dimethoxyacetaldehyde**
Parks, Clayton G. and Bennett, George D. Millikin University, Decatur, IL.

9:30 AM *** 5. Influence of aromatic substituents on the antibiotic activity of 5-aryl-4,4-dimethyl-3-oxo-delta-lactones against *Bacillus subtilis***
Hollandsworth, Lauren, Raube, Lee, Van Hise, Nicholas, Baudo, Dave and Andersh, Brad. Bradley University, Peoria, IL.

9:45 AM *** 6. Preparation and antibiotic testing of highly substituted 3-oxo-delta-lactones**
Ferguson, Robert, Wanken, Zachary, Baudo, Dave and Andersh, Brad. Bradley University, Peoria, IL.

10:00 AM *** 7. Catalysis by metal colloids synthesized within silane-containing polymers**
Miller, Josiah D., Kennedy, Branden F., Andersh, Brad J. and Campbell, Dean J. Bradley University, Peoria, IL.

10:15 AM **8. Why did the grass die? Problem-based learning in the Instrumental Analysis course**
Acheson, Edward R. Millikin University, Decatur, IL.

12:00 PM **Division Meeting**
Leighty-Tabor Science Center – Room 115

Division: Engineering & Technology
Leighty-Tabor Science Center – Room 115
Session Moderator – Casey Watson

10:45 AM *** 1. Electronic speckle pattern interferometry: opto-mechanics and application**
Trudell, Tanner N., James, Jesse and Steckenrider, John S. Illinois College, Jacksonville, IL.

11:00 AM *** 2. Electronic speckle pattern interferometry: image acquisition and data analysis**
James, Jesse, Trudell, Tanner N. and Steckenrider, John S. Illinois College, Jacksonville, IL.

12:00 PM **Division Meeting**
Leighty-Tabor Science Center – Room 209

Division: Environmental Science
Shilling Hall – Room 317
Session Moderator – Nic Guehlstorf

10:45 AM *** 1. Selenium Phytoremediation Management: Development of Selenium-Biofortified Mushrooms from Plant Waste**
Hong, Jie S.[1], Lin, Zhi Q.[1] and Banuelos, Gary[2]. [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]USDA-ARS, Fresno, California.

11:00 AM *** 2. Prehistoric and Historic Lead Levels in Catfish (Family Ictaluridae) Along the Illinois River**
Goss, Donald, Brugam, Richard, Holt, Julie, Vogel, Gregory, Lin, Zhi-Qing and Kohn, Luci. Southern Illinois University Edwardsville, Edwardsville, IL.

11:15 AM *** 3. Redeveloping Brownfields: An analysis on financing brownfield management in Illinois**
Gates, Christen. Southern Illinois University Edwardsville, Edwardsville, IL.

11:30 AM *** 4. Earthquake Education and Awareness Initiative in Southern Illinois**
Black, Christine[1], Henson, Harvey[1], Mumba, Frackson[1], Hodgson, Scott[2] and Podoll, Andrew[1]. [1]Southern Illinois University, Carbondale, IL. [2] University of Oklahoma, Norman, OK.

11:45 AM *** 5. Effects of service learning in the physical science curriculum**
Bittle, Cynthia K. Southern Illinois University Edwardsville, Edwardsville, IL.

12:00 PM **Division Meeting**
Shilling Hall – Room 317

Division: Health Sciences
Shilling Hall – Room 317
Session Moderator – Vance McCracken

8:30 AM *** 1. Effectiveness of solventless condensation and Diels-Alder methods in the synthesis of prospective aldosterone synthase inhibitors and four novel bicyclo[4.3.0]non-3-ene-7,9-diones; applications in the fields of medicinal and structural chemistry**
Bringman, Lauren R. and Bennett, George D. Millikin University, Decatur, IL.

8:45 AM *** 2. Effects of varying caffeine doses on heart rate in neonatal rats**
Cassidy, Daniel P. and McGilliard, Kip L. Eastern Illinois University, Charleston, IL.

12:00 PM **Division Meeting**
Leighty-Tabor Science Center – Room 117

Division: Microbiology
Shilling Hall – Room 317
Session Moderator – Vance McCracken

9:15 AM *** 1. Antibiotic resistant Group A *Streptococcus* among Aurora University students**
Singh, Nidhie and Zelman, Mark. Aurora University, Aurora, IL.

9:30 AM *** 2. Modeling the impact of colonic bacteria on dietary fiber: A mutant *E. coli* strain's efficiency in competition with its wild type for different carbohydrates**
Kruse, Joel and McCommas, Steven. Southern Illinois University Edwardsville, Edwardsville, IL.

9:45 AM *** 3. *Echinacea purpurea*'s immunomodulatory properties: assessment of morphological changes, CB2 and iNOS expression in macrophages treated with *Echinacea* simulated digestion**
Zurek, Oliwia W.[1] and Thompson, Christopher R. [1]Knox College, Mundelein, IL. [2]Loyola University Maryland, Baltimore, MD.

10:00 AM *** 4. Biofilm formation and survival of capsule-deficient mutants of *Enterococcus faecalis* in a root canal infection model**
Adair, Diana[1], McCracken, Vance J.[1], and Gillespie, M. Jane[2]. [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]Southern Illinois University School of Dental Medicine, Alton, IL.

12:00 PM **Division Meeting**
Leighty-Tabor Science Center – Room 117

Division: Physics, Mathematics & Astronomy
Leighty-Tabor Science Center – Room 115
Session Moderator – Casey Watson

11:15 AM *** 1. Modeling Electromagnetic Braking**
Trumpy, Shae. Millikin University, Decatur, IL.

11:30 AM *** 2. Computer Simulations of Solar System Formation**
Schenk, Andrew and Watson, Casey. Millikin University, Decatur, IL.

11:45 AM **3. "Whiskers in the wind" – The interaction of rat whiskers with air currents**
Gopal, Venkatesh[1], Kim, Minwoo[2], Chiapetta, Charles[2], Russ, Joel[2], Meaden, Michael[1] and Hartmann, Mitra J. Z.[4] [1]Department of Physics, Elmhurst College, Elmhurst, IL. [2]University of Illinois at Urbana Champaign, Champaign, IL. [3]Elmhurst College, Elmhurst, IL. [4]Northwestern University, Evanston, IL.

12:00 PM **Division Meeting**
Leighty-Tabor Science Center – Room 209

Division: Zoology
Pilling Chapel
Session Moderator – David Duvernell and Paul Brunkow

8:00 AM **1. Hydrodynamic drag is affected by shell size in *Pleurocera acuta***
Karcher, E. and Brunkow, P. Southern Illinois University Edwardsville, Edwardsville, IL.

8:15 AM **2. Comparison of Jumping Behavior in Leiopelmatid and Lalagobatrachian Frogs**
Essner, Jr., R. L.[1], Suffian, D.[1], and Reilly, S. M.[2] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]Ohio University, Athens, OH.

8:30 AM *** 3. Mate Preference and Association Behavior of Two Closely Related Topminnow Species *Fundulus notatus* and *F. olivaceus* (Cyprinodontiformes)**
Schoeneck, B. D.[1], Jablonski, M.[1], Duvernell, D. D.[1] and Schaefer, J. F.[2] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]University of Southern Mississippi, Hattiesburg, MS.

8:45 AM *** 4. Factors affecting the bottlenose dolphin's ability to interpret human-given social cues**
Butzen, C.[1], Templeton, J.[1] and Byerly, H.[2] [1]Knox College, Galesburg, IL. [2]Dolphins Plus, Key Largo, FL.

9:00 AM **Break**

9:15 AM **5. Phylogeography of Two Species of Stoneflies (Plecoptera) in Eastern North America**
DeWalt, R. E.[1], Giordano, R.[1], and Chabot, E.[2] [1]Illinois Natural History Survey, Champaign, IL. [2]University of Illinois, Champaign, IL.

9:30 AM *** 6. Impacts of prescribed burning on soil and litter invertebrate diversity in a northeastern IL oak woodland**
Boelter, B. J.[1], Jacobs, K. A.[1], Scharenbroch, B.[2] and Peters, E. L.[1] [1]Chicago State University, Chicago, IL. [2]Morton Arboretum, Lisle, IL.

9:45 AM *** 7. The use of essential oils as repellents of Lone Star (*Amblyomma americanum*) ticks**
Geiselman, J. and Chapman, E. Illinois College, Jacksonville, IL.

10:00 AM *** 8. Analysis of habitat utilization and foraging behavior of two species of woodpeckers in fragmented oak-hickory forest**
French, Z., Minchin, P. R. and Essner, R. L. Southern Illinois University Edwardsville, Edwardsville, IL.

10:15 AM *** 9. A phylogeographic analysis of the *Fundulus notatus* complex using nuclear Amplified Fragment Length Polymorphisms (AFLPs)**
Meier, S. L.[1], Kreiser, B.[2], Schaefer, J. F.[2] and Duvernell, D. D.[1] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]University of Southern Mississippi, Hattiesburg, MS.

10:30 AM **Break**

10:45 AM *** 10. Current range and regional population structure of *Acroneuria frisoni* Stark & Brown 1991 (Plecoptera:Perlidae): A prelude to reintroduction**
Chabot, E.[1], Giordano, R.[2] and DeWalt, R. E.[2] [1]University of Illinois, Champaign, IL. [2]Illinois Natural History Survey, Champaign, IL.

11:00 AM *** 11. Analysis of home range size and movement patterns of the blackstripe topminnow, *Fundulus notatus* (Family: Fundulidae), in Cahokia Creek**
Alldredge, P. A.[1], Duvernell, D. D.[1], Schaefer, J. F.[2], Schoeneck, B. D.[1] and Selby, H. Z.[1] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]University of Southern Mississippi, Hattiesburg, MS.

11:15 AM *** 12. Sex ratios and social forms in high elevation mating flights of the red imported fire ant, *Solenopsis invicta***
Fritz, N. E.[1], Lewis, W.[2], Uppuluri, A.[2] and Fritz, G. N.[2] [1]Charleston High School, Charleston, IL. [2]Eastern Illinois University, Charleston, IL.

11:30 AM *** 13. Effects of Diet on Mandible Shape in Family Mustelidae**
Schorsch, R. and Kohn, L. Southern Illinois University Edwardsville, Edwardsville, IL.

11:45 AM **14. Morphological Integration in Scapula Form: Data From Red Fox and Gray Fox (*Vulpes vulpes*, *Urocyon cinereoargenteus*, Family Canidae)**
Kohn, L., Sydow, M. and Watkins, J. Southern Illinois University Edwardsville, Edwardsville, IL.

12:00 PM **Division Meeting**
Pilling Chapel

POSTER PRESENTATION ABSTRACTS

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

Division: Agriculture

1. Varietal Information Program for Soybeans—Disease and pest evaluations

Slaminko, Tara L.[1], Bowen, C. Roger[2] and Hartman, Glen L.[1,2] [1]University of Illinois at Urbana-Champaign, Urbana, IL. [2]USDA Agricultural Research Service, Urbana, IL.

The Varietal Information Program for Soybeans (VIPS) provides independent, objective, and unbiased evaluations that enable growers to effectively compare resistance traits for cultivars from various companies. Varieties entered into the program are evaluated for sudden death syndrome (SDS), Sclerotinia stem rot (SSR, also known as white mold), Phytophthora root rot (PRR), *Soybean mosaic virus* (SMV), and soybean aphid resistance. Since 1998, publicly- and privately-developed soybean cultivars have been tested in Illinois through a cooperative effort by the University of Illinois Soybean Variety Testing Program and VIPS for the purpose of providing information on the agronomic and disease performance of soybean cultivars. VIPS developed from the Variety Testing program as a means to satisfy Illinois soybean producers' need to compare cultivars from multiple companies. Variety Testing yield sites are monitored each year for the opportunity to collect additional disease and pest information from the field. Data are published each year on the VIPS website (www.vipsoybeans.org) and in a booklet that is distributed to Illinois soybean growers.

* 2. Detection of mRNA by reverse transcription-PCR as an indicator of specificity and viability in *Phakopsora pachyrhizi*

Vittal, Ramya[1], Haudenshield, James S.[2] and Hartman, Glen L.[1,2] [1]University of Illinois at Urbana-Champaign, Urbana, IL. [2]USDA Agricultural Research Service, Urbana, IL.

Soybean rust, caused by the fungus *Phakopsora pachyrhizi*, is one of the most devastating foliar diseases of soybean, *Glycine max* (L.) Merr., and greatly reduces yield. Early diagnosis of the disease is important in developing timely and cost effective management strategies. Molecular detection methods, using both standard PCR and quantitative PCR (Q-PCR) are available, but their inability to distinguish between live and dead spores can limit their use for monitoring purposes. Therefore, we developed a novel, one-step reverse transcription Q-PCR (QRT-PCR) viability assay that exploits the rapid post-mortem degradation of mRNA as compared to DNA. We developed DNA primers and a linear hydrolysis probe specific to mRNA of *P. pachyrhizi* cytochrome b, a mitochondrially encoded membrane protein. Results showed that the quantity of total RNA extracted from heat-killed spores was one-sixth the amount extracted from an equal number of live spores. The mRNA of heat-killed spores was undetectable while the DNA gave a positive signal. To evaluate the specificity of the method, we tested nine different fungal species and they were undetectable. This indicates that our QRT-PCR assay specifically detects viable *P. pachyrhizi* spores, a feature important to the development of a biosensor having utility in disease management.

*** 3. Effect of male accessory gland extract on female copulation characteristics, *Anastrepha suspensa* (Diptera: Tephritidae)**

Lewis, Wesley R., Seelhoeffer, Lara B., 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 (secreted by male accessory glands). Proteins in male ejaculate fluid have been shown to reduce females' receptivity to additional copulations, increase oviposition, and decrease longevity. A previous study on Caribbean fruit flies reported no effect on females when these were injected with male accessory gland extracts comprised of male reproductive structures from varying ages, and injected into the mesothorax. Our study standardized the size and age of male accessory glands and injected extracts specifically into the region of the reproductive tract proper and the ganglion that innervates the female reproductive tract (ganglion in 1st abdominal segment). Receptivity of females to additional copulations and copulation duration were compared between positive controls (mated, non-injected females), negative controls (saline-only injected females) and treatment groups (injected with 1 male equivalent of accessory gland extract).

*** 4. Phytotoxic evaluation of nootkatone formulations and components**

Wetterauer, Alyssa M.[1] and Behle, Robert W.[2] [1]Eureka College, Washington, IL. [2]USDA-ARS-NCAUR, Peoria, IL.

Research of the essential oil nootkatone has shown acaricidal activity against *Ixodes scapularis*, commonly known as the deer tick. Development of extended release formulations providing lasting toxicity against ticks is hopeful research in the prevention of Lyme disease, a spirochete infection vectored by the deer tick. However, a prepared formulation (EC Oil) causes phytotoxicity of plant tissue due to properties of the compound and formulation ingredients. The burning of vegetation causes problems in both marketing development and for application use. Cabbage plants were used for assays to evaluate alternative surfactants and formulations of nootkatone. Formulation treatments included: EC Oil (standard), and two spray-dried encapsulated formulations (Maillard and lignin) applied at rates of 5%, 10%, 15%, 20%, and 25% (g nootkatone/g H2O) (25% ~ 1.6 g nootkatone/m2). Visual estimations of phytotoxicity were made by back-lighting treated leaves with fluorescent light to see the extent of damage within the treated area. Phytotoxicity was also measured in terms of leaf tissue weight loss, signifying that greater tissue damage would mean less tissue mass. The surfactants Tween 85, Tween 20, E-Z-Mulse, and Triton X-100 were also evaluated for phytotoxicity using the same methodology. Nootkatone encapsulated with lignin provided the most promising results with little to no damage (visual or weight reduction) shown except at the two highest application rates. The EC Oil formulation caused the greatest phytotoxicity with a weight reduction of 45.7% in leaf tissue at the lowest

*** 5. Public beliefs and attitudes concerning wind farms in Central Illinois**

Theron, Sophie, Winter, Randy J., Spaulding, Aslihan D. and Loomis, David G. Illinois State University, Normal, IL.

Energy consumption in the United Sates has been increasing and petroleum prices have been unstable in recent years. Expanding investment in renewable energy is one way to reduce the

nation's dependence on oil. The NIMBY syndrome and other concerns raised by opponents may inhibit the expansion of wind energy in Illinois. This study aims to identify the public beliefs and opinions toward wind energy in central Illinois. A survey was sent to random samples selected from four areas of the state: an area with an operating wind farm, an area with a proposed wind farm, an area with wind resource potential but no wind farm proposal yet, and an area with limited wind resource. More than 80% of the respondents support the development of wind farms in their community. Respondents agree that wind farms are good for the environment, for job creation and for rural economic development. The majority also agrees that federal and state governments should have a mandate for renewable energy. Nevertheless, the study indicates that Illinois households are reluctant to pay extra for green energy. Few differences in attitudes among the areas were found, indicating that opinions tend to be the same if the community is in the middle of a project or not.

Division: Anthropology & Archaeology

* 1. Investigation of Dietary Texture During the Archaic-Woodland Transition at the Carrier Mills Archaeological District (Saline County, Illinois)

Forsythe, Lauren A.[1], Forsythe, Elliott C.[1], Gamza, Tammy R.[1], and Prowse, Tracy L.[2] [1]Southern Illinois University Carbondale, Carbondale, IL. [2]McMaster University, Hamilton, Ontario, Canada.

Dental microwear analysis was used to investigate changes in dietary texture in a sample of Archaic (10,000-3,000 B.P.) and Woodland period (3,000-950 B.P.) Native American teeth from the Carrier Mills Archaeological District (Saline County, Illinois). Facet 9 was examined on the occlusal surface of thirty individuals in a scanning electron microscope at a resolution of 500x, and the number of pits and scratches were visually quantified. Four interrelated variables (number of pits, number of scratches, total number of features, and the pit-to-scratch ratio) were used to compare differences in dietary texture between the Archaic and Woodland period individuals using Gaussian statistics. The results indicate that there were no significant differences in dietary texture between the Archaic and Woodland periods ($p<0.05$) for any of the analyzed variables. These results indicate that dietary texture remained relatively constant at Carrier Mills across the Archaic-Woodland transition, a finding contrary to previous studies of this time period in Indiana and Mississippi. This finding is, however, consistent with the relative stasis in the archaeobotanical and faunal remains at the Carrier Mills Archaeological District, and together these lines of evidence strongly support a nearly constant diet at this site throughout its occupation. Further research into the patterned interrelationship between faunal, floral and osteological materials is warranted to verify these findings.

Division: Botany

1. Biomass production during two years of succession in an old field in Rock Island County, Illinois

Liva, Robert and Dziadyk, Bohdan. Department of Biology, Augustana College, Rock Island, IL.

A study in ecological succession was started in 2008, following abandonment of a half hectare agricultural field. The old field is a contiguous part of the 40 ha Beling Ecological Preserve of Augustana College on the north shore of the Rock River in central Rock Island County, northwestern Illinois. After a dozen years of cropping the site has been abandoned to natural

succession. Floristic structure and biomass production are being analyzed at three permanent study sites (15 m X 20 m), each a different distance from the forest edge. Aboveground biomass production is estimated by the harvest method at each site at two week intervals through the growing season. Site locations (from the forest edge) and the peak standing crop biomass (g/m^2 in 2008/2009, and the percent increase) at each are: Site I - 2 m, 258/502 - 95% (the wettest area); Site II - 20 m, 345/424 - 23%; Site III - 40 m, 515/559 - 9% (the driest location). In both years peak biomass occurred in late August. Such increase across growing seasons is not unexpected in early succession in Midwestern old fields. Consistent with expectations based on distance from the forest edge, the number of seedlings (density per m^2) of the dominant tree *Acer saccharinum* in 2009 varied from 19 at site I to 17 at site II to 4 at site III.

*** 2. Examination of hybridization relationships between *Schoenoplectus hallii* and *S. saximontanus* (Cyperaceae) using ISSR markers**

Stapay, Tara[1], Smith, Marian[1], McKenzie, Paul[2] and Esselman, Elizabeth[1]. [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]U.S. Fish and Wildlife Service, Columbus, MO.

Schoenoplectus hallii, commonly known as Hall's bulrush belongs to *Schoenoplectus* section *Supini* (Cherm.) J. Raynal in the Cyperaceae. It is an annual species restricted to wetland habitats experiencing fluctuating water levels. This rare summer annual has suffered devastating population losses over the last 25 years and the survival and conservation of this taxon is a concern wherever it has been reported. A continuing threat to the survival of *S. hallii* could be the possibility of hybridization with another more common species *S. saximontanus*. Putative hybridization has been reported between *S. hallii* and *S. saximontanus* where the two species co-occur in some sites in OK. The purpose of this study is to use ISSR markers to support or refute the hypothesis that hybridization exists between these species. We examined individuals from both species and proposed hybrids from the Wichita Mountain Wildlife Refuge in Ok with three ISSR primers. We identified species-specific markers in the individual species and these markers were present in the putative hybrids plants. Our results support previous studies suggesting that the two species are hybridizing. Examination of more populations where the species co-occur needs to be done to assess how great the threat of hybridization is to *S. hallii*.

*** 3. The floristic quality index (FQI) as a tool to examine the regenerative capabilities of a previously disturbed field in Illinois**

Spagnolo, Sara, Bryant, Carol and Esselman, Elizabeth. Southern Illinois University Edwardsville, Edwardsville, IL.

The purpose of this study was to determine the floristic quality index of a field in Macoupin County, Illinois. The field was previously the site of farming activities but has now remained undisturbed for over 25 years. The results may suggest a time frame for a previously disturbed field to return to an Illinois prairie flora. A preliminary survey was done on the field revealing 112 species with 97 native species and 15 alien species. The floristic quality index was then used to determine the floristic composition and quality of the field. This index assigns a conservation coefficient number to each taxon in the Illinois vascular flora. Farming and other anthropogenic activities typically will produce a habitat dominated by flora with a low conservation coefficient. We had hypothesized that the FQI of the field would be similar to that of a lower quality field because of the history of farming and the short time for late successional species to develop. However, when calculated, the FQI for this field was 34.48, which is a

relatively high number. This data suggests that previously disturbed Illinois areas posses a resilient ability to return to a previous habitat in a relatively short period of time.

*** 4. Burning system to collect water soluble compounds from the smoke of plant materials**
Finn, Daniel J., Prosser, Stephanie D., Coons, Janice M., Coutant, Nancy E. and Lawrence, Barbara A. Eastern Illinois University, Charleston, IL.

Fire plays a crucial role in maintaining the natural landscape of tallgrass prairie habitats. Past studies show that smoke produced by fires in the prairie habitat can break seed dormancy for some tallgrass species. More recent studies show that water soluble butenolides released in the smoke are involved with breaking seed dormancy. However, it is not clear if the release of these compounds varies with different species. Our objective was to design a system to collect compounds in the smoke that dissolve in water. A 10 x 23.5 cm stainless steel bee smoker (model 15239, GloryBee Foods, Inc., Eugene, OR) was filled with dried plant material—totaling 200 g burned in two 100 g portions. After the plant material was ignited with a butane torch, the bellows were used to force a consistent flow of smoke from the smoker, through a 77.5 cm long by 2.7 cm (inside diameter) heat resistant tubing, into water (300 mL) contained in a 1,000 mL sidearm flask. One end of the tube was clamped to the open end (2 cm diameter) of the funnel-shaped bee smoker top and the other end was placed just below the water surface in the sidearm flask. To pull the smoke through the tube into the water, a water aspirator—acting as a vacuum—was connected to the arm of the flask. The burning process for 200 g of plant material required approximately five hours. The proper assembly of this system will allow successful creation of smoke-water solutions for analysis of smoke compounds.

*** 5. Influence of smoke solutions on the germination of twenty prairie plant species**
Ervin, Stefanie L., Daugherty, Bradley M., Coutant, Nancy E. and Coons, Janice M. Eastern Illinois University, Charleston, IL.

One management technique often used for prairies is fire. Studies from fire prone plant communities over the last 20 years report that seeds of some species require smoke exposure to germinate. Our objective was to examine the influence of 4 smoke/ash solutions on seed germination of 20 prairie species. Smoke/ash solutions were: IL Smoke, IL Ash, African Smoke, and Hickory Seasoning. For each species, 50 seeds were placed in each of 3 Petri dishes on filter paper moistened with each smoke solution. Germinated seeds were counted for 6 weeks. Data were analyzed using ANOVA. At least one of the smoke/ash solutions increased germination for 13 species: *Astragalus crassicarpus, Ceanothus americanus, C. herbaceus, Coreopsis palmata, Echinacea atrorubens, E. pallida, E. simulata, Liatris aspera, L. punctata, Oligoneuron riddellii, O. rigidum, Pycnanthemum pilosum* and *P. virginianum*. The Illinois Ash for *Ceanothus herbaceus* was the only combination that decreased germination relative to the control. Smoke solutions had no effect on germination of seven species including: *Astragalus canadensis*, *Bouteloua curtipendula, B. hirsuta, Coreopsis lanceolata, Echinacea purpurea, Lespedeza capitata* and *L. virginica*. This information has implications relative to fire management of prairies, and to protocols for growth of native plants for use in restoration or sales by the horticulture industry.

*** 6. Efficacy of glyphosate injection to eradicate *Ailanthus altissima* (Simaroubaceae)**
Wright, Jessica, Harroun, David, Schulz, Kurt, Reese, Nathan, Dugan, Erin, Tripp, Tim, McDonald, Erica and Hall, Melissa. Southern Illinois University Edwardsville, Edwardsville, IL.

Tree of heaven (*Ailanthus altissima*) is an aggressive, wind-dispersed invasive tree native to Asia. Once established the species can spread through clonal growth. It casts shade and secretes potent allelochemicals that act against native understory plants. In summer 2008, 352 stems of an established population were injected with glyphosate capsules using the EZject™ Lance (Arbor Systems, Omaha, NE). We previously reported on the success of this technique based on a survey taken fall 2008. In fall 2009, stems were reevaluated to estimate mortality and recovery rates in relation to tree diameter and canopy position. With this new data we examined the predictive value of the 1988 damage ratings. Overall 66% of injected trees died, as compared to 11% of controls. Mortality rates for injected saplings (80%) and subcanopy individuals (90%) were high, but upper canopy individuals had lower mortality (51%). Tree diameters reflected a similar pattern, with dead trees having smaller diameters (9.8 vs. 17.6 cm dbh). Status evaluated in the fall after treatment was a good predictor of death (98 and 67% died in classes 1 and 2 on a 1-5 scale; in classes > 3, 45-27% died). We emphasize herbicide dosage should be greater than label directions for trees > 10 cm dbh).

*** 7. A cautionary tale: ineffective stump treatments increase *Ailanthus* (Simaroubaceae) density six-fold**
Reese, Nathan, Wright, Jessica and Schulz, Kurt. Southern Illinois University Edwardsville, Edwardsville, IL.

Invasive species cause foresters and ecologists great concern over the future of natural habitats. Simple, inexpensive methods are being sought to eradicate invasive species from our landscape. This study documents a failed attempt to use CrossbowTM herbicide mixed for foliar application to prevent regrowth of cut trunks of *Ailanthus altissima*. In fall 2009/winter 2010 we evaluated *Ailanthus* regrowth in a grid of 12, 5 x 5 m plots in a successional field where *Ailanthus* saplings had been cut and sprayed with herbicide in summer 2008. We evaluated regrowth by the number and basal area of new coppice stems in comparison with the basal area and numbers of original stems. In addition, we tabulated new shoots growing in the plots. There was substantial proliferation shoots off the cut stumps (3.1 shoots per parental stem). However the basal area of the new stems did not replace the basal area of the original stems (ca. 20%). In addition, there was a six fold increase in sprouts (to 21,000 stems ha-1), quite possibly stimulated by the cutting of the original stems. This study provides a caution to those who wish to eradicate this species without proper stump treatment.

*** 8. Natural canopy gap formation facilitates Asiatic honeysuckle invasion of an old growth forest**
Wright, Jessica and Schulz, Kurt. Southern Illinois University Edwardsville, Edwardsville, IL.

The natural hardwood forests of the Mississippi River Valley and surrounding bluffs and floodplain are largely fragmented remnants especially subject to invasion by non-native species. The Asiatic bush honeysuckles (*Lonicera* spp.), which readily invade secondary forests in the Midwest, are also invading old-growth stands (albeit more slowly). Bohm Woods Nature Preserve, an old-growth remnant in Madison County, Illinois, presented an opportunity to study the role of canopy gaps in the invasion process. Invasive honeysuckle species preferentially

colonize high-light environments such as forest edge, but will germinate and survive in shaded environments. We examined the woody vegetation of natural canopy gaps to test the hypothesis that honeysuckle colonization was facilitated in higher light situations, such as at the center and north sides of gaps. The invasion of this old-growth stand is occurring rapidly and the process is being accelerated throughout by overlapping canopy gaps created by multiple disturbance events. Whether the rate of gap formation has increased in this stand is unclear. Some authors suggest old growth communities are very resistant to invasion. Nonetheless, canopy turnover in old growth is apt to permit colonization in these stands as well.

*** 9. Comparing edge and interior population contributions to the seed rain of invasive bush honeysuckle (*Lonicera maackii*, Caprifoliaceae)**

Hall, Melissa and Schulz, Kurt. Southern Illinois University Edwardsville, Edwardsville, IL.

Amur honeysuckle (*Lonicera maackii*) is a prominent invader of rural and suburban situations in the lower Midwest. Honeysuckle colonizes a wide range of light conditions, including open grassland, forest edge, and even deeply shaded forest interior habitats. Within the regional landscape honeysuckles are far more abundant in forest interiors than on the forest edge, however edge shrubs are larger, produce more fruit per node, produce more seeds per fruit, and produce larger seeds. We developed a series of simulations to compare the relative fruit and seed production of the forest edge and forest interior for square stands of 0.5, 1.0, 4.0, and 16.0 ha. Seed production estimates were weighted by seed size to compare seed quality as well. The model incorporated density and size distributions for four forest interior populations, as well as empirically derived data for edge population characteristics. In most simulations, edge shrubs contribute over 90% of the dispersible fruits, a larger percentage of seeds, and an even more disproportionate contribution to seed quality. Stand sizes do not greatly affect these proportions. Forest restoration programs would be most efficient if they concentrated on clearing forest edges of honeysuckle and replacing it with native bird-dispersed species.

10. Predictors of the diversity of the spring ephemeral community in a fragmented landscape

Laquet, Jennifer and Minchin, Peter R. Southern Illinois University Edwardsville, Edwardsville, IL.

The spring ephemeral community is a distinctive component of deciduous forests in the midwest. It consists of herbaceous plants that overwinter as underground organs and take advantage of high light levels in early spring, before the trees leaf, out to grow rapidly, flower and set seed. This community has been reduced as a majority of the forests have been lost or fragmented by agricultural development and urbanization. My research will aim to find predictors of the diversity of the spring ephemeral community in forest fragments. I hypothesize that diversity will increase with age of the forest, distance from the forest edge, area of fragments and canopy closure but decrease as invasive species become more abundant and the degree of disturbance increases. The study sites are two relatively disturbed forest fragments on SIUE campus, Sweet William Woods and Bluebell Woods, and Bohm Woods, a State Nature Preserve. Using 129 previously established sampling plots I will measure percent cover and counts of spring ephemeral species in randomly located subplots. Species will be identified using a portable herbarium which I will make specifically for this study. Predictor variables will be either measured in the field or determined using a geographic information system (GIS) that I will develop. Data will be used to construct multiple regression models that test the hypotheses. The

results will aid in the conservation management of the spring ephemeral community. Managers can identify which factors affect diversity and where conservation efforts should be focused.

*** 11. A quantitative assessment of the effectiveness of buffer zones in conserving the core forest habitat in oak-hickory forest fragments**

Fritzgerald, Adam and Minchin, Peter R. Southern Illinois University Edwardsville, Edwardsville, IL.

Forest fragmentation increases the ratio of edge to area. Edge effects can lead to a decrease in the quality of the core forest habitat. A hard edge is where a forest is bordered abruptly by non-forest habitat (matrix). A soft edge has a buffer zone, consisting of younger regrowth forest or a tree plantation, between the forest and the surrounding matrix. I hypothesize that presence of a buffer zone ameliorates edge effects, leading to an increase in the quality of core habitat. I aim to select ten oak-hickory forest fragments with a buffer zone and ten without a buffer, making sure that fragments are similar in area, shape and tree species composition. Core habitat in each fragment will be defined by analyzing variation in abiotic variables (light, temperature, humidity, soil moisture) and biotic variables (tree and shrub species composition) along transects from the hard or soft edge into the forest interior. The quality of the core habitat in each fragment will be evaluated by calculating indicators of community diversity and integrity, such as species richness, Shannon diversity and Floristic Quality Index (FQI) and differences between fragments with and without a buffer zone will be tested using t-tests. The results will assist land managers by quantifying the effectiveness of buffer zones in oak-hickory forest.

12. Invasion potential of golden rain tree in bluff forests of the Mississippi River

Browning, Roberta, Minchin, Peter R. and Retzlaff, William A. Southern Illinois University Edwardsville, Edwardsville, IL.

This project investigates the patterns of establishment and spread of an exotic tree species, *Koelreuteria paniculata* (golden rain tree), which was planted in 1961-1962 at the Mississippi Sanctuary, near Godfrey, Illinois. The 19.5 ha site is now managed as a nature preserve by The Nature Institute. In previous projects in 2007-2008, all individuals of golden rain tree were located and mapped and the majority of individuals were cut and aged by ring counts. The remaining individuals, including all of the largest trees, were cut in 2009 and I sanded the stem sections and aged them to complete the data set. Regression models of basal diameter on age were used to determine growth rates of the two groups of golden rain trees on the site. Trees which established in the arboretum area with no forest canopy, had a higher mean growth rate that was also highly variable. Trees established in intact oak-hickory forest had a slower growth rate. Histograms were constructed to observe the frequency distribution of recruits by the year established. Establishment increased exponentially until the late 1980s, after which it showed a linear decline, most likely due to the use of prescribed fire as a management tool. Distances and bearings of each tree from the nearest potential parent were computed. Analysis showed that most recruits are within 40 m of parent, with a clear bias in the down-wind direction, suggesting that the main dispersal agent is wind. Golden rain tree is moderately invasive in bluff forests but can be controlled by the use of fire.

*** 13. Comparison of control of two spotted spider mites, *Tetranychus urticae* Koch (Arachnida: Acari: Tetranychidae), in greenhouse grown *Glycine max* (soybeans) using neem oil and predatory mites, *Phytoseiulus persimilis***

Pantoja, Gerald A. and Parrish, Judy Damery. Millikin University, Decatur, IL.

Herbivory can be devastating to plants, imposing a multitude of harmful effects such as reduced leaf area, yield, and plant function. *Tetranychus urticae* Koch (Arachnida: Acari: Tetranychidae), two spotted spider mites, are one of many prominent herbivores infesting gardens, greenhouses, and other botanical settings. However, chemical treatments such as neem oil have been shown to reduce these herbivore populations. Additionally, the predatory mite *Phytoseiulus persimilis* may also be effective in minimizing threat of *T. urticae* to plants. The purpose of our experiment was to compare the effectiveness between chemical control of NEEM and biological control of predatory mites in minimizing spider mite populations in *Glycine max*. We compared incidence of *T. urticae* populations including numbers of adults and eggs, leaf area, final yield, and final shoot growth over a period of three months in three treatment groups of *G. max*, no control, control with *P. persimilis*, and control with neem herbicide at recommended concentrations. Our hypothesis was that chemical control methods would be more effective in reducing effects of mite populations over time. Our results show that control of *T. urticae* varies considerably in effectiveness, depending upon greenhouse temperature. Predatory mites were very effective once established, but failed to establish if greenhouse temperatures exceeded 40C. Neem, however, caused damage to the *G. max* at those temperatures, so neem treated soybeans were not significantly more productive than untreated.

*** 14. Ethylene stimulates the *in vitro* germination of *Schoenoplectus hallii*, a native wetland sedge**

Miller, Brandon and Barry, Kelly J. Southern Illinois University Edwardsville, Edwardsville, IL.

Hall's bullrush (*Schoenoplectus hallii*) is a native sedge found along the margins of transient, seasonal wetlands. A native to the Mid-Western states, it is threatened in Illinois and endangered in several other states. This species is vulnerable to habitat decline through human actions. In undisturbed areas, populations may return after several years of absence due to long-lived seeds that persist in the soil seedbank. Unlike many plants, ethylene stimulates the germination of *S. hallii* seeds. In this investigation we report that germination of surface-sterilized seeds exposed to ethephon concentrations up to 100 □M.

*** 15. *In vitro* propagation of *Desmantus illinoensis*, a native perennial of agricultural interest**

Mulherin, Craig and Barry, Kelly J. Southern Illinois University Edwardsville, Edwardsville, IL.

The Illinois bundleflower (*Desmanthus illinoensis*) is a warm-season, herbaceous perennial, in the legume family. It is native to the Mid-Western states of North America. Being coined as one of our most important native legumes, Illinois bundleflower is of agricultural interest as a perennial grain crop and forage crop. With strong nutritional value, high seed yields, and nitrogen fixation capabilities, there is potential for a healthy, clean, and renewable forage and grain source. The purpose of this study is to initiate *in vitro* growth of Illinois bundleflower. Procedures were established for surface sterilizing seeds for producing axenic seedlings. Explants for *in vitro* propagations included axenic seedlings and single-node explants from greenhouse grown plants. Explants were placed in ½ MS media supplemented with varying

concentrations of BA and NAA in order to determine appropriate concentrations for shoot multiplication.

*** 16. PCR amplification of endomycorrhizal fungal DNA from *Trillium recurvatum* roots**
Nichols, Bethanne, Peddicord, Layton, Fowler, Thomas and Barry, Kelly J. Southern Illinois University Edwardsville, Edwardsville, IL.

Trillium recurvatum is a native woodland plant which flowers in mid- to late-spring. It is a slow growing, rhizomatous plant that is common in Illinois woodlands. However, *T. recurvatum* populations are vulnerable to habitat disturbances and herbivory. Preferred growth conditions for *T. recurvatum* include evenly moist and fertile soil with partial shade. Growth at higher, drier sites that occur at the crests of wooded hills may be enhanced through the association of endomycorrhizal fungi with the trillium roots. DNA was isolated from trillium roots grown in regions where the plants were found at low, moist locations as well as nearby higher and drier sites. PCR amplifications of trillium root DNA using primers specific for endomycorrhizal fungi was used to evaluate the association of endomycorrhizal fungi with *T. recurvatum*.

*** 17. ISSR marker diversity in *S. hallii* (Cyperaceae) populations of Illinois**
Archdale, Emmaline L., Stapay, Tara, Esselman, Elizabeth, Mckenzie P. and Smith, Marian. Southern Illinois University Edwardsville, Edwardsville, IL.

Schoenoplectus hallii, commonly known as Hall's bulrush, is an annual species restricted to wetland habitats that experience fluctuating water levels. It occurs most often as an emergent species on bare soil as water recedes from transient ponds. This rare taxon has suffered devastating population losses over the last 25 years in Illinois and the Illinois Endangered Species Protection Board lists *S. hallii* as threatened in 2009. Understanding the levels of genetic diversity is an important component of any conservation strategy for rare species because genetic diversity is often an indicator of the long term ability of a species to adapt and evolve. In this study we used ISSR markers to examine the levels of genetic diversity in two of the 2009 eight existing populations in Illinois of *S. hallii.* We made comparisons with other populations of *S. hallii* from OK, and MO and another population of a more common congener *S. saximontanus* from Texas. Preliminary results suggest that the sampled Illinois populations contain higher levels of genetic similarity (0.796) than levels found in all other populations examined except for one site from Missouri (0.807). The implications of these findings on the preservation of the species will be discussed.

Division: Cell, Molecular & Developmental Biology

*** 1. Three amino acid positions cooperatively determine *Schizophyllum commune* (Aphyllophorales) pheromones' specificity for Bα receptors**
Springer, Kate M. and Fowler Thomas J. Southern Illinois University Edwardsville, Edwardsville, IL.

Mate recognition in *Schizophyllum commune* is initiated by G protein-coupled receptors and short lipopeptide pheromones. These pheromones and receptors were functionally expressed in *Saccharomyces cerevisiae* to investigate amino acids in the pheromone that permit receptor activation. In all cases, the wild-type pheromones are true to the activation specificity seen in *S. commune*. Pheromones Bap1(3) and Bap2(3) are similar in their predicted 12 amino acid

sequence aside from three amino acid positions. Site-directed mutagenesis on the three amino acid positions allowed analysis of their contributions to activation of receptors Bar1, Bar2, and Bar 3. The wild-type pheromone Bap1(3) activates receptors Bar2 and Bar3 while Bap2(3) activates Bar1 and Bar3. All changes in Bap1(3) and Bap2(3) in these amino acid swap experiments resulted in pheromones that activated Bar3. However, switching the amino acids LTY to LTT produced a pheromone that no longer activated Bar1. The triplet NTY (activates Bar1, Bar3) when changed to NTT resulted in a pheromone that activated Bar2 and Bar3, but not Bar1. A mutant pheromone with the triplet NCY activated all three receptors. Analysis of a series of mutant pheromones clearly linked changes at the triplet position to specificity, but no rule connecting the amino acid properties of the triplet to the receptor specificity has been identified. This implies that specificity involves a composite characteristic of the triplet, unlike other *S. commune* pheromones that have one key amino acid controlling specificity for receptors (Fowler *et al*., 2001).

*** 2. 5-Hydroxytryptamine's effect on each region of *Lumbricus terrestris'* (Lumbricidae) digestive tract**

Neal, Michael W. and Krajniak, Kevin G. Southern Illinois University Edwardsville, Edwardsville, IL.

It has been previously shown that neurotransmitters modulate the motility of the isolated crop-gizzard of *L. terrestris*. 5-hydroxytryptamine (serotonin) is known to inhibit spontaneous contractions of the combined crop-gizzard. Since the role of serotonin on the digestive tract has yet to be explored, we decided to examine the effects of serotonin on the isolated pharynx, esophagus, crop, gizzard, and intestine. The organ of choice was removed from the animal and placed in a tissue bath. Contractions were measured with a force transducer, and analyzed with LabScribe. Aliquots of serotonin, increasing in concentration, were added to the tissue bath, and the resulting changes in contractions were used to create log-dose response curves. It was determined that serotonin decreases amplitude and frequency of pharyngeal, esophageal, and crop contractions, increases frequency and decreases amplitude of intestinal contractions, and modulates gizzard contractions. Threshold concentrations for contraction frequency and amplitude of the pharynx range from 0.1 to 1.0 µM, of the esophagus range from 0.1 to 1.0 pM, of the crop range from 0.1 to 1.0 µM and 10 to 100 µM, of the gizzard range from range from 0.1 to 1.0 µM, and of the intestine range from 0.1 to 1.0 µM.

*** 3. Effect of temperature and caspase inhibitors on UVB irradiation induction of apoptosis in human leukemia cells, HL60**

Gniadek, Jamie, Brenegan, Teryn V., Ahmadian, Fatemeh, Chambers, Andre S. and Wanda, Paul E. Southern Illinois University Edwardsville, Edwardsville, IL.

Apoptosis in mammalian cells can be induced by exposure to UVB radiation. There are many important changes in the orientation, type, and concentration of membrane components that occur during apoptosis. It is unclear, however, the extent of the cell membrane contribution, compared to other cellular contribution, in UVB-induced apoptosis. In order to study these relative contributions, HL60 cells were irradiated with UVB light for varying lengths of time and at varying distances from the light source at cold and warm temperatures. Cell viability was determined by the trypan blue dye exclusion assay. Apoptosis was assayed by measuring caspase 3 activity. In addition, we also assayed for apoptosis in the presence and absence of caspase 3 and caspase 8 enzyme inhibitors. Our results showed (1) that the degree of apoptosis was

significantly decreased in cold irradiated cultures, indicating that the physical state of the membrane plays a role in the induction of apoptosis and (2) the presence of a non-membrane contribution to caspase 3 activity. We gratefully acknowledge support from the Fraternal Order of Eagles-Granite City Aerie 1126.

*** 4. Atg1 positively regulates synapse formation**
Beatty, Derek, McKeown, Cassandra and Liebl, Faith L. Southern Illinois University Edwardsville, Edwardsville, IL.

Chemical transmission in the central nervous system (CNS) relies on specialized structures called synapses. Synaptic communication is dependent upon the spatially correct formation of presynaptic terminals and the localization of postsynaptic receptors. The development and assembly of glutamatergic synapses is of particular importance because the majority of excitatory transmission in the CNS occurs via ionotropic glutamate receptors. Our preliminary data indicates that the autophagy-specific gene 1 (*Atg1*) is necessary for the formation of glutamate receptor (GluR) clusters in *Drosophila* at the neuromuscular junction. Animals lacking a functional *atg1* gene exhibit a reduction in GluR cluster size. Our data suggests Atg1 may be involved in the assembly of synapses because 1) mutations in *atg1* do not affect GluR mRNA levels and 2) mutations in *atg1* affects the localization of other synaptic proteins. We will investigate whether Atg1 signals through Atg13 to promote synaptic development.

*** 5. Mutations in *Drosophila* (Drosophilidae) postsynaptic density homologs affect glutamate receptors at the neuromuscular junction**
Ferguson, Matt, Davis, Dustin and Liebl, Faith L. Southern Illinois University Edwardsville, Edwardsville, IL.

In the mammalian Central Nervous System, AMPA receptors are responsible for rapid excitatory synaptic transmission. These receptors have previously been implicated in long-term potentiation and contextual fear learning. Many glutamate receptors (GluRs) reside within the postsynaptic density (PSD), a network of proteins that links the receptors to the cellular cytoskeleton and downstream signaling pathways. We have previously identified Drosophila homologs for approximately 96% of published mammalian PSD proteins [1]. Using immunocytochemistry and qRT-PCR we sought to determine whether mutations in several previously uncharacterized PSD proteins affect the expression or synaptic localization of GluRs.
1. Liebl, FL and Featherstone, DE. (2008). Identification and Investigation of *Drosophila* postsynaptic density homologs. Bioinformatics and Biology Insights, 2: 375-387.

*** 6. Kismet affects transcription of glutamate receptor subunits**
Spencer, Lauren and Liebl, Faith L. Southern Illinois University Edwardsville, Edwardsville, IL.

Glutamate receptors are neurotransmitter receptors in the central nervous system that mediate excitatory signaling between neurons. These receptors are involved in normal processes such as learning and memory as well as pathological processes such as epilepsy and neurodegeneration. To identify genes that regulate glutamate receptors, we are conducting a forward genetic screen to find mutations that affect glutamate receptor localization. Kismet is a protein that promotes transcription. Our forward genetic screen revealed that mutations in Kismet led to a reduction of glutamate receptors at the synapse and a reduction of glutamate receptor mRNA. Here we

investigate whether Kismet specifically affects glutamate receptors or whether kismet affects other synaptic proteins including Brp, DLG, SV2, and Synaptotagmin.

*** 7. Analysis of gene silencing in mammalian cell hybrids**
Dust, Audra J. Eastern Illinois University, Charleston, IL.

In eukaryotic cells, DNA is tightly packed into a form known as heterochromatin. In this form, many genes are silenced, while others are expressed depending on the type of cell and location in the body. The process by which this happens is relatively unknown, and experiments have been completed to examine this further, many looking at transcription factors because these are needed to initiate transcription. The theory that we propose is that genes are silenced in clusters. To test this, we examined the phenomenon of gene silencing that occurs when mammalian cells of distinct origins are fused to genetic cell hybrids. RNA we extracted from rat hepatoma (FTO2B), rat fibroblast (RAT1), and hepatoma-fibroblast hybrid (FR) cell lines, and these cells were reverse transcribed into rat cDNA, then applied to a whole genome array from Affymetrix. Data was sorted to identify the differentially expressed genes between the FTO2B cell line and the FR cell line, excluding all genes not expressed in the FTO2B cells. Next, the chromosomal location of all genes represented greater than five fold in the FR cells was found using a Rat Genome Database website (http://www.ensembl.org/Rattus_norvegicus/Info/Index). These genes were then mapped according to this location and these maps were compared to gene density maps in order to identify that clustered genes are “turned off” in groups. Using this information, we identified a large number of gene clusters that are repressed, as well as many genes outside of clusters. We are now examining whether these clustered genes have similar regulatory functions.

*** 8. Where's Ypt11p? Expression and purification studies**
Westemeyer, B. Augustana College, Rock Island, IL.

Ypt11p is a small, Rab-type GTPase in *Saccharomyces cerevisiae*. Although Ypt11p is known to positively affect both mitochondrial and endoplasmic reticular inheritance in budding cells, its cellular localization is still unclear. In this study, a high expression vector was constructed to express GST-tagged Ypt11p in *E. coli*. Additional expression studies were performed with this vector to determine the effects of temperature, concentration of the inducer IPTG and time of growth after induction on the expression level of the protein. Solubility tests suggest that, while much of the expressed Ypt11p is insoluble, ~20% of the protein is soluble under certain growth conditions. Preliminary GST affinity chromatography purification reveals that the expressed Ypt11p can be enriched. The next step in this project is to express and purify milligram amounts of modified Ypt11p for production of polyclonal antibodies to be used in immunolocalization experiments.

*** 9. Role of liver-specific transcription factor-binding on gene expression**
Allen, Kerstin K. and Bulla, Gary A. Eastern Illinois University, Charleston, IL.

Mammalian development is regulated by genes which must be expressed at appropriate times and locations. Gene expression is influenced by factors binding to them and activating transcription. Here, the correlation between gene expression in rat liver tumor cells and the binding of liver-specific transcription factors previously shown to be instrumental in the expression of liver-specific genes was examined. Both liver and non-liver cell lines were included for comparison using data from whole genome microarray analyses of hepatoma

(FTOB2), fibroblasts (RAT1), and liver cells fused with fibroblasts (producing cell hybrids [FR]). Genes known to bind these transcription factors and which are off in these cell lines were screened, ignoring those genes expressed at less than 100 units. Results show that of 37 genes which are known to bind hepatic nuclear factor 1 alpha (HNF1 α) in rat hepatoma cells, 9 were expressed at 100 to 500 units and 28 were expressed at >500 units. The rat fibroblast cells and hybrid cells show expression in 20 and 26 of these genes, respectively (despite the lack of expression of HNF1α. Similar results were found for HNF6 bound genes. Analyses to date indicate that several genes that bind these factors are active only in the presence of the factor, while other genes are active despite the absence of the factor(s).

*** 10. Analysis of phosphorylation levels in wild type and Pez-overexpressing *Drosophila melanogaster* (Diptera Drosophilidae)**

Spelde, Audrey E. Millikin University, Decatur, IL.

A tyrosine phosphatase is an enzyme that removes a phosphate from the amino acid tyrosine in a protein while a tyrosine kinase carries out tyrosine phosphorylation. Important cell regulation proteins are activated by phosphorylation. Phosphatases that are specifically involved in dephosphorylating tyrosines are known as protein tyrosine phosphatases (PTPs). PTPs are thought to act as molecular "on/off" switches in signaling pathways where they remove the phosphates from phosphorylated tyrosines. The Drosophila *Pez* gene codes for a PTP. We have made the unexpected observation that Pez increases phosphorylation of proteins. From its amino acid sequence we suspected that Pez might be a phosphatase in vivo, and thus Pez over-expression might excessively dephosphorylate phospho-tyrosines (Ptyr) in proteins. We induced Pez in a variety of fly tissues using recombinant DNA techniques. The Ptyr distribution and levels were examined by 1-dimensional and 2-dimensional gel electrophoresis protein gel blots visualized with anti-Ptyr. Levels of Ptyr increased in the Pez-expressing cells. Thus, Pez in vivo activity is the opposite of its predicted enzymatic activity. This result suggests that Pez is not a strong, general phosphatase, but is involved with a tyrosine kinase pathway. To explain this data most simply, we hypothesize that (at least when in excess) Pez removes an inhibitory phosphate on a kinase, triggering it to become overactive and raising local Ptyr levels.

*** 11. Taurine supplemented diet confers life span extension in adult *Drosophila melanogaster* (Drosophilidae) and arrests development in eggs**

Habib, Ishtiaq, Talon, Brian, Shirkey, Stephanie, Milne, Alexander and Smith, Lee Ann. Benedictine University, Lisle, IL.

As the amino acid taurine is being used more frequently in human diets, the exact physiological role and benefit have not been fully elucidated. To determine if taurine can impact long term physiology, we investigated the effects of a chronic taurine supplemented diet using the model organism *Drosophila melanogaster*. We specifically studied how life span and development are affected. Life span studies on adult fruit flies show chronic taurine can extend the median and maximum life spans. Taurine provided within the first weeks of adulthood rather than the latter weeks of the life span demonstrate the most benefit. Fruit fly eggs are sensitive to exogenous taurine concentrations reducing the number of hatched larvae. Our studies indicate that taurine may be beneficial to life span extension in early adulthood.

*** 12. In *silico* inquiry into the structure-function relationship of MDM20 protein in *Saccharomyces cerevisiae* (Saccharomycetaceae), baker's yeast**
Liva, Robert B., Crawford, Patrick and Singer, Jason. Augustana College, Rock Island, IL.

The purpose of this inquiry is to hypothesize base substitutions in *S. cerevesiae* gene MDM20 that will alter organism phenotype to a measurable degree. Phenotypic consequence will provide an entry point for inquiry into the protein structure function relationship. In silica bioinformatics data was gathered for protein primary and secondary structure predictions (heptad repeats and motifs respectively); consensus sequence domains; and construction of a hydrophobic scale for scoring secondary motifs. Data was integrated for insightful base substitutions engineered by PCR mutagenesis. PCR mutant strains were measured for performance in growth rate using spec20 ha

*** 13. Physiological effects of Met-enkephalin on the gizzard of the earthworm, *Lumbricus terrestris* (Haplotaxida/Lumbricidae)**
Rapp, John D. and Krajniak, Kevin G. Southern Illinois University Edwardsville, Edwardsville, IL.

Methionine-enkephalin is an opiate that has been localized in a diverse array of animals from invertebrates to mammals. Previous experimentation has determined the distribution of immunoreactive met-enkephalin throughout Lumbricus terrestris via the use of radioimmunoassay techniques. While the biological effects of immunoreactive met-enkephalin vary, in many species it functions in regulating the smooth muscle of the digestive tract. We examined met-enkephalin on the isolated gizzard of the earthworm, *Lumbricus terrestris*, in order to ascertain any physiological effects it may have on the strength and rate of smooth muscle contractions. Our results show that met-enkephalin has no discernable physiological effects on the gizzard, thereby indicating another function besides smooth muscle regulation. Other research has suggested a possible role for met-enkephalin is the regulation of the immune response of *Lumbricus terrestris*.

*** 14. Analysis of protein expression differences in MCF-7 breast cancer and U-2 OS osteocarcinoma cells due to exposure with varied concentrations of acetochlor and chlorpyrifos**
Rich, Jessica D. and Schultz-Norton, Jennifer R. Millikin University, Decatur, IL.

Acetochlor, a highly toxic herbicide most commonly used for weed prevention in field crops, is primarily a protein inhibitor in plants, but has also shown adverse effects towards mammalian systems. Chlorpyrifos, a moderately toxic insecticide also used on field crops, has also been thought to have negative effects on such systems. Transient transfections were performed with each of the two chemicals in order to determine their effects on both the MCF-7 breast cancer and U-2 OS osteocarcinoma cell lines. Dimethyl sulfoxide (DMSO) was used as the negative control and 10-8M estradiol as the positive control. Acetochlor and chlorpyrifos were tested for estrogenicity in concentrations ranging from 10-8M to 10-5M. The most significant differences in relative luciferase units from the control were noted in the 10-8M amount of acetochlor of the MCF-7 line, contrary to many literature and consumer label warnings denoting that the higher concentration of the chemical is most detrimental. Results for chlorpyrifos were inconclusive in MCF-7 cells due to inconsistent data over the five trials. U-2 OS cells are also being utilized to study differences in transactivation with ERα and ERβ after acetochlor and chlorpyrifos

treatment. Preliminary data indicate that 10-8M acetochlor shows an increase in luciferase expression relative to higher concentrations in the presence of ERα. Preliminary data with ERβ using either acetochlor or chlorpyrifos indicates that the highest relative luciferase values can be seen at the 10-7M and 10 6M concentrations.

*** 15. FMRRamide receptors in the intestine of the Earthworm *Lumbricus Terrestris***
Miller, Tyler and Krajniak, Kevin. Southern Illinois University Edwardsville, Edwardsville, IL.

The motility of the earthworm digestive tract is modulated by the neuropeptide FMRFamide. Our lab has shown that this peptide has an effect on the muscular activity of both the crop-gizzard and the intestine. FMRFamide increased the rate of contractions in both organs. The focus of this project was to determine whether the same FMRFamide receptor regulates both tissues using a series of FMRFamide analogs. The intestine was removed from the animal and placed in a tissue bath. Contractions were measured with a force transducer, and analyzed using LabScribe. Increasing concentrations of peptide were added to the tissue bath and the resulting changes in contractions were used to generate a log-dose response curve. To determine which amino acids in the FMRFamide sequence were critical for biological activity we used peptides in which one of the amino acids was changed from the normal L-conformation to the D-conformation. The resulting dose-response curves were compared to that of the standard FMRFamide. FMRFamide caused an increase in the rate of contractions of the intestine with a threshold between 0.1 to 1 nM. When the N-terminal phenylalanine was changed to the D-conformation there was an drastic increase in potency to .01 nM. When the methionine, arginine, and the C-terminal phenylalanine were changed to the D-conformation there was no response from the intestine to concentrations as high as 10 μM. The same responses were observed in the isolated crop-gizzard. Thus the receptor in both organs requires a C-terminal L-phenylalanine for biological activity.

Division: Chemistry

*** 1. Impact of fermentation on the total phenolic and antioxidant activity of cocoa bean polyphenols**
Nottoli, Katheryn and Kouassi, Gilles K. Western Illinois University, Macomb, IL.

Cocoa beans contain polyphenols including phenolic acids and flavonoids. Polyphenols are universally distributed in plants and fruits. They are thought to exhibit antioxidant activity by preventing oxidation or limiting the extent of oxidation of fats and oils. In human health, they are thought to combat oxidative stress; a process associated with some neurodegenerative diseases. In this study, the total phenolic of fermentated and non-fermentated cocoa beans was determined using the Folin Ciocalteu's method, in order to explore possible change induced on the phenolic profile during fermentation. The antioxidant potential of cocoa polyphenol extracted from fermented and non-fermented beans was also evaluated. Minute amounts of cocoa polyphenol extracts were added to samples of omega-fatty acid (OFA), mixed and exposed to heat at 60°C. Samples of OFA samples were taken at time intervals of 1 hour and the amount of hydroperoxides formed was determined using UV-vis spectroscopy method, at 234 nm.
The results indicated that the fermented cocoa beans have about 8 times less total phenolic than the non-fermented ones. This suggested a substantial reduction of the total phenolic through the fermentation process. However, there was no noticeable difference between fermented and non-fermented cocoa bean extracts, in their potential to prevent oxidation. Further studies using HPLC are under way to determine the effect of fermentation on the phenolic composition and its

subsequent impact on antioxidant activity. This preliminary study showed that cocoa beans contain effective polyphenol antioxidants that may help prevent degenerative disorders in humans. Cocoa polyphenols can be used as natural additives in the preparation of edible products.

*** 2. New cathepsin B inhibitors**
Inapudi, Kalyani, Kadasala, Naveen Reddy, Jin, Jin, Zhang, Shaozhang and McConnell, Rose. Western Illinois University, Macomb, IL.

Cathepsin B, a lysosomal protease, has been proposed to be involved in the progression and metastatic spread of breast cancer. Associations have been made between high concentrations of cathepsin B and poor patient prognosis in primary breast cancer. Active cathepsin B localized to the plasma membrane has been shown in invasive bladder tumor cells whereas non-invasive tumor cells have cathepsin B confined to the lysosomes. This suggests that membrane associated cathepsins may participate in tumor invasion. Specific proteinase inhibitors could lead to the development of theraputic agents for treatment of many types of carcinomas. Described is the design and synthesis of inhibitors of Cathepsin B. Inhibition data for these cathepsin B inhibitors is reported using N-Benzoyl-DL-Arginine-2-Naphthylamide hydrochloride (BANA) as the substrate.

*** 3. New cathepsin D inhibitors with hydroxyethyl amine isosteres**
Kadasala, Naveen Reddy, Ambati, Rama Krishna, Koneru, Lunita Nagini, Zhang, Shaozhong, Jin, Jin and McConnell, Rose. Western Illinois University, Macomb, IL.

Cathepsin D has been suggested to play important roles in the metastatic potential of several types of cancer. Also, a high activated cathepsin D level in breast tumor tissue has been associated with an increased incidence of relapse and metastasis. High levels of active cathepsin D have also been found in lung cancer, colon cancer, prostate cancer, uterine cancer, and ovarian cancer. In fact cathepsin D levels have been used as markers to predict the prognosis of breast cancer and uterine cancer patients. The design and synthesis of new (hydroxyethyl)amine isosteres containing cyclized tertiary amines as inhibitors as cathepsin D is reported. These compounds utilize substituted piperazines as the hydroxyethyl tertiary amine. Ki values by fluorometric assay for inhibition of Cathepsin D hydrolysis of substrate: Ac-Glu-Glu(Edans)-Lys-Pro-Ile-Cys-Phe-Phe-Arg-Leu-Gly-Lys(Methyl Red)-Glu-NH2 is reported.

*** 4. Synthesis of potential new cathepsin K inhibitor**
Yarlagadda, Karthika, Saichek, Nicholas, Ambati, Rama Krishna, Vinod, Thottumkara K., Jin, Jin and McConnell, Rose. Western Illinois University, Macomb, IL.

Cathepsin K has recently been identified at the major cysteine protease expressed in osteoclasts. The abundance and selective location of cathepsin K in cells responsible for bone resorption has lead to a new interest in design of cathepsin K inhibitors for the treatment of osteoporsis. Increased bone resorption may release factors from the extracellular matrix that contribute to tumor growth. In fact, recent reports indicate that interactions between prostate cancer cells, osteoblasts, osteoclasts, and bone matrix are essential in the formation of bone metastases. The design and synthesis of cyclic thiones and ketones that have a substituted N-aromatic piperazino group to accommodate the S3 subsite of cathepsin K as well as the S2, S1, and S1' subsites is reported.

*** 5. Rapid assembly of multi-functionalized alkanes by co-halogenation of alkene precursors**

Kistammagiri Nalla, Madhumitha R., Saraf, Swetha V. and Vinod, Thottumkara K. Western Illinois University, Macomb, IL.

Regio- and stereoselective 1,2-addition to olefinic double bonds resulting in the incorporation of two different vicinal functional groups is a highly sought synthetic manipulation. Cohalogenation reactions where a halogen and a nucleophile are added to a C=C are extensively studied and products from halohydroxylation, haloalkoxylation, haloacetoxylation, halophosphoryloxylation reactions are valuable synthetic intermediates in pharmaceutical, agrochemical, and specialty chemical industries. Here in we wish to report our results from a systematic exploration of the co-addition of I-Nu across double bonds using in situ generated acetyl-hypoiodite intermediate obtained from the oxidation of elemental iodine with (diacetoxyiodo)benzene. The method provides easy assembly of highly functionalized alkane and cycloalkane derivatives from readily available alkene precursors.

*** 6. Demonstration of solvent dependant oxidation behavior of water-soluble *o*-iodoxybenzoic acid (IBX) derivatives**

Raya, Balaram, Jajam, Savithri and Vinod, Thottumkara K. Western Illinois University, Macomb, IL.

While oxidation of benzylic, allylic and other primary alcohols carried out in polar aprotic solvents (DMF, DMSO) using IBX and its water-soluble derivatives show the expected selective oxidation of the alcohols to aldehyde stage, the reactions carried out in aqueous solvent mixtures using water-soluble IBX derivatives oxidizes only benzylic and allylic alcohols to the corresponding aldehydes. The observed slow oxidation of non-benzylic alcohols in aqueous solvent mixtures in presence of large excess of the water-soluble IBX reagent depends on the nature of the organic co-solvent used. The differences in the bond dissociation energies (BDE) of the relevant C-H bonds involved in the oxidation step is invoked to mechanistically explain the observed selectivities. Synthesis and selective oxidation of substrates that bear both benzylic and non-benzylic alcohol functional groups will be discussed.

*** 7. Ruthenium(III) catalyzed kinetics and mechanism of indigo carmine oxidation by manganese(III) in sulfuric acid medium**

Cholkar, Kishore, Poloju, Sridhar, Akita, Vikram and Made Gowda, Netkal. Western Illinois University, Macomb, IL.

Indigo carmine (IC) or indigotindisulfonate sodium is a natural dye, which finds applications in clinical diagnosis, chemistry and biology. Reactions of manganese(III)-porphyrins have been studied as possible models for closely related and biologically significant systems. In this project, 0.040 M manganese(III) sulfate stock solution was prepared using a standard method of anodic oxidation of 0.10 M manganese(II) sulfate in 5 M H_2SO_4 in an electrochemical cell. The IC-Mn(III) reaction, under pseudo-first-order conditions, has been spectrophotometrically monitored at a fixed λ_{max} and at a constant temperature. The experimental rate law for the reaction is as follows: rate = k_1 [IC] $[H^+]^x$ $[Ru(III)]^y$, where x and y are fractional orders. This shows a zero-order dependence on [Mn(III)]. Additionally, the effects on the rate of reduction product of Mn(III) (i.e., Mn(II)), and oxidation product of IC (isatin sulfonate, IS or sulfonated

anthranilic acid, SAA) have been negligible. Variations of the ionic strength and the dielectric constant of the reaction medium have negligible effect on the rate. Based on the effect of temperature, activation parameters have been evaluated using Arrhenius and Erying plots. We will present a mechanism consistent with the experimental kinetic and activation data and a derived rate law.

*** 8. Synthesis and antioxidant activities of some transition metal complexes of pyridoxine**

Puram, Swetha[1], Kaur, Devinder[1], Chaitanya, Lakshmi G.[2], Ananda, S.[2] and Made Gowda, Netkal M.[1] [1]Western Illinois University, Macomb, IL. [2] University of Mysore, Mysore 570 006, India.

The vitamin B6 complex consists of pyridoxine or PyH ($C_8H_{11}NO_3$) along with pyridoxal and pyridoxamine. Pyridoxine differs from pyridoxamine by the substituent at the 4' position. In this project, we have prepared several transition metal complexes of PyH prepared with the starting metal salts such as $CuCl_2$, $NiCl_2$, $CdCl_2$, $HgCl_2$, and $PdCl_2$. The products have been recrystallized from warm MeOH-acetone mixtures. The characterization of the products has been performed based on their elemental analysis, molar conductance, magnetic susceptibility, MS, IR, and NMR data. The molecular formulations and proposed structures of the complexes will be discussed. Furthermore, the results of antioxidant activities, determined using standard methods, of PyH and its complexes will be presented.

*** 9. Investigation of the retention behavior and separation of explosives on reversed phase liquid chromatography using 1-octyl-3-methylaimmadazolium salt (OMIM) as mobile phase additive**

Sharp, Stephanie and Heagy, Ashlie. Western Illinois University, Macomb, IL.

The closing of military bases throughout the world, a need for identifying polluted sites for remediation has increased. The most common pollutants found at these sites are nitromaines and nitroamine explosives and their degradation products. HPLC continues to be the main analytical technique for identification and verification of the presence of explosives. Many of these techniques use a dual column verification process whereby two separate analyses are done. Added into this array for the analysis of explosives is the need of the forensic chemist to detect and confirm the identity of explosives. Since two different stationary phases are involved, it is not unreasonable to be concerned with issues such as long-term chromatographic performance and column-to-column reproducibility. 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. Because of these particular properties, they are currently, of considerable interest in the separation and analysis. To meet the above challenges, 1-octyl-3-methylaimmadazolium salt (OMIM) RTIL will be used as mobile phase additives for the separation of explosives . In the present work we will investigate the retention behavior and resolution of the explosives using reversed phase liquid chromatography and OMIM as mobile phase additive.

*** 10. The quantitative determination of capsaicin in hot sauce and the development of a case study for an analytical chemistry lab**
Bruno, Carrie. Millikin University, Decatur, IL.

The goal of this project is to develop an experiment based on a real world scenario using HPLC for an analytical chemistry lab. The problem selected for this project was "Which of a variety of hot sauces is the hottest?" Capsaicin in hot sauce was extracted and quantitated using a modified version of a procedure originally developed by Batchelor and Jones. In this method, ethanol was used as the extraction solvent and the mobile phase consisted of acetonitrile, water, and phosphoric acid (0.1%). The preceding method was modified by replacing ethanol and acetonitrile with methanol, and adapted to fit the equipment available in our laboratory. The methanol extraction gave recoveries of capsaicin comparable to those of ethanol. A variety of hot sauces will be tested for their capsaicin content. The capsaicin content will be correlated to the Scoville Organoleptic Scale for hotness. The product of this project will be a guide for teachers and a scenario handout for students to be used in an analytical chemistry lab.

*** 11. Do water treatment processes remove pharmaceuticals from the water?**
Holthaus, Zach. Millikin University, Decatur, IL.

Previous studies by researchers have shown that trace amounts of pharmaceuticals are found in the water supply. There are several possible health implications involved to any species that may be exposed. Water samples with a known concentration of pharmaceutical chemicals will be made and run through a water treatment process in the lab. Using LC-MS methods, we will examine the samples after the process to see if the treatment process helped remove any or all of the pharmaceuticals from the water supply. Using this research, hopefully we can ensure the safety of our drinking water supply in the future.

*** 12. Monofunctionalization of diols for the synthesis of new cylindrical supramolecular hosts**
Makineni, Anupama. Eastern Illinois University, Charleston, IL.

The main goal of this project is to synthesize calix[4]arene based cylindrical supramolecular host by connecting two or more calix[4]arene units by substituting the phenolic hydroxy hydrogens with alkyl chains. Three diols (1,10-decanediol; 1,4-butanediol; benzene-1,4-dimethanol) were mono-functionalized with either silyl group, tosyl group or bromine. The monosubstituted silyl butanol and decanol were obtained in 30-38% of yields in THF. The monotosylated butanol and decanol was obtained in a yield of 30-46% under solvent-free condition. The desired monofunctionalized products were obtained when excess of the diol was used. When pyridine was used as the solvent, poor percent yields were observed. The diol with an aromatic ring (benzenedimethanol) was treated with HBr to give monobromo-product (p-bromomethyl benzyl alcohol) with a yield of 50%. In all the methods we used so far, a mixture of the diol reactant, the monofunctionalized and the difunctionalized products were observed in different ratios. All these monofunctionalized diols were isolated by column chromatography and characterized by ^{1}H NMR spectroscopy. The monofunctionalized diols are currently used in subsequent reactions with calix[4]arene.

*** 13. Characterizing sodium chloride crystallized in the presence of sodium ferrocyanide with powder x-ray diffraction and scanning electron microscopy**

Elkins, Sarah C. and Wiediger, Susan D. Southern Illinois University Edwardsville, Edwardsville, IL.

Commercially available kits use substances such as ammonium dihydrogen phosphate to produce dramatic crystals; however, such kits do not always identify their components, making such activities less useful in an educational setting. We used powder x-ray diffraction to study several kits in order to identify the components. Another goal was to optimize sodium chloride for dendritic crystal growth. This would produce a safer classroom crystal-growing activity that uses more readily available materials than ammonium dihydrogen phosphate. Sodium chloride has been studied with a range of additives to produce different crystal habits such as dendritic and spherical. Of interest to this project is sodium ferrocyanide because this additive is commonly used as an anti-caking agent in road salt and produces dendritic crystals in "crystal garden" activities for children. Varying concentrations of sodium ferrocyanide were added to saturated sodium chloride solutions. Crystals were developed through two methods: slow evaporation or heating to induce crystal formation followed by filtration. Crystal habits were studied using optical and scanning electron microscopes. The crystals displayed forms from cubic to extremely dendritic. Regardless of crystal habit, the powder x-ray diffraction results indicated that all crystals had the cubic structure expected for sodium chloride, consistent with work done by Davey, et al. The range of concentrations that produced dendritic formations did not correlate with prior studies.

*** 14. Replacing cadmium carbonate as the primary compound in analytical lab**

Wolfe, Eric B. Millikin University, Decatur, IL.

There is a compound called cadmium carbonate that is used in the Analytical Chemistry lab. The problem with this compound is that cadmium is very toxic and can cause problems to scientist. The research conducted here shows twenty five compounds that were reacted with a sodium hydroxide solution in the titration tests. Each compound had HEDTA, CDTA or EDTA along with a known metal compound. The object of this experiment is to replace the cadmium carbonate lab with something safer and use the aspects of Green Chemistry. The lanthanum nitrate compound worked the greatest because it produced a high volume of crystallized and titrated very well. These experiments were only used to replace the cadmium carbonate compound.

*** 15. Conformational states and kinetics of the calcium binding domain of NADPH oxidase 5**

Levek, Kelli, Boyle, Tiffany Rose, Wetherell, Kristen, Motl, Nicole and Wei, Chin-Chuan. Southern Illinois University Edwardsville, Edwardsville, IL.

Superoxide generated by NADPH oxidase 5 (NOX5) is of growing importance for physiology and pathology and the activity of NOX5 appears to be regulated by a self-contained Ca^{2+} binding domain (CaBD). Here we generated the recombinant CaBD, and characterize it using fluorescence spectroscopy and circular dichorism (CD). Ca^{2+} binding to CaBD induces a conformational change that exposes hydrophobic patches and increases the quenching accessibilities of its Trp residues and AEDANS at cys107. However, the CD spectra indicated no significant change in the secondary structures of CaBD upon metal binding. Stopped-flow

spectrometry revealed a fast calcium dissociation from the N-terminal half, followed by a slow calcium dissociation from the C-terminal half. Using this data, combined with chemical stability studies, we concluded that the C-terminal half of CaBD has a higher calcium binding affinity, a higher chemical stability, and a slow calcium dissociation. The Mg^{2+}-bound CaBD was also investigated and the results indicate that its structure is similar to the apo form, but the rate of Mg^{2+} dissociation was close to that of calcium dissociation. Our data also suggest N- and C-terminal halves of CaBD are not completely structurally independent.

*** 16. Synthesis of cinnamaldehyde semicarbazones to explore their photochromicity**
Fortin, Stacy M., Murray, Kenzi M., Wysocki, Thomas J. and Treadwell, Edward M. Eastern Illinois University, Charleston, IL.

It has been reported that the semicarbazone of cinnamaldehyde, as well as its *o*- and *p*-methoxy derivatives, display photochromicity in the solid state. This relatively rare phenomenon has potential use in the design of optical switches and light modulating materials. Additionally, these compounds are simple to prepare, and are fairly resistant to fatigue. This project seeks to systematically study the steroelectronic and regioisomeric effects of various substituents off the aromatic ring, and the length of the olefin chain between the ring and imine, on the photochromicity. These substituted cinnamaldehyde semicarbazones can be easily prepared in only three steps. Commercially available aldehydes, such as piperonal, *o*-methoxycinnamaldehyde, and 9-anthraldehyde, were subjected to a K_2CO_3-initiated Wittig reaction with a protected formylmethylphosphonium salt to give 1:1 to 4:1 ratios of alkene stereoisomers, in 60% or higher yields. Acidic hydrolysis to remove the protecting group and conversion to the semicarbazones occurred with near quantitative yields. The UV-VIS and NMR spectra, as well as molecular modeling calculations, on these compounds will be presented.

*** 17. Domain-domain and protein-protein interactions in NADPH oxidase 5**
Reynolds, Nicole R., Wetherell, Kristen, Motl, Nicole, Dixon, Robert and Wei, Chin-Chuan. Southern Illinois University Edwardsville, Edwardsville, IL.

Superoxide generated by non-phagocytic NADPH oxidases (NOXs) is of growing importance for physiology and pathobiology. The overproduction of superoxide by NOX5 has been linked to disease development and cancers. NOX5 consists of a transmembrane heme domain, a flavoprotein domain, and a calcium binding domain (CaBD) that contains four EF-hands, with each binding to one calcium ion. It is hypothesized that the superoxide-generating mechanism of NOX5 involves Ca^{2+} binding to CaBD which induces conformational change, resulting in a binding surface for the flavoprotein domain, thus allowing for electron transfer from NADPH to FAD to heme, and to molecular oxygen. Furthermore, NOX5's sensitivity to calcium has shown to be enhanced upon calmodulin (CaM) binding. To investigate the CaBD-flavoprotein and NOX5-CaM interaction, here we expressed and isolated recombinant CaBD, flavoprotein, and a peptide (CP1) within the flavoprotein domain, and characterized them using fluorescence and isothermal titration calorimetry (ITC). Our preliminary data show that Cys-labeled AEDANS CaBD interacts with the flavoprotein, resulting in decrease in the fluorescence intensity. Several flavoprotein constructs ranging from 100 to 300 residues have been generated, which will be used to determine its CaBD binding sites.

*** 18. Study of the retention behavior and separation of explosives on reversed phase liquid chromatography using 1 butyl 3-methylaimmadazolium salt (BMIM) as mobile phase additives**

Heagy, Ashlie and Sharp, Stephanie. 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 the two aminodinitrotoluene isomers and two of the three dinitrotoluene isomers. To fully identify each of the 14 compounds, an additional HPLC run must be performed using a cyano column, leading to an increase in analysis time and sample handling complexity. These disadvantages have led to the search for alternative LC techniques to the traditional isocratic HPLC 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. Because of these particular properties, they are currently, of considerable interest in the separation and analysis. 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 and resolution of the explosives.

*** 19. Development of a Disposable Pipette Extraction (DPX) Method for the Trace Analysis of Common Propellant Powder Stabilizers in Gunshot Residue**

Lamb, Seth, Daughenbaugh, Timothy and Guan, Hongxia. Western Illinois University, Macomb, IL.

Determination of organic gunshot residues (OGSR) is critical to investigations that necessitate the association of GSR and firearms usage. Traditional methods for analysis of OGSR are based on liquid-liquid extraction, and solid phase extraction followed by GC (gas chromatography), LC (liquid chromatography), or capillary electrophoresis (CE) analysis. These sample preparation techniques, however, require many steps and increase analysis time. A simple and reliable analytical technique capable of performing extraction, concentration, and sample introduction is desirable for use in the forensic laboratory. Presented here is a novel solid-phase extraction technique using disposable pipette extraction (DPX). DPX's intrinsic mixing capabilities provide unsurpassed extraction efficiencies and equilibration times. The DPX methodology incorporates styrene divinyl benzene (SDVB) for reversed phase mechanisms, DPX-RP. Extraction of OGSR from finger using this technique achieved a sample preparation throughput on the order of a few minutes per sample. High performance liquid chromatography (HPLC) with UV detection was used for quantification, and comparisons of different columns are presented. The developed method exhibited an overall recovery of 80-100% for all of the common propellant powder stabilizers, with relative standard deviations of the recoveries below 10%, which indicates a good accuracy and precision of the proposed method.

*** 20. Effect of catechin on stability of nanoencapsulated vitamin K**

Teriveedhi, Vinod K. and Kouassi, Gilles K. Western Illinois University, Macomb, IL.

The stability of vitamins is a known concern in the food and pharmaceutical industries. Polyphenols are known to exhibit protective action against oxidation. In this study the protective effect of encapsulation and the antioxidant potential of catechin were investigated. Vitamin K was encapsulated into a dual polymer matrix composed of whey protein and guar gum. Minute amounts of catechin were added to K vitamin and the mixture was encapsulated into a whey protein/guar gum matrix using power ultrasound technique. The resulting emulsion was freeze-dried for 96 hours. A similar system was prepared without adding catechin. The sizes of the particles were investigated using atomic force microscopy, AFM. The amount of vitamin K effectively encapsulated was determined by extracting the surface vitamin using petroleum ether, and the total vitamin was extracted using hexane. The thermal stability of K vitamin was investigated by storing aliquots of the freeze–dried samples at various at 60°C at various times between 30 to 90 min. Thereafter the vitamin contents of the samples were monitored using high performance liquid chromatography, HPLC. It was found that 64% of the vitamin was effectively encapsulated into the matrix. HPLC results indicated that about 43% of the encapsulated vitamin was lost from the sample having no catechin compared to the sample containing catechin. This result shows that catechin prevented the degradation of the vitamin and could be used to improve formulation of foods or pharmaceuticals containing degradable vitamins.

Division: Environmental Science

*** 1. Degradation of Metolachlor in Drummer soil under different environmental conditions**

Kanissery, Ramdas G.[1] and Sims, Gerald K.[2] [1]Department of Natural Resources and Environmental Sciences, University of Illinois at Urbana-Champaign, Urbana, IL. [2]USDA-Agricultural Research Service, Urbana, IL.

Understanding the role of microorganisms and effect of environmental conditions on herbicide fate is critical for stewardship of herbicide use in cropping systems. As compared to the modernized perceptions of soil redox status, diminutive progress has been made in characterizing the impact of anaerobic micro sites and transient soil saturation on the biological fate of herbicides. Microcosm studies were undertaken to determine the dissipation of the herbicide [14C]metolachlor [2-chloro-N-(2-ethyl-6-methylphenyl)-N-(methoxy-1-methylethyl) acetamide] under aerobic and anaerobic environmental conditions in Drummer soil from Urbana, IL. Mineralized, aqueous, extractable and bound 14C-residues were quantified with LSC and characterized using HPLC and soil combustion. Soil redox and Fe(II) status were monitored throughout the duration of study. The half lives of the [14C] metolachlor under aerobic and anaerobic incubation were 30 and 20 days respectively. The disappearance of the herbicide from the anaerobic microcosm was evidently rapid till the detection of Fe (II) in the soil. Significant amount of unknown radioactivity was detected in both aerobic and anaerobic incubation which could be attributed to the presence of metabolites in the soil. Evolution of 14CO2 was noticed after the 8th day of incubation in both aerobic and anaerobic conditions and about half of the applied radioactivity was eventually incorporated as soil-bound residue under these soil conditions.

*** 2. Active and reserve soil acidity as influenced by N-fertilization and irrigation**
Pedigo, Trent M., McConnell, J. Scott, Altfillisch, Chad J., Nicioli, Stephanie M., Ribory, Karen E. and Sheppard, Donald R. Western Illinois University, Macomb, IL.

Soil acidity presents a complex production problem in the growth of plants. Excessive soil acidity may liberate plant toxic levels of manganese and aluminum, and interfere with nitrogen and phosphorus availability. Soil acidity is composed of active soil acidity (measured as soil pH) and potential or reserve acidity (replenishes active acidity). Anthropic produced soil acidity may be generated from the application of ammoniacal-nitrogen fertilizers, sulfur and sulfide fertilizers, and the removal of basic cations of the soil with crop harvest. Irrigation water with high salt content or high bicarbonate content is known to neutralize acidity and add basic cations to the soil, thereby reducing soil acidity. Studies to determine the effect of ammoniacal-nitrogen fertilizer treatments and high bicarbonate irrigation methods were conducted. Fertilization with ammoniacal-nitrogen was increased soil acidity. Irrigation with water high in bicarbonate was found to neutralize and decrease soil acidity

*** 3. Dynamics of soil nitrate-nitrogen distribution as influenced by long-term nitrogen fertilization and irrigation**
Altfillisch, Chad J., McConnell, J. Scott, Nicioli, Stephanie M., Pedigo, Trent M., Ribory, Karen E. and Sheppard, Donald R. Western Illinois University, Macomb, IL.

Nitrogen (N) fertilization is a potential source of environmental contamination. Long-term studies of cotton responses to N-fertilization and irrigation methods were utilized to determine soil nitrate-N. The irrigation blocks were: furrow (FI) and center pivot (CP), and a dry land (DL) control. Nitrogen treatments within each irrigation block ranged from 0 to 168.0 kg N/ha in 33.6-kg N/ha increments. Nitrogen treatments were tested for 18 years (1982-1999), discontinued for four years (2000-2003), and resumed in 2004. Significant differences were observed in nitrate-N in the FI and CP blocks, although the values and differences were too small to be practically importance. Distribution of nitrate-N in the DL block was dependent on interactions of sample depth with N-treatment. Greatest nitrate-N was found with 134.4- and 168.0-kg N/ha. Depletion of nitrate-N was evident in the surface 0.45 m of the 100.8- to 168.0-kg/N ha treatments in 2004.

*** 4. Comparisons of organic carbon content of native prairies and conventionally tilled soils in Illinois**
Ribory, Karen E., McConnell, J. Scott, Altfillisch, Chad J., Nicioli, Stephanie M., Pedigo, Trent M. and Sheppard, Donald R. Western Illinois University, Macomb, IL.

Carbon is a fundamental component of all living organisms, the atmosphere, non-living organic matter, fossil fuels, certain minerals, and dissolved gases and solutes in water. Carbon is dynamic in the environment and readily moves among different forms. Atmospheric carbon dioxide is increasing rapidly raising concerns regarding global warming. A potential way to reduce atmospheric carbon dioxide is to increase the amount of atmospheric carbon held in soils. As these plants die, some of the carbon is retained in the soil as decaying organic matter. The reported research examines five native prairies and compares the soil organic carbon content with analogous soils under crop production and cultivation. The organic carbon content of the soil samples was determined using oxidation titrations, and compared using analysis of variance

techniques. These results indicate more organic carbon was retained in the native prairies than in the cultivated soil, and is an effective carbon sink.

*** 5. Phytoplankton assessment of the Calumet and Little Calumet Rivers with an emphasis on seasonal changes and nutrient relationships**

Bertucci, Angela M. , Potluri, Devi Prasad V., Bell, Timothy J. and Richter, Robert C. Chicago State University, Chicago, IL.

This study is aimed at providing insight into the phytoplankton populations of the Calumet and Little Calumet Rivers. The work included assessment of biodiversity of phytoplankton and their relationships with nutrient and physical parameters. There is scant information available on phytoplankton in the Calumet River system. Monthly water samples from the two rivers were collected at four locations from May to October 2009. Algal species were identified at each site. Water pH, temperature, dissolved oxygen, turbidity, conductivity, nitrate, and ammonium were measured at the time of each sampling. Phosphorus, sodium, potassium, magnesium, calcium, iron, copper, zinc, and manganese were measured with inductively coupled plasma mass spectrometry for each sampling. A total of fifty six phytoplankton species were identified during the study, with Chlorophyta being most diverse group over all while Dinophyta and Euglenophyta were the least diverse groups. Significant positive correlations were observed for the overall May and August samples between algal diversity and nitrate, ammonium, and phosphorus. There was a significant positive correlation between Fe and total number of algal species at one of the four sites. Nutrient levels barely reached mesotrophic status. These results will be discussed in relation to overall Calumet River ecosystem.

*** 6. Stable Isotopes of Nitrogen and Carbon in Collagen from Modern and Archeological Animal Bone from the Illinois River Valley**

Little, Kayla, Brugam, Richard B., Holt, Julie Z., Kohn, Luci and Vogel, Gregory. Southern Illinois University Edwardsville, Edwardsville, IL.

Stable isotopes of nitrogen and carbon can be used to reconstruct food sources of animals. We did a preliminary study of the isotopic composition of bone collagen samples from archaeological sites of Native Americans and early Illinois settlers. We compared the archaeological samples with modern samples to understand long-term environmental change. Humans have altered the natural habitat of the Illinois River disrupting it with dams, levees, and additions of human sewage so we might expect changes in isotopic composition of aquatic organisms from the river over time. Our study establishes the validity of the stable isotope approach to understanding long-term environmental change in the Illinois River. The largest and oldest archaeological sample examined comes from early Holocene strata at Koster, which lies at the base of the bluff. Samples were also examined from two sites located in the floodplain proper, Carlin and Kamp House. Carlin samples date to the later Holocene (ca. AD 500), while the Kamp House samples were recovered from a 19th century privy.

*** 7. Evaluating Storm Water Runoff of Green Roofs with Varying Growth Medium and Species Composition**

Hilligoss-Volkmann, E.[1], Jost, V.[2], Luckett, K.[3], Morgan, S.[1], Celik, S.[1] and Retzlaff, W.[1]
[1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]Jost Greenhouses. [3]Green Roof Blocks.

Storm water runoff has become a significant environmental concern. Impervious surfaces that result from growing urbanization are rapidly replacing green spaces. This landscape of impervious surfaces can interfere with natural systems; storm water runoff in developed areas can be increased by as much as 90% (Mentens et al. 2005). Municipalities are struggling to keep up, especially with the fluctuation in runoff volumes. Green roof systems may pose a solution to the problem by retaining water in the pore spaces of the growth media and providing for increased evapotranspiration of storm water (Dzombak et al. 2005). Since roofs account for 40-50% of impervious surfaces in developed areas, green roofs can be installed on the existing roofs and no additional space would be affected (Mentens et al. 2005). I have analyzed plant growth and storm water retention of green roof systems containing Coal Bottom Ash, Hadite, Lava, Pumice, and Stalite growth media since October 25, 2008. Green roof coverage by Sedums growing in Coal Bottom Ash blends was only 6.48 and 2.32 percent after one year – indicating that organic content of the media blends was too low. Green roof systems with Coal Bottom Ash growth media blends (36.6 and 34.2%) retained more storm water than control roofs (17.9%). It remains to be seen whether Coal Bottom Ash is a viable growth media component for green roof systems.

*** 8. The effect of duckweed removal on the biogeochemistry of an urban riparian marsh**

Craig, Matthew E. and Lepore, Jessie A. Augustana College, Rock Island, IL.

The study was conducted in a duckweed-dominated urban riparian marsh along the Rock River. To study the effects of duckweed removal, enclosed experimental chambers were placed in the wetland and duckweed was removed from half of them. Dissolved oxygen, conductivity, nitrate concentrations, ammonia concentrations, ammonium concentrations, pH, temperature, light, and depth were monitored in the chambers every few days. Sediment samples were collected at the beginning and end of the experimental period to determine relative rates of nitrification. At the end of the experiment, a most probable number method was used to estimate the amount of nitrifying bacteria in each chamber. Shortly after the treatments were established, the pH of treatments with no duckweed began to increase. On some days, the difference between the pH of the two treatments was significant, perhaps due to an increased consumption of dissolved CO_2 by primary producers in the water. Some of the treatments with no duckweed showed signs of significant algal growth, likely a result of less competition within the chamber. Higher levels of dissolved oxygen accompanied the growth of algae in some of the chambers.. An effect of duckweed on nitrification or nitrifying bacteria populations was not demonstrated. This may be a result of constraints on the experiment or the heterogeneous environment of the marsh.

*** 9. Evaluating the environmental benefits of green wall systems**

Ostendorf, M.[1], Thompson, K.[1], Woolbright, M.[2], Morgan, S.[1], Celik, S.[1] and Retzlaff, W.[1]
[1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]Green Wall Ventures, LLC.

Eighteen circular (7-foot diameter) green walls (donated by Hercules Manufacturing of St. Louis) have been located on the SIUE campus. The project is designed to evaluate the

environmental performance of green wall systems planted with five Sedum species and one unplanted wall on north, south, east, and west wall aspects. We have determined that plant surface temperatures are less than wall block surface temperatures while the growing medium (Ameren Bottom Ash) has the greatest surface temperature. North and east wall aspects have the lowest afternoon surface temperatures - more than 25 degrees F lower than west and south aspects. Plant growth also varies by wall aspect – wall coverage is greatest by Sedums planted on west wall aspects. In a preliminary storm water saturation test in fall 2009, we determined that storm water runoff was delayed in a planted green wall compared to a non-planted green wall. Our evaluation so far indicates that living wall systems have the potential to reduce urban heat flux and storm water runoff.

*** 10. Evaluating the thermal performance of residential green roof systems**

Murphy, D.[1], Ferando, B.[1], Luckett, K.[2], Morgan, S.[1], Celik, S.[1] and Retzlaff, W.[1]
[1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]Green Roof Blocks.

In order to determine the thermal performance of residential green roofs, eighteen shingled roof models were constructed at three different slope angles, 1˚, 20˚ (5/12), and 40˚ (10/12). A modular green roof system designed for residential roofs was installed on nine of the roofs. The roof models were divided into three replications in a completely randomized design. Each replication includes two roofs at each slope angle, one of which is fitted with a green roof and the other a conventional shingled roof model. The green roofs were planted with mixed plantings of seven Sedum species: S. kamtschaticum, S. reflexum, S. sexangulare, S. album, S. spurium, S. floriferum 'Weihenstaphaner Gold', and S. immergrunchen. Temperatures of the undersides of each of the eighteen roof decks were monitored at midday once a week for five months. We have determined that the green roofs were significantly cooler than the conventional roofs during this study period. We also found that the 1˚ slope was cooler than the other two slope angles on three measurement dates for the conventional shingled roof models and on one measurement date for the green roofs.

*** 11. Invasive Weed Species on a Midwestern Green Roof**

Greeling, B.[1], Krutsinger, R.[1], Jost, V.[2], Luckett, K.[3], Morgan, S.[1] and Retzlaff, W.[1] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]Jost Greenhouses. [3]Green Roof Blocks.

The study of green roof systems in the Midwestern region has focused extensively on determining the plant species most suitable for growth in rooftop conditions. The project goal for this study is to identify the diversity of weed species that are found on a green roof after it is installed. A 16,000 ft² green roof was established on the Student Success Center at Southern Illinois University Edwardsville. The green roof was planted April of 2009 with 5 Sedum species and installed in August 2009. Three replicate test plots were selected in different rooftop locations – an east roof edge, a west roof edge, and a center plot. Each plot consists of four sections of ten Green Roof BlocksTM each based on their clipping cycle; in one section all weeds (non- Sedum species) are clipped every two weeks, in the second all weeds are clipped every four weeks, in the third all weeds are clipped every six weeks, and the fourth section is left unclipped. Twenty-one non- Sedum species were clipped (collected) for the period October 2nd through December 18th, 2009. We are in the process of identifying the genus and species of these invasive weeds. We will continue to follow this project to determine if weed invasiveness impacts the establishment (roof coverage) of a green roof.

*** 12. Evaluation of Aboveground Weed Biomass on a Midwestern Green Roof**

Krutsinger, R.[1], Greeling, B.[1], Jost, V.[2], Luckett, K.[3], Morgan, S.[1] and Retzlaff, W.[1] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]Jost Greenhouses. [3]Green Roof Blocks.

The study of green roof systems in the Midwestern region has focused extensively on determining the plant species most suitable for growth in rooftop conditions. The project goal for this study is to identify the biomass of weed species that are found on a green roof after it is installed. A 16,000 ft² green roof was established on the Student Success Center at Southern Illinois University Edwardsville. The green roof was planted April of 2009 with 5 Sedum species and installed in August 2009. Three replicate test plots were selected in different rooftop locations – an east roof edge, a west roof edge, and a center plot. Each plot consists of four sections of ten Green Roof BlocksTM each based on their clipping cycle; in one section all weeds (non- Sedum species) are clipped every two weeks, in the second all weeds are clipped every four weeks, in the third all weeds are clipped every six weeks, and the fourth section is left unclipped. The aboveground biomass of each non- Sedum species found in each section was determined and the total aboveground biomass found in all sections was evaluated for the period October 2nd thru December 18th, 2009. For this growth period, aboveground biomass in the 2, 4, and 6 week clipping-plots were not different. The total aboveground biomass clipped during this period was 137.73 grams. We will continue to follow this project to determine if weed invasiveness impacts the establishment (roof coverage) of a green roof.

*** 13. Storm Water Retention of Green Roof Models Planted with Mixed Sedum Plugs**

Kelleher, J.[1], Jost, V.[2], Luckett, K.[3], Morgan, S.[1], Celik, S.[1] and Retzlaff, W[1]. [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]Jost Greenhouses. [3]Green Roof Blocks.

Storm water runoff is a serious environmental concern, created by discharges generated by precipitation and runoff from land, impervious surfaces, building rooftops, and other surfaces (USEPA 2007). Green roof systems are an established vegetative cover on a building rooftop that replaces the ecological footprint lost when the building was constructed. Research has shown that green roofs absorb, filter, retain, and store storm water, decreasing the quantity of runoff by as much as seventy-five percent (Femp 2004). Green roof models were first established at the Southern Illinois University Edwardsville Environmental Sciences field site in 2005. In this long-running experiment, green roof systems planted with Sedum immergrunchen retained more than 80% storm water runoff during the 2007 growing season (Woods et al. 2009). The objective of my study was to evaluate the performance of green roof systems planted with a mixture of seven Sedum species and compare the storm water retention to that from green roofs established previously with a single Sedum species. During 2009, storm water retention of green roof models planted with mixed Sedum plugs did not vary by growth media depth, but storm water retention was greater than control roof systems. However, storm water retention of green roof models planted with mixed Sedum plugs in 2009 retained less storm water than green roof models planted with Sedum immergrunchen in 2005. It remains to be seen as the green roof systems with mixed Sedum species become more established whether species composition will impact green roof storm water runoff.

*** 14. Evaluation of Inquiries about the UIS Environmental Studies Online Master's Degree Program**

Killam, Lenore, Wei, Hung-Lung and Ruez, Jr., Dennis R. University of Illinois at Springfield, Springfield, IL.

The Department of Environmental Studies at the University of Illinois at Springfield offers a fully online MA degree with a concentration in Sustainable Development and Policy. The Department has collected information on nearly 1300 inquiries to the online coordinator about the online degree program since its inception in 2006 through the end of 2009. Of the persons filing inquiries, 821 provided addresses within the US. Approximately half of these inquiries are from just six states: Illinois, California, Florida, Pennsylvania, New York, and Texas. Overall, there is a highly-significant, and strong, correlation between the population of states and the number of inquiries from the state. This finding has implications for the targeting of advertising and recruitment efforts for online programs. Although this should perhaps be expected of an online program, there is little documentation. Because inquiries are typically submitted months before the applications, inquiries can be used to estimate the number of future applicants. Approximately 7% of the persons inquiring later applied, but this is likely a slight underestimate resulting from our time interval used. Approximately 60% of the applicants submitted inquiries to the online coordinator prior to filing their applications. This underscores the importance of not only our online presence and resources, but that of the human element; even students intending to take courses online seek out a human presence for questions.

Division: Health Sciences

*** 1. Respiratory effects of 8-cyclopentyl-1.3-dipropylxanthine in newborn rats**

Marcelin, Alain C. 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 act by antagonizing adenosine receptors. They are known to stimulate respiration in infants who are at risk of apnea spells, but they also cause unwanted side effects, such as cardiostimulation. A related drug, 8-cyclopentyl-1,3-dipropylxanthine (DPCPX), is highly selective for antagonism of adenosine A1 receptors in the brain. It is proposed that a selective adenosine A1 antagonist can stimulate respiration in infants without the unwanted side effects caused by caffeine and theophylline. The effects of DPCPX 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 s.c. dose of DPCPX (80, 160, 320, or 640 ug/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), and mean inspiratory flow (MIF) gradually decreased over time after saline treatment. The highest dose of DPCPX (640 ug/kg) significantly increased VE and MIF compared to saline controls.

*** 2. Small molecule analogues of schizozygane indoline alkaloid as potential antimicrobial agents**

Schwarm, Sam, Nieto, Marcelo, Mercado, Reesa and McCracken, Vance J. Southern Illinois University Edwardsville, Edwardsville, IL.

Antimicrobial agents are used everyday across the world. However, they are often used incorrectly and this can cause the microorganisms to become resistant to these agents. This has created a need for new antimicrobial agents to be discovered. Our objective is to find new antimicrobial agents by synthesizing small molecule analogues of the active molecule found in *Schizozygia coffaeoides*; a plant that is known to have antimicrobial activity. The series of compounds was prepared by solution phase parallel synthesis (SPPS). The characterization and quality control was completed by using NMR, LCMS, IR, and m. p. of representative samples. The minimum inhibitory concentration (MIC) was determined for each compound against some representative microbes. This will be done to attempt to achieve the most potent compound possible. The overall goal of this research is to discover an antimicrobial agent that can be used to help fight infection in both people and animals.

Division: Microbiology

*** 1. Utilization of bioelements and carbohydrates in an acidophilic consortium comprising of suspected nitrogen fixer**

Khan, Mohammed A. W. and Hung, Kai F. Eastern Illinois University, Charleston, IL.

Extremophiles are organisms which thrive in hostile conditions that are otherwise detrimental to most life forms. For example, acidophiles require pH < 4 for growth. An unclassified acidophilic community comprising of fungi and prokaryote(s) that seem to share a mutualistic relation has been isolated. Interestingly, this community grows in a basal medium (0.1% (w/v) glucose, pH 1.0 with sulfurate), which lacks detectable levels of organic nitrogen, suggesting that nitrogen fixation is taking place. Some of the common cofactors from different nitrogenases, e.g. manganese, molybdenum, iron, and vanadium, are being examined for their effects on the growth of the acidophilic community. Preliminary data suggest that Mn(II) (0.2 micromolar to 0.1 millimolar) promotes growth, whereas Fe(II) and Mo(VI) do not. In addition to metal ions important to nitrogen fixation, the effect of phosphate for growth is also being examined. Preliminary results show that basal medium supplemented with 1 micromolar to 0.1-millimolar potassium phosphate supports growth better than control medium containing 0.1% (v/v) yeast extract or peptone. Furthermore, different carbon sources are being examined for their effects on the community's growth. Early results indicate that starch and glucose support growth, while sucrose and lactose do not. Additional carbohydrates will be examined as well. Finally, interactions between metal ions, phosphate, and carbon sources will also be investigated. Results from these studies will shed light on how acidophiles thrive in their ecological niche.

*** 2. Using PCR amplification to investigate nitrogen fixation in a novel acidophilic community**

Flowers, Samantha L. and Hung, Kai F. Eastern Illinois University, Charleston, IL.

In 1990, the Environmental Protection agency allowed scientists to explore a pyrite mine located in California which had been closed since 1962. Upon investigation, scientists found not only the most acidic waters discovered in the environment (pH -3.6), but also a myriad of organisms

which thrive in these conditions. A group of these unknown organisms composed of a fungus and prokaryotes were isolated from these waters, and have become the focus of research. These acidophiles can be cultured in laboratory conditions without the addition of organic nitrogen. Nitrogen is the most abundant gas within our atmosphere, but it is also unusable in this form unless fixed into more usable forms. The process of nitrogen fixation requires an immense amount of energy, and is only performed by certain prokaryotes. Therefore, the hypothesis is that a member of this community is capable of fixing nitrogen. Our research aims to employ PCR amplification, ligation, and transformation to test for the presence of the marker gene nifH, which has been conserved through all prokaryotes able to fix nitrogen. Amplified products will be sequenced and the data analyzed using bioinformatics tools. If our hypothesis proves correct, this data can be used not only to further understand the dynamics of the community, but also could shed light on the process of nitrogen fixation in such a hostile environment.

*** 3. Investigating the nitrogen fixing capacity of an acidophilic microbial community using PCR**

Janezic, Kristopher J. and Hung, Kai F. Eastern Illinois University, Charleston, IL.

Nitrogen is the most abundant element found in Earth's atmosphere. Not only is it the most abundant element, it is also the main component for the building blocks of life. There are a few prokaryotes that are capable of converting atmospheric nitrogen into usable forms through a process called nitrogen fixation. Often, these organisms form mutually beneficial symbiotic relationships with eukaryotes, such as legumes. The Richmond Mine, an abandoned pyrite mine, is host to the most acidic water known anywhere in the environment (pH -3.6). Despite the highly acidic water, organisms that thrive in this condition were discovered. A group of unknown organisms composed of a filamentous fungus and some prokaryotes has been isolated from these mine water. Since this consortium grows in laboratory conditions without detectable levels of an organic nitrogen source, we hypothesize that one or more of the members in this consortium is a nitrogen fixer. To test the hypothesize, Polymerase Chain Reaction (PCR) technique will be used to amplify a portion of the nifH gene. The nifH gene codes for nitrogenase, an enzyme that is conserved in all known nitrogen fixers. Primer pairs that are specific to different homologs of nifH based on prokaryotic phylogeny will be tested. Analyses of the size of amplified products will be done using agarose gel electrophoresis. Once amplified products of expected size (~370 bp) are identified, sequencing will be performed following subcloning. Results of the PCR optimization and sequence analyses of products will be presented.

*** 4. A mutant *E. coli* strain that can outcompete wildtype in a rich medium**

Barrett, Kimber and McCommas, Steven. Southern Illinois University Edwardsville, Edwardsville, Illinois.

Dietary fiber promotes health by reducing the risk of colon cancer and levels of cholesterol. Insoluble fiber can head through the intestines, while soluble fiber attaches to fatty acids. Soluble fibers are large complex carbohydrates (polysaccharides); mitogenic lectins that bind to soluble fiber molecules cannot bind to epithelial cells, which may substantially reduce colon cancer risk. In our experiment we chose to use a model organism (*E. coli*) that could digest a variety of carbohydrates and create an isogenic mutant that makes it better at utilizing galactose. I have been working with wild type (MG1655) and mutant (RDF3), letting them grow in a complete medium (LB Broth). My goal is to compete the two strains in this rich medium, without galactose, and see which one grows faster. Thus far, my mutant strain has proven to be

better than the wild type in this environment, suggesting that our hypothesis is correct that a single, simple mutation could give a new strain a real advantage over its ancestor.

*** 5. Colon cancer occurrence and dietary fiber: Example of a mutant strain of *E. coli***
Williams, Simone and McCommas, Steven. Southern Illinois University Edwardsville, Edwardsville, Illinois.

Colon cancer is a common cancer, affecting approximately seven percent of the USA population. The link between diet and cancer incidence is relatively high as diet is indicated as one of the primary environmental factors related to cancer. It has been proposed that eating a diet high in dietary fiber has protective effects against colon carcinogenesis. However, it is plausible that over a person's lifetime, normal flora in the colon can mutate and compete with wild type bacteria, digesting dietary fiber more effectively and consequently diminishing the preventative effects of dietary fiber. The objective of our research is to study the properties of such a mutation by using a simplified model system of *E. coli* and an in vitro environment that substitutes for the human colon. Wild-type *E. coli* (MG 1655) and its isogenic mutant (KR11) were subjected to a series of competition experiments to determine how the two strains would perform in liquid culture using a rich medium, Luria Bertani broth. The numbers of each of the strains was determined by the number of red colonies (MG 1655) and white colonies (KR 11) on MacConkey plates. Results show that after only a couple of cycles MG1655 is able to outperform KR11.

*** 6. *E. coli* strain MG1655 growth in complete medium compared to mutant strain KR4**
Stehlin, Courtney and McCommas, Steven. Southern Illinois University Edwardsville, Edwardsville, Illinois.

Previous studies have suggested that consuming a high fiber diet may lower the risk of developing colon cancer. *E. coli*, a very well characterized bacterium that can be found in the human gut, has many mutant strains and some of these may be better at digesting fiber than the wild type. If so, they might reduce the beneficial effects of fiber. For this study, two strains of the wild type, MG1655, and a spontaneous mutant, KR4 - are grown together in a complete medium (Luria-Bertani broth) and then are counted to see the number of cells that each strain grows It was found from these experiments that the wild type, MG1655, grew better than the mutant in this environment. Having established this, we are now ready to introduce a novel carbohydrate source (representing dietary fiber) and determine if it is feasible for a mutant to displace its ancestral strain.

***7. Competition of wild-type *E. coli* strain, MG1655, and mutant JS15**
Wu, Precious and McCommas, Steven. Southern Illinois University Edwardsville, Edwardsville, Illinois.

Dietary fiber is the portion of food that the body cannot digest or absorb, but has a significant role in human health, such as reducing the risk of colon cancer and lowering cholesterol levels. *Escherichia coli* is one of the naturally occurring bacteria that resides in the digestive tract. If a mutant *E. coli* strain were to overtake its wild-type in the digestive tract, the mutant's characteristics may differ, and possibly digest too much of the dietary fiber. If this were to happen, the benefits of dietary fiber may be reduced. A series of competition experiments were conducted to determine if the mutant strain of *E. coli*, JS15, would out-compete the wild-type,

MG1655 in vitro. The strains were grown together in Luria-Bertani broth overnight, then serially diluted and counted on MacConkey agar plates (which differentiates the two strains). The data show that the MG1655 and JS15 mutant strains are growing equally in competition, but further experimentation is being conducted.

*** 8. Evaluation of potential antimicrobial effects of heterocyclic compounds on microbial growth**

Mercado, Reesa D., McCracken, Vance J. and Nieto, Marcelo J. Southern Illinois University Edwardsville, Edwardsville, IL.

Before antibiotics, people died from bacterial infections and diseases. Together, they accounted for one-third of all deaths. Antibiotics revolutionized modern medicine by controlling bacterial growth, treating bacterial infections, and alleviating human suffering. Unfortunately, bacterial resistance is rapidly emerging. The answer to drug resistance is to develop new drugs and find new targets in bacteria. Heterocycles are privileged structures that exhibit a wide range of biological properties. To enhance these properties, different substituents were added to the base molecule. The series of heterocyclic compounds were designed, synthesized, and tested for antimicrobial activity. Minimum inhibitory concentrations (MICs) of these series against Gram negative (*Escherichia coli*; ATCC 25922 and *Pseudomonas aeruginosa*; ATCC 27853) and Gram positive (*Staphylococcus aureus*; ATCC 25923 and *Enterococcus faecalis*; ATCC 29212) bacteria were determined using microbroth dilution methods. A two-fold serial dilution was performed for all test compounds, obtaining concentrations ranging from 128 mg/L to 0.125 mg/L. Bacteria were also tested against a standard antibiotic, tetracycline. Tetracycline had the expected MIC according to published values for each bacterium. Some test compounds did not show inhibition, but others inhibited microbial growth at the highest concentration of 128mg/L. These compounds did not exhibit significant antimicrobial growth. The information from these studies will assist in the further design of additional test compounds with different substituents.

*** 9. Competing *E. coli* mutant strain LB9 and wild type strain MG1655**

Garcia, Maria and McCommas, Steven. Southern Illinois University Edwardsville, Edwardsville, Illinois.

A mammal's diet contains lectins; lectins resist digestion and may cause biochemical changes in intestinal cells that may that lead to colon cancer. Soluble fiber binds to lectins and cleanses the body of them. If a mutant *E. coli* strain can take over in the gut, it can potentially digest the soluble fiber too well, having detrimental results. This study was conducted in order to experimentally determine if a mutant *E. coli* strain could beat out the wild type strain in vitro; if it can, the mutant strain would be the only strain left after a period of competition experiments. The competition experiments would force the wild type strain MG1655 and mutant strain LB9 into a process of natural selection. Single colonies of the two strains were grown on Luria-Bertani (LB) agar plates. A colony of each strain was then transferred and grown in LB broth. After allowing the bacteria to grow in the LB, an equal amount of each strain was transferred into another test tube containing fresh LB and the competition took place. Samples were then serially diluted and counted on McConkey agar plates which differentiated the strains. The data show that under these environmental conditions, the wild type grows faster than this mutant.

*** 10. Supplementation of high-fat diet with hyperimmunized egg decreases inflammation in diet-induced obese mice**

Castre, Erin M. and McCracken, Vance J. Southern Illinois University Edwardsville, Edwardsville, IL.

Obesity has reached epidemic proportions for both adult and juvenile populations. Obesity is associated with chronic inflammation, including a macrophage infiltrate in adipose tissue, as well as an increase in inflammatory markers such as IL-6 and TNF-α. Potential anti-inflammatory effects of a commercial hyperimmunized egg product were evaluated in a diet-induced obese mouse model of chronic inflammation. Diet and treatment groups included mice fed a low-fat diet (10% kcal from fat; control), a high-fat diet (HFD, 60% kcal from fat), HFD supplemented with 5% nonimmunized egg, and HFD supplemented with 5% hyperimmunized egg product. All groups fed HFD showed a greater percent change in body mass compared to the control group. An oral glucose tolerance test demonstrated that the hyper-immunized egg group had lower glucose levels from 0 to 60 minutes post-challenge compared to the non-immunized egg group, indicating decreased insulin resistance. RT-PCR from epididymal fat indicated an increase in TNF-α, IL-6, and Emr-1 (macrophage marker) in HFD alone and the nonimmunized egg groups. However, only TNF-α was increased in the mice fed hyperimmunized egg. These results indicate that hyperimmunized egg may protect from inflammation resulting from diet-induced obesity.

*** 11. Effects of hyperimmunized egg on intestinal microbial populations in diet-induced obese mice**

Ansteatt, Kristin A. and McCracken, Vance J. Southern Illinois University Edwardsville, Edwardsville, IL.

Obesity is a major risk factor for the development of type 2 diabetes, is known to induce local and systemic inflammation, and is associated with alterations in the intestinal microbiota. The aim of this study was to evaluate the effects of a hyperimmunized egg product on microbial populations in the gastrointestinal tract of mice fed high-fat diets. The diet and treatment combinations were: normal fat diet (10% of calories from fat) which was the non-inflamed control group, high-fat diet (60% calories from fat), high-fat diet + nonimmunized egg (5% w/w), and high fat diet + hyperimmunized egg pellet (5% w/w). Denaturant gradient gel electrophoresis (DGGE) and RT-PCR were performed on fecal DNA to measure diet-induced alterations in overall bacterial populations and specific microbial populations of the mouse gastrointestinal tract. DGGE revealed diet-dependent differences in bacterial populations, although the addition of egg had less pronounced effect. Comparison of fecal DNA using RT-PCR also revealed changes in bacterial populations between mice with varying diets.

12. The *Meiothermus ruber* (Thermales, Thermaceae) Genome Analysis Project – an authentic research experience for undergraduates in microbial genome analysis

Scott, Lori R.[1], Ghrist, Angela C. [2], Westemeyer, Blaine[1], Petersen, Max[1], Edison, Kristina[1], Sieg, Alex[1], Allibone, Kevin[1], Baumgartner, Angela[1], Curtis, Troy[1], Geison, Elizabeth[1], Lehpamer, Nicole[1], Sollenberger, Ryan[1], and Oldfather, Nicole[2]. [1]Augustana College, Rock Island, IL. [2]Scott Community College EICCD, Bettendorf, IA.

The *Meiothermus ruber* Genome Analysis Project is an offshoot of the Department of Energy-Joint Genome Institute's Genome Encyclopedia of Bacteria and Archaea (GEBA) project, a program whose goal is providing low-cost and readily accessible authentic research experience

to undergraduates in the field of microbial gene annotation. In this initial study, undergraduates used the DOE/JGI's online bioinformatics platform, called the Integrated Microbial Genomes Annotation Collaboration Tool (IMG-ACT,) to annotate 30 of 3000 putative genes in the *M. ruber* genome. All 30 open reading frames are predicted to be protein-coding genes, two of which showed evidence of possible horizontal gene transfer. In another component of this study, genomic DNA was isolated using Promega's Wizard SV Genomic DNA kit. The 16S rRNA region was amplified by PCR using universal 16S rRNA primers and confirmed to be from *M. ruber* using restriction enzyme analysis. Three genes were subsequently cloned into a pUC18 vector for future functional genomics studies.

*** 13. Competition between wildtype *E. coli* (MG1655) and a mutant strain (WRL2) derived from it**

Weekley, Heather and McCommas, Steven. Southern Illinois University Edwardsville, Edwardsville, Illinois.

There is much evidence that a high fiber diet can help decrease the risk of colon cancer and lower levels of cholesterol. However, the sugars in soluble fiber in the gut can be used as nutrition by bacteria, reducing the amount of fiber present and its beneficial effects. We are interested in the possibility of mutants arising that can utilize fiber more efficiently than their ancestors, thus lowering fiber levels even more. This experiment tests how well *Escherichia coli* wild type MG1655 and its isogenic mutant WRL2 compete against each other in a rich medium. We hypothesized that one of the strains would outcompete the other through several transfers into fresh medium. The results of the experiments support this hypothesis.

*** 14. Determining the nutritional requirements of the bile acid-metabolizing gut bacteria *Clostridium hylemonae* and *Clostridium hiranonis***

Huckaba, J'nai K. and Daniel, Steven L. Eastern Illinois University, Charleston, IL.

Clostridium hylemonae and *Clostridium hiranonis* are anaerobes that reside in the human gut and convert primary bile acids to secondary bile acids. Increased levels of secondary bile acids have been associated with gallstone disease and colon cancer. Resolving the nutritional requirements of these bacteria will provide insight into the factors which may regulate their activities in the gut. The goals of our study were to determine the vitamin and amino acid requirements of *C. hylemonae* and *C. hiranonis*. *C. hylemonae* and *C. hiranonis* were grown in an undefined medium (UM; yeast extract, glucose, minerals, metals, bicarbonate, CO_2 gas phase, and cysteine) at 37ºC. When both organisms were transferred from UM to a defined medium (DM; UM without yeast extract), growth was negligible. Only when DM was supplemented with vitamin and amino acid mixes was growth observed. The leave-one-out technique was used to determine the specific vitamin(s) and amino acid(s) required for growth by supplementing DM with the complete amino acid mix and vitamin mixes which lacked one of the vitamins and by supplementing DM with the complete vitamin mix and amino acid mixes which lacked one of the amino acids, respectively. Three vitamins (pyridoxal, riboflavin, and pantothenate) and three amino acids (methionine, valine, and tryptophan) were found to be required for growth by *C. hylemonae*. This approach is now being employed to resolve the nutritional requirements of *C. hiranonis*.

*** 15. Common herbs and household items tested for antimicrobial properties**
Ohrlund, Joel V. Millikin University, Decatur, IL

With new forms of resistant bacteria emerging, it is important to look for new antimicrobials. With that in mind, different household items were tested for antimicrobial activity. The items tested can be grouped into two different categories: oil solutions and water solutions. The oils used were camphor oil, marjoram oil, nutmeg oil, a mix of the above oils, and Oreganol. The water solutions were CureChrome, Ipecac, brown mustard seed, anise seed, hawthorn berries, and Yunnan Palyao. The seeds needed to be crushed in a mortar and pestle then mixed with water. The hawthorn berries and Yunnan Palyao came in capsules that were opened and the contents were mixed with water. CureChrome and Ipecac were already in a water based liquid state. All test subjects were evaluated with *Escherichia coli* using the paper disc agar diffusion method, the diameter of the zone of inhibition was measured in millimeters, and three trials were done for each substance. The results were compared to find the substance most effective at clearing the microbe, and are listed from greatest average clearing to least average clearing: Ipecac, 30.67 ± 3.0mm; CureChrome, 25.0 ± 2.0mm; Camphor oil, 15.9 ± 1.0mm; Oreganol, 12.5 ± 0.5mm; Oil mix, 10.3 ± 0.8mm; Marjoram oil, 5.83 ± 0.5mm; Nutmeg oil, 2.65 ± 1.0mm; Brown mustard seed, 2.1 ± 0.2mm; Anise seed, 1.8 ± 0.2mm; Hawthorn berries, 0mm. Yunnan Palyao was classified as indeterminate due to a microbe it contained. This information will hopefully spur more research into different household items and their antimicrobial properties.

Division: Physics, Mathematics & Astronomy

1. Detailed Computer Modeling of the Gas Law of Real Gases by Molecular Dynamics Simulation
Zou, Jie and Chastain, Michael. Eastern Illinois University, Charleston, IL.

Molecular Dynamics (MD) Simulation is a computational approach to the study of materials at the microscopic level. In this approach, atomic positions and velocities as a function of time are first simulated on a computer; material properties are then computed. Currently, undergraduate thermal physics is limited to the study of ideal gases, where the atoms are considered as point masses which move freely without any intermolecular forces except when they collide with each other and with the container walls. In this project, we carry out a detailed study of the gas law of real gases by MD Simulation taking into account the intermolecular forces. Undergraduate participation is a major component of this project. In our simulation, gaseous Argon is chosen as the system of interest and the Lennard-Jones inter-atomic potential is used to model the inter-molecular forces. Equations of motion of the atoms are solved using the Euler-Cromer method. An algorithm is developed to calculate the gas pressure assuming elastic collisions between the gas atoms and the container walls. To obtain the gas law, different temperatures are set up in the system by scaling the atomic velocities. At each temperature, the system is first allowed to equilibrate; the pressure is then calculated. The obtained gas law is compared to the ideal gas law and the van der Waals Equation of State. We report on the simulation procedure and the simulation results. The effectiveness of computer modeling and simulation in teaching and learning thermal concepts in undergraduate physics is also discussed.

Division: Zoology

*** 1. Avian community succession in bottomland forest restoration sites in the Upper Mississippi Alluvial Valley**

Harster, L., Minchin, P. R. and Essner, R. L. Southern Illinois University Edwardsville, Edwardsville, IL.

Bottomland hardwood (BLH) forest habitat is important as habitat for many species of wildlife and provides ecosystem services, such as flooding mitigation, improved water quality and nutrient cycling. This type of habitat is rapidly decreasing due to habitat fragmentation from farming and logging, making restoration efforts important and necessary. My research will utilize a series of BLH restorations carried out in the Upper Mississippi Alluvial Valley since the mid-1990s. I will examine changes in vegetation structure and the species composition, richness and diversity of avian communities in sites at different stages of restoration and in old growth reference sites, to reconstruct changes that occur over time. Bird communities will be quantified using point count methods and temporal changes will be analyzed using statistical modeling and ordination. The results will provide valuable information to land managers and conservationists in the region.

*** 2. Effects of Flooding on a Contact Zone Between Two Closely Related Killifish Species**

Gafford, A., Schoeneck, B. and Duvernell, D. D. Southern Illinois University Edwardsville, Edwardsville, IL.

The black-striped topminnow (*Fundulus notatus*) and the black-spotted topminnow (*Fundulus olivaceus*) are two closely related species that are distributed throughout the Mississippi drainage region. The two species differ in habitat preference with *F. olivaceus* typically preferring small headwater streams and *F. notatus* preferring larger rivers. Where habitats grade together the two species occasionally overlap. Field collections in 2007 and 2008 of Sexton Creek, a small tributary of the Mississippi River in southern Illinois, found that *F. olivaceus* was dominant in Sexton Creek while *F. notatus* was dominant in floodplain waters of the Mississippi River at the confluence with Sexton Creek. In 2008, the Mississippi River and Sexton Creek flooded for a prolonged period of time, changing an *F. olivaceus* preferred habitat into an *F. notatus* habitat. The purpose of this study was to determine if the distributions of these species responded to the environmental fluctuation caused by the flooding. The proportion of *F. olivaceus* individuals within the flooded portion of Sexton decreased significantly from 2008 to 2009, consistent with our hypothesis. This change in species distributions in response to flooding may have resulted from active dispersal of individuals of the respective species into and out of preferred and unpreferred habitat, or it could have resulted from a species bias in recruitment in the next generation within the region altered by flooding.

*** 3. Genetic study of hybridization and introgression between two topminnow species in an artificial stream system**

Anciulis, N.[1], Schaefer, J. F.[2] and Duvernell, D. D.[1] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]University of Southern Mississippi, Hattiesburg, MS.

The blackstripe topminnow (*Fundulus notatus*) and blackspotted topminnow (*F. olivaceus*) are closely related killifish species with broadly overlapping distributions throughout much of the southern and mid-western USA. In contact zones, where these species encounter one another in

their natural habitats, hybridization is rare, but the presence of multi-generation backcross individuals suggests that interspecific gene flow is possible. In this study we investigated the genetic contribution of F1 hybrid individuals in artificial streams that simulated natural contact zones. Streams were populated with two-week old larval individuals of both species and lab-reared F1 hybrids in summer of 2008. In spring of 2009 artificial spawning substrates were introduced and eggs were collected. The sexually mature parents and their eggs were genotyped to characterize the gene pools and identify parental, F1 hybrid and backcross offspring. A deficit of heterozygous genotypes was observed in the offspring relative to predictions based on the composition of adults in the streams.

*** 4. Marine vertebrates from the Upper Cretaceous in southeastern Colorado**

Nagrodski, M.[1], Shimada, K.[1] and Schumacher, B.[2] [1]DePaul University, Chicago, IL. [2]USDA Forest Service, La Junta, CO.

The Hartland Shale Member of the Greenhorn Formation is a sedimentary rock unit that was deposited under the middle of an epicontinental sea in North America, the Western Interior Seaway, approximately 94.3 million years ago (Upper Cretaceous: middle Late Cenomanian). Fossiliferous rock samples were collected from the Hartland Shale in southeastern Colorado in order to analyze the taxonomic composition of its vertebrate fauna. Vertebrate remains were extracted through acid treatment of rock samples. So far, 26 marine vertebrate taxa have been identified, including eight chondrichthyans (sharks and rays), at least 17 osteichthyans (bony fishes), and one marine reptile (marine lizard). Because the identified marine vertebrates are mostly carnivores, the trophic structure of the paleocommunity must have been complex.

5. Fossils of Illinois' Meekest: Ice age Rodents and Rabbits

Ruez, Jr., D. R. University of Illinois at Springfield, Springfield, IL.

There are more than 200 Pleistocene and Holocene vertebrate fossil localities in Illinois, but historically the research emphases were placed on the larger-bodied mammals. This is partly due to the relatively poorer record of smaller fossils, but also because larger animals are often perceived as more 'charismatic.' However, fossils of small mammals may be better for recreating paleoecological conditions, because of more confining environmental tolerances, and may also better allow for examination of changes at the population level, because of typically-larger sample sizes at individual localities. Here I review the published record of fossil rodents and rabbits of Illinois, and discuss the potential for future collections. Additionally, I provide examples as to the ability of these small mammals to help interpret paleoenvironmental and evolutionary patterns. Specifically, species-level diversity of small mammals correlates strongly to temperature, and other climatic values, in modern environments; application of these correlations to past environments is more appropriate for small mammals than for large ones, because the former did not experience the significant late Pleistocene extinctions. Population-level evolution can also be examined because large sample sizes, usually not available for large-bodied fossil mammals in Illinois, better show morphological variation, and include multiple age categories.

*** 6. Morphometric Analysis of Mandible Form in Family Mustelidae**
Jones, M. and Kohn, L. Southern Illinois University Edwardsville, Edwardsville, IL.

Natural selection will influence differences in skeletal form between closely related taxa. The mandible body and ramus experience both developmental and functional differences. Dietary differences have been shown to significantly influence mandible form. Selection due to dietary differences can differentially influence the functional regions of the mandible. We examined mandibles of four members of the Mustelidae: the Long-tailed Weasel (*Mustela frenata*), American Mink (*Mustela vison*), North American River Otter (*Lontra canadensis*), Badger (*Taxidae taxus*). All samples were from the collections of the Illinois State Museum or the Illinois Natural History Survey. Dimensions were measured from digital photographs. We tested for form differences in the mandible body and ramus across taxa, once mandible dimensions were adjusted for differences in size. Taxa were distinguished by differences in the premolar or molar regions, and in dimensions associated with the muscles of mastication. Overall similarities in mandible morphology are consistent with recent taxonomic similarities based on molecular data. Morphological distance based on mandible form largely reflects genetic distance, though also accounts for functional differences among taxa.

*** 7. Physics versus phylogeny in the North American sunfishes**
Miller, K., Hubbs, M. and Brunkow, P. Southern Illinois University Edwardsville, Edwardsville, IL.

Diversification in fishes has been mainly driven by changes in mouth functional morphology. A well-studied example of such diversification is found in the family Centrarchidae, with most studies focusing on comparing bluegill (*Lepomis macrochirus*) and largemouth bass (*Micropterus salmoides*). Differences seen between these two species are reflected in the morphology of lever elements responsible for opening and closing the lower jaw. However, species in the genus *Lepomis* are quite diverse morphologically and ecologically compared to those in *Micropterus*. We have expanded jaw morphological analysis to include green sunfish (*L. cyanellus*) and redear sunfish (*L. microlophus*). The experimental design used allowed *in situ* viewing of the lower jaw bones required to measure the opening and closing lever ratios. Green sunfish were found to have closing lever ratios intermediate between, but significantly different from, bluegill and largemouth bass as predicted, but their opening lever ratio was significantly higher than that for both largemouth bass (as predicted) and even bluegill (not as predicted). Redear sunfish were found to have intermediate jaw morphology for both closing lever ratio and opening lever ratio. Our results suggest that mouth functional morphology in *Lepomis* is more diverse than previously assumed. Future research will continue to expand analysis to other species in *Lepomis* to increase our understanding of how physics and phylogeny work in concert to diversify the ecologically important centrarchid sunfishes.

*** 8. Using insects to explore diversity and ecological connections: an assessment of student learning and interest**
Malone, K. B. and Fritz, A. H. Eastern Illinois University, Charleston, IL.

Using insects as a model, we designed and taught a module on ecological connections of the living world and organismal diversity. Utilizing a hands-on lesson, 5th and 6th grade students explored classification of insect orders and specialization of feeding structures specific to

different ecological niches. Student learning and interest were compared before and after participation in the module by scores on a pre-activity and post-activity assessment.

*** 9. Test of the monophyly of the subfamilies Perlinae and Acroneuriinae (Plecoptera: Perlidae Latreille 1802)**

Pessino, M.[1], Giordano, R.[2], Cameron, S. A.[1], and DeWalt, R. E.[2] [1]University of Illinois, Urbana, IL. [2]Illinois Natural History Survey, Champaign, IL.

Plecoptera (stoneflies) is an order of hemimetabolous insects usually associated with clean, cool running water. The presence of branched thoracic gills is diagnostic of the family Perlidae. Results from recent studies supported the clade Perloidea (Perlodidae, Chloroperlidae, Perlidae) and confirmed the division of Perlidae in the two subfamilies Perlinae and Acroneuriinae. However, one should regard this classification with caution because some members of the two subfamilies have biological characteristics that overlap extensively. In this paper we will test two hypotheses: 1) Is the monophyly of Perlinae and Acroneuriinae supported by molecular markers? 2) Are phylogenetic relationships between genera of stoneflies better explained by mitochondrial or nuclear markers? We have utilized three mitochondrial genes (12s, 16s and COII) and three nuclear genes (18s, 28s and H3). Three methods of phylogenetic inference were applied: Neighbor-joining distance method, Maximum Likelihood, and Bayesian inference. All tree topologies obtained from ML and Bayesian showed that Acroneuriinae and Perlinae are not monophyletic, but rather that Perlinae is a monophyletic clade within a paraphyletic group of Acroneuriinae. This result indicates that the subfamily circumscriptions need to be reassessed, and that some genera, such as *Dinocras* and *Hansonoperla*, may need to be reclassified.

10. Revision of the aquatic true bugs (Insect: Heteroptera) of the Crato Formation, northeastern Brazil

Tinerella, P. P. and Heads, S. W. Illinois Natural History Survey, Champaign, IL.

The Crato Formation of northeastern Brazil contains an ancient biota of Early Cretaceous age (~110 mya), representing some of the most exquisitely preserved arthropod fossils on the planet. Within this Gondwanan biota, composed of a diverse assemblage of vertebrates, invertebrates and plant life, the true bugs, or Hemiptera-Heteroptera comprise the highest familial-level diversity of the recorded arthropods. Much of the true bug diversity is represented by the aquatic bugs (Nepomorpha, Gerromorpha, Leptopodomorpha), which have previously lacked systematic study. Preliminary results are presented from systematic study and synthesis of Crato water bug material, focusing on identification and description of species and higher-level taxa, overall diversity, Gondwanan biogeography, and paleoenvironmental context.

*** 11. The effects of weather conditions on avian mortality at three television towers in central Illinois**

Lundstrom, L. A., Huschen, M. S., Gibson, J. A., and Horn, D. J. Millikin University, Decatur, IL.

Avian mortalities have been documented at television towers and other man-made lighted structures for over 150 years, and it is estimated that a minimum of 4-5 million birds are killed annually due to the impacts of lighted structures. We examined the effects of weather conditions on mortality at three television towers in central Illinois. Forty-three searches were conducted between August and November 2006-2009 with a total of 415 birds from 16 families found.

Most birds found were of Family Parulidae (59%), Family Emberizidae (9%), and Family Turdidae (9%). We found that more birds were killed following nights with winds from the north and greater than 50% cloud cover. Most studies of tower collisions have focused on lighting conditions rather than weather conditions; however, it is the combination of tower lighting and weather that plays the greatest role in avian mortality.

*** 12. Japanese Beetle (Coleoptera) Distributions in Soybean Fields**

Sara, S. A., Boersma, E. and Switzer, P. V. Eastern Illinois University, Charleston, IL.

The Japanese beetle, *Popillia japonica* Newman, was introduced into the USA in 1916 to New Jersey. Since then, it has extended its range west to the Mississippi River and is now well established in the eastern USA. The Japanese beetle is a serious pest of many agricultural and horticultural plants. Little is known about the distributions of Japanese beetles in agricultural fields which makes pest management all the more difficult. We studied the spatial distribution of Japanese beetles in soybean fields. In particular, we examined how distance from an edge, edge direction, and edge type affected the distribution of beetles. Twenty-five soybean fields were transected parallel with the field edges at varying distances from the field edges and sampled once during July or August 2009. An edge effect was discovered; beetle numbers decreased significantly with increasing distance to the field edge. The south sides averaged higher numbers of beetles than the west and north. Sex ratio and individual size did not vary with distance from the edge or edge type, but the egg loads of females increased with increasing distance from the edge. Differences in aggregation seeking behavior, in combination with movement in relation to wind and obstructions such as hedgerows are possible explanations for these spatial patterns.

13. The biology and phenology of an outbreak of Pine False Webworm (PFW), *Acantholyda erythrocephala* (L) (Hymenoptera: Pamphiliidae), in Central Illinois

Staples, J. K.[1] and Whitman, D. W.[2] [1]University of Southern Maine, Gorham, ME. [2]Illinois State University, Normal, IL.

The pine false webworm (PFW) (*Acantholyda erythrocephala* L.) (Pamphiliidae), is an invasive conifer defoliator of Eurasian origin that has recently been identified in large numbers at the Sand Ridge State Forest Preserve (SRSFP), in Mason County. This outbreak is the newest and most southerly large-scale outbreak of this forest pest reported to date in North America. Here we described the biology, phenology, and habitat characteristics of this insect at SRSFP. The PFW overwinter as larvae-like pronymphs in subterrarian cells. They pupate immediately after spring thaw and emerge from the soil as adults in mid-April. Adults live for ~ 1 week, during which females mate and lay up to 44 eggs on conifer foliage. At SRSFP, larvae feed gregariously, under silken webs for about one month, on white and red pine. Mature larvae drop the ground, enter the soil, and remain there for ~ 10 months. Demographic analysis suggests that that there are ~ 3 billion PFW at SRSFP, with densities of up 600 individuals/sq meter. During larval feeding some trees sustained up to 100% defoliation and crown death in the first part of the season. Without an active management program, this well-established population of PFW will persist for many years, not only threatening the unique ecology of SRSFP, but may also act as an epicenter for a larger regional level outbreak.

*** 14. Population trends of southern sea otters (*Enhydra lutris*) along a four mile stretch of coast in Big Sur, California**

Crane, N. L.[1], Mahoney, T. R.[2] and Dybas, L. K.[2] [1]Wildlands Studies Program, Santa Cruz, CA. [2]Knox College, Galesburg, IL.

In the 1700's sea otter populations experienced a severe decline due to overhunting for the fur trade. Sea otters are a keystone species currently listed as threatened under the Endangered Species Act. Uncertainty remains regarding why otter populations along the coastline are recovering slowly. In this study data from a long-term investigation on a resident population of sea otters off of a four mile stretch of coastline in Big Sur, CA were analyzed and compared to published data. The long-term study has been conducting annual late summer surveys since 1996, using a double blind survey method. This region encompasses about 1.6% of the known range of southern sea otters, is relatively pristine and protected, and experiences a minimum of the anthropogenic disturbances associated with lower quality nearshore aquatic environments. Although the population growth rates vary from year to year, with increases in some years and decreases in others, over the period of the study (1996-2009) the average growth rate is -.45%. This indicates a stable or slightly declining population growth rate, which is consistent with other published data. Results from this study suggest that this population is failing to successfully recover pointing to the need for continued research and management.

*** 15. The effects of circadian rhythm on the olfactory learning and recall ability of the common house cricket, *Acheta domesticus* (Insecta: Orthoptera)**

McDaniel, C. L., Robertson, M. and Watson, C. Millikin University, Decatur, IL.

The link between olfactory recall ability and circadian rhythm has rarely been investigated in invertebrate learning studies. To help fill this gap we conducted a study on the effects that circadian rhythm have on the olfactory learning and memory of the common house cricket *Acheta domesticus*. We conducted an initial odor preference test and confirmed that *A. domesticus* have an innate preference for vanilla. We then trained crickets to associate peppermint odor with a reward of water and vanilla odor with a punishment of 20% saline solution. Next, we tested the crickets' recall ability by presenting only the odors without rewards or punishments. We tested control crickets at 1900, when they are normally active; and experimental crickets at 0800, when they are not. Comparing the results of the initial preference trials to the learning trials revealed clear evidence of statistically significant learning among both groups of crickets to avoid the 20% saline solution punishment associated with the vanilla odor and to obtain the reward of water associated with the peppermint odor. However, the time of day did not have a statistically significant impact on the crickets olfactory recall ability or memory; i.e., the behaviors of control and experimental groups were statistically indistinguishable.

16. Freezing at a mild subzero temperature enhances survival of the gall fly, *Eurosta solidaginis*, to subsequent low temperature exposures

Haskell, S., Roberts, V., and Williams, J. Southern Illinois University Edwardsville, Edwardsville, IL.

Survival to a low temperature exposure was assessed at the tissue level on goldenrod gall fly larvae, *Eurosta solidaginis*, after being subjected to various mild freezing exposures. Fat body cells from larvae subjected to a 30 minute freeze at -20°C survived a subsequent 24 h exposure to -80°C at a much higher rate (58.7% survival) than cells from larvae exposed to only the low

temperature freeze (38.9% survival). To determine if the added protection from the mild freezing exposure was due to freezing or merely the temperature they were exposed to, a second experiment was performed that compared survival of fat bodies from larvae subjected to -80°C for 24 h after being either frozen at -5°C or held unfrozen at -5°C. The fat body from unfrozen larvae had slightly higher rates of survival to the -80°C exposure (49% survival) compared to those that were frozen at -5°C (43% survival) suggesting that high subzero temperature, rather than freezing itself may be conferring protection to a subsequent low temperature freeze. Data is currently being collected on winter survival and future spring development of whole larvae that were subjected to a mild freeze (-5 and -20°C) prior to being frozen at -40°C for 48 h.

17. Divergent embryological development in two closely related lubber grasshopper species (Family Romaleidae)

Stauffer, T. W. and Whitman, D. W. Illinois State University, Normal, IL.

We compared embryological development in two closely related species of lubber grasshopper: *Romalea microptera* from the Everglades marsh and *Taeniopoda eques* from the arid Chihuahuan Desert. In nature, each undergoes a 9-month egg stage. Our results show that in the laboratory at ~ 27C both species pass through a similar series of 23 different embryological stages. However, the two species differ dramatically in rate of embryological development and timing of egg diapause. *Romalea* begins development immediately after oviposition, continues until Stage 13 (~ 60 d), then diapauses for 3-4 months, followed by rapid completion of development and hatching at ~ 160 d. In contrast, *Taeniopoda* eggs diapause immediately after oviposition, and exhibit no visible embryological development until ~ 60 d prior to hatching, at ~ 240 d. These radically divergent embryological patterns may be adaptive in their respective habitats, allowing the eggs of each species to diapauses during the winter. Desert *Taeniopoda* lays immediately before winter, and its eggs have evolved to diapause immediately after laying. Everglades *Romalea* lays in mid-summer, and its eggs have evolved to diapause after ~ 60 d. The longer egg development time for *Taeniopoda* may also be adaptive, given that early hatching for this species would be lethal in the hot mid-summer drought of its desert habitat. Our results suggest rapid evolutionary divergence in egg development in these closely related species that live in very different habitats.

*** 18. Effects of shell orientation on drag experienced by *Elimia pototsiensis***

Miller, S. and Brunkow, P. Southern Illinois University Edwardsville, Edwardsville, IL.

Freshwater snails utilize a form of locomotion that is among the most energetically expensive in the animal kingdom. Given the numerical and functional significance of snails in streams and rivers, any factor which affects hydrodynamic drag experienced by snails may affect their energetic relationship with the rest of the ecosystem. And while drag forces have been measured in much larger marine snails, we know of no studies that have examined drag in freshwater snails. In this study, we used a terminal velocity assay to evaluate the effect of shell orientation to flow on drag experienced by shells of *Elimia potosiensis*, a locally abundant snail of Ozark streams and rivers. These snails are asymmetric in shape both longitudinally and laterally. Across three different velocity ranges, drag was significantly lower when shells were parallel with flow, regardless of whether flow interacted with the anterior or posterior ends of the shell. Drag was significantly higher when flow interacted with the left or right sides of the shell, but there was no significant difference in drag between sides. We hope to expand this analysis in the future by including a wider range of shell sizes and shapes.

19. Phenotypic plasticity in reproduction in the Eastern Lubber Grasshopper
Luong, M. H. and Whitman, D. Illinois State University, Normal, IL.

Phenotypic plasticity is the ability of individuals to alter their development, morphology, physiology, behavior, and life-history in response to altered environments. In some cases phenotypic plasticity can be highly beneficial in increasing survival and reproduction. We examined reproductive phenotypic plasticity in response to low nutrition in female Eastern Lubber grasshoppers, *Romalea microptera*, in the laboratory. Starved adult females delayed reproduction by shutting down reproduction and resorbing up to 92% of their developing primary oocytes. In contrast, healthy, well fed *R. microptera* resorbed only a quarter of their developing oocytes. Adult virgin females maintained at low density, with no male contact, resorbed fewer oocytes than females maintained at higher densities with males, suggesting that high densities or continual harassment from males also stressed females. The reproductive flexibility exhibited by females allows them to not only postpone reproduction during unfavorable periods, but to dismantle existing oocytes and recycled those nutrients for somatic maintenance during times of stress.

*** 20. Evaluating operant conditioning using positive reinforcement in the millipede *Orthoporus texicolens* (Diplopoda: Spirostreptida)**
Rigdon, B., Robertson, M. and Watson, C. Millikin University, Decatur, IL.

The ability of invertebrates to learn has been an increasing area of study in recent years. When compared to vertebrates, invertebrate species have simpler nervous systems. The simpler system allows for better viewing of the synapses and neural pathways that control behavior. Operant conditioning is a form of learning in which a consequence is used to modify a behavior. Because operant conditioning had never been studied in millipedes, we examined whether millipedes, *Orthoporus texicolens*, could be operantly conditioned using positive reinforcement. We evenly distributed 60 millipedes into control and experimental groups. We presented the control millipedes with an empty tube. For the experimental millipedes, we filled the tube with dark, moist substrate as a positive reinforcement. We subjected each millipede to 15 trials of up to 5 minutes, during which we recorded when and how often they entered and exited the tube. Although our data revealed no significant difference between the entry and exit times of the control and experimental millipedes, we did find that experimental millipedes entered the tube significantly more often than control millipedes (260 times versus 190 times, respectively, out of 450 trials per group). The latter results indicate that millipedes are capable of learning through operant conditioning.

*** 21. Even a bad dog has its day. Domestic dog (*Canis familiaris*) behavior and its effect on human attachment**
Stoune, J. A. and Thorn, J. M. Knox College, Galesburg, IL.

In the past, attachment was only applied to relationships with children and caregivers however, more recently, attachment to pets has been studied. Researchers have concluded that pets can serve as attachment figures but are not replacements for human relationships. In the present study pet behavior is correlated with owner attachment. Fifty participants completed surveys about themselves and their dogs. Of those fifty participants, the majority (34%) were between the ages of forty and forty nine and 74% were women. Human attachment to pets was classified

in four ways: secure, dismissing, preoccupied, and fearful. Owners were asked to choose the attachment type that best described them and subsequently score each of the four types of attachment related to themselves. As expected, there was a negative correlation found between dogs exhibiting aggression towards humans and attachment of the owner. Surprisingly, there was a positive correlation between owners who identify as having fearful attachment and dogs exhibiting owner directed aggression. These results suggest that pet behavior does have an effect on owner attachment however not in the hypothesized ways. Results like these have practical application in animal shelters. Owners who fill out a survey before adopting could be matched with a dog that exhibits behaviors complimentary to their attachment type. This process may eliminate owner surrenders and lead to more healthy human-animal relationships.

22. High temperature eliminates microsporidia pathogens from an insect host
Johny, S., Omer, A., Newgent, W., Elmer, K., Stoerger, R. and Whitman, D. Illinois State University, Normal, IL.

Some hosts have higher temperature tolerances than their pathogens and thus use high temperature from solar-basking to fight pathogenic infections. We tested the ability of heat to reduce levels of the pathogenic microsporidium, *Encephalitozoon romaleae,* infecting the grasshopper *Romalea microptera*. We subjected grasshoppers to 10 d of a repeating thermoperiod of 14 h of high temperature ($\leq 46^{o}$C), interspersed with 10 h of medium temperature ($\leq 38^{o}$C), combined with a daily 10-min acute heat shock ($\leq 53^{o}$C). Our results show a 99% reduction in spore count in heat-treated insects as compared to Control animals. In 56% of treated grasshoppers, we were unable to find a single spore, suggesting that heat treatment had eliminated the pathogen. In a 2nd experiment, we tested effects of acute heat shock alone. We maintained grasshoppers for 10 d under normal rearing temperatures of 32^{o}C (day)/28^{o}C (night), but subjected animals to 1, 10-min heat shock ($\leq 56^{o}$C) on each of Days 1, 4, and 7. We observed significant reduction (70%) in spore count, compared to Control animals; however, acute heat shock alone was not as effective at eliminating microsporidia spores as the combination of chronic + acute high temperatures. Our data imply that long periods of moderately high temperatures may be more effective at reducing pathogens than short periods of extremely high temperatures. Overall, our results support the hypothesis that cold-blooded animals can combat disease by behavioral increase in body temperature, and they suggest that pathogens could be reduced or eliminated in laboratory colonies using heat treatments.

*** 23. The Ticks of Illinois (Arachnida: Acari: Ixodida): A WWW Online Resource for Identification, Distribution, Biology, and Epidemiological Associations**
Jana, R. L., Tinerella, P. P., and Mateus-Pinilla, N. Illinois Natural History Survey, Champaign, IL.

Ticks include three families: Ixodidae, Argasidae, and Nuttaliellidae, with 800 known species worldwide. This study focuses on the approximate 15 species that are distributed in Illinois. Certain tick species are known vectors for diseases such as Rocky Mountain Spotted-Fever and Lyme disease. Both diseases are on the rise and are of increasing concern within Illinois. This study focuses on complete data processing of several thousands of historical and modern-day tick specimens retained in the entomology collections at the Illinois Natural History Survey. This research will contribute to a better understanding of tick distribution, ecology, and associations in Illinois. No such resource currently exists. Data processed will be used to generate on-line interactive identification resources, as well as tick species distribution maps of Illinois. These

maps will serve as useful models for comparing and predicting the distribution of tick-borne disease in Illinois. In addition, this research will be used to generate a comprehensive WWW-resource on tick biology and morphology for public use, while also serving as a 'clearing house' for information on the ticks of Illinois.

*** 24. Using Negative Reinforcement to Test Spatial Learning and Memory in the Orange Baboon Tarantula, *Pterinochilus murinus* (Araneae: Theraphosidae)**

Jesek, S. M., Robertson, M. W. and Watson, C. R. Millikin University, Decatur, IL.

We used negative reinforcement to test the spatial learning and memory of the orange baboon tarantula, *Pterinochilus murinus*. We subjected 50 tarantulas to 20 learning trials and 17 memory trials each. During the learning trials, control tarantulas (n = 25) went through a T-maze with both arms at room temperature. For experimental tarantulas (n = 25), we heated a copper plate on the floor of one of the arms of the T-maze (the incorrect side). During memory trials, we maintained both arms of the maze at room temperature. We conducted memory trials at regular intervals until 80 minutes after the final learning trial. We hypothesized that the control group would exhibit random selection of the arms, while experimental tarantulas would learn through negative reinforcement to select the unheated arm. We found that the choices of the control group were statistically consistent with random behavior, whereas experimental tarantulas showed statistically significant learning and were able to remember what they learned for up to 50 minutes after the final learning trial.

ORAL PRESENTATION ABSTRACTS

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

Division: Botany

*** 1. Can seed banks assist prairie restorations?**

Zylka, Jason[1], Molano-Flores, Brenda[2] and Whelan, Christopher[2]. [1]University of Illinois at Urbana-Champaign, Urbana, IL. [2]Illinois Natural History Survey, Champaign, IL.

A variety of non-prairie landscapes are returned to prairie on a yearly basis including pastures, crop fields, and unmanaged seral ground. Most of these restoration efforts do not take into account the seed bank associated with these non-prairie lands as a potential source of plant diversity. The main goals of this study are to examine the seed bank potential of these non-prairie lands and the relationship between above ground vegetation and seed bank composition. Six different land histories were surveyed for this study: remnant prairie, restored prairie, row crop, old field, historic pasture, and pasture recently converted from row crop at the Midewin National Tallgrass Prairie (Will Co., IL). In 2008, vegetation surveys and soil cores were collected in July and October, respectively, for a total of 30 sites (five sites per land history) and 600 soil cores (20 cores per site). In 2009, half of the collected soil cores were then grown in a greenhouse and the seedlings identified to species. The other half, were elutriated for an additional seed soil inventory. Results indicate that the seed banks vary per land history. In addition, the amount of species similarity between the seed bank and the above ground vegetation was minimal. Although seed banks may not reflect aboveground vegetation, they can provide a snapshot of past vegetation and restoration potential of a site.

*** 2. Determining zinc nutrition and toxicity for oogenesis of the brown algae *Macrocystis integrifolia* and *Saccharina japonica***

Hunt, Hayley C. and Lewis, Raymond J. Wheaton College, Wheaton, IL.

Zinc is both an essential nutrient and toxicant for many organisms. This study examines the effect of varying zinc concentrations on oogenesis in the microscopic gametophytes of two species of brown algae, *Macrocystis integrifolia* and *Saccharina japonica*. These large brown algae, or kelps, occur in near-shore waters of the Pacific Ocean. This study seeks to determine the optimal concentration for oogenesis by measuring the proportion of fertile gametophyte fragments and the number of eggs produced by these two species, and to determine toxicity to gametogenesis at higher concentrations. In a first trial, kelp gametophytes were grown in concentrations of zinc from 0 to 5.080 μM. In this range *S. japonica* responded to zinc more as a toxicant, with significantly lower fertility at the higher concentrations. *M. integrifolia* responded to zinc more as a nutrient, with significantly lower fertility at the lowest concentrations. Both species showed maximal oogenesis at the standard concentration for algal growth of 0.254 μM zinc. In a subsequent experiment *M. integrifolia* was cultured for 40 days without zinc and then at 0 – 16.25 μM zinc. The optimal concentration for oogenesis after starvation from zinc was much higher, at 8.164 μM. In a similar study *S. japonica* was starved from zinc and reintroduced at 0.254 – 101.6 μM zinc. The EC_{50} for zinc toxicity, determined by a probit analysis, was 31.8 μM for fertile fragments and 23.2 μM for oogenesis. This study shows that the production of gametes by kelp gametophytes is responsive to zinc both as a nutrient and as a toxicant.

*** 3. Development of scientific investigation skills among pre-service teachers**
Jacobs, K. A. and Koziarski, R. Chicago State University, Chicago, IL.

The National Science Education Standards state that science teachers should focus on "guiding students in active and extended scientific inquiry." A common deficiency among pre-service science teachers is the skills necessary to conduct sound scientific investigations that include testing hypotheses and analyzing data. Over the last three years, we have developed an open inquiry scientific investigation for pre-service biology, physics and chemistry pre-service students as part of the "Methods of Teaching Secondary Science" course. The investigation focuses on plant germination and requires students to work cooperatively to generate a question and hypothesis, define methods with independent, dependent and control variables, and compare data using statistics to drive their conclusions. The often forgotten last "step" of scientific investigation is stressed as students generate new ideas to explain unexpected results and suggest further studies. Although relatively brief, lasting 3- 4 weeks, the germination investigation fortifies math, graphing and data presentation skills, as well as exposes students, often for the first time, to simple statistical methods needed to interpret data. Students' comments indicate that the investigation deepens their understanding of the creativity and rigor that underlies scientific studies. Overall, the investigation provides pre-service teachers with both a first-hand understanding of essential aspects of the nature of science, and the skills needed to help guide others effectively in inquiry investigations.

*** 4. Agar to seedling establishment of the federally endangered Hawaiian endemic, *Platanthera holochila* (Orchidaceae) *in vitro***
Yates, Ashley D.[1], Zettler, Lawrence W.[1], Perlman, Steve[2] and Oppenheimer, Hank.[3] [1]Illinois College, Jacksonville, IL. [2]National Tropical Botanical Garden, Kauai, HI. [3]Plant Extinction Prevention Program, University of Hawaii, HI.

In 2002, the Orchid Recovery Program at Illinois College began a collaborative effort with the National Tropical Botanical Garden to cultivate the U.S. federally endangered terrestrial orchid, *Platanthera holochila* (Hbd.) Krzl. (Orchidaceae), from seed. Only ca. 36 individual plants remain of this Hawaiian endemic spanning three islands (Kauai, Maui, Molokai), and only a single specimen exists on Kauai. Initially, the technique of symbiotic seed germination was employed as a means to grow seedlings quickly *in vitro*, and to prompt seedling establishment *ex vitro* following deflasking. Unfortunately, the Hawaiian mycorrhizal fungi required for this procedure were ineffective at initiating germination, and an alternative, time-consuming, and generally less reliable procedure – asymbiotic germination – was attempted. Thirteen seed sources originating from two islands (Kauai, Molokai) collected during 4 years (2002, 2003, 2005, 2006) were utilized. A total of 24,940 seeds were sown on various asymbiotic media, and a sizable number (300+) of leaf-bearing seedlings have been obtained so far. We describe our efforts to transfer the largest, root-bearing seedlings to soil *in vitro*. In addition, we report germination and development for seeds collected from the Maui population for the first time.

*** 5. Floral fragrance composition of the ghost orchid, *Dendrophylax lindenii* (Lindley) Bentham ex Rolfe (Orchidaceae)**

Smith, Jaclyn M.[1], Sadler, James J.[1], Zettler, Lawrence W.[1], Alborn, Hans T.[2] and Richardson, Larry W.[3] [1]Illinois College, Jacksonville, IL. [2]United States Department of Agriculture, Gainesville, FL. [3]Florida Panther National Wildlife Refuge, Naples, FL.

The ghost orchid, *Dendrophylax lindenii* (Lindley) Bentham ex Rolfe (Orchidaceae), is one of North America's rarest and well-known orchids. The species frequents shaded swamps in S Florida as a leafless epiphyte where its stunning floral often attracts the attention of poachers as well as its natural pollinator (presumably the giant sphinx moth, *Cocytius antaeus*). Surprisingly little information exists on *D. lindenii*'s biology in situ, raising conservation concerns. During the summer of 2009 in Collier County, FL, a substantial number (ca. 13) of plants initiated anthesis offering a unique opportunity to study this species in situ. Flowers were sampled on site during 2 nights using absorbent connected to a battery-powered vacuum pump. Samples were then analyzed in the laboratory via gas chromatography/mass spectrometry (GC-MS spectral analysis). Eight volatile compounds were identified as the primary constituents of the ghost orchid's floral scent. These compounds consisted mostly of monoterpenes along with sesquiterpenes, benzenoids, phenylpropanoids, and one aliphatic. Our presentation will reveal these 8 compounds, and list the mean abundance for each as a percentage spanning 4 trials. A highlight of this study was the technique used to trap volatiles in situ with minimal disturbance to this rare orchid.

*** 6. *In vitro* seedling development of the Florida clamshell orchid, *Prosthechea cochleata* (L.) W.E. Higgins var. *triandra* (Ames) W.E. Higgins, on three different asymbiotic media**

Zimmerman, Clare C.[1], Zettler, Lawrence W.[1] and Richardson, Larry W.[2] [1]Illinois College, Jacksonville, IL. [2]Florida Panther National Wildlife Refuge, Naples, FL.

The Florida clamshell orchid, *Prosthechea cochleata* (L.) W.E. Higgins var. *triandra* (Ames) W.E. Higgins (Orchidaceae) is a state-endangered, epiphytic species that frequents shaded cypress domes in S Florida, usually affixed to hardwoods (e.g., maple, pop ash). The species has been propagated from seed for the horticultural trade for its unusual, non-resupinate flowers that are said to resemble an octopus. Seeds of *P. cochleata* var. *triandra* readily germinate and grow rapidly on a variety of asymbiotic media, and deflasked seedlings are generally easy to establish in a greenhouse. Despite this apparent success, these methods are not well-documented, in part because growers do not often freely yield such information. In this experiment, seeds collected from the Florida Panther National Wildlife Refuge (Collier County) in March of 2009 were sown on the asymbiotic medium, P723 (PhytoTechnology Laboratories, Shawnee Mission, KS). Leaf-bearing seedlings were then transferred to one of three asymbiotic media: P723 (control), P748, Murashige & Skoog basal salt mixture. To determine if pH had any effect on seedling development, each medium was adjusted to pH 5.5 and 7.0. Preliminary results suggest that P748 was the most effective medium at prompting seedling development and survival *in vitro*, and that pH had a little or no effect.

7. Branch growth architecture in the hyper-shade tolerant shrub, *Dirca palustris* (Thymelaeaceae)
Schulz, Kurt and Harroun, David. Southern Illinois University Edwardsville, Edwardsville, IL.

Dirca palustris is a small (usually < 2 m tall), shade tolerant understory shrub of northern conifer hardwood forests in the northeast. It features slow rates of branch growth that increase moderately with canopy opening. Branch growth is tied to reproductive output because each node produces three flowers, and the number of nodes is 1-3 per branch. We examined vegetative characteristics of understory shrubs to develop an individual based model of reproductive output for shrubs growing in shade. In a study of 50 understory shrubs, branch extension lengths, branching angles, and nodes per branch were examined at upper, middle, and lower positions in canopies, across a gradient of light conditions. Extension lengths were quite short, and increased with ascending position (4.0, 5.8, 7.3 cm). Numbers of nodes per branch increased significantly with ascending position (1.5, 1.7, 1.9 per stem). Branch angles changed from drooping (78^{o}), to horizontal (90^{o}), to ascending (98^{o}) with position. Higher light levels caused higher branch angles independent of position (ca. 10^{o} over the entire range), and numbers of nodes (from 1.5 to 2.0 across the range). We conclude shrub growth progressively relegates reproductive output away from lower branches, but this effect is tempered by light availability.

*** 8. Gender differences in the reproductive ecology of *Lobelia spicata* L. (Campanulaceae), a gynodioecious prairie species**
Ruffatto, Danielle Marie[1] and Molano-Flores, Brenda[2]. [1]University of Illinois at Champaign, Champaign, IL. [2]Illinois Natural History Survey, Champaign, IL.

Gynodioecy, the classification assigned to all joint hermaphrodite and female breeding systems, is utilized by only 7% of angiosperms. Gynodioecious populations can derive a number of potential benefits from the inclusion of female plants due to the females' ability to produce more flowers, larger fruit and seed sets, and larger, more quickly-germinating seeds than hermaphrodites. Despite these advantages, female plants' inability to produce pollen necessitates dependence on hermaphroditic pollen donation, while their lack of nectar incentives and smaller mean flower size may result in lower pollinator visitation. The objective of this study was to determine if the predicted patterns of gender differences between hermaphrodite and female plants are found for *Lobelia spicata* (Campanulaceae), a gynodioecious prairie species. In 2008, eleven *L. spicata* populations located across Illinois were visited to gather the following measurements for both plant genders: population counts, gender ratios, fruit set, seed set, and seed germination rate. High variation in population sizes and gender ratios was observed among the surveyed populations. Additionally, differences in female and hermaphrodite fruit sets, seed sets and seed germination rates were found. Gender patterns appear to be similar to other gynodioecious systems, although variation among populations was also found.

9. Effects of white-tailed deer on the early growth and survival of bottomland hardwood tree species in restoration sites
McGuire, Ben and Minchin, Peter R. Southern Illinois University Edwardsville, Edwardsville, IL.

Bottomland hardwood (BLH) forests have been greatly reduced in area since European settlement and damage by white-tailed deer can limit restoration success. This project examined

the effects of white-tailed deer on early growth and survival of several large-seeded bottomland forest species at the Two Rivers National Wildlife Refuge (TRNWR). The study was conducted at Pohlman Slough, which was planted in 2002 and 2004 to a mix of five species, using Root Production Method (RPM) seedlings. Heights and basal diameters of tagged trees in 56 plots established in 2006 were re-measured in summer 2009 to determine the three-year growth and survival by species relative to white-tailed deer damage. Only three species had adequate sample sizes for analysis: *Carya illinoinensis* (pecan), *Quercus bicolor* (swamp white oak), and *Quercus palustris* (pin oak). Analysis of covariance, using diameter in 2006 as a covariable, found no difference in 3-year basal diameter growth or height growth between trees that showed rubbing damage in 2006 and trees that had not been rubbed. There was no difference in growth rate among species. Binomial Generalized Linear Modeling, entering initial diameter as a covariable, found no difference in 3-year mortality between rubbed and unrubbed trees for each species. Mortality of *C. illinoinensis* (15%) was lower than that of the two oak species (35%). A large flood occurred in summer 2008 and flooding stress may have had a greater influence on mortality than deer damage.

10. Invasive oriental bittersweet vines (*Celastrus orbiculatus*) are marketed as native American bittersweet (*C. scandens*) by Midwestern vendors

Zaya, David N.[1], Ashley, Mary V.[1], Leicht-Young, Stacey A.[2] and Pavlovic, Noel B.[2]
[1]University of Illinois at Chicago, Chicago, IL. [2]U.S. Geological Survey, Great Lakes Science Center, Porter, IN.

Two species of bittersweet vines occur in Illinois. American bittersweet (*Celastrus scandens*) is a native vine of open habitats and forest edges. The invasive oriental bittersweet (*C. orbiculatus*) was introduced from Asia to the northeastern USA in the 1860s as an ornamental vine, and has been rapidly spreading west since the early twentieth century. The two species (and their hybrids) are difficult to distinguish morphologically, especially in young plants with no reproductive structures. We believed that some vendors might be mislabeling oriental bittersweet or hybrids because of oriental bittersweet's morphological similarity to American bittersweet, long history in horticulture, and faster growth rate. We genetically tested the species identity of commercially available bittersweet advertised as "American bittersweet" or "*Celastrus scandens*" from Illinois and Midwestern vendors using microsatellite DNA markers. Six of 10 vendors sold oriental bittersweet that they advertised as "American bittersweet" or "*Celastrus scandens*." We found all individuals from the varieties 'Diana', 'Hercules', 'Indian Mix', 'Indian Brave', and 'Indian Maiden' were genetically identified as oriental bittersweet. The variety 'Autumn Revolution' was genetically identified as American bittersweet. Vendors selling bittersweet with no variety name were usually (3 out of 4) selling oriental bittersweet. Whether accidental or intentional, mislabeling commercially available bittersweet poses a threat to native habitats and species by encouraging the spread of an aggressive invasive plant.

11. Effect of removal of garlic mustard (*Alliaria petiolata*, Brassicaeae) on arbuscular mycorrhizal fungi (AMF) inoculum potential in forest soils

Anderson, Roger C.[1], Anderson, Mary Rebecca[1], Bauer, Jonathan T.[2], Slater, Mitchell[1], Herold, Jamie[1] and Borowicz, Victoria[1]. [1]Illinois State University, Normal, IL. [2]Indiana University, Bloomington, IN.

Garlic mustard (*Alliaria petiolata*), a biennial species, is considered to be among the most troublesome of the invasive plants in the Eastern Deciduous forest of North America. It has been

shown to prevent or reduce mycorrhizal colonization of native herbaceous ground layer plants and trees in these forests. It is estimated that 70-90% or more of herbaceous native ground layer plant species form arbuscular mycorrhizal fungi (AMF) associations. Loss of the mycorrhizal association can reduce growth, reproductive success, and competitiveness of plant species. Using a corn root bioassay, we examined the effect of garlic mustard removal on the soil AMF mycorrhizal inoculum potential (MIP), in control plots and plots that had second-year garlic mustard removed for the past five years (2005-2009). Removal treatment plots had significantly ($P = 0.024$, $df = 28$) greater MIP than control plots (25.72±2.26% and 18.29±2.04%, respectively). A significant negative correlation ($r2 = 0.1325$, $P < 0.05$, $df = 30$) was found between cover of garlic mustard and MIP, which accounted for 13.2% of the variation in MIP. Cover of native vegetation in the removal treatment plots (104.5±2.6%) was greater than that of the control plots (92.2±2.6%), ($P = 0.0223$, $df = 115$). These results show that removal of garlic mustard results in an increase in soil MIP and cover of native species; however, there is not a complete loss of MIP associated with garlic mustard invasion.

12. The effects of varying atmospheric conditions on soybean (*Glycine max*) cell biology

Miller, Kristin L.[1], Dybas, Linda K.[1] and Ewy, Robert G.[2] [1]Knox College, Galesburg, IL. [2]State University of New York at Potsdam, Potsdam, NY.

Using University of Illinois at Urbana-Champaign's SoyFACE (Free Air Concentration Enrichment) technology, soybean plants were grown under increased concentrations of O_3, CO_2, CO_2 and O_3, and ambient conditions with otherwise normal field conditions. Leaf samples of plants from the different conditions were analyzed using a transmission electron microscope over a two month growing period, July and August of 2007. The objectives of this analysis were to determine the effect of atmospheric conditions on the cell organelle abundance of mitochondria, thylakoid strands per granum, lipid droplets, and starch composition. Mitochondria were analyzed to determine how energy production was effected by growing conditions. Thylakoid strands per granum indicate photosynthesis levels. The number of lipid droplets present and the percentage of starch in each chloroplast signify the nutrient accumulation of chloroplasts. All of these factors influence the ability of the plant to produce viable seeds. Results from the July leaf samples showed significant statistical differences indicating that the combination of increased O_3 and CO_2 levels produced fewer thylakoid strands per granum and the presence of increased O_3 levels alone produced lower percentages of starch in chloroplasts. The presence of CO_2 in the atmosphere increased this starch percentage, even when combined with O_3. These results are expected to carry over to the August leaf samples.

13. Diaspore morphometrics and self-burial in *Hesperostipa spartea* from different soil types

Molano-Flores, Brenda. Illinois Natural History Survey, Champaign, IL.

Hesperostipa spartea (Trin.) Barkworth (Poaceae), or porcupine grass, is a native perennial cool season bunch grass with diaspores with one hydroscopic awn. In Illinois, this species is found in a wide variety of habitats, including sandy and loam soil prairies. The aim of this study was to evaluate morphometrics and self burial differences between diaspores from populations of *Hesperostipa spartea* found in sandy and loam prairies. In 2007, diaspores were collected from three sandy and three loam soil prairies. To determine if morphological differences existed between diaspores from sandy vs. loam soil prairies, 50 diaspores were selected per site and the following characters were measured: length from callus to tufts of hair, total seed length, seed

width, length of awn's active part, length of awn's passive part, and awn width. In 2008, a reciprocal study was conducted to determine self-burial rate of diaspores by soil type. Results show that morphometric and self-burial differences were found between diaspores from loam vs. sandy prairies. Overall, this study demonstrated that intraspecific morphometric differences exist between *Hesperostipa spartea* diaspores from loam and sandy prairies, suggesting two ecotypes in Illinois.

14. Does nonlinear rescaling of axes in detrended correspondence analysis (DCA) produce ecologically meaningful measures of beta diversity?

Minchin, Peter R.[1] and Oksanen, Jari[2]. [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]University of Oulu, Oulu, Finland.

Detrended correspondence analysis (DCA) was developed to correct perceived inadequacies of correspondence analysis in the ordination of community data. Nonlinear rescaling, incorporated into DCA to correct the compression of sampling unit scores towards the axis extremes, adjusts the scaling of species scores within axis segments in an effort to equalize the dispersions of species scores within sampling units. It has been claimed that rescaling produces axes along which the mean Gaussian tolerances of species' responses is 1.0, so that the length of the rescaled axis is a measure of beta diversity. We used both simulated community data, in which species had specified Gaussian responses to gradients, and field data for which the major driving gradients are understood to investigate the success of rescaling in producing axis lengths that matched beta diversity. For a species packing model, nonlinear rescaling performs well. With field data and more realistic models, in which heights, tolerances, the spacing of optima or the sampling intensity varied, rescaling no longer performs as suggested. It tends to spread the optima of species more evenly across the rescaled gradient but this usually does not equalize tolerances. In fact, variation among tolerances is often enhanced by rescaling. We show that equalizing the dispersions of species scores within sampling units does not, in general, result in rescaled axes along which the mean tolerance approaches 1.0 within all regions of the axis. Hence axis lengths in DCA do not provide meaningful estimates of beta diversity.

Division: Cell, Molecular & Developmental Biology

*** 1. Response to constitutive pheromone receptor activity is observable following site-directed mutagenesis in *Schizophyllum commune* (Aphyllophorales)**

Settlemoir, Emily and Fowler, Thomas J. Southern Illinois University Edwardsville, Edwardsville, IL.

G-protein coupled receptors (GPCR) with a seven-transmembrane (TM) domain are important cell surface signaling molecules in eukaryotes. The mushroom *Schizophyllum commune* employs GPCRs and their specific pheromones in its mating signals. Receptors that are always active are called constitutive, and their excess activity is related to many human diseases. A constitutive pheromone receptor in *S. commune* was expected to produce an unhealthy fungus. Using site-directed mutagenesis, four mutant receptor genes were constructed from receptor gene *bbr1*. These receptors each had a single amino acid change as follows: F5L, a phenylalanine replaced with a leucine at position 5 in TM1; C86Y, a cysteine replaced with a tyrosine at position 86 in TM3; L205P, a leucine replaced with a proline at position 205 in inner loop 3; L213P, a leucine replaced with a proline at position 213 in TM6. Each *bbr1* mutant was introduced into a sterile strain of *S. commune* that has no mating pheromone receptor or pheromone activity. The

transformants were analyzed, and at least one of the mutant receptor genes (L213P) produced transformants with the phenotype that was predicted for constitutive pheromone receptor activity. In addition to causing the fungus to grow with few aerial hyphae, this condition produced many stubby hyphal branches. Because the imino acid proline has a ring-structure, it is suspected that proline distorts the α-helix of TM6 to produce constitutive receptor activity. The L205P receptor mutant also has altered activity, but the F5L and C86Y mutations produced no detectable changes.

*** 2. Isolate-specific encapsidation of soybean dwarf virus subgenomic RNAs**

Thekke Veetil, Thanuja[1] and Domier, Leslie L.[2] [1]Department of Natural Resources and Environmental Sciences. [2]USDA-ARS, University of Illinois at Urbana-Champaign, Urbana, IL.

Packaging of RNAs by virus coat proteins is a highly specific process and an important step in the life cycle of RNA viruses. Soybean dwarf virus (SbDV), a luteovirus, encapsidates its single-stranded positive-sense RNA genome in isometric particles. During infection, SbDV produces full-length genomic RNA and two smaller subgenomic RNAs. To analyze the encapsidation of SbDV RNAs, an agroinoculation method was developed for SbDV. Agrobacterium tumefaciens was transformed with a binary vector that contained full-length cDNAs of either soybean (W4) and red clover (ClIL2) isolates of SbDV. The clones replicated and packaged SbDV RNAs into virus particles in *Nicotiana benthamiana*. Virus particles were purified from agroinfiltrated leaves and fractionated by sucrose gradient centrifugation. RNA blot analysis of gradient fractions showed that virus particles from plants infiltrated with ClIL2 contained both genomic (g) and small subgenomic (Ssg) RNAs. Virus particles from plants infiltrated with isolate W4 contained only g RNA. To determine which portions of the SbDV genome are responsible for the differential encapsidation, two mutants were constructed in which the ORF encoding the minor capsid protein or the Ssg RNA of W4 were replaced by the corresponding regions from ClIL2. Encapsidation assays on these mutants will be conducted to identify the region(s) involved in the isolate-specific packaging of Ssg RNA.

*** 3. Relating Dr. Jekyll and Mr. Hyde transmogrification and intraguild predation to *Tetrahymena* (Tetrahymenidae)**

Orlando, Paul[1], Buhse, Jr., Howard E.[1], Brown, Joel S.[1], Knudtson, Tegan[1], Naim, Marriam[1], Abufarha, Najeeb[1], Orlof, Rozalia[1], and Whelan, Christopher J.[2] [1]University of Illinois at Chicago, Chicago, IL. [2]University of Illinois at Urbana-Champaign, Urbana, IL.

The protist, *Tetrahymena vorax* exists as a benign microstomal cell (small-mouth) that consumes bacteria in competition with other protists including other species of *Tetrahymena* Under appropriate conditions, *T. vorax* transmogrifies into a macrostomal form (large mouth) that consumes its protist competitors including other species of *Tetrahymena*. This ecological Dr. Jekyll and Mr. Hyde represent a unique form of intra-guild predation, a phenomena in which one consumer species, either intentionally or accidentally, preys upon a competing consumer species. We modeled the dynamics, behavioral strategies, and opportunities for species coexistence in a community including a Dr. Jekyll-Mr. Hyde species like *T. vorax*, along with a competing species such as *T. pyriformis*. We examine when the transmogrifying species may coexist with its competitor, forming a system exhibiting intra-guild predation. In the case of *Tetrahymena*, we ask under what conditions will *T. pyriformis* coexist with *T. vorax*? We then address what sorts of strategies of transmogrification are favored in a Dr. Jekyll-Mr. Hyde species. We compare a fixed strategy of transmogrification with one based on cues relating to the

adaptiveness of transmogrification. Transmogrification as exhibited by *T. vorax* always stabilizes population dynamics. We find that a strategy of transmogrification can be highly adaptive, and, moreover, it enhances biodiversity by promoting coexistence between the intra-guild predator and its competitors.

*** 4. The study of a heat shock protein, GrpE, in the scope of fluorescence spectroscopy**
Nagata, Akina. Knox College, Galesburg, IL.

This research aims to obtain the size and shape of the active form of the GrpE protein, which is involved in the DnaK and DnaJ chaperon system in *E.coli* using fluorescence anisotropy. Anisotropy measures the rate of rotation of fluorescent molecules, which will be integrated into the Perrin equation to calculate a volume of a protein sample. Since GrpE does not have any intrinsic fluorescence, a tryptophan residue was integrated into two positions, V108W and T145W. V108W has been over-expressed in E. coli, purified by a basic purification protocol for wild type GrpE, and subjected to fluorescence anisotropy to measure an optimum concentration of the sample. Also, wild type GrpE has been purified for comparison purposes.

5. Characteristics of two active transposable elements and related sequences within the *Schizophyllum commune* (Aphyllophorales) genome, strain 4-8
Fowler, Thomas J. Southern Illinois University Edwardsville, Edwardsville, IL.

Transposable elements influence genomes in many ways, such as disrupting individual genes, facilitating rearrangements within the genome, and increasing the total DNA content in many species. Two active transposable elements have been identified in the mushroom-producing fungus *Schizophyllum commune*. Both were identified as insertions into a gene, *thn1*, whose null mutants have distinctive corkscrew hyphae. Spontaneous *thn1* mutants with transposon insertions are evidence of extant transposon activity. The *S. commune* genome was released publicly in 2008, which allowed a closer look at the number and distribution of these two transposable elements and their relatives. One element, *scooter*, was identified in numbers that matched well with previous DNA blot hybridizations estimates. The distribution of *scooter* family elements indicated that *scooter* was not highly restricted. The second transposon has very few related sequences in the genome. For each transposon type, no candidate was identified for an autonomous element that would encode a transposase and control movement. One possibility is that the autonomous elements are embedded in the small portion of the genome that is yet unsequenced due to the difficulty of sequencing DNA that is rich in repeated sequences.

*** 6. Construction of a *tpsA* knockout strain of *Fusarium verticillioides* (Hypocreales)**
Boudreau, Beth A.[1], McQuade, Kristi L.[1] and Larson, Troy M.[2] [1]Bradley University, Peoria, IL. [2]USDA, Peoria, IL.

Fusarium verticillioides is a species of fungus that infects the stalk, ear, kernel, and root of corn and produces mycotoxins that have dangerous health effects. We have observed that the intracellular concentration of trehalose, a storage sugar for *F. verticillioides*, changes dramatically upon exposure to heat or cold stress or in the presence of the antibiotic validamycin A. With this knowledge, we hypothesize that enzymes involved in trehalose metabolism could be good targets for the control of the disease. In order to test this hypothesis, we are generating knockout strains using a double homologous recombination approach in which genes involved in

trehalose metabolism are deleted. Here we report progress on development of a straining lacking the *tpsA*-gene, which encodes the enzyme trehalose-6-phosphate synthase.

*** 7. Probing the stability and folding/unfolding pathway of the tetrameric protein GrpE 1-112**

Kurian, Sarah T. Knox College, Galesburg, IL.

GrpE is a heat-shock protein of homodimeric structure with homologues in most other organisms. Previous research (Protein Science 2003) on the structure of GrpE found that a deletion mutant (GrpE 1-112) forms a tetrameric species. Of interest is the folding pathway of this GrpE mutant since the folding pathways of oligomeric proteins are less known. Such studies are of practical use for fields such as protein design and the novel treatment of diseases involving protein mis-folding (e.g., Alzheimer's, cystic fibrosis). Initial work involved purification and isolation of the mutant. An unfolding study under equilibrium conditions was conducted using Gel Filtration Chromatography with Guanidine Hydrochloride as the denaturant. A presumed monomeric species has been found to elute from the column at concentrations of 0.3-0.4M guanidine hydrochloride. Future work includes an equilibrium study using Circular Dichroism (CD) spectroscopy to study the effects of various concentrations of the denaturant urea as well as the kinetics of refolding involving a stop-flow apparatus paired with CD spectroscopy.

*** 8. A model of the mechanism of Centrin/Spasmin-based contractility in *Vorticella convallaria* (Sessilida)**

Konior, Katarzyna, McCutcheon, Suzanne and Buhse, Howard. University of Illinois at Chicago, Chicago, IL.

In the stalked ciliated protozoan, *Vorticella convallaria*, a mechanical stimulation results in a calcium induced rapid contraction of the cytoskeletal fiber system (myonemes and spasmoneme). Ultrastructural studies revealed two distinguishable regions within these organelles: a "fibrillar mass" composed of longitudinally oriented 2-5 nm fibers and "membrane-bounded tubules" that are evenly distributed throughout the fibrillar mass. Interestingly, the membrane-bounded tubules are also filled with 2-5 nm fibers and contain calcium which suggests a calcium storage/release function for these structures. The characterization of calcium-binding proteins, centrins/spasmins, show differential distribution of these proteins within the spasmoneme. At the TEM level, centrin localizes to fibrillar mass and tubules, whereas spasmin is almost exclusively found within fibrillar mass. We propose a model that explains both the role of tubules as a calcium storage/release compartment and the role of centrin fibers within these compartments. Upon receipt of a signal, the tubules release calcium to the fibrillar mass and this change in calcium concentration causes disassociation of self-assembled centrin. Within the fibrillar mass, calcium binds to centrin/spasmin molecules that are tightly associated with SFI1p (a centrin-binding protein). This leads to coiling and therefore shortening of the stalk. During stalk re-extension, calcium, released from centrin/SFI1p complex, is pumped back into the tubules allowing self-assembly of centrin and restoring rigidity of tubular compartments which assists in the extension process of the spasmoneme.

*** 9. Consequences of sleep fragmentation induced circadian clock gene disruption in peripheral tissues of mice (Murinae)**

Jaeger, Cassie D.[1] and Tischkau, Shelly[2]. [1]Millikin University, Decatur, IL. [2]Southern Illinois University School of Medicine, Springfield, IL.

Disruption of normal sleep patterns causes a change in circadian rhythm. We hypothesize that altering this rhythm changes expression of circadian clock genes and Endoplasmic Reticulum (ER) stress genes. In this study, mice (*Mus muscularis,* strain c57bl6) were subjected to sleep fragmentation (SF) for either six or twelve hours. Controls were left in their home cage. After SF, mice were euthanized and tissue samples of liver and lung were collected. RNA was extracted from the tissues, cDNA was synthesized, and quantitative PCR was performed to compare mRNA expression levels. The clock genes Per1 and Bmal demonstrated a circadian rhythm and an increase in mRNA expression after SF. Relative change from the control could be a result of a shift in the peak of expression or an altering of the rhythm altogether.

Division: Chemistry

*** 1. Selective introduction of alpha-beta unsaturation in diketones**

McDonald, William and Vinod, Thottumkara K. Western Illinois University, Macomb, IL.

Currently available methods for the introduction of alpha, beta- unsaturation on carbonyl compounds involve the use of either toxic and foul-smelling chalcogen reagents or expensive palladium catalysts. The development of a reliable and convenient protocol for the introduction alpha, beta-unsaturation in carbonyl compounds is thus a worthwhile research objective. A successful development of a procedure capable of selective introduction of alpha, beta-unsaturation in dicarbonyl compounds will be even more useful for synthetic chemists. Our continued interest in oxidative transformations using water-soluble hypervalent iodine reagents have identified the feasibility of selective introduction of alpha-beta unsaturation to ketones that enolize to place an abstractable hydrogen atom vicinal to the enolic OH group. We believe that the selective abstraction of such a hydrogen atom stems from the favorable (low) bond dissection energy of the C-H bond involved. Synthesis of suitable dicarbonyl substrates and the selective introduction of the desired alpha, beta-unsaturation using water-soluble IBX derivatives will be discussed.

*** 2. Design of a new tool for macrocyclic synthesis**

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

Co-halogenation of alkenes where a halogen atom and a nucleophile are added across a double bond to in a regio and stereoselective manner is a useful method for the assembly of highly functionalized alkane derivatives from easily available alkenes. We have recently demonstrated that alkenes bearing tethered nucleophilic functional groups can be made to undergo internal nucleophilic capture during co-halogenation reaction yielding macrocyclic compounds in good to excellent yields. Synthesis of a variety of macrocyles bearing different heteroatoms will be discussed.

*** 3. Separation of chiral D and L-valine by high performance liquid chromatography**
Orech, Tara K. and Welch, Lawrence. Knox College, Galesburg, IL.

The enantomers D and L-valine were separated by the method of high performance liquid chromatography using a Nucleosil Chiral-3 column. The valine analyzed was reacted with FMOC-Cl to make it soluble in the heptane-dominant eluent. Similar techniques can be applied to other amino acids, including tyrosine and phenylalanine. The settings for these two amino acids can then be utilized to try and analyze their newly synthesized beta-amino phosphonic acid derivatives for chiral purity.

*** 4. Synthesis of 1,1-dimethoxybutan-2-one by ether extraction and a Grignard reaction with dimethoxyacetaldehyde**
Parks, Clayton G. and Bennett, George D. Millikin University, Decatur, IL.

Flavopereirine is a molecule with known DNA-intercalating ability that has recently proven effective in helping to treat certain types of cancer. Both 5,6-dihydroflavopereirine and flavopereirine have been isolated from herbal extracts in studies performed on the African *Strychnos usambarensis* and South American *Geissospermum* leaves, but as of yet, no attempts have proven very promising in the development of an effective route to the synthesis of these indoles in the laboratory. One method that efficiently forms quaternized bridgehead nitrogens in polycyclic heteroaromatic systems is the Westphal condensation. Retrosynthetic analysis of flavopereirine revealed 1,1-dimethoxybutan-2-one to be a suitable synthon for use in the Westphal method. In the laboratory, we have endeavored to devise a facile and green synthetic route to flavopereirine involving the preparation of 1,1-dimethoxybutan-2-one via Grignard reaction. Dimethoxyacetaldehyde dissolved in a 60 wt.% solution of water was extracted with ether and dried over magnesium sulfate before being introduced into the Grignard reaction with ethylmagnesium bromide. All successful Grignard reactions produced rather low yields, but the product was analyzed by IR and 1H NMR to confirm its identity as 1,1-dimethoxybutan-2-ol. Later, oxidation of 1,1-dimethoxybutan-2-ol produced the desired 1,1,dimethoxybutan-2-one.

*** 5. Influence of aromatic substituents on the antibiotic activity of 5-aryl-4,4-dimethyl-3-oxo-delta-lactones against *Bacillus subtilis***
Hollandsworth, Lauren, Raube, Lee, Van Hise, Nicholas, Baudo, Dave and Andersh, Brad. Bradley University, Peoria, IL.

5-Aryl-4,4-dimethyl-3-oxo-delta-lactones can be prepared by treating a mixture containing a substituted benzaldehyde and methyl isobutyrylacetate with potassium carbonate in an absolute alcohol solvent. It had been previously shown that 5-aryl-3-oxo-delta-lactones with substituents in the 2-position of the lactone ring possess antimicrobial activity. Using both paper disc assays and minimum inhibitory concentration (MIC) determinations, we have found that 5-aryl-3-oxo-delta-lactones, without substituents in the 2-position of the lactone ring, exhibit antibiotic activity against both gram-positive and gram-negative bacteria. In an effort to gain a greater understanding of the influence of the aromatic substituents on the activity of 5-aryl-4,4-dimethyl-3-oxo-delta-lactones against *Bacillus subtilis*, a Hansch equation incorporating the hydrophobicity and the electronic contributions of the aromatic substituents is being developed. Details of our synthetic work as well as results from antibiotic susceptibility tests will be presented.

*** 6. Preparation and antibiotic testing of highly substituted 3-oxo-delta-lactones**
Ferguson, Robert, Wanken, Zachary, Baudo, Dave and Andersh, Brad. Bradley University, Peoria, IL.

Potassium carbonate in absolute ethanol or methanol can be used to induce a novel condensation reaction between a benzaldehyde and an acetoacetate ester, yielding a 5-aryl-3-oxo-delta-lactones (6-aryl-dihydro-2H-pyran-2,4(3H)-diones) instead of the expected Knoevenagel product. Because substituents at the 2- and 4-positions of the acetoacetate ester do not impede this reaction, this route provides a simple pathway for preparing highly substituted 5-aryl-3-oxo-delta-lactones, a class of compounds that have been previously shown to possess antiviral and antifungal activity. We have found that 5-aryl-3-oxo-delta-lactones also possess activity against gram-positive and gram-negative bacteria. Details of this synthetic work as well as results from paper disc assays and minimum inhibitory concentration (MIC) determinations will be presented.

*** 7. Catalysis by metal colloids synthesized within silane-containing polymers**
Miller, Josiah D., Kennedy, Branden F., Andersh, Brad J. and Campbell, Dean J. Bradley University, Peoria, IL.

Colloidal heterogeneous catalysts are often more effective than heterogeneous catalysts comprised of larger particles because the surface to volume ratio is greater for the colloid particles. Encapsulating the colloidal catalysts in polydimethylsiloxane (PDMS) enables the colloidal catalysts to be easily removed from the product after the reaction is completed. Gold, palladium, and platinum colloids were prepared within PDMS via reduction of potassium tetrachloroaurate(III), sodium tetrachloropalladate(II), and sodium tetrachloroplatinate(II) with free silane groups within the cured PDMS polymer structure. The PDMS-confined gold, palladium, and platinum colloids were used to catalyze the hydrogenation of multiple bonds and the hydrogenolysis of carbon-oxygen sigma bonds in the benzylic position.

8. Why did the grass die? Problem-based learning in the Instrumental Analysis course
Acheson, Edward R. Millikin University, Decatur, IL.

Someone once said that Problem-Based Learning (PBL) suffers from the "Kleenex" phenomenon: everyone calls what they do Problem-Based Learning, but everyone does it differently. I use a form of PBL developed by Dr. Howard Barrows at the Southern Illinois University School of Medicine. In this form of PBL, students work through a series of problems designed to be authentic (i.e., address real-world concerns) and to target defined areas of the curriculum. The problem presentation approximates the real world as nearly as possible so that students find themselves actually engaged in the problem and not just observers of it. Ideally, as students work through the problem, their knowledge and skills are developed. The Barrows approach to PBL is student-centered: students are coached by a teacher who is trained to facilitate their reasoning with the problem. The teacher helps students generate hypotheses, gather data, draw conclusions, but never tells students what to think or what to learn. In this presentation, I will describe the form of PBL that I use, and my rationale for using it. We will also model the process by working on the problem in the title of this presentation, and discuss some of the successes and not-so-successes in using this approach.

Division: Engineering & Technology

*** 1. Electronic speckle pattern interferometry: opto-mechanics and application**
Trudell, Tanner N., James, Jesse and Steckenrider, John S. Illinois College, Jacksonville, IL.

Electronic Speckle Pattern Interferometry, or ESPI, is an imaging and analysis technique used to characterize and measure the deformation of material surfaces. In this investigation, we have developed an ESPI system designed to measure the in-plane motion of a surface of interest with nanometer-scale resolution. This particular interferometer uses polarized light beams split from a 15 mW diode-pumped solid-state (DPSS) CW Nd:YAG laser operating at 532 nm. Separate beams of horizontally and vertically polarized light are each projected onto an object surface by a system of polarizers, mirrors, and lenses. An additional beam polarized at 45 degrees is reflected off of a piezoelectric actuated mirror chip and projected onto the same surface by a similar system of polarizers, mirrors, and a lens. The speckle patterns reflected off of the object's surface are digitally captured and analyzed and used to characterize the behavior of the surface. In the current work, we present examples of examined behaviors, such as thermal expansion and contraction, strain, and structural integrity.

*** 2. Electronic speckle pattern interferometry: image acquisition and data analysis**
James, Jesse, Trudell, Tanner N. and Steckenrider, John S. Illinois College, Jacksonville, IL.

Electronic Speckle Pattern Interferometry (ESPI) is a common tool used to view and analyze the deformation of surfaces. Digital image acquisition permits the visualization of surface displacement through interferometric fringes, but quantification of that displacement requires additional analysis. The interferometer used in the current application uses a 532 nm CW Nd:YAG laser in a polarization multiplexing arrangement to separate the components of surface motion. To quantify this motion, stepping in the interferometer is phase-stepped using a piezoelectric-mounted mirror. Phase stepping and all image acquisition and data analysis, is implemented in software developed using LabView. Images are acquired of an illuminated surface, pre and post-deformation, with a 10-bit digital fire wire camera. Once acquired, a dual three-step phase algorithm is used to extract the phase from the images. The phase is then filtered with an FFT-sine/cosine filter and unwrapped using a simple Mod 2π algorithm. This consistently produces accurate and smooth two-dimensional displacement maps of one-dimensional deformation phase maps in one-dimension of flat surfaces with nanometer-scale resolution.

Division: Environmental Science

*** 1. Selenium Phytoremediation Management: Development of Selenium-Biofortified Mushrooms from Plant Waste**
Hong, Jie S.[1], Lin, Zhi Q.[1] and Banuelos, Gary[2]. [1]Southern Illinois University, Edwardsville, Edwardsville, IL. [2]USDA-ARS, Fresno, California.

Phytoremediation of selenium (Se)-polluted agricultural soil and water can be environmentally sustainable and cost-effective. However, the management or disposal of Se-phytoremediation plant material is challenging. Earlier studies showed high levels of Se can be accumulated in fungal tissues. We hypothesized that Se- phytoremediation plant materials can be managed and used as substrate for producing Se-enriched edible mushrooms. The objectives of this study were

to measure Se concentrations in different mushroom species or varieties commonly found in the US; to determine the capacity of selected edible mushrooms to accumulate Se when substrates were treated with different chemical forms of Se, and to produce Se-enriched mushrooms using Se-contaminated plant materials that were harvested from the phytoremediation field. Results showed that most of commercial mushrooms contained low levels of Se, ranging from 0.01 to 2.68mg kg-1, and concentrations of Se varied significantly between species. Accumulation of Se in Oyster mushroom (Pleurotus ostreatus) or Enokitake mushroom (Flammulina populicola) was significantly affected by the chemical form of Se in substrate. Compared to the Se concentration of 0.2mg Se kg-1 observed in commercial Oyster mushroom tissues, the Se-biofortified Oyster mushroom accumulated 2.8mg Se kg-1 from Se-contaminated plant materials containing 1.9mg Se kg-1.

*** 2. Prehistoric and Historic Lead Levels in Catfish (Family Ictaluridae) Along the Illinois River**

Goss, Donald, Brugam, Richard, Holt, Julie, Vogel, Gregory, Lin, Zhi-Qing and Kohn, Luci. Southern Illinois University Edwardsville, Edwardsville, IL.

Lead levels of catfish residing in the Illinois River were examined to determine the degree of contamination, and test whether modern lead levels reflect levels observable in fish from prehistoric and early historic communities. Modern samples were obtained from local fisheries and compared to those of archeological samples found in 3 excavated sites along the Illinois River (4000 B. C. E. – early 1900's). Soil core samples were used to compare lead levels in soil to lead levels in bone. Concentration of lead and other heavy metals were estimated in both modern and archeological fish samples, as well as soil samples from each site. A high level of lead contamination was expected in modern fish samples compared to pre-industrial era archeological samples, however sample data proved the opposite. Modern fish exhibited lower levels of lead compared to the older samples. While the results may reflect variation in the presence of lead through time, we also examined the possibility of contamination of bone by soil over time in the archeological sites, or contamination of the archeological samples after excavation.

*** 3. Redeveloping Brownfields: An analysis on financing brownfield management in Illinois**

Gates, Christen. Southern Illinois University Edwardsville, Edwardsville, IL.

In this analysis, the management of brownfields is assessed on both a macro and micro level. The macro-analysis investigates four research questions. 1) How has the IEPA distributed brownfield grants throughout the state? 2) Has there been a correlation between brownfield grant distribution and population clusters throughout the state? 3) Have political boundaries like congressional districts influenced the distribution of brownfield grants? 4) How effectively has the IEPA distributed grants on the basis of environmental justice and economic need concerns? The micro-analysis investigates the manner in which other government financing tools, such as Tax Incremental Financing (TIF) and Enterprise Zones (EZ), influence brownfield management? Through the course of this investigation, variables are collected from the U.S. Census Bureau, Illinois Department of Revenue, and EPA. The results show that brownfield financing is not significantly correlated to population density and is distributed most significantly to Congressional Districts in the north. Brownfield financing is not significantly correlated to median income, median property value, unemployment, or ethnic population. The micro-analysis, conducted on a large population cluster in the southern Illinois, suggests that EZs are

targeted in cities with the lowest median incomes and property values and a medium range of population diversity. Brownfield financing is targeted in cities the highest levels of unemployment and a wide range of population diversity. TIF is used in cities with the lowest unemployment, highest property value and income, and smallest range of population diversity.

*** 4. Earthquake Education and Awareness Initiative in Southern Illinois**

Black, Christine[1], Henson, Harvey[1], Mumba, Frackson[1], Hodgson, Scott[2] and Podoll, Andrew[1].
[1]Southern Illinois University, Carbondale, IL. [2] University of Oklahoma, Norman, OK.

The earthquake awareness program at Southern Illinois University Carbondale (SIUC) is funded by IEMA/FEMA to promote earthquake hazard mitigation. Content and pedagogy experts at SIUC train geology students to work with local elementary and middle school teachers and to bring earthquake awareness and preparedness presentations into the classrooms. Presentations emphasize general earthquake knowledge, specific information about local seismic concerns such as the New Madrid and Wabash Valley seismic zones, and guidance about what students can do to prepare for an earthquake at home and at school. Students and teachers benefit from having a geologist in their classroom and efforts are made to coordinate visits with an earth science unit in the teacher's curriculum. Presentations are expressly designed to engage young learners by including thought-provoking questions, award-winning earthquake simulation videos, and a question and answer segment. Elementary and middle school students complete questionnaires before and after viewing the presentation to help researchers improve the presentation effectiveness and to assess student learning. Preliminary data analysis indicates that students gain important educational content and earthquake safety information.

*** 5. Effects of service learning in the physical science curriculum**

Bittle, Cynthia K. Southern Illinois University Edwardsville, Edwardsville, IL.

Service-learning (SL) is a teaching and learning methodology which fosters civic responsibility and applies classroom learning through meaningful service to the community. Subjects were 9th graders at a St. Louis area suburban district. At this time, there is no other service learning requirement at the school. The SL project consisted of a recycling "junk mail" collected from students' homes during a 4-week period. After collection, students weighed the material, calculated household impact and placed the "junk mail" in the school's recycle bin. Students were then charged with a task of reducing "junk mail" at the source. In this quasiexperimental design, the curriculum for the treatment and comparison group was the same, however, the two classes were taught by different teachers. It was hypothesized that a 4-week service learning project would improve 9th grade students' science grade, their interest in science and would enhance the students' understanding of science - community connections. Modest gains in science scores, science attitudes and students' understanding of connection to community were found.

Division: Health Sciences

*** 1. Effectiveness of solventless condensation and Diels-Alder methods in the synthesis of prospective aldosterone synthase inhibitors and four novel bicyclo[4.3.0]non-3-ene-7,9-diones; applications in the fields of medicinal and structural chemistry**

Bringman, Lauren R. and Bennett, George D. Millikin University, Decatur, IL.

Solventless chemistry techniques are beginning to be widely adapted in the chemical industry as a means to reduce harmful waste production as well as to decrease the expense of product synthesis. Studies in this growing field are beneficial in countless scientific areas. Two of the scientific areas in which the study of solventless reactions is relevant are medicinal and structural chemistry. This study examined the effectiveness of solventless methods in the synthesis of compounds with potentially useful medicinal and structural properties. In the medicinal area, the syntheses of prospective inhibitors of aldosterone synthase were attempted through various condensation reactions, including aldol condensations and imine formation. Aldosterone invokes sodium reabsorption, and thus acts as a regulator for blood pressure; the overproduction of which can lead to congenital heart failure and myocardial fibrosis. An absence of solvent in this case did not prove to be particularly effective, so methods involving the use of low risk solvents were implemented in reactions between various imines and aldehyde compounds, as well as reactions between various imine and aldol compounds. In the structural area, the solventless Diels-Alder cycloaddition method was employed to successfully yield four novel bicyclo[4.3.0]non-3-ene-7,9-diones in moderate to high yield with experimental atom economies ranging from 21 to 32%, and E-factors ranged from 2.7 to 3.7.

*** 2. Effects of varying caffeine doses on heart rate in neonatal rats**

Cassidy, Daniel P. and McGilliard, Kip L. Eastern Illinois University, Charleston, IL.

The effects of caffeine on heart rate were analyzed in neonatal rats. Four- to seven-day-old rats were administered either 40, 80, or 120 mg/kg of caffeine subcutaneously. Electrocardiogram (ECG) recordings were made for one hour following drug treatment using mini-electrodes. Recordings were displayed using the PowerLab, a computer-based physiological analysis program, and heart rates were determined at 5-min intervals. Heart rate was unchanged over 60 min in saline-treated rats. In comparison to the saline control group, all doses of caffeine produced an overall increase in heart rate. The 40 mg/kg dose of caffeine peaked at 30 min, with a 15% increase in heart rate. The 80 mg/kg dose produced a 30% increase in heart rate, which was similar to the change induced by the 120 mg/kg dosage. Both 80 mg/kg and 120 mg/kg caffeine produced statistically significant increases in heart rate. Data suggest that a positive correlation exists between heart rate and caffeine dosage, yet, at high doses, this correlation seems to become less definite. The results of this experiment demonstrate the utility of the ECG technique in obtaining heart rates over time in gently restrained neonatal rats. Further studies are planned in order to analyze the effect of related compounds on heart rate.

Division: Microbiology

*** 1. Antibiotic resistant Group A *Streptococcus* among Aurora University students**
Singh, Nidhie and Zelman, Mark. Aurora University, Aurora, IL.

Streptococcal pharyngitis (strep throat) occurs most frequently among school age children but people of all ages are susceptible. Infections cause many lost work and school days and may lead to serious complications. Mainly a community-acquired infection, strep throat is caused by group A beta-hemolytic *Streptococcus pyogenes* and is transmitted by respiratory droplets. The prevalence of non-symptomatic carriers and of antibiotic resistant bacteria among those carriers is not well known. The specific aim of this study is to determine the prevalence of carriers and of antibiotic resistance among undergraduate students at Aurora University. Student volunteers age 18 and over were screened via throat swabs cultured on sheep blood agar plates. Beta-hemolytic colonies that were found to be positive in a rapid strep agglutination test were then screened using Kirby-Bauer disk diffusion. Six of approximately 80 students carried group A beta-hemolytic bacteria, in contrast with a past study in which half of the students carried *S. pyogenes* in their throats. Four of the six carriers showed antibiotic resistance. One individual showed resistance to vancomycin, penicillin, and ampicillin. The results were further analyzed to examine associations between antibiotic resistance and individual demographics and history.

*** 2. Modeling the impact of colonic bacteria on dietary fiber: A mutant *E. coli* strain's efficiency in competition with its wild type for different carbohydrates**
Kruse, Joel and McCommas, Steven. Southern Illinois University Edwardsville, Edwardsville, IL.

Many studies have shown that fiber in the diet may reduce a person's risk of developing colorectal cancer. Some evidence points to the role of proteins called lectins. Lectins bind to cell surface receptor proteins causing a mitogenic reaction. This binding of lectins to epithelial cells in the colon could start them on a pathway to becoming cancerous. Sugar residues in polysaccharides that compose soluble dietary fiber could bind to these lectins, displacing them from epithelial cells and preventing colorectal cancer. Our research deals with mutant strains of *E. coli* and the possibility that a mutant strain could over-utilize dietary fiber and thus decrease the fiber's protective benefits. By the use of a model system imitating the gut microbiome using wild type (MB1655) and mutant strains of *E. coli* we may have found such a mutant strain, CH6. In experiments using a single carbohydrate sugar (instead of soluble fiber), CH6 consistently prevailed over MG1655 when the two were grown together in competition, strongly supporting our hypothesis.

*** 3. *Echinacea purpurea*'s immunomodulatory properties: assessment of morphological changes, CB2 and iNOS expression in macrophages treated with *Echinacea* simulated digestion**
Zurek, Oliwia W.[1] and Thompson, Christopher R. [1]Knox College, Mundelein, IL. [2]Loyola University Maryland, Baltimore, MD.

Echinacea purpurea, or the purple coneflower, has been used as an herbal remedy for centuries. Despite a wealth of anecdotal evidence, very little is understood about the actual cellular effects and mechanisms involved in treatment with echinacea. A number of in vitro experiments have shown that echinacea can enhance inflammatory response by activating phagocytes such as

macrophages. More specifically, research suggests that bioactive compounds found in the herb can bind to receptors located on macrophages which then trigger the release of various anti- and pro-inflammatory cytokines. Given the previously reported significance of cannabinoid receptor 2 (CB2) in interactions between purified echinacea compounds and macrophages, our studies were designed to determine whether echinacea subjected to simulated digestion (ESD) exerted its immunomodulatory functions by binding to CB2 receptors. Furthermore, to examine echinacea's activating properties, we assessed morphological changes in macrophages treated with ESD using scanning electron microscopy. Our results demonstrate that while CB2 receptor is responsible for mediating some cytokine secretion, ESD significantly inhibits CB2 transcription and enhances inducible nitric oxide synthase (iNOS) expression suggesting there might be other pathways by which echinacea exerts its anti- and pro-inflammatory functions in macrophages. The observed changes in surface morphology, which consisted of wide and elongated lamellipodia projections, indicate that echinacea activates macrophages in a time-dependent manner.

*** 4. Biofilm formation and survival of capsule-deficient mutants of *Enterococcus faecalis* in a root canal infection model**

Adair, Diana[1], McCracken, Vance J.[1], and Gillespie, M. Jane[2]. [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]Southern Illinois University School of Dental Medicine, Alton, IL.

The most common bacterial species isolated after failure of endodontic therapy is *Enterococcus faecalis*. This study evaluates if the *E. faecalis* capsule facilitates the organism's ability to penetrate and colonize the root canal system post-treatment. One of three strains was used in each variable group: OG1RF (wild-type) and the capsule-deficient OG1RF insertion mutants TX5179 and TX5180. Using a root canal infection model, each variable group of extracted single-rooted human teeth was infected with 3.12×10^6 ($\pm 2.16 \times 10^6$ depending on the canal size) *E. faecalis* cells grown in BHI media. The control group was infected with BHI only. Models were incubated aerobically at 37°C for 21 days and checked daily for failure, as indicated by turbidity in the broth. After incubation, paper point samples were taken for colony forming unit (CFU) counting. Instrumented teeth roots were split longitudinally and each half root was used for scanning electron microscopy. Mutant-infected roots took on average 1.8 days longer to fail than the wild-type infected roots. Culturing of paper point samples revealed average CFU/mL was 100-fold higher in the wild-type samples than the other mutants groups. Preliminary scanning electron microscopy showed the wild-type group had a higher percentage of biofilm coverage while mutant groups showed isolated cells of *E. faecalis*. Results indicate the OG1RF strain of *E. faecalis* survives more effectively within the root canal system compared to capsule-deficient strains, and this survival may be due to biofilm formation.

Division: Physics, Mathematics & Astronomy

*** 1. Modeling Electromagnetic Braking**

Trumpy, Shae. Millikin University, Decatur, IL.

If a cylindrical magnet is dropped into a nonferrous conductive tube, it will travel at a slower rate than if it were dropped into a tube of non-conducting material. This phenomenon is known as electromagnetic braking. Using a Vernier Instruments magnetic field probe and National Instruments LabVIEW software, we measure the magnetic field of the magnet. From this data

we calculate the expected induced current, induced magnetic field, and dissipated power, and compare our experimental results with our computations for the energy lost to electromagnetic braking.

*** 2. Computer Simulations of Solar System Formation**
Schenk, Andrew and Watson, Casey. Millikin University, Decatur, IL.

In 2009, the International Year of Astronomy, the total number of known planets outside our solar system or exoplanets grew to more than 400. With the expansive night sky and limited equipment capable of locating Earth-like planets, it is important to have an understanding of where to spend resources to look for sister Earths. We have attempted to develop a computer simulation of solar system formation in part to predict probable locations of life- supporting exoplanets; i.e., which stars, if any, tend to host the most Earth-like planets. Our simulation, written in Objective-C, starts with a sun-like proto-star and a distribution of randomly generated planetesimals. Over time, these planetesimals shift their orbit about the proto-star and merge with one another in response to the gravitational influences of the proto-star and other nearby planetesimals.

3. "Whiskers in the wind" – The interaction of rat whiskers with air currents
Gopal, Venkatesh[1], Kim, Minwoo[2], Chiapetta, Charles[2], Russ, Joel[2], Meaden, Michael[1] and Hartmann, Mitra J. Z.[4] [1]Department of Physics, Elmhurst College, Elmhurst, IL. [2]University of Illinois at Urbana Champaign, Champaign, IL. [3]Elmhurst College, Elmhurst, IL. [4]Northwestern University, Evanston, IL.

Many species of mammals have a regular array of facial whiskers (mystacial vibrissae) which emerge from sensory follicles embedded in the cheek. Each whisker-follicle pair constitutes a highly sensitive mechano-transducer, and the whiskers are often used for the tactile exploration of objects. Rats, for example, actively sweep their whiskers against objects between 5 – 12 Hz in a behavior called "whisking." Using only whisking movements, a rat can actually extract object features such as size, shape, orientation and texture. However, many animals with large and prominent vibrissae, such as dogs, do not actively whisk. Why, then, are the vibrissae so prominent, and so regularly arranged, even in species that do not actively whisk? We hypothesized that in addition to their direct tactile function, whiskers may also enable rat's to sense wind direction (rheotaxis), and that the rat's vibrissal array can be used to measure information about local airflow. To test this hypothesis, we measured the interactions of vibrissae with air currents in anesthetized rats. Turbulent air streams were blown onto the vibrissae of an anesthetized rat at various angles. Whisker deflections were measured using high-speed video cameras at a frame rate of 1KHz. Whisker kinematic parameters were measured and compared across vibrissae on both sides of the face. Our preliminary results show significant differences in response frequency and amplitude across the right and left sides of the vibrissal array, depending on the orientation of the air stream. We discuss these results in the context of odor localization behaviors.

Division: Zoology

1. Hydrodynamic drag is affected by shell size in *Pleurocera acuta*
Karcher, E. and Brunkow, P. Southern Illinois University Edwardsville, Edwardsville, IL.

Snails are important members of stream and river communities, both numerically and functionally. Snails also use a form of locomotion that is among the most energetically expensive in the animal kingdom. Thus, factors affecting hydrodynamic drag, such as shell size and shape, may have far reaching consequences for the ecosystem role played by snails. Drag has been measured in larger marine snails, but we know of no drag studies performed on freshwater snails. We used a terminal velocity assay to measure drag in *Pleurocera acuta* from the Meramec River of east-central Missouri. Shell size and shape covaried, with larger shells being relatively narrow and conical compared to smaller shells. We were able to detect a significantly positive relationship between drag and shell size across the range of velocities assayed; however, this preliminary analysis found no relationship between drag and shell shape after accounting for size variation. We hope to expand this analysis by including a broader range of *Pleurocera* shell shapes, and by comparing drag in *Pleurocera* to that in the confamilial and syntopic *Elimia potosiensis*, which possesses very different shell architecture.

2. Comparison of Jumping Behavior in Leiopelmatid and Lalagobatrachian Frogs
Essner, Jr., R. L. [1], Suffian, D.[1], and Reilly, S. M.[2] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]Ohio University, Athens, OH.

Rocky Mountain tailed frogs, *Ascaphus montanus* (Anura: Leiopelmatidae), are semi-aquatic anurans belonging to a basal clade that diverged from all other frogs (Lalagobatrachia) at least 170 mya. Leiopelmatids retain a suite of plesiomorphic morphological features, including nine amphicoelous presacral vertebrae, free ribs, epipubic cartilage, and a "tail-wagging" muscle. They are unique among frogs in their use of an asynchronous (trot-like) rather than synchronous swimming gait. Detailed studies of leiopelmatid jumping behavior are currently lacking. However, it has been assumed that all anurans jump in a similar manner by rapidly extending hindlimbs during the propulsive phase and initiating a mid-air rotation during flight in order to land forelimbs-first. Recovery begins near mid-flight by protracting and flexing extended hindlimbs and protracting and extending forelimbs so they are positioned to absorb impact forces. We compared jumping in *A. montanus* with basal and derived lalagobatrachians, *Bombina orientalis* and *Rana pipiens*, using high-speed video. *Ascaphus montanus* differed from lalagobatrachians in the timing of key kinematic events and exhibited dramatically different landing posture. *Bombina orientalis* and *R. pipiens* reflected the general lalagobatrachian condition of early hindlimb recovery and forelimbs-first landings. In contrast, *A. montanus* exhibited delayed hindlimb recovery and avoided forelimbs-first landings. We propose that the jumping behavior of lalagobatrachian frogs is derived and that the unique behavior of *A. montanus* represents the ancestral condition.

*** 3. Mate Preference and Association Behavior of Two Closely Related Topminnow Species *Fundulus notatus* and *F. olivaceus* (Cyprinodontiformes)**

Schoeneck, B. D.[1], Jablonski, M.[1], Duvernell, D. D.[1] and Schaefer, J. F.[2] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]University of Southern Mississippi, Hattiesburg, MS.

Fundulus notatus and *F. olivaceus* are two species of topminnows that occupy largely overlapping North American ranges including the Mississippi River and Gulf of Mexico drainages, and are occupants of similar ecological niches. These closely related fishes are very similar, with the primary phenotypic difference being presence or absence of spots along their dorsal surfaces. The species are capable of interbreeding and hybridization and backcrossing has been documented in nature to a limited extent. However, studies of laboratory no-choice crosses have demonstrated that prezygotic isolation contributes to reproductive isolation. The goal of this study is to test the strength of conspecific mate preference as a mechanism of prezygotic isolation in both males and females. In separate experiments conducted in outdoor pools we have analyzed mate preference of these species using 1) genetic identification of offspring parentage when either males or females are presented with a choice of conspecific or heterospecific mates and 2) behavioral analysis of association preferences of single individuals when presented with a choice of potential conspecific and heterospecific mates. Genetic analysis demonstrated that females of both species exhibited a strong conspecific mate preference while males showed no such preference. Behavioral analyses suggest a similar pattern. Taken together, these studies provide evidence that prezygotic isolating mechanisms serve an important role in genetic isolation between these species.

*** 4. Factors affecting the bottlenose dolphin's ability to interpret human-given social cues**

Butzen, C.[1], Templeton, J.[1] and Byerly, H.[2] [1]Knox College, Galesburg, IL. [2]Dolphins Plus, Key Largo, FL.

Atlantic Bottlenose Dolphins (*Tursiops truncates*) have been shown to use human-given social cues in an object-choice task that used two dolphins of the same age. Therefore, we studied the influence of age and personality on dolphins' understanding of human given social cues. Five Atlantic Bottlenose Dolphins, ages two to thirty-three years, were used in an object choice task where a reward was concealed under one of two containers on opposite ends of a training platform. A human experimenter gave one of three social cues (point, gaze, and point and gaze) indicating the container where the reward was hidden. Correct choices were determined by whether the subject touched its rostrum to the container or remained stationary in front of the container for five seconds. We predicted that if the ability of the subject to recognize that a social cue indicated a reward was simply the result of being a highly social species, then both younger and older dolphins would perform equally well. However, if older dolphins performed better than younger dolphins, this would indicate that the ability to use social cues is at least partly a developmental process. We also determined which of five dolphin personality factors correlated best with performance.

5. Phylogeography of Two Species of Stoneflies (Plecoptera) in Eastern North America
DeWalt, R. E.[1], Giordano, R.[1], and Chabot, E.[2] [1]Illinois Natural History Survey, Champaign, IL. [2]University of Illinois, Champaign, IL.

There is little information about the phylogeography of aquatic insects in North America, yet these insects are great models for such research due to large population sizes and wide distributions. Our objectives were to determine the glacial refugia usage and relative contribution of these refugia to repopulation of once glaciated areas. Haplotype frequency and distribution for the entire length of the cytochrome c oxidase 1 (COI) gene of mtDNA was analyzed for this purpose. Current data support both species using the Ozark Mountains and central and eastern Tennessee and Kentucky as major refugia, while only minor leakage of Ozark haplotypes appear to have spread into southern Illinois, creating a secondary contact zone. Once glaciated areas appear to have been repopulated mostly from Tennessee and Kentucky. Populations in once glaciated areas are largely comprised of 1-3 frequent haplotypes (those from the original wave of migrants), plus a large number of low frequency haplotypes of 1-3 bp difference derived from them. More sampling is need in Atlantic and Gulf Coast drainages to complete our understanding of glacial refuge usage and post-glacial migration in these two species.

*** 6. Impacts of prescribed burning on soil and litter invertebrate diversity in a northeastern IL oak woodland**
Boelter, B. J.[1], Jacobs, K. A.[1], Scharenbroch, B.[2] and Peters, E. L.[1] [1]Chicago State University, Chicago, IL. [2]Morton Arboretum, Lisle, IL.

The effects of low-intensity, prescribed burning on soil and litter-dwelling invertebrates were studied in an oak-dominated woodland in northeastern Illinois. Soil and litter samples were collected in Fall (2008-2009) and Spring (2009) from 40 plots distributed among annually-burned (20 years), periodically-burned (every 2-3 years for 20 years), or unburned (control) areas. Three soil types were represented. Invertebrates extracted with Burlese-Tullgren funnels were counted and identified to Order based on morphology. Thirteen taxa were identified in soil samples, with Orders Acari and Collembola most abundant (density = 64.84/kg and 7.33/kg, respectively). Seventeen orders were identified in litter, with Acari and Collembola predominating, as well. ANOVAs revealed lower invertebrate richness, abundance, and diversity (all $P < 0.001$) occurred in spring versus fall soils, but season of sampling affected only richness in litter samples ($P < 0.0089$). Burning and soil type produced no significant effect on soil invertebrates, but litter samples from unburned plots tended to have the lowest richness, abundance, and diversity values. A similar trend was noted in soil samples, suggesting that overall, burning may enhance biodiversity. However, pronounced differences between spring and fall samples indicate sampling over multiple seasons is needed.

*** 7. The use of essential oils as repellents of Lone Star (*Amblyomma americanum*) ticks**
Geiselman, J. and Chapman, E. Illinois College, Jacksonville, IL.

Serial dilutions of essential oils in acetone were tested for their ability to repel adult Lone Star (*Amblyomma americanum*) ticks. Ten-microliter aliquots of garlic oil (*Allium sativum*), peppermint oil (*Mentha arvensis*), rose geranium oil (*Pelargonium rosium*) and tea tree oil (*Melaceuca alternifolia*), pennyroyal (*Mentha pulegium*), Lemongrass (*Cymbopogon citratus*) , white thyme (*Thymus vulgaris*) lavender (*Lavandula augustifolia*) and sage (*Salvia officinalis*) each in acetone were applied to filter paper in a Petri dish. After the droplet was visibly dry, 10

Lone Star ticks were placed in the Petri dish and the dish was covered and sealed with Parafilm. After 24 hrs. the Petri dishes were checked and the number of ticks in the control (acetone only) vs. experimental areas (essential oil) of the filter paper were counted and recorded. This procedure was repeated 10 times for each treatment. The percentages of ticks found on the control areas (acetone only) were: 66% in 0.01% garlic oil; 84% in 0.01% tea tree oil; 66% in 0.1% peppermint; 69% in 0.1% rose geranium oil; and 80% in tea tree oil. The other oils showed no repellent activity. Further studies will involve various combinations of the oils in an attempt to find an effective tick repellent.

*** 8. Analysis of habitat utilization and foraging behavior of two species of woodpeckers in fragmented oak-hickory forest**

French, Z., Minchin, P. R. and Essner, R. L. Southern Illinois University Edwardsville, Edwardsville, IL.

Woodpeckers play an important role in forest communities by providing nesting and roosting cavities for a variety of wildlife, such as the once threatened Wood duck (*Aix sponsa*). Previous studies in the northern USA have shown woodpeckers to be valuable in controlling invasive insects and in particular the Emerald Ash Borer (EAB). EAB currently stands as the number one threat to ash (*Fraxinus* sp.) trees in North America. Two particular species, the Hairy woodpecker (*Picoides villosus*) and the Downey woodpecker (*Picoides pubescens*) are extremely aggressive in removing pupal EAB and are considered the number one cause of biotic mortality to EAB. These two woodpeckers have been heavily studied in coniferous forest in the northwest, upper Midwest and the northeastern parts of USA, where EAB outbreaks have already occurred. Very little research has been conducted on their foraging behaviors in the midwest and in deciduous forest where no invasion has occurred. Research was conducted in the fall of 2009 to examine tree species preference, foraging height, diameter class preference and behavioral repertoire between the two species. Preliminary results show a clear division in foraging height between the two species, but no significant differences in tree species utilization or foraging behavior. Both species spent a significant amount of time in foraging bouts on ash trees. This research will be continued and expanded as part of my Master of Science project.

*** 9. A phylogeographic analysis of the *Fundulus notatus* complex using nuclear Amplified Fragment Length Polymorphisms (AFLPs)**

Meier, S. L.[1], Kreiser, B.[2], Schaefer, J. F.[2] and Duvernell, D. D.[1] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]University of Southern Mississippi, Hattiesburg, MS.

The *Fundulus notatus* species-complex comprises a group of closely related killifish species including two broadly distributed members, *F. notatus* and *F. olivaceus*, and several narrowly endemic populations/species. The purpose of this research was to infer the phylogeographic history of this complex using a nuclear multi-locus approach (AFLPs – Amplified Fragment Length Polymorphisms), and evaluate the concordance of historical inferences to those provided by a mtDNA cytochrome b gene phylogeny. A total of 223 individuals, representing all recognized species and lineages, were analyzed, with representative samples from drainages in Illinois, Missouri, Mississippi, Arkansas, Oklahoma, Louisiana, and Texas. A total of 866 variable AFLP loci were scored and a Neighbor Joining phylogeny was constructed. Coastal drainages generally each exhibited distinct clades indicative of deep ancestry among populations in the southern distribution of the species complex. Among more northern drainages, some

populations were closely related to populations in coastal drainages, indicating recent range expansions, while others formed distinct clades indicative of deeper ancestry.

*** 10. Current range and regional population structure of *Acroneuria frisoni* Stark & Brown 1991 (Plecoptera: Perlidae): A prelude to reintroduction**

Chabot, E.[1], Giordano, R.[2] and DeWalt, R. E.[2] [1]University of Illinois, Champaign, IL. [2]Illinois Natural History Survey, Champaign, IL.

Recent conservation concerns continue to escalate due to the increasing trends of habitat loss among all organisms. However, one group consistently remains underrepresented in the conservation effort, namely aquatic insects. To understand the historical phylogeography of these sensitive species would provide insight into the post-glacial recolonization and expansion patterns and ultimately inform future preservation efforts of related taxa. *Acroneuria frisoni* Stark & Brown(Plecoptera: Perlidae) is an ideal model for phylogeographic study due to its rapid life cycle and widespread distribution across North America. The regional genetic structure of *A. frisoni* has been determined by sequencing 1511 bases of the mitochondrial gene Cytochrome Oxidase I of 300 individuals from populations across its range. Data suggest this species was maintained within at least two distinct refugia: the Ozarks within Arkansas and Missouri and an eastern refugium in central Tennessee. Central Tennessee, through the course of multiple expansion events, appears to be the main source for northward recolonization. Sequence data demonstrating regional variation also reveal a point of secondary contact between refugia within southern Illinois, suggesting some leakage of Ozark haplotypes eastward. These data provide information on the expected genetic structure of historical populations formerly inhabiting central Illinois that have since been extirpated. With the added support of these haplotype data, some of Illinois' biological heritage might be reclaimed through an informed reintroduction of *A. frisoni*.

*** 11. Analysis of home range size and movement patterns of the blackstripe topminnow, *Fundulus notatus* (Family: Fundulidae), in Cahokia Creek**

Alldredge, P. A.[1], Duvernell, D. D.[1], Schaefer, J. F.[2], Schoeneck, B. D.[1] and Selby, H. Z.[1] [1]Southern Illinois University Edwardsville, Edwardsville, IL. [2]University of Southern Mississippi, Hattiesburg, MS.

This research evaluated the home range size of the blackstripe topminnow, *Fundulus notatus*. Habitat preferences and the influence of sex and size on movement patterns were also investigated to provide an understanding of the effects of home range size in determining partitioning of individual feeding habitats. Resource partitioning affects species distribution which can have consequences on interspecific interactions, such as hybridization. Individuals were collected from Cahokia Creek, a small tributary of the Mississippi River in southern Illinois. Each individual was injected with a unique combination of two elastomer tag markings. Weekly recapture events occurred from mid-June through August. We hypothesized that *F. notatus* individuals would conform to the restricted movement paradigm which states that the majority of steam fishes are non-mobile and restrict their movements to a home range that is well-defined within 20-50 meter stretches of stream. We further predicted that males and large individuals would exhibit territorial behavior and would therefore be less mobile than females and smaller individuals. We found that the majority of individuals remained in the pool of initial capture, suggesting that *F. notatus* individuals follow the restricted movement paradigm. Our

data show there was no effect of sex on estimated daily movement distances. However, when a size effect was tested for all data, small fish moved significantly greater distances than large fish.

*** 12. Sex ratios and social forms in high elevation mating flights of the red imported fire ant, *Solenopsis invicta***

Fritz, N. E.[1], Lewis, W.[2], Uppuluri, A.[2] and Fritz, G. N.[2] [1]Charleston High School, Charleston, IL. [2]Eastern Illinois University, Charleston, IL.

Mating flights of the red imported fire ant (RIFA) occur at high elevations and provide opportunities for long-distance dispersal of this pest species. The RIFA has two social forms (single and multiple-queen colonies) that are determined by a single di-allelic gene. The purpose of this study was to provide baseline data on the sex ratios and social forms present at different elevations during a mating flight to help resolve the social dynamics, mating structure, and potential dispersal dynamics of the RIFA. A 10 ft. diameter, helium-filled balloon was used to lift a series of sticky traps to various elevations up to 450 ft. during a mating swarm. Ants were sexed, and dissected for their mating status (e.g., presence or absence of sperm). Male and female ants, and stored sperm were also genotyped for the locus that determines social form. Our results show that mating flights occur at high elevations (approximately 250 to 450 ft.) and with significant stratification by sex.

*** 13. Effects of Diet on Mandible Shape in Family Mustelidae**

Schorsch, R. and Kohn, L. Southern Illinois University Edwardsville, Edwardsville, IL.

The size and shape of the mandible varies among all species, even those within the same family. Diet has a significant effect on mandible morphology. Variation in morphology can be seen in the dental region as well as sites for muscle attachment. This study examines the mandible morphology and the effects of dietary differences on the mandible within the Family Mustelidae. Mandibles of the American Mink (*Mustela vison*), Long-tailed Weasel (*Mustela frenata*), North American River Otter (*Lontra canadensis*), and Badger (*Taxidae taxus*) were borrowed from the Illinois State Museum and the Illinois Natural History Survey. Dimensions of two functional areas, the alveolus and ramus, were obtained from digital photographs. Significant differences were observed across both the regions; however the taxa were more distinguished by the dimensions of the ramus. This supports the previous literature that differences in food selection and food preparation can affect the morphology of the mandible. These differences demonstrate selection for dietary specialization, accommodating their main food source.

14. Morphological Integration in Scapula Form: Data From Red Fox and Gray Fox (*Vulpes vulpes*, *Urocyon cinereoargenteus*, Family Canidae)

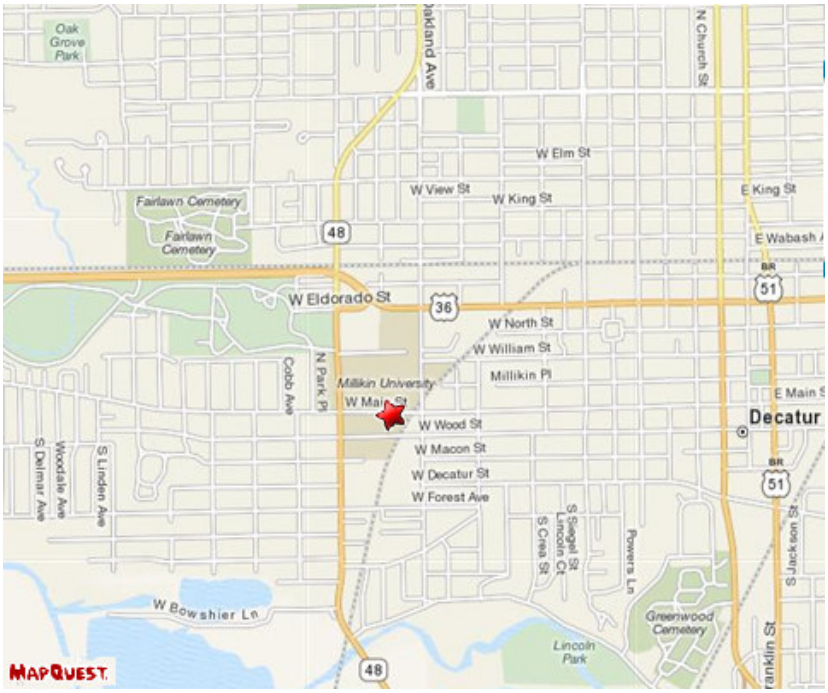
Kohn, L., Sydow, M. and Watkins, J. Southern Illinois University Edwardsville, Edwardsville, IL.

The scapula is a single bone made up of distinct developmental tissues. Regions within the scapula also have distinct functional relationships in its role as the interface between the appendicular and axial skeleton. Scapular forms in red fox (*Vulpes vulpes*) and gray fox (*Urocyon cinereoargenteus*) provide an opportunity to test for the presence of distinct functional and developmental regions. Foxes are distinguished in their locomotor patterns, with gray foxes having an ability to climb trees. We test whether regions that are functionally related or developmentally related are more highly correlated, or show greater integration, than areas that

are unrelated. Results indicate form differences between red and gray fox that are consistent with their different locomotor patterns. Scapula form is the result of both functional and developmental integration. The results complement earlier studies of Primate scapula and cranial integration.

DRIVING DIRECTIONS TO MILLIKIN UNIVERSITY

Millikin University, 1184 W. Main Street, Decatur, IL 62522



Traveling east on I-72 from Springfield

- Take the first Decatur exit (Decatur/Pana)
- Proceed into Decatur
- Turn right (fourth stoplight after exiting the interstate) on Oakland Avenue then first right on Main Street

Traveling south on 51 from Bloomington

- Travel south on 51 to Route 36
- Turn right on Eldorado Street (36 West)
- Proceed to Oakland Avenue and turn left
- At the next stop light turn right on Main Street

Traveling west on I-72 from Champaign

- Take the 51 south exit
- Travel south on 51 to Route 36
- Turn right (36 West) on Eldorado Street
- Proceed to Oakland Avenue, turn left
- At the next stop light turn right on Main Street

Traveling north on 51

- Follow 51 into Decatur
- Turn left on Main Street
- Millikin University is approximately 12 blocks west

MILLIKIN UNIVERSITY CAMPUS MAP

Conference Buildings

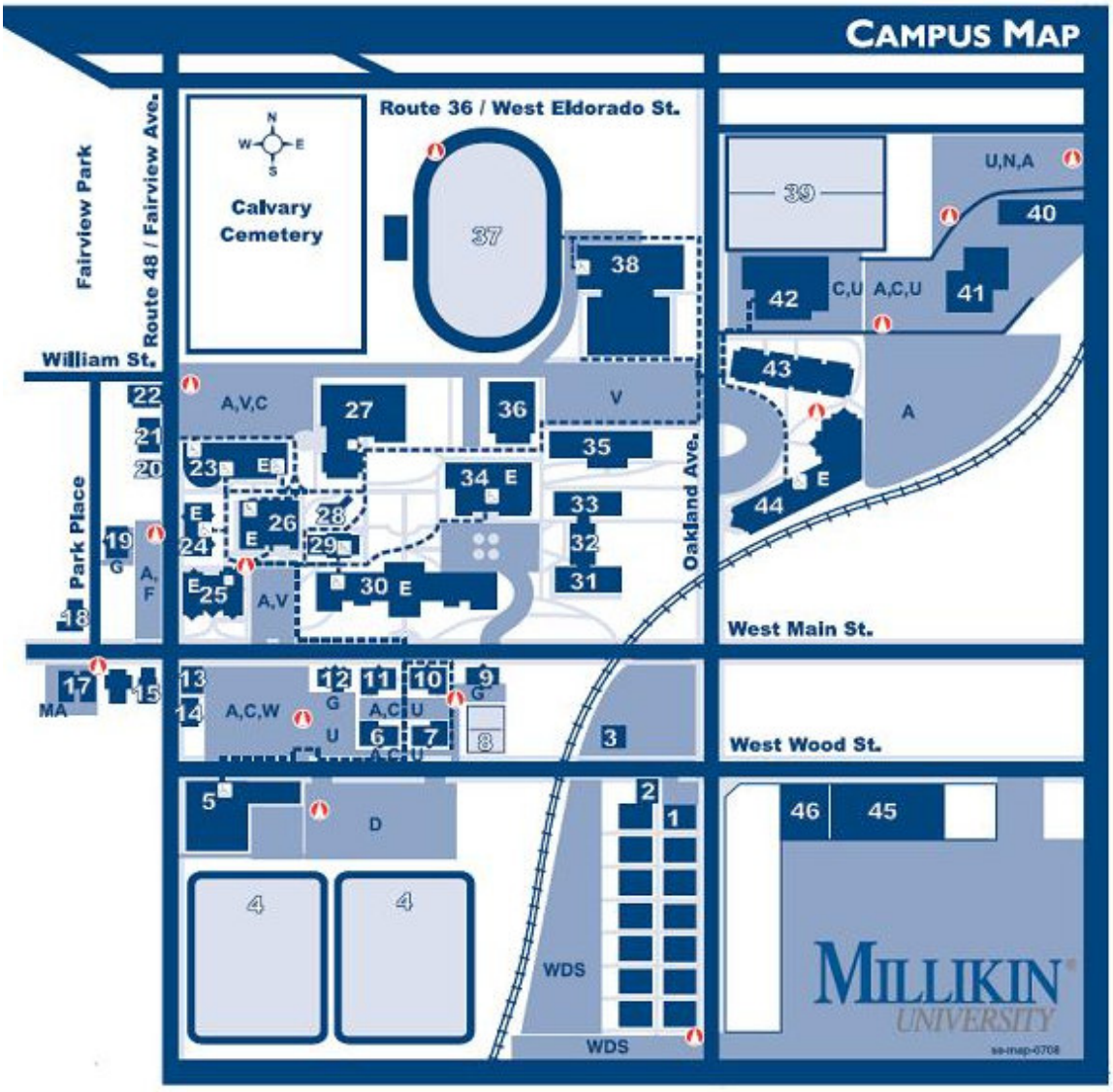
#23 - Leighty-Tabor Science Center: Registration, Star Gazing, Oral Presentations, and Division Meetings

#27 - Kirkland Fine Arts Center: Poster Session

#28 - Pilling Chapel: Oral Presentations and Division Meetings

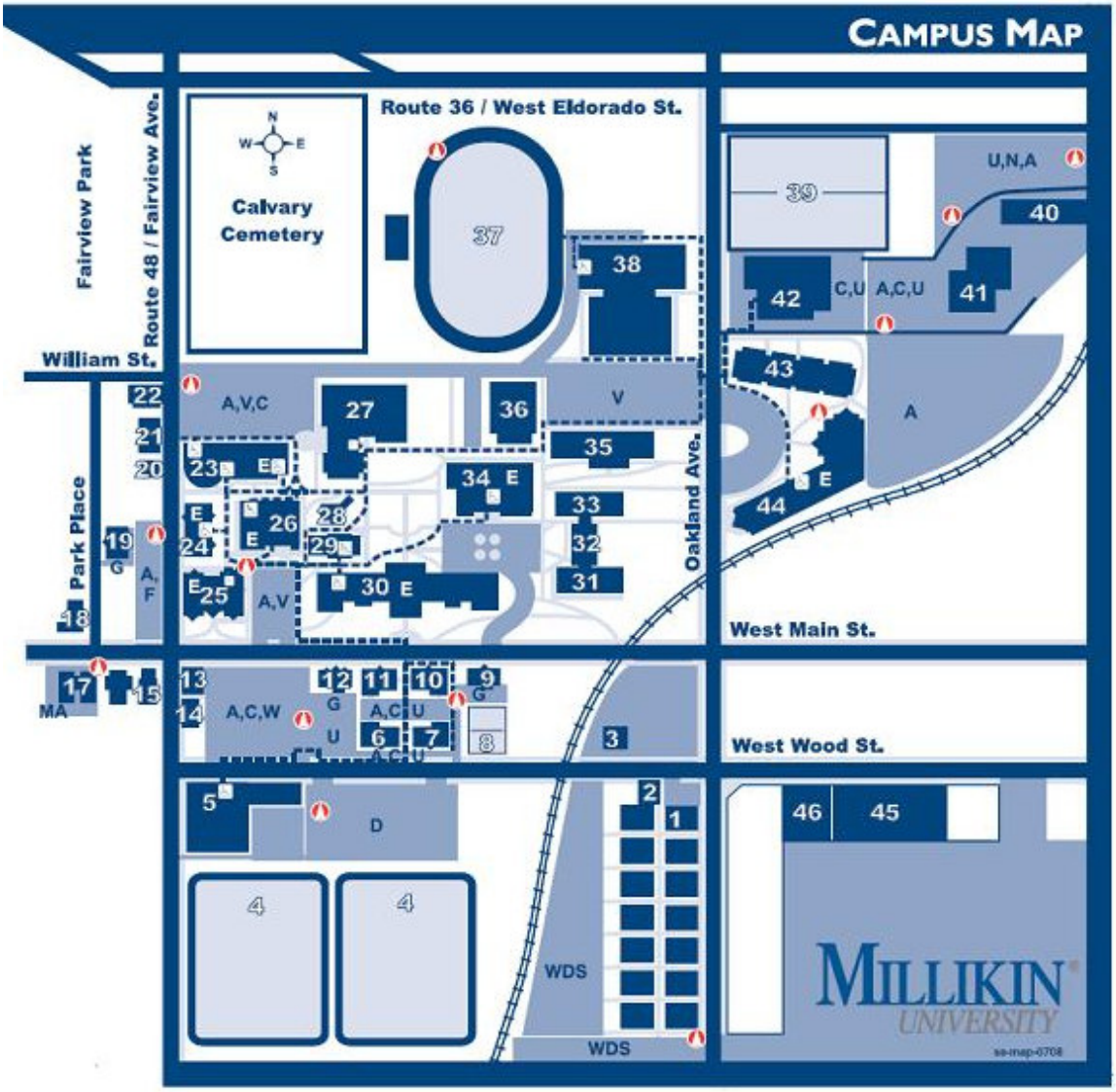
#30 - Shilling Hall: Oral Presentations and Division Meetings

#34 - Richards Treat University Center: Council Meeting, Graduate School/Job Fair, Banquet, Breakfast, Lunch, Business Meeting, and Award Announcements



PARKING

On both Friday and Saturday, parking will be available in two locations: 1) the lot labeled A,V,C immediately north of building #23 (Leighty-Tabor Science Center), and 2) the lot labeled A,F across the street and west of building #25 (Perkinson Music Center). The lot labeled A,F is accessed at the south end off of West Main. St.



OFFICIALS OF THE ILLINOIS STATE ACADEMY OF SCIENCE

May 2009 - May 2010
(As of March 2010)

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Constitution and Bylaws: Open

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Meetings and Expositions: Open

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Museum Board Room: 217-782-5860

FUTURE MEETINGS

April 2011: Eastern Illinois University

FELLOWS OF THE ILLINOIS STATE ACADEMY OF SCIENCE

Year	Fellow	Area
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

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 102nd Annual Meeting at Millikin University was no exception, and we would like to thank everyone for their assistance. We would especially like to thank the President of the ISAS, Ed DeWalt, and the Executive Secretary, Robyn Myers, for their assistance in all 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. Dozens of individuals at Millikin University from facilities and catering to faculty and administration have worked tirelessly in preparation for the meeting. To the students, staff, and faculty of Millikin: Thank you. Finally, and most importantly, we thank the attendees, presenters, and our keynote speakers. It is an honor to organize and host a meeting showcasing such amazing scientific endeavors.

Sincerely,
David Horn and Stacey Shonkwiler
Vice Presidents, 2010 Annual Meeting

AUTHOR INDEX