TRANSACTIONS OF THE ILLINOIS STATE ACADEMY OF SCIENCE

Supplement to Volume 106

105th Annual Meeting

April 5-6, 2013

Illinois College

Jacksonville, Illinois

Illinois State Academy of Science

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Affiliated with the Illinois State Museum, Springfield, Illinois

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ORAL AND POSTER PRESENTATION ABSTRACTS

Oral Presentation Abstracts

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SCHEDULE OF EVENTS

Friday, April 5

1:00 – 5:00	Registration – Memorial Gymnasium Lobby
1:00 – 2:00	ISAS Council Meeting Parker Dining Room of Cumings Hall Lunch is available in Cumings Dining Hall for Council Members
1:00 – 3:00	Poster set up – Memorial Gymnasium

Snacks and juice will be available in the Memorial Gymnasium Lobby during the poster session.

3:00 – 4:00	Poster Session – Memorial Gymnasium – Even numbers
4:00 – 5:00	Poster Session – Memorial Gymnasium – Odd numbers
5:00 – 6:30	Oral presentations – Parker Science Hall 106
6:30 – 7:30	Banquet – Cumings Dining Hall

7:30 pm, Keynote Address: Dr. Pamela Gay, astronomer and citizen science advocate:
Crowdsourcing understanding: a new way to accomplish science through pro-am collaboration

Saturday, April 6

Coffee, juice, and pastries will be available in the first floor rotundas of both Parker Science Hall and Kirby Learning Center during the morning sessions.

7:30 – 12:00	Registration - Parker Science Hall Rotunda
8:00 – 12:00	Oral Presentations (See detailed schedules)
12:00 – 12:30	Division meetings
12:30 – 1:30	Lunch and Award Announcements
1:30 – 5:00	Optional field trip to Starhill Arboretum

ORAL PRESENTATION SCHEDULE AT-A-GLANCE

Friday, April 5	
Session	**1**
Room	**Parker 106**
5:00 PM	Physics/Math
5:15 PM	Physics/Math
5:30 PM	Physics/Math
5:45 PM	Physics/Math

	Saturday, April 6					
Session	**2**	**3**	**4**	**5**	**6**	**7**
Room	**Kirby 110**	**Parker 106**	**Kirby 108**	**Kirby 112**	**Parker 107**	**Kirby 006**
8:00 AM						Set up
8:15 AM	Set up	Set up				Zoology
8:30 AM	Botany	CMDB				Zoology
8:45 AM	Botany	CMDB				Zoology
9:00 AM	Botany	CMDB				Zoology
9:15 AM	Break	Break	Set up	Set up	Set up	Break
9:30 AM	Botany	CMDB	Chem	Env Sci	Health	Zoology
9:45 AM	Botany	CMDB	Chem	Env Sci	Health	Zoology
10:00 AM	Botany	CMDB	Chem	Env Sci	Health	Zoology
10:15 AM	Break	Break	Break	Break	Break	Break
10:30 AM	Botany	CMDB	Chem	Env Sci	Micro	Zoology
10:45 AM	Botany	CMDB	Chem	Env Sci	STEM Ed	Zoology
11:00 AM	Botany	CMDB	Chem	Zoology		Zoology
11:15 AM	Botany	CMDB	CS	Zoology		Zoology

Division meetings will follow the conclusion of the appropriate sessions.

ORAL PRESENTATION SESSIONS

Division business meeting will convene at the close of each session unless otherwise scheduled by the Division Chair. An asterisk (*) indicates the presentations eligible for a Student Presentation Award.

Friday, April 5th 5 pm - 6 pm:

Session 1: Oral presentations in Parker Science Hall 106
Division: Physics, Mathematics, & Astronomy

1. Error-Correcting Codes Classical to Quantum
Woodworth, Timothy S. and Kapale, Kishor T.; Western Illinois University, Macomb, IL.

2. *Covering the Square Lattice with Disjoint Unit Disks
Manary, Elizabeth, Hommowun, Nick, and Alm, Jeremy; Illinois College, Jacksonville, IL.

3. *Investigating the Dispersion of Conoscopic Interference Patterns
Olorunsola, Oluwatobi Gabriel and Pengqian, Wang; Western Illinois University, Macomb, IL.

4. *Effect of Temperature-Dependent Migration Rates on Metapopulation Dynamics
Liu, Shufang and Ekanayake, Amy J.; Western Illinois University, Macomb, IL.

Saturday, April 6th 8 am – 12 pm

Session 2: Oral presentations in Kirby Learning Center 110
Division: Botany

8:30 - 9:15 am:

1. *Schoenoplectiella* ×*magrathii* (Cyperaceae), a new interspecific hybrid between *S. hallii* and *S. saximontana* from Oklahoma, USA
[1]Smith, Marian and [2]McKenzie, Paul M.; [1]Southern Illinois University Edwardsville, Edwardsville, IL and [2]US Fish & Wildlife Service, Columbia, MO.

2. *Puccinia mariae-wilsoniae* and *Claytonia virginica*: A pathogen's tale
Schlund, Sarah A., Methven, Andrew S., and Carlsward, Barbara S.; Eastern Illinois University, Charleston, IL.

3. *Characterization and multivariate analysis of floodplain forest communities in Mississippi River Pool 24

[1]Israelitt, David M., [1]Brugam, Richard, [2]Walton, Elizabeth, and [1]Schulz, Kurt; [1]Dept. of Biological Sciences and [2]Program in Environmental Sciences & Dept. of Geography, Southern Illinois University Edwardsville, Edwardsville, IL.

9:30 am – 10:15 am:

4. Influence of Deer Browsing on Abundance, Diversity, and Floristic Quality of Prairie Forbs

[1]Anderson, Roger C., [1]Anderson, M. Rebecca, and [2]Corbett, Erica A.; [1]Illinois State University, Normal, IL and [2]Southeastern Oklahoma State University, Durant, OK.

5. *The Effects of Simulated Herbivory on Chlorophyll Anthocyanin Content of White Ash (*Fraxinus americana* L.) Leaves

Staudenmaier, Allyson B. and Parrish, J. A. D.; Millikin University, Decatur, IL.

6. Vegetative anatomy of the *Aerides* alliance (Vandeae, Orchidaceae)

Carlsward, Barbara S. and Stanley, Kevin; Eastern Illinois University, Charleston, IL.

10:30 am – 11:30 am:

7. *Endophytic fungi and seed germination of critically endangered epiphytic orchids from Madagascar – preliminary results.

[1]Edwards, Korrie E., [1]Thixton, Hana, [1]Zettler, Lawrence W., [1]Stice, Andrew L., [2]Kendon, Jonathan, [3]Rajaovelona, Landy, and [2]Sarasan, Viswambharan; [1]Illinois College, Jacksonville, IL, USA; [2]Royal Botanic Gardens, Kew, United Kingdom; and [3]Madagascar Conservation Centre, Antananarivo, Madagascar

8. **Tulasnella irregularis* (Basidiomycota: Tulasnellaceae) from roots of *Encyclia tampensis* (Orchidaceae) in South Florida, and confirmation of its mycorrhizal symbiosis through symbiotic seed germination

Jacks, Alishia L., Gruender, Luke T., Lopez, Alyssa M., Corey, Laura L., and Zettler, Lawrence W.; Illinois College, Jacksonville, IL.

9. **Ex vitro* growth and survival of *Encyclia tampensis* (Orchidaceae) seedlings harboring mycorrhizal fungi following transfer to different substrates

Hembrough, Ashley M. and Zettler, Lawrence W.; Illinois College, Jacksonville, IL.

10. *Reintroduction of asymbiotically-grown epiphytic orchid seedlings in South Florida (*Epidendrum amphistomum*, *Polystachya concreta*), and subsequent assessment for mycorrhizal colonization

Conley, Sara B., Morton, William G., Stice, Andrew, L., and Zettler, Lawrence W.; Illinois College, Jacksonville, IL.

Session 3: Oral presentations in Parker Hall 106
Division: Cell, Molecular, & Developmental Biology

8:30 - 9:15 am:

1. Evidence for the presence of an Sfi1-like protein in *Vorticella convallaria*.
Konior, Katazyzna, McCutcheon, Suzanne, and Buhse, Howard E.; University of Illinois at Chicago, Chicago, IL.

2. Mitotracker green® , Molecular Probes™, as a marker to determine prey selection of *Tetrahymena vorax* macrostomal cells.
Leong, Lester and Bushe, Howard E.; University of Illinois at Chicago, Chicago, IL.

3. *Effects of peroxynitrite decomposing catalyst, SR-135, on -cell function in obesity induced diabetes
[1]Fyalka, Robert, [1]Johns, Michael, [2]Neumann, William, [2]Rausaria, Smita, [2]Kamadulski, Andrew, [2]Zollars, Harry, [2]Schober, Joseph, [1]Wanda, Paul, and [2]Kwon, Guim; [1]Department of Biological Sciences and [2]School of Pharmacy, Southern Illinois University Edwardsville, Edwardsville, IL.

9:30 am – 10:15 am:

4. The Effects of YLRFamide on the Isolated Crop-Gizzard of the Earthworm
Voss, Benjamin, Vu, Christine, Engelke, Aaron, and Krajniak, Kevin; Southern Illinois University Edwardsville, Edwardsville, IL.

5. *Improving Mitochondrial Bioenergetics in an Alzheimer's Mouse Model via Estrogen Therapy
Hendricks, Eric W., Menze, Michael A., Nathan, Britto P.; Eastern Illinois University, Charleston, IL.

6. *Introvert regeneration in *Themiste lageniformis* (phylum Sipuncula): a Fluorescent and Scanning Electron Microscopy study
Mustaly, Hatim M. and Dybas, Linda K.; Knox College, Galesburg, IL.

10:30 am – 11:30 am:

7. *Identifying the Expression and Interaction between Two Isoforms of Intersectin 1 of *Xenopus laevis* and NF-κB
Jimenez, Oscar A., Coatney, Caroline G., and Thorn, Judith M.; Knox College, Galesburg, IL.

8. *The importance of intersectin 1 (itsn1) on *Xenopus laevis* development
Cheng, Cheng, Coatney, Caroline G., and Thorn, Judith M.; Knox College, Galesburg, IL.

9. The role of *Arabidopsis thaliana* Toc159 family of receptors in protein import and glycerolipid synthesis
Afitlhile, Meshack and Workman, Samantha; Western Illinois University, Macomb, IL.

10. *Early introvert regeneration in *Themiste lageniformis*: A light and transmission electron microscopy study
Brownell, Joshua R. and Dybas, Linda K.; Knox College, Galesburg, IL.

Session 4: Oral presentations in Kirby Learning Center 108
Divisions: Chemistry (1-6) and Computer Science (7)

9:30 am – 10:15 am:

1. *Production and Characterization of Nanoscale Metal Oxide Films from Household Sources
[1]Hinman, Jordan J., [1]Ziegenhorn, John W., [1]Baliss, Michelle S., [1]Campbell, Dean J., [2]Andrews, Mark J., and [2]Stevenson, Keith J.; [1]Bradley University, Peoria, IL and [2]University of Texas-Austin, Austin, TX.

2. *Probing the origin of solvent dependent oxidation behavior of water-soluble hypervalent iodine reagents
Kupireddy, Nikhil and Vinod, Thottumkara K.; Western Illinois University, Macomb, IL.

3. *Synthesis of a biphenyl based water-soluble hypervalent iodine reagent to probe hypervalent iodine twist
Medikonda, Tejaswini and Vinod, Thottumkara K.; Western Illinois University, Macomb, IL.

10:30 am – 11:30 am:

4. *Oxidation of 2-phenylethanol derivatives using water-soluble *o*-iodoxybenzoic acid (IBX) derivatives in aqueous solvent mixtures
Thamisetti, Abhilash and Vinod, Thottumkara K.; Western Illinois University, Macomb, IL.

5. *Synthesis of a new water-soluble *o*-iodoxybenzoic acid (IBX) derivative and its oxidation of alcohols
Gude, Harika C., Vodnala, Thirupathi, and Vinod, Thottumkara K.; Western Illinois University, Macomb, Il.

6. *Synthesis and Antibiotic Testing of Enantiomerically Enriched 5-Aryl-3-oxo-delta-lactones

Brooks, Joshua, Raube, Lee, Remsen, Edward, Campbell, Dean, and Andersh, Brad; Bradley University, Peoria, IL.

7. A Study on the Social Media-based Merchant Reviews and Social Merchants' Performance

Lee, In; Western Illinois University, Macomb, IL.

Session 5: Oral presentations in Kirby Learning Center 112
Division: Environmental Science (1-5) and Zoology (6 & 7)

9:30 am – 10:15 am:

1. Storm Water Runoff of Residential Green Roof Systems.

Mosby, Katie, Retzlaff, Bill, and Murphy, Dan; Southern Illinois University Edwardsville, Edwardsville, IL.

2. Habitat Characteristics of River Otter (*Lontra canadensis)* Latrines at the Emiquon Complex

Fretueg, Gregory R., Ruez Jr., Dennis R., and Lin, Yi-Sz; University of Illinois at Springfield, Springfield, IL

3. *Colonization of green infrastructure by cavity nesting bees and wasps.

[1]Buckles, Brittany J., [2]MacIvor, J. Scott, and [1]Retzlaff, William A.; [1]Southern Illinois University Edwardsville, Edwardsville, Illinois, USA and [2]York University, Toronto, Ontario, Canada

10:30 am – 11:30 am:

4. Lead and tin concentrations in fish from the Lower Illinois River

Matthew, Stephanie A. and Brugam, Richard B.; Southern Illinois University Edwardsville, Edwardsville, IL.

5. *The Source-Partitioning of Selenium Volatilization in the Soil-Prince's Plume (*Stanleya pinnata*) System

Jones, Leighann, Sever, Victoria, Lin, Z.-Q.; Southern Illinois University Edwardsville Department of Biological Sciences, Edwardsville, IL.

6. Response of the Franklin's Ground Squirrel to Recreational Trail Development in Springfield, Illinois
Young, Christopher and Ting, Tih-Fen; Department of Environmental Studies, University of Illinois at Springfield, Springfield, IL.

7. Implementing Habitat Improvement for Franklin's Ground Squirrels in Sangamon County, Illinois
Ting, Tih-Fen; Department of Environmental Studies, University of Illinois at Springfield, Springfield, IL.

Session 6: Oral presentations in Parker Science Hall 107
Divisions: Health Sciences (1-3), Microbiology (4), and STEM Education (5)

9:30 am – 10:15 am:

1. *Gd-DTPA enhanced in vivo imaging of *Xenopus laevis* development using an Ultra-Compact MRI
[1]Huebner, Kelli R., [2]McDowell, Andrew F., and [1]Thorn, Judith M.; [1]Knox College, Biology Dept., Galesburg, IL and [2]ABQMR, Albuquerque, NM.

2. *New antibacterial germacrene from *Verbesina negrensis*
Alpan, Lara B., Mora, Flor D., McCracken, Vance J., and Nieto, Marcelo J; Southern Illinois University Edwardsville, Edwardsville, IL.

3. *Harnessing Apoptotic Pathways to Control Drug-Induced Gingival Hyperplasia.
[1]Yu, Hayoung, [1]Chamberlain, Seth, [1]Wanda, Paul E., [2]Joy, Anita; [1]Department of Biological Sciences, Southern Illinois University Edwardsville, Edwardsville, IL and [2] Southern Illinois University School of Dental Medicine, Alton, IL.

10:30 am – 11:30 am:

4. *An *In Vitro* Assessment of the Antibacterial Effects of Various Plant Essential Oils
[1]Mullen, Keena, [2]Lee, Amanda, [3]Lyman, Roberta, [1]Washburn, Steve, and [3]Anderson, Kevin; [1]Department of Animal Science, North Carolina State University, Raleigh, NC, [2]Knox College, Galesburg, IL, and [3]Department of Population Health and Pathobiology, CVM North Carolina State University, Raleigh, NC.

5. Introducing lecture with a mystery picture
McGilliard, Kip, L.; Eastern Illinois University, Charleston, IL.

Session 7: Oral presentations in Kirby 006
Division: Zoology

8:00 - 9:00 am:

1. *A new species of *Cryptoapseudes B□ cecsu*, 1976 (Crustacea: Tanaidacea: Apseudomorpha) from the Hawaiian Archipelago
[1]David, Shanna E. and [2]Heard, Richard W.; [1]Illinois College, Jacksonville, IL and [2]University of Southern Mississippi, Gulf Coast Research Lab, Ocean Springs, MS.

2. *A winter survey of insects inhabiting the Florida Panther National Wildlife Refuge
[1]Martin, Angela M.; [1]Stice, Andrew L.; [1]Zettler, Lawrence W.; and [2]Richardson, Larry W.; Illinois College, Jacksonville, IL and [2]Florida Panther National Wildlife Refuge, Naples, FL.

3. *Boisduval scale (*Diaspis boisduvalii*, Hemiptera: Diaspididae) on native epiphytic orchids in South Florida's Fakahatchee Strand State Preserve – an update
[1]Zindel, Adam J., [1]Elliott, Crystal A., [1]Zettler, Lawrence W., and [2]Zettler, Jennifer A.; [1]Illinois College, Jacksonville, IL and [2]Armstrong Atlantic State University, Savannah, GA.

4. *Nest-boxes as kestrel conservation tools: occupancy by kestrel and non-kestrel species in the Midwest.
[1]Joray, Taylor P., [2]Eschenbauch, Janet, [3]Mueller, William, [4]Droske, Alice, [4]Schwarzmeier, Judith, [4]Palzkill, Joseph, [5]Petznick, Steven, [6]Standlee-Hanson, Carolyn D., and [7]Giovanni, Matthew; [1]Biology Department, Illinois College, Jacksonville, IL, [2]Central Wisconsin Kestrel Research, Amherst Junction, WI, Western [3]Great Lakes Bird and Bat Observatory, Belgium, WI, [4]Beaver Creek Reserve, Fall Creek, WI, [5]New London, WI, [6]Spring Grove, MN, [7]The Peregrine Fund, Boise, ID.

9:30 am – 10:15 am:

5. *Effects of corticosterone on development and immunocompetence in Western Chorus Frogs (*Pseudacris triseriata*) and Southern Leopard Frogs (*Lithobates sphenocephalus*)
Stoltz, Katie A., Wilcoxen, Travis E., and Carlson, Rebekah D.; Millikin University, Decatur, IL.

6. *Efficacy of using the double-observer point count method and Program MARK to estimate population sizes
Commons, Kelly A., Carlson, Rebekah D., Lundstrom, Lisa A., Horn, David J., and Wilcoxen, Travis E.; Millikin University, Decatur, IL.

7. *Pelvis Sexual Dimorphism in Mustelidae
Thompson, Andrew and Kohn, Luci; Southern Illinois University Edwardsville, Edwardsville, IL.

10:30 am – 11:30 am:

8. *Scapular Sexual Dimorphism In Mustelidae
Norman, Steven and Kohn, Luci; Southern Illinois University Edwardsville, Edwardsville, IL.

9. *Tree and shrub species composition and physiognomics of Ovenbird (*Seiurus aurocapilla*) and Kentucky Warbler (*Geothlypis formosa*) territories.
Lichtenstein, James L.; Knox College, Galesburg, IL.

10. *Field Tracking, Behavioral Observations and Nest Discovery of a Solitary Eagle (*Buteogallus solitarius*) in Belize
Novy, Stacia A.; Southern Illinois University Edwardsville, Edwardsville, IL.

11. Pre-European settlement range predictions for stoneflies (Plecoptera) of the Midwest
[1]Dewalt, R. E., [1]Cao, Y., [1]Robinson, J.L., [2]Grubbs, S.A., Tweddale, T.[1] and [1]Hinz, L.; [1]Illinois Natural History Survey, Champaign, IL, USA and [2]Dept. Biological Sciences, Western Kentucky University, Bowling Green, KY.

POSTER PRESENTATION SESSIONS: TITLE AND AUTHOR LISTINGS

Division: Agriculture

1. *_In vitro_ propagation of _Desmantus illinoensis_, a native perennial of agricultural interest
Flaugher, Keith and Barry, Kelly; Southern Illinois University Edwardsville, Edwardsville, IL.

Division: Botany

2. *Determination of seed viability in a rare species: The Tennessee Coneflower
[1]Mosby, Lisa A., [2]Albrecht, Matthew A., [1]Esselman, Elizabeth J., [3]Clawitter, Helen, and [2]Rhodes, Matt; [1]Southern Illinois University Edwardsville, Edwardsville, IL, [2]Center for Conservation and Sustainable Development, Missouri Botanical Garden, St. Louis, MO, and [3]Washington University, St. Louis, MO.

3. *Cloning the Old Main Oak (_Quercus macrocarpa_ Michx.): Preliminary studies on stem cuttings and leaf explants
Bolin, Jae F., Westcott, Kasey D., and Owen, Henry R.; Eastern Illinois University, Charleston, IL.

4. *Seed Germination Rates Of the Invasive Vine _Humulus japonicus_ (Cannabaceae)
Clark, Jonathan, Israelitt, David, and Schulz, Kurt; Southern Illinois University Edwardsville, Edwardsville, IL.

5. *An Evaluation of Grassland Restoration Success in Illinois Based on Ecosystem Function
Krutsinger, Roxane, and Schulz, Kurt; Southern Illinois University Edwardsville, Edwardsville, IL.

6. *Soil Disturbance Effects on Riparian Marsh Vegetation at Riverlands Migratory Bird Sanctuary
Karrick, Megan, McGuire, Ben, and Schulz, Kurt; Southern Illinois University Edwardsville, Edwardsville, IL.

7. *_Lonicera maackii_ (Caprifoliaceae) Seeds Display Plastic Traits in Response to the Sun Exposure of the Parent Plant
Ashbaker, Sabrina, Kohn, Luci, Brunkow, Paul, and Schulz, Kurt; Southern Illinois University Edwardsville, Edwardsville, IL.

8. *Seed Ecology of Federally Threatened _Pinguicula ionantha_ (Godfrey's Butterwort)
[1]Annis, Jenna M., [1]O'Brien, Jennifer E., [1]Coons, Janice M., and [2]Molano-Flores, Brenda; [1]Eastern Illinois University, Charleston, IL, and [2]Illinois Natural History Survey, Champaign, IL.

9. *Baseline analysis of forest in the bluff corridor section of the SIUE Nature Preserve: exotic species abundance

Miles, Cassidy R. and Minchin, Peter R.; Southern Illinois University, Edwardsville, IL.

10. *Seed Germination of *Scutellaria* Species

[1]O'Brien, Jennifer E., [1]Annis, Jenna M., [1]Coons, Janice, M. and [2]Molano-Flores, Brenda; [1]Eastern Illinois University, Charleston, IL, U.S.A. and [2]Illinois Natural History Survey, Champaign, IL. USA.

11. *Baseline analysis of forest in the bluff corridor section of the SIUE Nature Preserve: conservation value of the canopy tree stratum

Leinweber, Chay W.C. and Minchin, Peter R.; Southern Illinois University Edwardsville, Edwardsville, IL.

12. *Effect of Presoaks with Sulfuric Acid and Gibberellic Acid on Seed Germination of *Ferocactus wislizeni*

Tuegel, Erin R., Hughes, Michael P., Annis, Jenna M., Idleman, Ursulla A., Moore, Julian G., O'Brien, Jennifer E., Samarajeewa, Dilini A., and Coons, Janice M.; Eastern Illinois University, Charleston, IL.

13. *Investigating hybridization relationships between *Schoenoplectiella hallii* and *S. saximontanus* using flow cytometry

Sutton, Alexandra and Esselman, Elizabeth; Southern Illinois University Edwardsville, Edwardsville, IL.

14. *Evaluating the success of bottomland forest restoration in the Upper Mississippi Valley

Ballen, Lindley B. and Minchin, Peter R. Southern Illinois University Edwardsville, Edwardsville, IL.

15. *Evaluating the effect of native species diversity on resistance to invasion by exotic species in prairie restoration

Weber, Irene and Minchin, Peter; Southern Illinois University Edwardsville, Edwardsville, IL.

16. *Primary Production During Five Years of Succession in a Northwestern Illinois Old Field.

Killion , Alexander K. and Dziadyk, Bohdan; Biology Department, Augustana College, Rock Island, IL.

17. **In vitro* germination and propagation of *Polygonatum canaliculatum*

Engelke, Aaron and Barry, Kelly; Southern Illinois University Edwardsville, Edwardsville, IL.

18. *Assessing Quality of a Regenerated Prairie Using Floral and Faunal Indices
Spagnolo, Sara, Bryant, Carol, Schulz, Kurt, Minchin, Peter, and Esselman, Elizabeth; Southern Illinois University Edwardsville, Edwardsville, IL.

Division: Cell, Molecular, and Developmental Biology

19. *Effects of Annetocin and Oxytocin/Vasopressin Related Peptides on the Receptor in *Lumbricus terrestris*
Vu, Christine and Krajniak, Kevin; Southern Illinois University Edwardsville, Edwardsville, IL.

20. The Effects of YIRFamide on the Isolated Crop-Gizzard of the Earthworm
McKibben, Tyler P., Volin, Christine, Jones, Kevin, and Krajniak, Kevin; Southern Illinois University Edwardsville, Edwardsville, IL.

21. *Targeted proline substitutions in a mating pheromone of *Schizophyllum commune* disrupt pheromone signaling
Link, Stephanie L. and Fowler, Thomas J.; Southern Illinois University Edwardsville, Edwardsville, IL.

22. *Quantitative Analysis Method for Heterologous *Schizophyllum commune* Mating Assays in Yeast
Drumm, Libby; Katchen, Hannah; and Fowler, Thomas J.; Southern Illinois University Edwardsville, Edwardsville, IL.

23. *Knockout strain of a WD40-like repeat protein in *Schizophyllum commune*
Dungan, Kyle, Hills, Jillian, P., and Fowler, Thomas J., Southern Illinois University Edwardsville, Edwardsville, IL.

24. The Effects of APKQYVRFamide on Intestinal Tissue from the Earthworm *Lumbricus terrestris*
McCullough, Kyle and Krajniak, Kevin Southern Illinois University Edwardsville, Edwardsville, IL.

25. The Effects of FNRFamide on the Isolated Crop-Gizzard of the Earthworm
Krajniak, Kevin, McCullough, Kyle, and Martineau, Mitchell; Southern Illinois University Edwardsville, Edwardsville, IL.

26. *Mitochondrial Bioenergetics in Response to Estrogen Therapy
Tofte, Austin J., Spenser, Willow G., Nathan, Britto, and Menze, Michael; Eastern Illinois University, Charleston, IL.

27. The Effects of FMRFamide and its Related Peptides on the Isolated Crop-Gizzard of the Earthworm *Lumbricus terrestris*
Cornwell, Fred and Krajniak, Kevin; Southern Illinois University Edwardsville, Edwardsville, IL.

28. Induction of Apoptosis in Human Leukemia Cells
[1]Yu, Hayoung; [1]Miller, Patrick M, [1]Saunders, Jazmine, [2]Joy, Anita, [2]Welch, Dan B., and Wanda, Paul E.; [1] Southern Illinois University Edwardsville-Biology, Edwardsville, IL. and [2]Southern Illinois University-Dental Medicine, Alton, IL.

29. A mutant *of Arabidopsis thaliana*, plastid protein import 2-1 that lacks Toc159 receptor accumulates polyunsaturated lipids and has high desaturase expression levels
[1]Afitlhile, Meshack, [1]Workman, Samantha, [2]Matlak, Abraham, and [1]Dutton, Madison; [1]Western Illinois University, Macomb, IL, USA and [2]Macomb High School, Macomb, IL.

30. A mutant *of Arabidopsis thaliana*, toc132toc120 (+/-) accumulated reduced levels of linolenic acid and has repressed expression of the ER localized Δ15 desaturase
Afitlhile, Meshack. Workman, Samantha, Davis, Abigail, and Fry, Morgan; Western Illinois University, Macomb, IL.

31. A cold-acclimated mutant of Arabidopsis thaliana that is defective in the major chloroplast receptor, Toc159 has reduced levels of linolenic acid
Workman, Samantha and Afitlhile, Meshack; Western Illinois University, Macomb, IL.

32. *Type-2 Diabetes: Does MitoNEET Impact Mitochondrial and Catalase Functions by Multiple Mechanisms?
[1]Ferry, Nicolas A., [2]Roberts, Morgan E., [2]Konkle, Mary E., and [1]Menze, Michael M; [1]Department of Biological Sciences and [2]Department of Chemistry, Eastern Illinois University, Charleston, IL.

33. *Neuromuscular control of mastication and brux-like movements in the freely behaving rat.
[1r]Taylor, Jaclyn E.; [1]Cunningham, M. Mitchell; [1]Fowler, Sarah E.; [1]Wanda, Paul E.; and [2]Welch, Dan B.; [1]Department of Biological Sciences, Southern Illinois University Edwardsville, Edwardsville, IL and [2]Southern Illinois University School of Dental Medicine, Alton, IL.

Division: Chemistry

34. *Development of a green chemistry oxidation experiment for undergraduate curriculum
Talluri, SriHarika, Kore, Naresh, and Vinod, Thottumkara K.; Western Illinois University, Macomb, IL.

35. *Component Variation in Ugi-Smiles Couplings
Meyers, Michael S., Richey, Bree, and Luesse, Sarah B.; Southern Illinois University Edwardsville, Edwardsville, IL.

36. *Exploration of a Tandem Ugi-Smiles Diels-Alder Reaction
Richey, Bree L., Meyers, Michael S., and Luesse, Sarah B.; Southern Illinois University Edwardsville, Edwardsville, IL.

37. *Effects of Phenol and Isocyanide Variation on the Ugi-Smiles Reaction
Mason, Katelynn and Luesse, Sarah B.; Southern Illinois University Edwardsville, Edwardsville, IL.

38. *A Fluorescent Oscillating BZ Reaction
Behymer, Nicholas J. Knox College, Galesburg, Illinois, USA

39. *Synthesis of Allyl □ -Keto Esters for Use in Asymmetric Reaction Development
Rintz, Meredith, Summers, Chanté, and Luesse, Sarah B.; Southern Illinois University Edwardsville, Edwardsville, IL.

40. *Exploration of Intramolecular Carroll Rearrangements
Summers, Chanté, Rintz, Meredith, and Luesse, Sarah B.; Southern Illinois University Edwardsville, Edwardsville, IL.

41. *Synthesis and Use of BAM Ligands for Reaction Development
Moutria, Julie and Luesse, Sarah B.; Southern Illinois University Edwardsville, Edwardsville, IL.

42. *Studying the Scope of the Passerini-Smiles Reaction
McClary, Kyle and Luesse, Sarah, B.; Southern Illinois University Edwardsville, Edwardsville, IL.

43. *Caveman Chemistry: Looking at History Through the Eyes of Science
Gilbert, Kyle, Martin, Seth, and Iler, Darrell.; Greenville College, Greenville, IL.

Division: Computer Science

44. On the Stability of Banking Networks
[1]DasGupta, Bhaskar, [2]Berman, Piotr, and [3]Karpinski, Marek; [1]University of Illinois at Chicago, Chicago, Illinois, USA; Pennsylvania State University, Chicago, IL, USA; and [3]University of Bonn, Bonn, Germany.

45. On communication protocols that compute almost privately

[1]Comi, Marco, [1]DasGupta, Bhaskar, [2]Shapira, Michael, and [1]Srinivasan, Venkatakumar; [1]University of Illinois at Chicago, Chicago, IL, USA and [2]School of Computer Science and Engineering, The Hebrew University of Jerusalem, Jerusalem, Israel.

Division: Earth Science

46. Initial Response of Bed Morphology at a River Confluence to the Development of an Upstream Bend Cutoff on a Meandering Tributary

[1]Riley, James D. and [2]Rhoads, Bruce L. [1]Eastern Illinois University, Charleston, IL and [2]University of Illinois at Urbana-Champaign, Urbana, IL.

47. Ecological stress in the evolution of fossil hominids in South Africa

Ruez, Jr., Dennis R.; University of Illinois at Springfield, Springfield, IL.

48. *A GIS Analysis of 80 Years of Channel Migration of the Little Wabash River in Clay County Southeastern Central Illinois

LaVeau, William J., Viertel, David C., and Burns, Diane M.; Eastern Illinois University, Charleston, IL.

Division: Environmental Science

49. Preliminary findings of Epizoochory as a possible mechanism for garlic mustard (*Alliaria petiolata*) seed dispersal

Loebach, Chris and Anderson, Roger; Illinois State University, Normal, IL.

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

Le, Paul T., Essner, Richard L., Minchin, Peter R., and Ballen, Lindley; Southern Illinois University Edwardsville, Edwardsville, IL.

51. A Study in Lead: An Analysis of Human Lead Exposure in the Old Lead Belt of Southeastern Missouri

Finch, Jordan, Schulz, Kurt, Brugam, Richard, Lin, Zhi-Qing, and Kohn, Luci; Southern Illinois University Edwardsville, Edwardsville, IL.

52. *Remediation of Amoxicillin in wastewater using treated fly-ash

Barringer, Brandon and Acheson, Edward; Millikin University, Decatur, IL.

Division: Health Sciences

53. Antibacterial Antibiotics Stimulate DTH and Microbicidal Activity by Mice.
Babyak, Megan, Hurt, Mariah, Horn, Nicholas, Pullam, Kristopher, Kitz, and Dennis J.; Southern Illinois University Edwardsville, Edwardsville, IL.

54. Mechanisms Involved in Antibacterial Antibiotic Enhanced Microbicidal Activity by Mouse Macophages and T Cell DTH.
Jones, Kevin, Curry, Shawn, McCracken, Vance, and Kitz, Dennis J.; Southern Illinois University Edwardsville, Edwardsville, IL.

55. *Effects of Rolofylline on Respiration in Newborn Rats
Ferry, Blake W. and McGilliard, Kip L.; Eastern Illinois University, Charleston, IL.

56. *Bond Strength of Repaired Resin Modified Glass Ionomer
[1]Seesengood, Brooke N., [2]Hopp, Christa D., [1]Wanda, Paul E., and [2]Welch, Dan B.; [1]Southern Illinois University Edwardsville, Edwardsville, IL and [2]Southern Illinois University School of Dental Medicine, Alton, IL.

Division: Microbiology

57. Comparative Analysis of Alternansucrase Genes from *Leuconostoc*
Holt, Scott M.; Western Illinois University, Macomb, IL.

58. Sucrase Production and Growth of *Leuconostoc* in Chemically Defined Media.
Holt, Scott M., Liles, Jordan L., McGlone, Megan A., Bauer, Matt D., and Andrew, Zac R.; Western Illinois University, Macomb, IL.

59. *The Role of Biofilms in Dreissenid Recruitment in Milwaukee Harbor – Ten Years Later
[1]McCormick, Deirdre S., [2]Maki, James S., and [1]Kavouras, Jerry H.; [1]Lewis University, Romeoville, IL and [2]Marquette University, Milwaukee, WI.

60. *I Brought Home a Coliform?
Colclasure, Victoria J. and Kavouras, Jerry H.; Lewis University, Romeoville, IL.

61. Formulating a Defined Growth Medium for the Acidophilic Archaeon *Ferroplasma acidarmanus*
Qu, Yudong and Hung, Kai.; Eastern Illinois University, Charleston, IL, USA.

62. *The Impact of Ferrous and Zinc Ions on the Growth of an Acidophilic Consortium
Amarh, Elizabeth, D.; Eastern Illinois University, Charleston, IL.

63. *Pathogenesis of *Helicobacter canadensis*
Amirahmadi, Sara and McCracken, Vance.; Southern Illinois University Edwardsville, Edwardsville, IL.

64. *Production Optimization of Two Putative Methionine-gamma-lyases from *Ferroplasma acidarmanus* strain fer1
Miller, Megan and Hung, Kai F.; Eastern Illinois University, Charleston, IL.

65. *Metal toxicity of nanoparticles in bacteria
Bright, Rebecca L., Theodorakis, Christopher, and McCracken, Vance J.**;** Southern Illinois University Edwardsville, Edwardsville, IL.

66. *Attenuated Immune Response in Neonate versus Adult Mice Infected with *Helicobacter felis*
Hoppenrath, Jean M. and McCracken, Vance J.; Southern Illinois University Edwardsville, Edwardsville, IL.

67. The influence of phosphate on the growth of an acidophilic consortium.
Brown, April, M.; Eastern Illinois University, Charleston, IL

68. *Effect of Stress on Compatible solutes in *Pichia pastoris*
Alapati, Jyothirmai and Clutter, Blake; Bradley University, Peoria, IL.

Division: Physics, Mathematics, & Astronomu

69. *Towards Generation of Asymmetric Dicke States
DeYoung, Daniel and Kapale, Kishor; Western Illinois University, Macomb, IL.

70. Apoptosis and Quantum Mechanics
[1]Welch, Dan B., [1]Joy, Anita, [2]Wanda, Paul E.; [1]SIU-Dental Medicine and [2]SIUE-Biology, Edwardsville, Il, USA.

71. *Investigating the Dispersion of Conoscopic Interference Patterns
Olorunsola, Oluwatobi and Pengqian, Wang; Western Illinois University, Macomb, IL.

72. *Magic Circle
Liu, Shufang; Western Illinois Univerity, Macomb, IL, USA.

Division: Zoology

73. *The effect of rapid cold hardening on performance after a low temperature exposure
Davis, Cameron, Griffis, Nicole, and Williams, Jason; Southern Illinois University Edwardsville, Edwardsville, IL.

74. *Choice Between Light, Dark, & Visually Complex Substrate in the Spider, *Tigrosa helluo* (Araneae:Lycosidae)
Jerden, Meghann, Funao, Ayumi, Stork, Ryan, and Sztukowski, Russell; Greenville College, Greenville, IL.

75. *Diverse effects of stress on immune function in four songbird species.
Knott, Madeline, Wilcoxen, Travis E., and Horn, David J.; Millikin University, Decatur, IL.

76. *Using multiple measures of individual condition to examine the impact of commercial bird food on wild birds.
Hubble, Cody N., Wilcoxen, Travis E., and Horn, David J.; Millikin University, Decatur, IL.

77. *Stress physiology of songbirds in response to bird feeding activities.
Huber, Sarah J., Wilcoxen, Travis E., and Horn, David J.; Millikin University, Decatur, IL.

78. *The effect of food supplementation on feather growth and developmental stress in songbirds
Wassenhove, Samantha J., Wilcoxen, Travis E., and Horn, David J.; Millikin University, Decatur, IL.

79. *Genetic structure patterns of two closely-related species of Topminnow (Order: Cyprinodontiformes) in a Southern Illinois Contact Zone
Koepp, Kate E., Scott, Jason M., and Duvernell, David D.; Southern Illinois University Edwardsville, Edwardsville, IL.

80. Sequential DNA Analysis of the Mediterranean mussel, *Mytilus galloprovincialis*
Meyer, Mary A. and Theodorakis, Chris; Southern Illinois University Edwardsville, Edwardsville, IL.

81. *Blood parasite prevalence and plasma calcium levels in birds: a comparison between a migratory and a non-migratory species.
Guerra, Daniel F., Wilcoxen, Travis E., and Horn, David J.; Millikin University, Decatur, IL.

82. *The effects of supplemental food on innate immunity to a *Staphylococcus aureus* challenge in songbirds.
Flamm, Joseph C., Wilcoxen, Travis E., and Horn, David J.; Millikin University, Decatur, IL.

83. *The effects of supplemental feeding on forest bird populations in central Illinois
Commons, Kelly A., Carlson, Rebekah D., Lundstrom, Lisa A., Horn, David J., and Wilcoxen, Travis E.; Millikin University, Decatur, IL.

84. A Comparative Morphometric Analysis of Skull Shape in Evening Bats (Family: Vespertilionidae)
Wells, Ashley N. and Essner, Jr., Richard L.; Southern Illinois University Edwardsville, Edwardsville, IL.

85. Locomotor Response and Bioaccumulation of Heavy Metals via Mining Pollution in Rocky Mountain Tailed Frog Tadpoles (*Ascaphus montanus*)
Lybarger, Hollie, R. and Essner, Jr., Richard, L.; Southern Illinois University Edwardsville, Edwardsville, IL.

86. *Seasonal and cumulative changes in the number of bird visits to feeders in central Illinois
Carlson, Rebekah D., Commons, Kelly A., Lundstrom, Lisa A., Horn, David J., and Wilcoxen, Travis E.; Millikin University, Decatur, IL, USA.

87. *Effects of supplemental feeding on antioxidant capacity and baseline corticosterone in four common feeder-using bird species
Hogan, Brianna M., Wilcoxen, Travis E., and Horn, David J.; Millikin University, Decatur, IL.

88. Strategic territory defense in the black saddlebags dragonfly, *Tramea lacerata* (Odonata:Libellulidae)
Lojewski, Jeffrey A., Terzick, Jordan, Sherr, Kelsey, and Switzer, Paul V.; Dept of Biological Sciences, Eastern Illinois University, Charleston, IL.

89. Speed Effects on Serpentine Locomotor Kinematics in the Common Garter Snake (*Thamnophis sirtalis*)
Bulla, Andrew J. and Essner, Jr., Richard L.; Southern Illinois University Edwardsville, Edwardsville, IL.

90. Evolution of Jumping in Leiopelmatid and Lalagobatrachian Frogs: Comparison of Terrestrial and Aquatic Landing
Michael, Jamay L. and Essner, Jr., Richard L.; Southern Illinois University Edwardsville, Edwardsville, IL.

91. *Comparison of Whole and Sectioned Sagittal Otolith to Estimate Age in a Bluegill Population from a Thermally Altered Environment

[1]Lamb, Lindsey and [2]Porreca, Anthony P.; [1]Eastern Illionis University, Charleston, IL and [2]Southern Illinois University, Carbondale, IL.

92. *Sprint speed and fitness in the wolf spider Tigrosa helluo (Araneae: Lycosidae)

Sztukowski, Russell, Funao, Ayumi, Jerden, Meghann, and Stork, Ryan J.; Greenville College, Greenville, IL.

93. *Lateral Jaw Muscle Development and Metamorphosis in Tadpoles of *Bufo americanus* (Anura, Bufonidae)

Quiggins, Jessica and Jennings, David; Southern Illinois University Edwardsville, Edwardsville, IL.

94. *Ventral Jaw Muscle Development and Metamorphosis in Tadpoles of *Bufo americanus* (Anura, Bufonidae)

Barnfield, Rayla and Jennings, David; Southern Illinois University Edwardsville, Edwardsville, IL.

95. *The effect of exercise induced oxidative stress and age on mitochondria damage in the honey bee, *Apis Mellifera*

Oyler, Jennifer, Curry, Shawn, and Williams, Jason B.; Southern Illinois University Edwardsville, Edwardsville, IL.

96. *The effect of social environment on the pursuit of heterospecific targets by territorial black saddlebags dragonflies, *Tramea lacerata* (Odonata: Libellulidae)

Terzick, Jordan, Sherr, Kelsey, and Switzer, Paul V.; Dept. of Biological Sciences, Eastern Illinois University, Charleston, IL.

97. Functional and ecological aspects of the mucus trails of the freshwater gastropod *Elimia potosiensis*

Skiold-Hanlin, Sarah N., and Brunkow, Paul E.; Southern Illinois University Edwardsville, Edwardsville, IL.

98. Demography and Habitat Use in the Southern Flying Squirrel, *Glaucomys volans*, in Southwestern Illinois

Dunham, Loren N., Essner, Jr., Richard L., and Minchin, Peter R.; Southern Illinois University Edwardsville, Edwardsville, IL.

99. Effects of Prescribed Burning on Grassland Avifauna at Riverlands Migratory Bird Sanctuary

Wood, Travis J., Essner, Jr., Richard L., and Minchin, Peter R.; Southern Illinois University Edwardsville, Edwardsville, IL.

100. Influence of relatedness on cannibalism in successive instars of *Phidippus audax* (Araneae: Salticidae)

Delaney, D. M., Robertson, M. W., and Watson, C.; Millikin University, Decatur, IL.

ORAL PRESENTATION ABSTRACTS

Session 1: Physics, Mathematics, & Astronomy

1. Error-Correcting Codes Classical to Quantum

Woodworth, Timothy S. and Kapale, Kishor T.; Western Illinois University, Macomb, IL.

It is possible to perform reliable computation on classical computers in the presence of errors. Classical error correcting codes can also be used for reliable communication between two parties. In general, quantum computation can also be performed in the presence of errors. Nevertheless, understanding error thresholds is still an open problem. We are carrying out a comparative study of classical and quantum error correction protocols for information processing and communication. The hope is that the parallels between the two systems will provide deeper understanding of the error thresholds and practical constraints on the physical systems used for implementation of quantum information processing protocols.

2. *Covering the Square Lattice with Disjoint Unit Disks

Manary, Elizabeth, Hommowun, Nick, and Alm, Jeremy; Illinois College, Jacksonville, IL.

In this talk we consider the following problem: Consider the square lattice in the plane with inter-point distance d. For which positive numbers d is it possible to cover every point of this lattice with closed disks of unit radius having pairwise-disjoint interiors? We show that for certain values of d>0, such a disk covering is possible, and discuss some of the difficulties involved in approaching this problem.

3. *Investigating the Dispersion of Conoscopic Interference Patterns

Olorunsola, Oluwatobi Gabriel and Pengqian, Wang; Western Illinois University, Macomb, IL.

The conoscopic interference patterns produced by light propagating in anisotropic crystals are important in understanding the structure and properties of optical materials. In conventional interferometers the isochromatic interference fringes are observed by using a circular polarizer and a circular analyzer, both constructed by a linear polarizer and a quarter wave plate. However, due to the dispersion of the quarter wave plates, the phase-retardance between the two light waves inside the quarter wave plates is wavelength-dependent, which results in different conoscopic interference patterns when the wavelength of the illumination light is tuned. In this presentation we will investigate the details of the variation of the interference patterns in anisotropic crystals when the wavelength of the light source is changed. In addition, we also designed a spinning-polarizer and spinning-analyzer method to eliminate the dispersion of the interference patterns, which provides a new way to visualize the isochromatic interference fringes in conoscopy. Our method produces similar interference patterns for all colors without dispersion and without the use of additional optical elements.

4. *Effect of Temperature-Dependent Migration Rates on Metapopulation Dynamics
Liu, Shufang and Ekanayake, Amy J.; Western Illinois University, Macomb, IL.

Wildlife species are increasingly forced into patchy environments, as landscapes become fragmented due to the spread of residential and business developments and agriculture. Additionally, some species require habitat which naturally occurs in fragmented patches. For example, the feeding and mating habitats for many varieties of butterflies are naturally fragmented. If the dynamics of local patch populations are influenced by migration between patches, the species can be mathematically modeled as a metapopulation. For some species, including various butterflies, temperature influences migration rates. We consider a spatially explicit single-species metapopulation model. Patch-specific parameter values account for variability in patch quality and we allow migration to depend on distances between patches. Further, rather than using constant coefficients of migration, we let migration vary temporally depending on temperature. We numerically solve the system for various temperature patterns and compare the resulting metapopulation size and spatial distribution.

Session 2: Botany

1. *Schoenoplectiella* ×*magrathii* (Cyperaceae), a new interspecific hybrid between *S. hallii* and *S. saximontana* from Oklahoma, USA
[1]Smith, Marian and [2]McKenzie, Paul M; [1]SIUE, Edwardsville, IL and [2]US Fish & Wildlife Service, Columbia, MO.

A new hybrid between two species of *Schoenoplectiella* is described. Morphological and DNA evidence indicate that it is a hybrid between *S. hallii* and *S. saximontana*. The hybrids show great morphological variability and individuals range from being 96% infertile to producing an array of fertile achenes that vary in shape, including either 2- or 3-sided achenes that are typical of one parent or the other, while some achenes are asymmetrical with a prominent bump on the adaxial surface.

2. *Puccinia mariae-wilsoniae* and *Claytonia virginica*: A pathogen's tale
Schlund, Sarah, A., Methven, Andrew S., and Carlsward, Barbara S.; Eastern Illinois University, Charleston, IL.

Rusts are economically important fungal plant pathogens. For the majority of rust species, complete life history data, including host range, geographic distribution, plant anatomical response to the rust, identity of alternate hosts, and mode of sexual reproduction are incomplete. The purpose of this study was to examine the life history of *Puccinia mariae-wilsoniae*, a rust on *Claytonia virginica* (spring beauty), and to observe responses in *C. virginica* leaf anatomy to its fungal pathogen. Spring beauty is an ephemeral woodland plant that lasts three to four weeks, and *P. mariae-wilsoniae* infects *C. virginica* almost as soon as the plant emerges from dormancy in spring. Population studies in March and April, 2012, as well as March and April, 2013, were used to study the abundance and spread of infection within several populations. Infected leaves, inflorescences, and corms with attached roots

were collected, fixed in FAA, stored in 70% ethanol, embedded in paraffin, sectioned, and mounted on slides for anatomical study. While the presence of aecia and aeciospores has been reported in other studies, this project has demonstrated the presence of telia and teliospores on *C. virginica* leaves and inflorescences. The population and anatomical studies will allow us to understand where the teliospores overwinter and how *P. mariae-wilsoniae* infects spring beauty so rapidly in the spring. DNA sequencing was utilized to assess the phylogenetic history and nomenclature of *P. mariae-wilsoniae* and will allow us to better understand its life history.

3. *Characterization and multivariate analysis of floodplain forest communities in Mississippi River Pool 24

[1]Israelitt, David, M., [1]Brugam, Richard, [2]Walton, Elizabeth, and [1]Schulz, Kurt; [1]Dept. of Biological Sciences and [2]Program in Environmental Sciences & Dept. of Geography, Southern Illinois University Edwardsville, Edwardsville, IL.

Flood control structures (e.g., levees) and navigation dams on the Upper Mississippi River modify river hydrology, potentially changing the composition of floodplain forests. Channel constriction and impoundment contribute to differing reductions in water level variation within navigation pools. We hypothesized low land forest community composition responds to the hydrologic gradient within the navigation pools. This study is intended to (1) quantify differing patterns in forest community within Navigation Pool 24 and (2) describe the differential responses of species in relation to the varying hydrology. Forest survey, river level (1993-2011), and elevation data were integrated using GIS. Non-metric multidimensional scaling was used to ordinate floodplain forest stands defined by combinations of river mile and elevation class. Ordination separated stands on 2 axes, with variability (SD of water level) negatively correlating ($r_s(n=15) = -0.69$, $p < 0.01$) with the first axis. Permutation tests (MRPP) separated all elevation groups of lowest river mile group (274-278) from all other river mile groups ($p < 0.05$), and separated the upper-most group (294-298) from the third (284-288; $p = 0.03$) and fourth (289-293; $p = 0.03$). These results suggest that Pool 24 floodplain forest communities differ in species dominance patterns as a result of their relative position within the hydrologic gradient between locks and dams.

4. Influence of Deer Browsing on Abundance, Diversity, and Floristic Quality of Prairie Forbs

[1]Anderson, Roger C., [1]Anderson, M. Rebecca, and [2]Corbett, Erica A.; [1]Illinois State University, Normal, IL and [2]Southeastern Oklahoma State University, Durant, OK.

We examined changes in forbs species abundance, floristic quality, and diversity (H' Shannon) in response to deer browsing and fire over ten years (1992-2001). Our study site was a species rich remnant prairie (100 forb species) in Goose Lake Prairie State Park (GLPSP), 70 km southwest of Chicago, Illinois. Deer densities in GLSPSP varied from 32-50 deer km^2 between 1992 and 1997 and declined to 7-9 deer km^2 following initiation of fall hunting in 1997. The study area was divided into four 24 m x 16.5 m quadrants (quarters). We used thirty-six 25 cm x 25 cm quadrats to sample

browsed and unbrowsed stems in each quadrant. After initial 1992 sampling, two quadrants were enclosed with a deer proof fence and two were left unprotected. Stem count data obtained for forbs species in protected and unprotected plots each year were analyzed using Detrended Correspondence Analysis (DCA). Axis one ordered samples along a deer browsing intensity/duration gradient and species stem counts were regressed against sample DCA scores. Five species had significant positive responses to browsing and ten species responded negatively. Using a weighted floristic quality index (Coefficients of Conservatism x Stem Counts), we found that floristic quality decreased with increasing browsing. Forb diversity was highest at intermediate levels of browsing intensity.

5. *The Effects of Simulated Herbivory on Chlorophyll Anthocyanin Content of White Ash (*Fraxinus americana* L.) Leaves

Staudenmaier, Allyson B. and Parrish, J. A. D.; Millikin University, Decatur, IL.

Stress, such as high salt content, herbivory, and drought, has a negative effect on growth of trees, resulting in physiological and morphological changes. The white ash, (*Fraxinus americana*), is common in the Eastern Deciduous forest within the upland areas and is used decoratively. We simulated herbivory on the White Ash tree by removing leaflets or half of each leaflet except the terminal leaflet and compared anthocyanin and chlorophyll content to the control terminal leaflet on the leaf directly opposite. We used ACM-200 plus and CCM-300 machines to measure anthocyanin and chlorophyll content, respectively, at one hour, 24 hours, and 3 weeks after damage. As we expected, paired t-tests showed significantly higher anthocyanin content in damaged treatments in both types of simulated herbivory. Chlorophyll content remained constant in both treatments on the first two dates, but was significantly higher in the control leaflets in the complete leaflet removal treatment at week three. Our results demonstrate anthocyanin's use in stress reactions in plants while chlorophyll was constant throughout the experiment with a change in week 3. Increased anthocyanin content suggests that anthocyanins respond to herbivory and may help restore the plant. Simulated herbivory significantly increased anthocyanin content in undamaged leaflets on the damaged leaves of the White Ash trees providing opportunity for the portion of the leaf to recover.

6. Vegetative anatomy of the *Aerides* alliance (Vandeae, Orchidaceae)

Carlsward, Barbara, S. and Stanley, Kevin; Eastern Illinois University, Charleston, IL.

Aeridinae are a diverse group of approximately 1350 orchid species commonly found as epiphytes in tropical Asia. The *Aerides* alliance is a clade of Aeridinae that is traditionally defined by having elongate leafy stems. The purpose of our project was to find features in the vegetative anatomy for characterizing genera in the *Aerides* alliance. Leaves and roots of 15 species were sectioned on a sliding microtome at 60-100 μm and stained with safranin and iron-alum hematoxylin. Sections were dehydrated in a graded ethanol series, cleared in limonene and mounted in Permount. Observations were made using a Zeiss Axioskop 40 and an attached OptixCam 3.3 ICE digital camera. In leaves, the mesophyll was homogenous, and stegmata were always associated with vascular bundle

sclerenchyma. Collateral vascular bundles formed a single row, except in *Papilionanthe*, where bundles formed two rows. A hypodermis of thick-walled fibers was found in all genera except *Aerides* and *Papilionanthe*. Scattered fibrous idioblasts were scattered in the mesophyll in *Ascocentrum*, *Neofinetia*, *Seidenfadenia* and *Vanda*. In roots, the velamen ranged from 2-6 cells wide with a distinct epivelamen layer. The exodermis was O-thickened in all genera except *Papilionanthe*, which was n-thickened. Cortical, fibrous idioblasts were found in most species examined. The endodermis was O-thickened and uniseriate in all genera except *Vanda*. The stele in all species was composed of a sclerified pith surrounded by alternating groups of xylem and phloem. Most anatomical characters we examined were homoplasious, but several genera (such as *Vanda* and *Papilionanthe*) showed unique anatomical features.

7. *Endophytic fungi and seed germination of critically endangered epiphytic orchids from Madagascar – preliminary results.

[1]Edwards, Korrie E., [1]Thixton, Hana, [1]Zettler, Lawrence W., [1]Stice, Andrew L., [2]Kendon, Jonathan, [3]Rajaovelona, Landy, and [2]Sarasan, Viswambharan; [1]Illinois College, Jacksonville, IL, USA; [2]Royal Botanic Gardens, Kew, United Kingdom; and [3]Madagascar Conservation Centre, Antananarivo, Madagascar

In 2012, a collaborative, 5-year research project was initiated between Illinois College and the Royal Botanic Gardens, Kew, aimed at studying selected critically endangered orchids in Madagascar. A few of the aspects investigated include: 1) isolation and use of mycorrhizal fungi to augment orchid population size, 2) using seeds as fungus "baits" to acquire fungi that facilitate seed germination in situ, and 3) developing seed germination protocols leading to seedling reintroduction. In June 2012, seeds of *Angraecum longicalcar* and *A. protensum* were placed within nylon packets and sown in situ as baits for eventual retrieval. Root segments from 19 taxa spanning 6 genera were collected for mycorrhizal fungus isolation: *Angraecum* (8 spp.), *Bulbophyllum* (2), *Cynorkis* (1), *Eulophia* (1), *Jumellea* (4), *Polystachya* (3). Intact pelotons were observed in *Eulophia* sp., *A. longicalcar*, *A. magdalenae, Bulbophyllum* sp., *J. intricata*, *Cynorkis* sp., and *P. cultriformis*, but were most prevalent in *A. calceolus*. Pelotons were most frequent in the distal region of the root, just beyond the tip. Hyphal tips from pelotons yielded mostly conidial endophytic fungi (e.g., Fusarium) and none (so far) were assignable to ubiquitous orchid mycorrhizal-forming Ceratobasidiaceae or Tulasnellaceae. Seeds from 2 genera (*Jumellea, Polystachya*) were sown on an asmbiotic medium (P723, PhytoTechnology Labs). Germination was observed in *Polystachya* 53 days after sowing.

8. **Tulasnella irregularis* (Basidiomycota: Tulasnellaceae) from roots of *Encyclia tampensis* (Orchidaceae) in South Florida, and confirmation of its mycorrhizal symbiosis through symbiotic seed germination

Jacks, Alishia L., Gruender, Luke T., Lopez, Alyssa M., Corey, Laura L., and Zettler, Lawrence W.; Illinois College, Jacksonville, IL.

Epiphytic orchids remain understudied with respect to their obligate mycorrhizal relationships – a key component of the integrated conservation model. Existing studies have revealed that these plants, like their terrestrial counterparts, commonly associate with basidiomycetes (e.g., *Tulasnellaceae*); however, few studies have verified their physiological role(s). Two strains of mycorrhizal fungi (UAMH 11541, UAMH 11543) were isolated from roots of an epiphytic orchid in South Florida, *Encyclia tampensis* (Lindl.) Small - one acquired from a seedling, one from a mature specimen. Seeds of four epiphytic taxa were inoculated separately with both fungal isolates in vitro: *Enc. tampensis, Epidendrum amphistomum, Epi. nocturnum,* and *Prosthechea cochleata* var. triandra. More than one-third of inoculated *E. tampensis* and *E. nocturnum* seeds developed leaves in darkness after 100 days. No significant differences were detected between the two strains on germination, nor any interaction between fungus and seed source (ANOVA, $\alpha = 0.05$). Using ITS amplification and sequencing, both strains were identified as the teleomorph, Tulasnella irregularis Warcup & Talbot (Basidiomycota: Tulasnellaceae), and both were genetically identical with a high (98%) degree of certainty. Thus, symbiotic germination and ITS sequencing results are in agreement that both strains are indeed the same fungus. This paper is meant to shed additional light into epiphytic orchid-fungal interactions, and highlights the need to identify, test, and safeguard mycorrhizal fungi necessary for conservation.

9. **Ex vitro* growth and survival of *Encyclia tampensis* (Orchidaceae) seedlings harboring mycorrhizal fungi following transfer to different substrates

Hembrough, Ashley M. and Zettler, Lawrence W.; Illinois College, Jacksonville, IL.

The Florida Butterfly Orchid, *Encyclia tampensis* (Lindl.) Small is an epiphyte native to Florida, the Bahamas and Cuba. Though locally abundant, this species is exploited commercially for its appealing floral display and sweet-smelling fragrance. Recently, *E. tampensis* was propagated from seed in vitro using a mycorrhizal fungus (symbiotic seed germination) identified *as Tulasnella irregularis* (Basidiomycota: Tulasnellaceae). For horticultural purposes, the use of fungi to germinate orchid seeds in this manner has been largely ignored for the epiphytes because of the ease by which these plants can be grown on asymbiotic (carbon-based) media. Yet for *E. tampensis* and other epiphytic orchids throughout the world, symbiotic germination appears to have considerable merit. We present a summary of research aimed at assessing initial ex vitro survival and growth of *E. tampensis* seedlings harboring *T. irregularis*. Tiny (1-2 cm), leaf-bearing seedlings were deflasked (ex vitro) and placed onto one of seven substrates: peat, bark, charcoal, peat/bark/charcoal, peat/bark, bark/charcoal, peat/charcoal. No significant differences were detected in seedling growth (leaf number, fresh weight), but seedlings placed on charcoal-based substrates experienced significantly higher mortality. Our results, though preliminary, suggest that seedling acclimatization of *E. tampensis* can be achieved using substrates lacking charcoal.

10. *Reintroduction of asymbiotically-grown epiphytic orchid seedlings in South Florida (*Epidendrum amphistomum*, *Polystachya concreta*), and subsequent assessment for mycorrhizal colonization

Conley, Sara B., Morton, William G., Stice, Andrew, L., and Zettler, Lawrence W.; Illinois College, Jacksonville, IL.

Although orchid seeds contain small traces of food reserves, the long-held assumption is that mycorrhizal fungi are required as a carbon source (mycotrophy) to propel orchid seedlings to a photosynthetic stage. For epiphytic orchids, this concept has received more scrutiny given that these plants have more access to sunlight in the host tree's canopy compared to terrestrials. Recent studies have revealed that epiphytic orchids do indeed associate with ubiquitous basidiomycetes (e.g., Ceratobasidiaceae, Tulasnellaceae), but it remains unclear if these orchids "recruit" fungi once photosynthesis is established. We describe the outcome of an experiment aimed at assessing asymbiotically-grown, epiphytic orchid seedlings for the presence of mycorrhizal fungi following reintroduction. Seedlings of two epiphytic orchid species, *Epidendrum amphistomum*, *Polystachya concreta*, were grown in the laboratory on a carbon-based medium without fungi. Seedlings were then reintroduced to natural host tree substrates within the Florida Panther National Wildlife Refuge and monitored for 2-3 years. Roots on selected seedlings were subsequently detached and assessed for mycorrhizal fungus colonization in the laboratory using agar, staining, and molecular techniques. To date, one fungus, tentatively identified as a strain of Tulasnella, has been recovered from *P. concreta*. If confirmed, the presence of this fungus lends support for the hypothesis that epiphytic orchids utilize mycorrhizal fungi even after attaining a photosynthetic capability.

Session 3: Cell, Molecular, & Developmental Biology

1. Evidence for the presence of an Sfi1-like protein in *Vorticella convallaria*.

Konior, Katazyzna, McCutcheon, Suzanne, and Buhse, Howard E.; University of Illinois at Chicago, Chicago, IL.

The cytoskeleton of the ciliated protist, *Vorticella convallaria*, exhibits a novel contraction-relaxation mechanism driven by releasing or sequestering calcium. Contraction is rapid, while relaxation is slower. The cytoskeleton consists of two contractile organelles: the myonemes located within the cortex of cell body and the spasmoneme surrounded by a membrane system and embedded in the glycoprotein matrix of the stalk. Each of these structures contains 3 to 5 nm filaments, believed to fold causing contraction, and tubular structures shown to release and sequester calcium. We have evidence that 20kDa calcium-binding proteins called spasmin/centrin are necessary for the contraction/relaxation cycle. Immunolocalization studies show that these proteins bind to myonemes and spasmoneme and recently we postulated the presence of a high molecular weight centrin/spasmin binding protein homologous to the Sfi1 and Sfi1-like proteins described from yeast and human, respectively. The anti-human Sfi1 antibody binds to the myonemes and spasmonemes. This antibody recognizes Vorticellan oral structures including in a similar manner described earlier

for anti-centrin antibodies. Anti-human Sfi1 antibody when applied to glycerinated models of *Vorticella* reduces the level of contraction from 90 to 22%. Additionally, pretreatment of the hSfi1 antibody using a peptide derived from human Sfi1 protein restored the contraction level to untreated control values. This data supports the postulate that centrins/spasmins and an Sfi-like protein are components of this contractile system.

2. Mitotracker green®, Molecular Probes™, as a marker to determine prey selection of *Tetrahymena vorax* macrostomal cells.

Leong, Lester and Bushe, Howard E.; University of Illinois at Chicago, Chicago, IL.

Under the right conditions, *T. vorax* microstomal cells are capable of transforming into larger macrostomal cells that are capable of feeding on *Tetrahymena thermophila* and/or *T, vorax* microstomal cells. Using two different colored specific mitochondrial fluorescent markers others in our laboratory have shown that for living cells it is possible to determine which potential prey is selected. The purpose of the present study is to refine their method by killing *T. thermophila* cells first, then staining them by Mitotracker® green for various periods of time. Cells exposed to Mitotracker® for 24 hr were the most intensely stained however, cells exposed for 1, 2, or 3 hr were bright and all cells were clearly marked by the dye. Furthermore, these fixed marked *T. thermophila* cells were clearly visible in the food vacuoles of the macrostomal cell following 10 washes in inorganic medium to remove the paraformaldehyde. Macrostomes fed equal numbers of marked *T. thermophila* cells and unmarked *T. vorax* microstomal cells allowed us to determine the feeding preference of the macrostomal cells. Macrostomal cells preferred *T. thermophila* 3 to 1 over *T. vorax* microstomal cells. However, 10 X washed *T. thermophila* cells apparently leaked Mitotracker® green that stained some of the *T. vorax* microstomal cells.

3. *Effects of peroxynitrite decomposing catalyst, SR-135, on □ -cell function in obesity induced diabetes

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Type 2 diabetes mellitus (T2DM), linked with obesity, is a disease that affects millions of people worldwide. Specific molecular mechanisms underlying □ -cell defects are not well understood. Our recent *in vivo* studies indicated that a new class of peroxynitrite decomposing catalyst, SR-135, effectively decreased fasting blood glucose levels and improved impaired glucose tolerance caused by high fat diet feeding, suggesting that peroxynitrite plays a significant role in diabetic mice. We studied the effects of SR-135 on □ -cell function using a mouse model by immunological and histological staining of both isolated islets and pancreas sections in *ex vivo* studies. SR-135 decreased levels of peroxynitrite, islet size, and intra-islet cell expansion. Furthermore, SR-135 prevented insulin content loss and preserved islet architecture in mice fed with high fat diet. In conclusion, this study confirms that peroxynitrite plays a key role in □ -cell dysfunction and a pharmacological agent

that blocks the formation of peroxynitrite may provide a strategy for a therapeutic intervention of T2DM.

4. The Effects of YLRFamide on the Isolated Crop-Gizzard of the Earthworm

Voss, Benjamin, Vu, Christine, Engelke, Aaron, and Krajniak, Kevin; Southern Illinois University Edwardsville, Edwardsville, IL.

Our laboratory has been examining the effects of FMRFamide-related peptides (FaRPs) on the digestive tract of the earthworm, *Lumbricus terrestris*. Many FaRP sequences have been isolated from annelids including the peptide YLRFamide. Previously we have shown that FMRFamide causes a decrease in contraction amplitude of the isolated crop-gizzard, while causing a biphasic effect on the contraction rate of the tissue. Therefore we decided to examine the effects of YLRFamide on the crop-gizzard preparation. The crop-gizzard was removed from the animal, placed in a tissue bath filled with earthworm saline and attached to a force transducer. The force transducer was connected to a computer. We used IWorx software to record the contractions of the crop-gizzard. Increasing concentrations of YLRFamide were injected into the tissue bath and the resulting changes in contraction rate and amplitude were used to create log-dose response curves. Prelimary results show that YLRFamide causes a biphasic effect on the rate with an increase (threshold of 1 nM) and a decrease (threshold of 0.1nM). YLRFamide failed to cause a change in contraction amplitude. The differences between YLRFamide and FMRFamide suggest that the YLRFamide may not be acting on the same receptor as FMRFamide or only partially active the FMRFamide receptor.

5. *Improving Mitochondrial Bioenergetics in an Alzheimer's Mouse Model via Estrogen Therapy

Hendricks, Eric W., Menze, Michael A., Nathan, Britto P.; Eastern Illinois University, Charleston, IL.

The Centers of Disease Control and Prevention (CDC) have predicted that nearly 16 million Americans will be diagnosed with Alzheimer's disease (AD) by the year 2050. Furthermore, the mortality associated with neurodegenerative diseases, like AD, is expected to rise by nearly 231% in the next 30 years. A current hypothesis for the onset of this debilitating disease is attributed to mitochondrial dysfunction; therefore, a potential strategy to treat AD is to improve the bioenergetic efficiency of this organelle. The aim of this study was to investigate the impact of estrogen's neuroprotective effects on both oxidative phosphorylation in the mitochondrion and substrate level phosphorylation in the cytoplasm in an AD mouse model. In addition, estrogen receptor expression in the olfactory bulbs was monitored. Three to six month old apolipoprotein E (ApoE) deficient mice, which served as the AD model, were used in this study. After removing the ovaries mice were allowed to recover for two weeks. Next mice were injected with either 500 ng/g of estrogen, 100 ng/g of estrogen, or a 1% ethanol corn oil solution. Nerve cell terminals (synaptosomes) were isolated from the forebrain of the mice and oxygen consumption was recorded under permeabilized

and non-permeabilized conditions. Mitochondrial performance was enhanced after low estrogen injections when compared to the control groups. However, estrogen receptor expression did not vary among the treatment groups. Our result suggests the improvement of mitochondrial bioenergetics as neuroprotective mechanism of estrogen (funded by EIU PFR to B.P.N and M.A.M).

6. *Introvert regeneration in *Themiste lageniformis* (phylum Sipuncula): a Fluorescent and Scanning Electron Microscopy study

Mustaly, Hatim M. and Dybas, Linda K.; Knox College, Galesburg, IL.

Marine peanut worms, phylum Sipuncula, regenerate amputated or damaged introverts, the retractable anterior end of their body. In this study, the time course for regeneration was followed in the peanut worm, *Themiste lageniformes*. The ventral nerve cord is visible in dissected, unsectioned introverts viewed under a dissecting microscope and, with greater resolution, under the scanning electron microscope. This data was compared to findings in 8 μm serially sectioned paraffin embedded introverts and serially sectioned 1 μm epoxy embedded regenerating introverts at 4 , 8, and 16 days. The main ventral nerve cord and the changes at the "cut" end were readily identifiable however the finer branches could not be followed. In order to follow the regeneration of the side branches we employed the DiI fluorescent stain. This is the first report of immunochemical data on regenerating neurons in adult sipunculans.

7. *Identifying the Expression and Interaction between Two Isoforms of Intersectin 1 of *Xenopus laevis* and NF-κB

Jimenez, Oscar A., Coatney, Caroline G., and Thorn, Judith M.; Knox College, Galesburg, IL.

Intersectin 1 (ITSN1) is a scaffolding protein seen to be upregulated in Down Syndrome patients and interacts with many cellular mechanisms implicated in endocytic and mitogenic pathways important in neurogenesis and maintenance. There are two main itsn1 isoforms, long and short. Itsn1 protein has five Src homology domains and two Eps 15 homology (EH). Itsn1-L has two more domains, a Rho guanine nucleotide exchange factor (GEF), and a putative calcium binding domain. These domains help facilitate interaction with the proteins JKN, AKT, CdGAP, and others forming complexes which have roles in neurodegeneration. There is evidence the transcription factor NF-κB is involved in these pathways as well, but no other studies have implicated an association with NF-κB and itsn1. I describe the mRNA expression of itsn1 isoforms during early embryonic determination of *Xenopus laevis* dorsal/ventral patterning and have started to examine association with the expression of mesodermal transcription factors regulated by NF-κB.

8. *The importance of intersectin 1 (itsn1) on *Xenopus laevis* development

Cheng, Cheng, Coatney, Caroline, G., and Thorn, Judith M.; Knox College, Galesburg, IL.

Intersectin 1 (ITSN1), located on the human chromosome 21, is associated with neurodegenerative diseases such as Down syndrome, Alzheimer disease and Hungtington diseases. Previous research has shown that itsn1 antisense injected *Xenopus laevis* oocytes produce ventralized tadpoles when fertilized. However, no research has been done on itsn1 protein depletion or overexpression after fertilization. The itsn1 translation blocking Morpholino was microinjected into the embryos at blastomeres from different cell stages to deplete the itsn1 protein. Surprisingly, no phenotypical abnormality was observed. The morpholino was then microinjected into oocytes, followed by host transfer. Host transfer results showed the failure of blastopore closure, abnormal pigmentation and a general shortened axis. Intersectin1-short form (itsn1-S) mRNA was also microinjected into the embryo at different cell stages to complete an overexpression experiment. The overexpression of itsn1-S causes a gastrulation delay and failure of the blastopore to close. However, neurulation continues even without the blastopore closure. Nevertheless, most of the tadpoles at stage 30 show various degrees of axis defects and abnormal pigmentation. Our results indicate that itsn1 protein is necessary pre-zygotically for early embryo development. And itsn1 is also important in regulating cell movement. Further research is going to be focusing on the causality of the axis defects due to protein overexpression and depletion.

9. The role of *Arabidopsis thaliana* Toc159 family of receptors in protein import and glycerolipid synthesis

Afitlhile, Meshack and Workman, Samantha; Western Illinois University, Macomb, IL.

The atToc159 gene family encodes Toc159, 132 and 120 receptors. Toc159 is the most abundant chloroplast receptor and it imports photosynthetic proteins. Toc132 and Toc120 are redundant receptors and are specific for the import of housekeeping proteins. Our data indicate that Toc159 receptor is not critical in lipid synthesis because *ppi*2 mutant accumulated normal levels of fatty acids and the expression of genes that encodes chloroplast localized fatty acid desaturases was up-regulated in the mutant. Although *ppi*2 has a full complement of lipid synthesizing enzymes, the content of glycerolipids was highly reduced in the mutant compared to wild type. This indicates that lipid synthesis is tightly linked to the developmental status of the plastids since *ppi*2 has undeveloped plastids. In toc132toc120 (+/-) mutant, we measured reduced levels of linolenic acid (18:3), which was mirrored by repressed ER localized Δ15 desaturase. It appears that a signal was sent from the plastids to the ER, which resulted in decreased production of 18:3. Studies have shown that phosphatidylcholine is exported from the ER to plastids in the form of diacylglycerol, which serves as a substrate in the synthesis of chloroplast glycolipids that are enriched in 18:3. Our data show reduced mRNA abundance for the ER-localized Δ15 desaturase in toc132toc120 mutant and this might account for the observed decrease in levels of 18:3.

10. *Early introvert regeneration in *Themiste lageniformis*: A light and transmission electron microscopy study

Brownell, Joshua R. and Dybas, Linda K.; Knox College, Galesburg, IL.

Themiste lageniformis, a marine worm of the phylum Sipuncula, has a retractable anterior introvert terminating with a cerebral ganglion and tentacles surrounding an oral opening to the digestive system. The introvert can be amputated, and will regenerate completely. Previous studies have shown that complete regeneration occurs over a period of about two months. In this study, the early stages (2, 4 and 8 days) of this process were observed by transversely amputating half of the introvert and allowing specimens to regenerate. Epoxy embedded samples sectioned at 1 μm were used to identify the early sequence of events that occur in the process of regeneration. At 2 days, no regeneration of internal tissues was observed. Phagocytic coelomocytes were observed in association with a prominent clot. Eight days post amputation clotting was absent. The ventral nerve cord had regenerated and was observed closely associated with the anterior end of the introvert. A cerebral ganglion was observed in association with the nerve cord. The tentacular system and the contractile vessel were present. Both immature and mature blood cells were found developing within the contractile vessel. Epithelial glands located under the cuticle contained densely staining granules.

Session 4: Chemistry (1-6) and Computer Science (7)

1. *Production and Characterization of Nanoscale Metal Oxide Films from Household Sources

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Interference of light waves by thin films makes those films appear to have color. Household items containing titanium and other metals were heated to produce metal oxide thin films with structural colors. These films with nanoscale thicknesses can be used as examples of nanostructures, and can be produced using a few simple, inexpensive items, such as coins and titanium-nitride coated tools. The structural color was characterized by visible light reflectance spectroscopy.

2. *Probing the origin of solvent dependent oxidation behavior of water-soluble hypervalent iodine reagents

Kupireddy, Nikhil and Vinod, Thottumkara K.; Western Illinois University, Macomb, IL.

Recently synthesized and reported water-soluble derivatives of *o*-iodoxybenzoic acid (IBX) have exhibited solvent-dependent oxidation behavior of alcohols. While the ease and selectivity of oxidation of alcohols using the new IBX derivatives parallel that of IBX in polar aprotic solvents, the selectivities observed in the oxidation of diol and triol substrates carrying benzylic, non-benzylic and homobenzylic alcohol moieties in aqueous solvent mixtures allude to an alternate oxidation mechanism. The observed selectivities are explained both using an alternate H-atom abstraction

mechanism and correlated to the bond dissociation energies of the benzylic, homobenzylic and non-benzylic alpha C-H bonds involved in the initial H-atom abstraction step. Synthesis of three diol substrates that carry combinations of benzylic, non-benzylic and homobenzylic alcohol moieties to further probe the observed selectivities will be discussed.

3. *Synthesis of a biphenyl based water-soluble hypervalent iodine reagent to probe hypervalent iodine twist

Medikonda, Tejaswini and Vinod, Thottumkara K.; Western Illinois University, Macomb, IL.

One of the ongoing projects in our laboratory is aimed at understanding the role of the recently theorized hypervalent iodine twist in the oxidation of alcohols carried out using *o*-iodoxybenzoic acid (IBX). Succinctly, the phenomenon of hypervalent twist refers to the coordinated motion of ligands around the iodine center in the IBX-alcohol adduct formed in the ligand exchange step. Attainment of planarity by the oxo ligands allows the transition state of the second reductive elimination step to resemble the planar product iodosobenzoic acid (IBA) produced. We report here the synthesis of a biphenyl based hypervalent iodine reagent with a sterically demanding hypervalent iodine center that will be unable to attain the needed planarity for the oxo-ligands. This structural feature in the reagent should make oxidation of alcohols very slow, if at all possible. The newly synthesized reagent also incorporates suitably positioned hydrophilic groups to make it water-soluble, thus enabling the reagent to potentially oxidize alcohols via the H-abstraction mechanism without relying on the sterically demanding ligand-exchange mechanism. Progress towards the synthesis of the biphenyl based reagent will be discussed.

4. *Oxidation of 2-phenylethanol derivatives using water-soluble *o*-iodoxybenzoic acid (IBX) derivatives in aqueous solvent mixtures

Thamisetti, Abhilash and Vinod, Thottumkara K.; Western Illinois University, Macomb, IL.

An extensive substrate scope investigation to understand the solvent dependent oxidation behavior of water-soluble derivatives of *o*-iodoxybenzoic acid (IBX) and the role of easily abstractable H-atoms with low bond dissociation energies (BDE) in substrates are currently underway in our laboratory. The currently proposed mechanism of oxidation predicts a differences in the rate and ease of oxidation of the various alcohols based on the bond dissociation energies (BDE) of the pertinent alpha C-H bond homolytically cleaved in the first step of the mechanism. Oxidations of a series of 2-phenylethanol analogs and derivatives using IBX and water-soluble derivatives of IBX have uncovered unique oxidation pathways for these substrates leading to unexpected products. Results from the oxidation of 2-phenylethanol, 2-methyl-2-phenylethanol, 2, 2-dimethyl-2-phenylethanol, 2-allyl-2phenylethanol, 2-benzyl-2-phenylethanol and 2-indanone using IBX and water-soluble derivatives of IBX in different solvent systems as well as under microwave conditions will be discussed.

5. *Synthesis of a new water-soluble *o*-iodoxybenzoic acid (IBX) derivative and its oxidation of alcohols

Gude, Harika C., Vodnala, Thirupathi, and Vinod, Thottumkara K.; Western Illinois University, Macomb, Il.

o-iodoxybenzoic acid (IBX)has emerged as a reagent of choice for a plethora of selective oxidative transformations in spite of the solvent limitations imposed by this reagent, which is practically insoluble in solvents other than DMSO (BP 189°C). Synthesis and oxidative properties of different derivatives of IBX has recently been reported highlighting the use of such reagents in solvents other than DMSO. An expedient synthesis of a water-soluble derivative of IBX, and its use for the oxidation of alcohols in water and other aqueous solvent mixtures will be discussed.

6. *Synthesis and Antibiotic Testing of Enantiomerically Enriched 5-Aryl-3-oxo-delta-lactones

Brooks, Joshua, Raube, Lee, Remsen, Edward, Campbell, Dean, and Andersh, Brad; Bradley University, Peoria, IL.

We have found that equilibrating bases, such as potassium carbonate or alkoxides, in absolute ethanol or methanol can be used to induce a novel condensation reaction between a benzaldehyde and an acetoacetate ester, yielding 5-aryl-3-oxo-delta-lactones (6-aryl-dihydro-2H-pyran-2, 4(3H)-diones) as a racemic mixture instead of the expected Knoevenagel product. We have also found that 5-aryl-3-oxo-delta-lactones possess activity against gram-positive and gram-negative bacteria. Because 5-aryl-3-oxo-delta-lactones possess one stereogenic center, we have prepared enantiomerically enriched samples of 5-aryl-3-oxo-delta-lactones, in an effort to determine if one enantiomer has greater activity than the other. Details of the synthetic work as well as results from minimum inhibitory concentration (MIC) determinations will be presented.

7. A Study on the Social Media-based Merchant Reviews and Social Merchants' Performance

Lee, In; Western Illinois University, Macomb, IL.

With the widespread adoption of social media by customers, businesses must find ways to capitalize on the social media to stay competitive. Taking advantage of social media's user participation and social networking capabilities, social intermediaries such as Groupon and LivingSocial have emerged as a promising online intermediary between merchants and consumers. Merchant reputation sites such as Yelp, TripAdvisor, and Angie's List enable consumers to generate online product reviews, merchant reviews, blogs, and social tagging.

Our study addresses the following questions using data provided by Yelp: (1) Is there any difference between social merchants' overall review scores and regular merchants' review scores? (2) How do Groupon customers rate social merchants? (3) How do the social merchants perform over time? and

(4) Is there a positive correlation between Groupon consumers' review scores and regular consumers' review scores?

Based on this study, core characteristics of social merchants were mapped. First, social merchants seem to be more resilient in the market than the regular merchants. Our data show that the failure rate of social merchants is smaller (13.89%) than regular merchants (20.37%), while the difference is not statistically significant. Second, as social merchants expand their market, their average review scores declines more than the regular merchants. Third, the social merchants tend to have poorer services to Groupon consumers than regular consumers.

Session 5: Environmental Science (1-5) and Zoology (6 & 7)

1. Storm Water Runoff of Residential Green Roof Systems.

Mosby, Katie, Retzlaff, Bill, and Murphy, Dan; Southern Illinois University Edwardsville, Edwardsville, IL.

Storm water runoff is an escalating issue that has arisen from the substantial amount of impervious surface in urban/suburban areas. Much of the storm water runoff in suburban areas can be attributed to residential roof systems. A popular resolution to manage storm water runoff in an urban center has become green roofs. Little has been done to explore the potential for green roof systems in residential developments to reduce storm water runoff. To evaluate the storm water runoff retention potential of residential green roof systems, eighteen residential roof models were built. The roof models were constructed at three different angles, 1°, 20° (5/12 pitch), and 40° (10/12 pitch), with six roofs at each slope angle. Nine of the eighteen composite shingled roofs were fitted with a modular green roof system called Steep Paks® filled with a blended arkalyte growth media. The residential green roof systems were planted with a mixture of seven *Sedum* species including: S. *kamtschaticum*, S. *reflexum*, S. *sexangulare*, S. *album*, S. *spurium*, S. *floriferum*, and S. *immergrunchen*. The experimental design was a completely randomized design with roof models facing south for maximum sun exposure. Each roof model was equipped with gutters and barrels to collect the storm water runoff following every rain event. Measurements from each barrel were taken after each precipitation event and were analyzed to compare the storm water retention of residential roofs at different slope angles and between standard residential roof systems and a residential green roof system. When this project was first established, green roof systems reduced the storm runoff by 42% while 82% of the rainfall ran off standard shingled roofing systems. (Murphy, 2012). Between November 7, 2011 and December 20, 2012, residential green roof systems reduced storm water runoff by 55%, while 76% of the rainfall ran off standard shingled roof systems. At the three roof slopes evaluated in this study, roof pitch did not influence storm water retention. When looking at previous results and these results it can be concluded that residential green roof systems retain more storm water runoff than standard residential shingled roofs. Therefore, residential green roof systems could be a solution for suburban storm water runoff issues.

2. Habitat Characteristics of River Otter (*Lontra canadensis)* Latrines at the Emiquon Complex

Fretueg, Gregory R., Ruez Jr., Dennis R., and Lin, Yi-Sz; University of Illinois at Springfield, Springfield, IL

River otters inhabit a wide variety of aquatic habitats where permanent water is available. Latrines are terrestrial sites along shorelines where deposits of urine, feces, and anal secretions are concentrated. These sites are an important component of river otter communication and social interactions. In this study, river otter latrines were located at The Nature Conservancy's Emiquon Preserve and the adjacent U.S. Fish and Wildlife Service's Emiquon National Wildlife Refuge in central Illinois to determine what habitat features were associated with these latrine sites. Fifteen river otter latrines were discovered during this study. The distance from the center of latrines to the nearest body of water was highly variable. Beaver activity was present at only two of the fifteen latrine sites, and only two latrine sites were not on a levee crossover. All fifteen latrine sites were located on levees surrounding bodies of water. Using USGS land cover data the land cover types at latrine sites were able to be characterized with 50 and 200 m buffers. The levee cover type was the dominant feature covering 51.1% of the total area within the 50 m buffers. Water was the next most abundant cover type (26.0%) followed by floodplain forest (15.0%), wet meadow (6.6%), roadside (grasses, forbs, shrubs) (0.7%), and shallow marsh perennial (0.5%). The dominant habitat types in the 200 m buffers were water (32.6%), levee (grasses and forbs) (17.4%), wet meadow (14.6%), and floodplain forest (14.4%). The results of this study along with others illustrate that river otters are highly adaptable.

3. *Colonization of green infrastructure by cavity nesting bees and wasps.

[1]Buckles, Brittany J., [2]MacIvor, J. Scott, and [1]Retzlaff, William A.; [1]Southern Illinois University Edwardsville, Edwardsville, Illinois, USA and [2]York University, Toronto, Ontario, Canada

Green roofs, a new environmental tool, may be especially suited for highly mobile species, such as birds, bees, and wasps. Most previous research on bees has been done specifically on honeybees (*Apis mellifera*); however wild bees are extremely important pollinators as well. Cavity nesting bees and wasps will house their larva in small cavities and may be especially suited for renewed ecosystems in urban areas. Foraging and nesting habitats for pollinating insects, such as bees and wasps could be increased by green infrastructure in urban settings. In 2012 and 2013, I evaluated the colonization of man-made nestboxes placed on green roofs and surrounding urban areas by cavity nesting bees and wasps. Each nestbox contained thirty possible nest tubes. In 2012 J. Scott MacIvor and I received fifty-five nestboxes that were installed in Canada and the United States. Forty-five of our sites from 2012 were on green roofs and ten were at ground level. Four different species were identified from the United States. In 2013 we received nestboxes from ninety-five locations. Seventy-six of these locations were on green roofs and nineteen were at ground level. Fifty-seven nestboxes were returned to me from seventeen areas across the United States. One hundred forty-six nest tubes were successfully colonized by cavity nesting bees and wasps (out of 1,710 in the US).

Cavity nesting bees and wasps are colonizing green roof infrastructure in urban areas. More analysis needs to be completed to explore the relationship between green infrastructure and nestbox abandonment rate.

4. Lead and tin concentrations in fish from the Lower Illinois River

Matthew, Stephanie A. and Brugam, Richard B.; Southern Illinois University Edwardsville, Edwardsville, IL.

The Illinois River is a major waterway that drains approximately 78, 000 km^2 of the land area in Illinois. Traditionally, it has been an important channel for transportation and the fishing industry; however, pollutants from industrial sources, barge traffic, and excessive silt deposition have severely comprised the integrity of the water quality. Pb and Sn are common metallic pollutants found in these waters and are known to affect neurological and endocrine function in aquatic wildlife. We expected to see increased [Pb] and [Sn] in fish from the Lower Illinois River (LIR) than those of non-polluted environments. To examine the lifetime exposure to these metals, bone samples were taken from Bigmouth Buffalo (*I. cyprinellus*), Asian (Silver) Carp (*H. molitrix*), Freshwater Drum (*A. grunniens*), Blue Catfish (*I. furcatus*), Channel Catfish (*I. punctatus),* and Flathead Catfish (*P. olivaris*) from the LIR and compared to those of a control environment. We found that [Pb] was significantly higher in the LIR samples (μ = .646 mg/kg) and showed wide variability across species. [Sn] was found to be higher in the control environment (μ = 6.42 mg/kg) with little variation among the species. Our results suggest that the lifetime exposure to these metals poses little to no threat to systemic functionality in the fish studied.

5. *The Source-Partitioning of Selenium Volatilization in the Soil-Prince's Plume (*Stanleya pinnata*) System

Jones, Leighann, Sever, Victoria, Lin, Z.-Q. Southern Illinois University Edwardsville Department of Biological Sciences, Edwardsville, IL.

Prince's Plume (*Stanleya pinnata*) is a plant species that has a superior ability to accumulate Se in tissues and volatilize Se from the soil to the atmosphere (Se hyper-accumulator), compared with non-hyper-accumulator species. We hypothesized that high rates of Se volatilization in the soil-Prince's Plume system may in part result from the unique Se metabolism pathway in the Se-hyper-accumulator plant (i.e. production of phytogenic dimethyldiselenide), which might result in significant Se volatilization directly from shoots of Prince's Plume. The objective of this study was to quantify the amount of volatile Se dissipated from shoots of Prince's Plume in the soil-plant system, compared with the amount of volatile Se from the soil-root system. A laboratory experiment was carried out using double volatilization chambers. After the soil was treated with 5mg Se kg-1 soil (dry weight)in a 6" pot, volatile Se was collected using H2O2-NaOH trap solution in gas washing bottles daily for six days, from shoots and the soil-root system separately. Concentrations of Se in the trap solutions were measured using ICP-MS. Preliminary results show that the cumulative Se volatilized by shoots during a 6-day experimental period was 1.78 $\pm$1.38 μg Se per pot, compared with 6.12 $\pm$ 1.86 μg Se per pot from the soil-root system. Selenium volatilization from Prince's

Plume shoots accounted for 23% of the total Se volatilization in the soil-Prince's Plume system, while non-Se-hyper-accumulator plant shoots only accounted for approximately 10% of the total Se volatilization in soil-plant systems.

6. Response of the Franklin's Ground Squirrel to Recreational Trail Development in Springfield, Illinois

Young, Christopher and Ting, Tih-Fen; Department of Environmental Studies, University of Illinois at Springfield, Springfield, IL.

Franklin's ground squirrel (*Poliocitellus franklinii*) listed as a state-threatened species is declining in Illinois and adjacent states. Many have considered Franklin's ground squirrel as a prairie-obligate species. While it can occur in habitat that is dominated by grasses and forbs, Franklin's ground squirrel is most frequently associated with habitat characterized by a mixture of grassy and woody vegetation, referred to as savanna-like habitat. Nowadays in the southern portions of its range, Franklin's ground squirrels are frequently found along roadside or railroad right-of-ways with a diverse mixture of grasses, forbs, woody vegetation when these areas are no longer in use. Nonetheless, these right-of-way habitats disappear quickly without active management to remove woody vegetation, especially trees that will shade out grasses and eventually turn prairie or savanna-like habitat into woodlands. Several colonies of Franklin's ground squirrels occur along sections of an abandoned Union Pacific Railroad corridor in Sangamon County, Illinois. Portions of the corridor that are owned by the Illinois Department of Natural Resources offer a unique opportunity to experimentally implement habitat management practices and monitor subsequent responses of Franklin's ground squirrels to removal or thinning of major woody structures. In this talk, I will present recent demographic information on Franklin's ground squirrel along the study corridor as well as the implementation of habitat improvement practices.

7. Implementing Habitat Improvement for Franklin's Ground Squirrels in Sangamon County, Illinois

Ting, Tih-Fen; Department of Environmental Studies, University of Illinois at Springfield, Springfield, IL.

Franklin's ground squirrel (*Poliocitellus franklinii*) listed as a state-threatened species is declining in Illinois and adjacent states. Many have considered Franklin's ground squirrel as a prairie-obligate species. While it can occur in habitat that is dominated by grasses and forbs, Franklin's ground squirrel is most frequently associated with habitat characterized by a mixture of grassy and woody vegetation, referred to as savanna-like habitat. Nowadays in the southern portions of its range, Franklin's ground squirrels are frequently found along roadside or railroad right-of-ways with a diverse mixture of grasses, forbs, woody vegetation when these areas are no longer in use. Nonetheless, these right-of-way habitats disappear quickly without active management to remove woody vegetation, especially trees that will shade out grasses and eventually turn prairie or savanna-like habitat into woodlands. Several colonies of Franklin's ground squirrels occur along sections of an abandoned Union Pacific Railroad corridor in Sangamon County, Illinois. Portions of the

corridor that are owned by the Illinois Department of Natural Resources offer a unique opportunity to experimentally implement habitat management practices and monitor subsequent responses of Franklin's ground squirrels to removal or thinning of major woody structures. In this talk, I will present recent demographic information on Franklin's ground squirrel along the study corridor as well as the implementation of habitat improvement practices.

Session 6: Health Sciences (1-3), Microbiology (4), and STEM Education (5)

1. *Gd-DTPA enhanced in vivo imaging of *Xenopus laevis* development using an Ultra-Compact MRI

[1]Huebner, Kelli R., [2]McDowell, Andrew F., and [1]Thorn, Judith, M.; [1]Knox College, Biology Dept., Galesburg, IL and [2]ABQMR, Albuquerque, NM.

Magnetic resonance imaging (MRI) is a noninvasive technique used to reconstruct a three dimensional image of an intact subject. MRI is necessary for in vivo imaging of internal development of *Xenopus laevis* embryos because they are opaque. Past in vivo research of internal *X. laevis* development has been completed using superconducting MRI systems that are both expensive and large for a research setting. An Ultra-Compact MRI (UC-MRI) was created and utilized specifically for imaging of *X. laevis* development. I have performed experiments using the UC-MRI which demonstrate the effectiveness of this machine in obtaining in vivo images. The concentration of a T1-weighted contrast agent, gadolinium chelated with diethylenetriaminepentaacetic acid (Gd-DTPA; MAGNEVIST), has been optimized and microinjected into embryos to further enhance contrast between the different tissues. The use of this contrast agent has produced clearer images without affecting embryo viability. Current and future experiments involve manipulating the dorsal/ventral axis patterning to see if failure to gastrulate can be detected internally before embryonic death. Also, I am *in vivo* fate mapping tissues using Gd-DTPA in hopes of uncovering new information that has not been available using fixed tissue.

2. *New antibacterial germacrene from *Verbesina negrensis*

Alpan, Lara, B., Mora, Flor D., McCracken, Vance J., and Nieto, Marcelo J; Southern Illinois University Edwardsville, Edwardsville, IL.

Magnetic resonance imaging (MRI) is a noninvasive technique used to reconstruct a three dimensional image of an intact subject. MRI is necessary for in vivo imaging of internal development of *Xenopus laevis* embryos because they are opaque. Past in vivo research of internal *X. laevis* development has been completed using superconducting MRI systems that are both expensive and large for a research setting. An Ultra-Compact MRI (UC-MRI) was created and utilized specifically for imaging of *X. laevis* development. I have performed experiments using the UC-MRI which demonstrate the effectiveness of this machine in obtaining in vivo images. The concentration of a T1-weighted contrast agent, gadolinium chelated with diethylenetriaminepentaacetic acid (Gd-DTPA; MAGNEVIST), has been optimized and microinjected into embryos to further enhance

contrast between the different tissues. The use of this contrast agent has produced clearer images without affecting embryo viability. Current and future experiments involve manipulating the dorsal/ventral axis patterning to see if failure to gastrulate can be detected internally before embryonic death. Also, I am *in vivo* fate mapping tissues using Gd-DTPA in hopes of uncovering new information that has not been available using fixed tissue.

3. *Harnessing Apoptotic Pathways to Control Drug-Induced Gingival Hyperplasia.

[1]Yu, Hayoung, [1]Chamberlain, Seth, [1]Wanda, Paul E, [2]Joy, Anita; [1]Department of Biological Sciences, Southern Illinois University Edwardsville, Edwardsville, IL and [2] Southern Illinois University School of Dental Medicine, Alton, IL.

Introduction: Gingival overgrowth is a side-effect of drugs like CyclosporineA, with an estimated 25-80% of patients affected. The overgrowth occurs by inhibition of apoptotic pathways necessary for tissue remodeling. Hyperplastic gingiva is associated with increased bleeding, infections and interference with occlusion, mastication and speech. Current management includes surgical procedures, electrocautery or CO_2 lasers. We hypothesized that induction of apoptosis via cytochrome-c (CytC) can help control Cyclosporine-A (CsA) induced gingival hyperplasia non-surgically. **Methods:** Cultured human gingival cells were treated with 100 and 500ng/ml concentrations of CsA and allowed to proliferate for 3,6,9 days to induce gingival overgrowth. Cells were permeabilized with 0.2% TritonX-100, incubated with exogenous CytC. Positive controls were incubated with CsA to induce gingival overgrowth but did not receive CytC treatment and negative controls were incubated only in CytC treatment. Cell proliferation was estimated and nuclei stained with DAPI to evaluate reversal of gingival overgrowth and induction of apoptosis. **Results:** The increased proliferation of gingival cells induced by CsA was significantly reduced by CytC treatment. Positive controls continued to show increased proliferation, while negative controls showed hypo-proliferation, as expected. **Conclusion:** This study opens up research targeting apoptotic pathways to manage hyperplastic tissue and conditions of uncontrolled tissue propagation. Tissue modeling by apoptosis will allow patients to return pathological tissue to a healthy state without the risks of surgery.

4. *An *In Vitro* Assessment of the Antibacterial Effects of Various Plant Essential Oils

[1]Mullen, Keena, [2]Lee, Amanda, [3]Lyman, Roberta, [1]Washburn, Steve, and [3]Anderson, Kevin; [1]Department of Animal Science, North Carolina State University, Raleigh, NC, [2]Knox College, Galesburg, IL, and [3]Department of Population Health and Pathobiology, CVM North Carolina State University, Raleigh, NC.

Previous research suggests that plant essential oils are effective at treating mastitis in dairy cattle. However, little is understood about how the essential oils function in mastitis treatment and prevention. The goal of this study was to test the antibacterial properties of the essential oil ingredients of Phyto-Mast, an herbal intramammary mastitis treatment, against three bacteria commonly associated with causing mastitis (*Streptococcus uberis*, *Staphylococcus aureus* and *Staphylococcus*

chromogenes). Oils tested included *Thymus vulgaris, Angelica dahuricae, Angelica sinesis, Gaultheria procumbens* and *Glycyrrhiza uralensis*. Following a modified CLSI standard for broth dilution testing, pasteurized whole organic milk was used as a growth medium. Thymus vulgaris was tested alone at 3%, 2% and 1%, concentrations while all the other essential oils were tested alone and in combination at 4%, 2%, 1% and 0.5% concentrations, resulting in 15 treatments over three replications. The control groups consisted of milk alone, milk +bacteria, and milk+penicillin-streptomycin (tested at 1% and 5% concentrations). We found that only *Thymus vulgaris* at 3% and 2% concentrations uniformly reduced bacterial growth compared to the controls. Additionally we saw varying success with each of the other tested essential oils individually and in combination. Further testing of the herbal components will need to be performed in order to better understand the effects of these oils on mastitis in dairy cattle.

5. Introducing lecture with a mystery picture

McGilliard, Kip, L.; Eastern Illinois University, Charleston, IL.

A classroom presentation is enhanced by generating questions in students' minds during a review or preview of concepts. I developed a series of mystery pictures for my Animal Physiology class that were used to introduce lectures. A figure was taken from the previous class presentation and cropped so that only a small portion remained visible. The mystery picture was displayed and students were asked to guess what the picture showed. The full picture was then revealed and students were asked to explain the concept illustrated by the figure. My hypothesis was that retention would be improved when concepts were introduced with a mystery picture. To test the impact on short-term retention of information, students were given a brief quiz during the latter part of each lecture period covering a concept that had been reviewed at the beginning of the lecture. A mystery picture was presented at the beginning of every other lecture, while a review of concepts was presented without a mystery picture on the days in between. Written student evaluations at the end of the course indicated that 88% of students rated the mystery pictures as "sometimes difficult" and 71% as "always valuable" to their educational experience. On the same evaluations, 88% rated the quizzes as "sometimes difficult" and 92% as "always valuable". It was concluded that the majority of students found both the brief quizzes and mystery pictures valuable, but there was no improvement in quiz scores on days that the material was introduced with a mystery picture.

Session 7: Zoology

1. *A new species of *Cryptoapseudes B□ cecsu*, 1976 (Crustacea: Tanaidacea: Apseudomorpha) from the Hawaiian Archipelago

[1]David, Shanna E. and [2]Heard, Richard W.; [1]Illinois College, Jacksonville, IL and [2]University of Southern Mississippi, Gulf Coast Research Lab, Ocean Springs, MS.

Cryptoapseudes leroyii, n. sp. occurred in collections made in the western Hawaiian Islands. The new species, which represents the fourth species attributed to the genus *Cryptoapseudes*, is distinguished from the other three members of the genus by the antennule usually with outer flagellum having three articles, mandibular palp article 3 with six or more setae, maxilliped with palp article 1 lacking stout spiniform seta on lateral margin, and uropodal endopod usually with five-articles. The discovery of C. *leroyii* extends the range for the genus from the western Indian Ocean over 14, 200 km northeast to the northern Pacific Ocean.

2. *A winter survey of insects inhabiting the Florida Panther National Wildlife Refuge

[1]Martin, Angela M.; [1]Stice, Andrew L.; [1]Zettler, Lawrence W.; and [2]Richardson, Larry W.; Illinois College, Jacksonville, IL and [2]Florida Panther National Wildlife Refuge, Naples, FL.

In 1989, the 10,600+ hectare Florida Panther National Wildlife Refuge (FPNWR) was established to protect the endangered Florida panther, *Puma concolor coryi*, and its habitat. Among the natural communities present include tropical hardwood hammocks, wet prairies, cypress strands, pinelands, and swamps that collectively support a diverse flora and fauna. To facilitate long-term conservation in a region vulnerable to invasive (exotic) pests, biological surveys are needed to document and monitor changes to the native flora and fauna. During a three-year period (2009-2011), the insects of the FPNWR were collected, identified, and preserved primarily during summer months (June, July). We present the first insect survey carried out during the winter season (January 2013). A hand net and black light were utilized to collect diurnal and nocturnal insects, respectively. Following identification, insects were preserved using standard entomological protocols, and permanently deposited in the Illinois College arthropod collection for safekeeping and future reference. A total of 58 insect families within 10 orders were identified including *Alaus oculatus* (Coleoptera: Elateridae) *Acrosternum hilare* (Hemiptera: Pentatomidae), and *Lethocerus americanus* (Hemiptera: Belastomatidae). Among the Saturniidae (Lepidoptera) collected include *Automeris io* and *Antheraea polyphemus*. Though relatively common, these insects provide a baseline for future surveys and suggest that insects remain active year-round in this important eco-region.

3. *Boisduval scale (*Diaspis boisduvalii*, Hemiptera: Diaspididae) on native epiphytic orchids in South Florida's Fakahatchee Strand State Preserve – an update

[1]Zindel, Adam J., [1]Elliott, Crystal A., [1]Zettler, Lawrence, W., and [2]Zettler, Jennifer A.; [1]Illinois College, Jacksonville, IL and [2]Armstrong Atlantic State University, Savannah, GA.

About half (106) of North America's orchid species are found in Florida, and half of these species are largely restricted to the Big Cypress Basin eco-region in the southern tip of the state. In the Fakahatchee Strand State Preserve, widely regarded as the "orchid capital of North America", at least 44 native orchid species have been documented, many of which are state-listed epiphytes. In 2011, Boisduval scale (*Diaspis boisduvalii*, Hemiptera: Diaspididae), was discovered at two sites within the Fakahatchee Strand for the first time. This phytophagous exotic species is considered the most important pest of cultivated orchids in Florida due to its ability to weaken or kill the host plant. Consequently, the presence of *D. boisduvalii* in this orchid-rich eco-region is of considerable concern. We present an update on the prevalence of Boisduval scale in the Fakahatchee Strand during a survey carried out in last summer (2012). Seven epiphytic orchid species were surveyed for *D. boisduvalii* and other phytophagous insect pests spanning 10 different sites. Boisduval scale was present at seven of the 10 sites, and primarily on two orchids: *Epidendrum amphistomum*, *Prosthechea cochleata* var. triandra. In addition, a new pest was also collected during the survey, *Pseudococcus microcirculus* (Hemiptera: Pseudococcidae), representing a state-record. Taken together, these exotic insects add an additional burden to state-endangered orchid populations.

4. *Nest-boxes as kestrel conservation tools: occupancy by kestrel and non-kestrel species in the Midwest.

[1]Joray, Taylor P., [2]Eschenbauch, Janet, [3]Mueller, William, [4]Droske, Alice, [4]Schwarzmeier, Judith, [4]Palzkill, Joseph, [5]Petznick, Steven, [6]Standlee-Hanson, Carolyn D., and [7]Giovanni, Matthew; [1]Biology Department, Illinois College, Jacksonville, IL, [2]Central Wisconsin Kestrel Research, Amherst Junction, WI, Western [3]Great Lakes Bird and Bat Observatory, Belgium, WI, [4]Beaver Creek Reserve, Fall Creek, WI, [5]New London, WI, [6]Spring Grove, MN, [7]The Peregrine Fund, Boise, ID.

American Kestrels (*Falco sparverius*), the smallest falcon species in North America, are experiencing declines across many regions of the United States. Still the most numerous falcon species present in North America, this little raptor has been enduring slow and steady declines for several decades. According to data from Christmas bird counts, breeding bird surveys, and numerous nest-box programs, the North American kestrel population has decreased 47% in the last 45 years. Possible causes for the decline include land use and habitat loss, exposure to environmental contaminants, climate change, a loss of prey sources, and competition for nesting cavities. In particular, this study focuses on nest-box competition in the Midwestern United States. Occupancy rates for American Kestrels and other species were calculated in 169 nest-boxes in Illinois, Wisconsin, and Minnesota. An occupied box was defined as a box where a breeding pair laid at least one egg, regardless if the nest produced successful fledglings or not. Of the 169 nest-boxes considered, American Kestrels

had an occupancy rate of 45.6%. European Starlings (*Sturnus vulgaris*) had an occupancy rate of 24.3%, while 20.7% of the boxes went unoccupied during the entire 2012 breeding season. These findings may indicate that European Starling, a non-native and highly aggressive species, may be a contributing factor in the decline of the American Kestrel.

5. *Effects of corticosterone on development and immunocompetence in Western Chorus Frogs (*Pseudacris triseriata*) and Southern Leopard Frogs (*Lithobates sphenocephalus*)

Stoltz, Katie A., Wilcoxen, Travis E., and Carlson, Rebekah D.; Millikin University, Decatur, IL.

The quality of a tadpole's habitat can influence the timing of metamorphosis. Unpredictable changes in a habitat such as pond desiccation, limited food resources, and predators can all affect stress levels. Stress has been shown to impact the rate of development in vertebrates. It has also been shown that the effects of stress are dependent on the timing of stressors. In our study, we investigated how treatments of corticosterone would affect the development and immune function of the Western Chorus Frog (*Pseudacris triseriata*), and the Southern Leopard Frog (*Lithobates sphenocephalus*), and hypothesized that corticosterone would increase the developmental rate of the tadpoles and decrease immunocompetence. Our hypothesis was supported for Western Chorus Frogs but not for Southern Leopard Frogs, suggesting physiological differences in the response to a stressor between these species that is likely linked to differences in life history and ecological characteristics.

6. *Efficacy of using the double-observer point count method and Program MARK to estimate population sizes

Commons, Kelly A., Carlson, Rebekah D., Lundstrom, Lisa A., Horn, David J., and Wilcoxen, Travis E.;
Millikin University, Decatur, IL.

Notwithstanding the popularity of point counts to estimate population sizes of bird species, their methodologies and data analysis vary considerably. We calculated population sizes of 17 bird species using three different methods: single-observer, double-observer, and double-observer using Program MARK. For the study, we performed fixed-radius, 10-minute point counts. The study was conducted over six field seasons at nine forested sites in central Illinois with 30 point counts conducted at each site each season. Population estimates were made using the total number of birds recorded by the primary observer, the total number of birds recorded by both the primary and secondary observer, and the best model derived from five different combinations of observer and distance models run using Program MARK. The population size estimate obtained through Program MARK differed little compared to the raw double-observer counts. Thus, there may be certain circumstances where there are limited benefits to using Program MARK to calculate population sizes.

7. *Pelvis Sexual Dimorphism in Mustelidae

Thompson, Andrew and Kohn, Luci; Southern Illinois University Edwardsville, Edwardsville, IL.

Sexual dimorphism can be characterized by form differences observed between males and females, and has been observed throughout the mammalian body, including the pelvis. The mammalian pelvis is formed by the fusion of three separate bones (the ilium, ischium, and pubis) into a single bilateral unit and is influenced by three main factors: locomotion, parturition, and weight-bearing. The mustelid family displays diverse modes of locomotion, which makes it an ideal study group. This study examines the sexual size dimorphism in three species of the Mustelidae family, *Neovison vison* (American mink), *Mustela frenata* (long-tail weasel), and *Mustela ermine* (stoat). Pelves of 37 N. vison, 31 M. frenata and 21 M. ermine, all of known sex, were photographed in a standard position and imported into ImageJ where two-dimensional coordinates of twenty-seven landmarks recorded. These landmarks were used to calculate dimensions within the pelvis, representing pelvis regions with either developmental or functional significance. Multivariate analysis of variance (MANOVA) was used to test for significant differences in pelvis form between males and females in each species. Differences in patterns of sexual dimorphism across taxa were also assessed MANOVA. These patterns of sexual dimorphism enable us to begin to assess sources of interspecific variation in the family Mustelidae.

8. *Scapular Sexual Dimorphism In Mustelidae

Norman, Steven and Kohn, Luci; Southern Illinois University Edwardsville, Edwardsville, IL.

Sexual dimorphism, or significant differences between males and females of a species, has been widely documented in mammals. While overall body size may exhibit sexual dimorphism, it is unclear whether all skeletal elements also exhibit sexual dimorphism. The scapula, part of the pectoral girdle, is influenced by upper limb movement. Members of the family Mustelidae exhibit large differences in size and differing forms of locomotion. This study tests for significant sexual dimorphism is present in the scapula within the family Mustelidae, and whether the degree of sexual dimorphism is associated with locomotion. Two-dimensional coordinates of 14 scapula landmarks were digitized from photographs of 192 mustelid scapulae representing seven species. Inter-landmark dimensions representing scapula form were calculated from these landmarks coordinates. Within each species, sexual dimorphism was tested by multivariate analysis of variance (MANOVA), and these results were compared across species. The patterns of scapula sexual dimorphism in the varied Mustelidae provide further insights on the nature of sexual dimorphism.

9. *Tree and shrub species composition and physiognomics of Ovenbird (*Seiurus aurocapilla*) and Kentucky Warbler (*Geothlypis formosa*) territories.

Lichtenstein, James L.; Knox College, Galesburg, IL.

The habitat preferences of territorial birds have serious implications for their conservation. Because many studies have found that structural characteristics of habitats are strong predictors of bird species composition, most studies that examine the habitat preferences of birds have focused

structural characteristics. However several studies have found strong relationships between plant species composition and bird species composition. This suggests that the plant species composition could yield valuable information about how suitable an area is for a particular species of bird. In order to test this I mapped Ovenbird (*Seiurus aurocapilla*) and Kentucky Warbler (*Geothlypis formosa)* territories, and compared the relative basal areas of 10 species of trees, the densities of 6 genera of shrubs, and multiple physiognomic factors in areas that contained these species to areas that did not. I found that the territories of Ovenbirds and Kentucky Warblers were both associated with gooseberry (*Ribes* spp.) density, the relative basal areas of several species of trees, and several habitat structural characteristics. These associations have specific conservation implications for these warblers and suggest that plant species composition is a valuable source of information concerning the habitat preferences of territorial birds.

10. *Field Tracking, Behavioral Observations and Nest Discovery of a Solitary Eagle (*Buteogallus solitarius*) in Belize

Novy, Stacia A.; Southern Illinois University Edwardsville, Edwardsville, IL.

The Solitary Eagle (*Buteogallus solitarius*) is a widespread, local resident of subtropical and tropical montane forest with a distributional range extending from western Mexico through Central America to northern Argentina. Sightings occur throughout its range, but confirmed breeding records are very scarce. Only two historical nest records exist for Mexico, in 1947 & 1958 respectively, and represent subspecies *B. solitarius sheffleri*. The nest sites in Mexico were discovered by chance and later reported to researchers by native villagers. On 30 June 2011, a third nest was discovered in the Mountain Pine Ridge, Cayo District, Belize (17.0254 N, 88.8217 W). This nest appears to be the first documented breeding record for Belize and subspecies *B. solitarius solitarius*. The Belize nest also differs from previous discoveries in that it was systematically tracked and located after ten field sightings within 24 days. An integrated knowledge of avian flight patterns, raptorial bird breeding behavior and traditional wildlife tracking methods led to the rapid disclosure of the third nest.

11. Pre-European settlement range predictions for stoneflies (Plecoptera) of the Midwest

[1]Dewalt, R. E., [1]Cao, Y., [1]Robinson, J.L., [2]Grubbs, S.A., Tweddale, T.[1] and [1]Hinz, L.; [1]Illinois Natural History Survey, Champaign, IL, USA and [2]Dept. Biological Sciences, Western Kentucky University, Bowling Green, KY.

Animal distributions have changed dramatically within the Midwest during the 20th century. Stoneflies (Plecoptera) are sensitive to changes in water quality and habitat structure and the majority have lost range due to agriculture and urban development. Our approach to reconstructing their ranges uses 24,000 museum and new specimen records, ~100 environmental variables, and Maximum Entropy species distribution models to predict pre-European settlement range and species richness patterns across IL, IN, MI, OH, and WI. Applications include refinement of stream health measures based on expected richness, establishment of conservation status for species, prediction climate related range change, and assessment of the relative risk for range loss for individual species.

Poster Presentation Abstracts

Division: Agriculture

1. *_In vitro_ propagation of _Desmantus illinoensis_, a native perennial of agricultural interest

Flaugher, Keith and Barry, Kelly; Southern Illinois University Edwardsville, Edwardsville, IL.

Illinois bundleflower (*Desmanthus illinoensis*) is a legume native to the Mid-Western. It has potential uses as a perennial forage crop, it produces large amounts of seeds, and it improves the nitrogen content of the soil. The purpose of this study is to initiate in vitro propagation of Illinois bundleflower through shoot multiplication. Seeds were surface sterilized and 12 seeds were placed in magenta boxes of ½ MS medium supplemented with auxins and cytokinins. Auxins tested were indole-3-acetic acid (IAA) and 1-Naphthaleneacetic acid (NAA) at concentrations of 0.0, 1.0, and 2.0 mg/L. Cytokinins were N6-Benzyladenine (BA) and Kinetin (K) at concentrations of 0.0, 0.2, and 0.5 mg/L. Plants were grown in 16 hours fluorescent light/8 hours dark at room temperature in order to determine the appropriate combination and concentration of growth regulators for shoot multiplication.

Division: Botany

2. *Determination of seed viability in a rare species: The Tennessee Coneflower

[1]Mosby, Lisa A., [2]Albrecht, Matthew A., [1]Esselman, Elizabeth J., [3]Clawitter, Helen, and [2]Rhodes, Matt; [1]SIUE, Edwardsville, IL, [2]Center for Conservation and Sustainable Development, Missouri Botanical Garden, St. Louis, MO, and [3]Washington University, St. Louis, MO.

The Tennessee purple coneflower (*Echinacea tennesseensis*) (Beadle) Small [Asteraceae]) is a state and formerly federal endangered species naturally found in cedar glades in middle Tennessee. A loss of habitat and a naturally restrictive geographic range contributed to this coneflower being listed as endangered. Conservation efforts have been made, new populations of Tennessee purple coneflower have been established, and the Tennessee purple coneflower has recently been delisted from the federal Endangered Species List. However, prior to delisting, there had been no recent attempts to determine if the nineteen natural and twenty-one introduced populations of this species were sexually reproducing and thus thriving. The purpose of this study was to examine current levels of seed set in both types of populations. The determination of successful sexual reproduction was needed to see if the Tennessee purple coneflower populations under consideration met the requirements for delisting.

3. *Cloning the Old Main Oak (*Quercus macrocarpa* Michx.): Preliminary studies on stem cuttings and leaf explants.

Bolin, Jae F., Westcott, Kasey D., and Owen, Henry R.; Eastern Illinois University, Charleston, IL.

Within the genus *Quercus* remains some of the most desirable tree species still without an efficient vegetative propagation protocol from mature tissue, including bur oak (*Q. macrocarpa).* The objective of this study was to develop an effective disinfestation method to allow for cloning the Old Main Oak at Eastern Illinois University. The first step was to surface disinfest the starting material. Stem cuttings were treated with varying hormone levels and half were kept in darkness at 6C for 7d. The stems were sprayed with 0.087% chlorothalonil and dipped in 1.6%, 3.0%, 4.5% indolebutyric acid (IBA) or 0.1 □ g/l thidiazuron (TDZ) before being placed in damp perlite (10/treatment). One series was placed under a 16 hr photoperiod and the other in darkness for 8 weeks. Stem cuttings treated with IBA did not respond as well as the TDZ-treated cuttings. The dark-treated cuttings reacted better than the cuttings exposed to light. Cold treated cuttings responded better. Some stem cuttings exhibited callus tissue, indicating cell division at the cut surfaces. Media for all leaf explants consisted of Murashige & Skoog (MS) inorganics and 0.4 □ g/l TDZ. Seven disinfestation treatments were examined, varying in $HgCl_2$ duration (30 sec to 40 min) and bleach concentration (10 or 20%) and duration (10 or 20 min). Each treatment was tested on 10 culture plates with 5 explants/plate. The proportion of tissue cultures showing contamination was 84%. The contamination decreased as bleach or $HgCl_2$ exposure times increased. A few of the cultures showed no fungal contamination and had exuded a halo of phenolic substances around the explants.

4. *Seed Germination Rates Of the Invasive Vine *Humulus japonicus* (Cannabaceae)

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

Japanese hops (*Humulus japonicus*) is an aggressive invader of forest edge habitats, floodplains and riparian zones. Its rapid growth and dense cover lets it outcompete native vegetation easily. This experiment was conducted to determine germination rates for a future study of the phenotypic plasticity in this spreading invasive. We modified proven techniques used to germinate American hops (*H. lupulus*) to develop a method for cleaning and stratification. Seeds were collected from multiple plants within multiple sites in forest edge and floodplain habitats in Madison County, IL. Sanitized seeds were placed into plates containing sterilized silica sand, and cold stratified at 4° C for 8 weeks. The plates were transferred to a light table with a 14/10 hour light/dark cycle and an average temperature of 23°C. Germination (radicle emergence) was monitored daily until no new germination was observed for 5 consecutive days. ANOVA and Tukey's HSD were used to compare germination rates between trials. Germination rate varied greatly (range 40-65% in trial 1, 83-92% in trial 2, 77-97% in trial 3) and significantly between trials ($p < 0.001$). The first trial fell short of the 80% germination rate of domestic hops, while the second and third trials exceeded the expected rate (all $p < 0.004$). Differences in germination rates between trials may be caused by the seed sanitation and stratification technique, or may be an effect of age of seed maturity before stratification.

5. *An Evaluation of Grassland Restoration Success in Illinois Based on Ecosystem Function

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

Grasslands in Illinois have declined rapidly since European settlement. Grassland ecosystems perform vital ecosystem functions including carbon sequestration, erosion control, water filtration, and as reservoirs of genetic diversity. Due to the importance of grassland ecosystem functions, grassland restoration projects have become more common. The majority of efforts to evaluate grassland restoration focus solely on species composition. The aim of my study is to determine if grassland ecosystem functions are actually regained in restored grasslands. Soil bulk density (BD), aboveground net primary productivity (ANPP), nitrogen availability and soil organic carbon (SOC) are being examined along a chronosequence of restored grasslands managed by The Nature Institute in Godfrey, IL. Grasslands used in this study were 1, 4, 10, 12, and 25 years old. BD ranged from 1.16 in year 25 to to 1.24 in year 1. Linear regression showed a weak pattern of declining BD over time ($p = 0.057$). ANOVA showed significant differences in peak aboveground standing crop (range 102-5540 g m-2)in sites of different ages ($p < 0.001$) and Tukey's test showed year 4 biomass to be greater than both the 10 and 12 year old sites (both $p < 0.001$) but the same as the 25 year-old site. Further analysis of the soil properties of these sites will include soil organic matter, pH, pore space, and nitrogen availability.

6. *Soil Disturbance Effects on Riparian Marsh Vegetation at Riverlands Migratory Bird Sanctuary

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

The Riverlands Migratory Bird Sanctuary located along the Mississippi river in West Alton, Missouri, was developed in 1988. It contains nearly 500 ha of actively managed restored bottomland prairie and marshland. Prolonged inundation during the 1993 flood destroyed vegetation beds and moist soil plants. This has necessitated aggressive ongoing restoration efforts. The goal of this study was to evaluate various soil disturbances as means to raise plant species diversity and cover, and also modify community composition to a more natural state. We hypothesized that tilling, the most extreme soil disturbance applied, would be most effective. A randomized complete block design consisting of six marsh complexes was used. Similarly-sized areas within each marsh were randomly assigned one of three treatments: disking, tilling, and control. Percent vegetative cover and the species present were recorded in 0.25 m^2 plots within the treatments. A pre-treatment sample was also taken for comparison. Strong interactions between site and treatment were seen for nearly every community measure. However, site effects for cover, species richness, and Shannon diversity were significant beyond this effect. In addition, community ordinations revealed a strong tendency for treatments to aggregate by site. Restoration activities should focus on site specific characteristics such as the species pool and local hydrology and lean away from immediate additional disturbances.

7. *_Lonicera maackii_ (Caprifoliaceae) Seeds Display Plastic Traits in Response to the Sun Exposure of the Parent Plant

Ashbaker, Sabrina, Kohn, Luci, Brunkow, Paul, and Schulz, Kurt; Southern Illinois University Edwardsville, Edwardsville, IL.

Lonicera mackii is a highly invasive exotic shrub with a number of phenotypic traits that seemingly allow it to often out-compete native species. This high level of phenotypic plasticity can be seen in variation in seed size within fruits gathered from *L. mackii* at different locations. Using fruits gathered from individual shrubs experiencing dichotomous light environments (sun exposure and heavy shading on different sides), seed length, width, and area were measured. Seeds collected from fruits with strong sun exposure were significantly larger in all measured parameters than those gathered from *L. mackii* on the shaded side. Analysis of variance showed significant effects of shrub identity, light regime, and the interaction of identity and light regime. Phenotypic differences in seed size lead to further questions concerning the growth and success of sun and shade grown seeds from the same parent plant. In this vein, a second, larger sample of seeds, acquired from 18 different shrubs from four different locations, has been measured and planted to examine germination rates of seeds of different mothers experiencing the sun/shade light dichotomy. Preliminary germination data show significant maternal effects and significant interactions between light regime and mother.

8. *Seed Ecology of Federally Threatened _Pinguicula ionantha_ (Godfrey's Butterwort)

[1]Annis, Jenna M., [1]O'Brien, Jennifer E., [1]Coons, Janice, M., and [2]Molano-Flores, Brenda; [1]Eastern Illinois University, Charleston, IL, and [2]Illinois Natural History Survey, Champaign, IL.

Pinguicula ionantha (Godfrey's butterwort) is a carnivorous plant occurring in historically fire-dependent bogs of longleaf pine savannas within the Florida Panhandle. *Pinguicula ionantha* is listed as federally threatened due largely to habitat loss. The objective of this study was to compare several methods to germinate *P. ionantha* seeds. Seed treatments included stratification (4°C for 1 or 2 months), Wrights® All Natural Hickory Smoke Seasoning (dilutions of 1:100, 1:500 and 1:1000), plant debris smoke solutions (dilutions of 1:5, 1:100 and 1:500), plant growth regulators (Benzyladenine purine--BA, Indole-3-butyric acid--IBA or a combination), Murashige and Skoog (MS) media (½ and ¼ concentrations), gibberellic acid (GA_3) soak (500 ppm), bleach soak (10%), and water soak. All germination trials occurred in chambers (16 hours light) at 25°C with germination counted daily. Seed treatments were on moistened filter paper, 1% agar, or filter paper on top of agar. Highest germination percentages were achieved with GA_3 soak, but bleach also significantly increased germination compared to the control. Stratification at 1 month, Wright's Hickory Smoke solutions, and BA treatment produced similar germination to control. Two month stratification, IBA and MS treatments inhibited germination. Control plates with agar were as high or higher than those with only filter paper. Future studies might focus on combining different concentrations of GA_3 presoaks with seeds sown directly on 1% agar.

9. *Baseline analysis of forest in the bluff corridor section of the SIUE Nature Preserve: exotic species abundance

Miles, Cassidy R. and Minchin, Peter R.; Southern Illinois University, Edwardsville, IL.

In 2011, Southern Illinois University Edwardsville reserved a 154-ha area of campus as a nature preserve that will be protected from development for at least 50 years. The preserve includes Sweet William Woods, the largest oak-hickory forest stand on campus. There is also a corridor that runs along the bluff line and connects with Bohm Woods State Nature Preserve, the most significant oak-hickory forest remnant in the region. Past research revealed that the younger portions of Sweet William Woods have a higher abundance of woody exotics. Since most of the corridor consists of younger regrowth forest, we hypothesized that the corridor contains a greater abundance of woody exotics than the most mature forest areas. We mapped the corridor boundary and 12 sampling plot locations were randomly placed within the area. All trees (DBH at least 10 cm) within each 0.1 ha circular plot were identified and their DBH measured. Stems of shrubs and saplings were counted in a 35.6 x 1 m belt transect along a diameter of the plot. The relative dominance of exotic trees and relative density of exotic shrubs were calculated for the corridor plots and also for 43 mature forest plots from Sweet William and Bohm Woods. Analysis of variance found that the corridor has higher means of both variables compared to mature forest, which supports our hypothesis. The most abundant exotic tree species was tree of heaven and Amur honeysuckle was the most common exotic shrub. We recommend that SIUE should actively manage exotics by removal and consider the use of periodic prescribed fire.

10. *Seed Germination of *Scutellaria* Species

[1]O'Brien, Jennifer E., [1]Annis, Jenna M., [1]Coons, Janice, M. and [2]Molano-Flores, Brenda; [1]Eastern Illinois University, Charleston, IL, U.S.A. and [2]Illinois Natural History Survey, Champaign, IL. USA.

Florida Skullcap, *Scutellaria floridana* (Lamiaceae), is a federally threatened species in the Florida Panhandle. Its habitat is a fire-prone, longleaf pine forest. Other *Scutellaria* species used in the study are found in southeastern U.S. The objective of this study was to compare several techniques to germinate seeds of *S. incana, S. lateriflora, S. ovata versicolor*, and *S. floridana*. *Scutellaria lateriflora* and *S. ovata versicolor* were stratified for one and two months at 4°C, whereas *S. floridana* was stratified for 6 weeks. All four species were scarified with concentrated sulfuric acid for various times (15 to 60 minutes). Smoke treatments were Wright's Hickory Smoke Seasoning (1:100, 1:500, and 1:1000) for all species, and also plant debris smoke (half and full strength) for *S. floridana*. All seeds were placed in petri dishes moistened with appropriate solutions on filter paper with 3 replications. Dishes were placed in a chamber with 16 hours light at 25°C for 30 days. The most effective treatment was 15 minute acid scarification for *S. lateriflora* with all other treatments yielding 13% germination or less for the 3 species, excluding *S. floridana*. Control seeds of *S. floridana* germinated significantly higher than stratification, scarification, and plant debris solutions, but were similar to Wright's. Overall, seeds of *S. floridana* responded differently than the other three species.

11. *Baseline analysis of forest in the bluff corridor section of the SIUE Nature Preserve: conservation value of the canopy tree stratum

Leinweber, Chay W.C. and Minchin, Peter R.; Southern Illinois University Edwardsville, Edwardsville, IL.

A 154-ha area of the campus of Southern Illinois University of Edwardsville was dedicated as a nature preserve in 2011. The preserve includes Sweet William Woods, the largest oak-hickory forest on campus, and a corridor along the bluff line that provides connectivity with Bohm Woods State Nature Preserve, the highest quality remnant of oak-hickory forest in the region. Previous research found that the oldest sections of Sweet William Woods have a conservation value comparable to Bohm Woods but little information is available on the corridor. We hypothesized that the corridor forest has lower conservation value than the mature woods. The boundary of the corridor was mapped and 12 sampling plot points were randomly generated. A 0.1 ha circular vegetation plot was established at each point, within which the species and DBH of each tree was recorded. For each plot, a weighted mean coefficient of conservatism (WMCC) was computed, using the dominance of each species present as weights. The WMCC of corridor plots was compared with that of 43 plots from the most mature sections of Sweet William and Bohm Woods using analysis of variance. Corridor plots had a lower WMCC than the mature forest, supporting our hypothesis. This was due to the dominance of the invasive tree of heaven and early successional species like hackberry, slippery elm, box elder, sycamore, and black locust. Management of the SIUE nature preserve should improve the quality of the corridor forest by removing invasive trees and encouraging the establishment of later successional species, such as oaks and hickories.

12. *Effect of Presoaks with Sulfuric Acid and Gibberellic Acid on Seed Germination of *Ferocactus wislizeni*

Tuegel, Erin R., Hughes, Michael P., Annis, Jenna M., Idleman, Ursulla A., Moore, Julian G., O'Brien, Jennifer E., Samarajeewa, Dilini A., and Coons, Janice M.; Eastern Illinois University, Charleston, IL.

Cactaceae includes many perennial and evergreen species which survive in areas where water is scarce due to an extensive set of unique adaptations. *Ferocactus wislizeni* (Candy Barrelcactus) is native to the Sonoran Desert, where it is protected in Arizona. Seed dormancy plays a role in controlling cactus seed germination. Studies show that presoaks in gibberellic acid (GA) or sulfuric acid can play a role in breaking seed dormancy, and thus stimulate seed germination in some cactus species. The objective of this study was to determine effects of GA and sulfuric acid presoaks on germination of *F. wislizeni*. Seeds of *F. wislizeni* were soaked in GA (500, 1000 and 2000 mg/L) for 24 hrs, and others were scarified with concentrated sulfuric acid for 15, 30, and 60 minutes. Three replications of 50 seeds each were placed in Petri dishes with moistened filter paper and placed in a growth chamber at 25°C with 16 hours of light at 33 $\mu mol/m^2/sec$. Germinated seeds were counted daily. Germination of seeds presoaked in 2000 mg/L GA (30%) was significantly higher than in 1000 mg/L GA (15%) or the control (9%), and 500 mg/L GA (17%) was intermediate. Sulfuric acid

presoaks did not alter germination (12-26%) significantly compared to the control. For propagation of *F. wislizeni*, GA would be beneficial to increase seed germination.

13. *Investigating hybridization relationships between *Schoenoplectiella hallii* and *S. saximontanus* using flow cytometry

Sutton, Alexandra and Esselman, Elizabeth; Southern Illinois University Edwardsville, Edwardsville, IL.

Schoenoplectiella hallii is a rare wetland sedge that is restricted to habitats of varying water fluctuations. Anthropogenic alterations to the habitat of *S. hallii* such as agricultural, developmental and recreational activities are major threats to the survival of this species. Evidence in recent years has also suggested that the survival of the species may also be threatened by hybridization with a congener, *S. saximontanus*. Morphological and molecular studies have shown that *S. hallii* and *S. saximontanus* have been hybridizing in a mixed population at the Wichita Mountains Wildlife Refuge in Oklahoma. Hybridization was not expected between these species because of the varying chromosome numbers of the parents. *Schoenoplectiella hallii* has a chromosome number of 2n = 22 while *S. saximontaus* has a chromosome number of 2n =50. Flow cytometry was used in order to determine DNA content of the putative hybrids. This data shows that the putative hybrids have a DNA content similar to *S. saximontanus*, which is consistent with previous studies that showed that hybrids are genetically more similar to *S. saximontanus*. It is a concern that the proliferation of hybrids may gradually eliminate one or both parents, which could ultimately lead to the extinction of *S. hallii*. Backcrossing could also lead to a loss of the genetic integrity of the parent plants as well. We suggest that these sites be continually monitored to assess population changes in *S. hallii*.

14. *Evaluating the success of bottomland forest restoration in the Upper Mississippi Valley

Ballen, Lindley B. and Minchin, Peter R. Southern Illinois University Edwardsville, Edwardsville, IL.

Since European settlement, clear-cutting for timber and farming, changes in hydrology, and urbanization have significantly reduced the area of bottomland forest (BLF) in the Upper Mississippi Valley (UMV). Recently, emphasis has been placed on restoring BLF, which provides vital ecosystem services, such as enhanced water quality, nutrient cycling, and wildlife habitat. Beginning in 1998, the US Army Corps of Engineers has restored BLF on a range of sites in the UMV, ranging in area from less than 1 ha to 120 ha. Root production method (RPM) seedlings of five species of flood-tolerant oaks and pecan were planted in an effort to rapidly establish large-seeded species that are not regenerating effectively under current conditions, with the expectation that small-seeded species will colonize later. My research aims to evaluate the success of these restoration efforts by assessing trajectories of change in forest composition and structure. I will utilize a chronosequence of 15 restoration sites ranging in age from 15 to 2 years. Mortality rates of the planted species will be estimated by comparing the number of each species currently surviving with their numbers at the time of planting. Time trajectories of tree diameter, height, and health will be analyzed for each planted species and changes in community properties, such as richness, diversity, total dominance,

and total density, will be compared to data from mature BLF reference sites. The results of this study will provide valuable information to inform future BLF restoration projects in the UMV.

15. *Evaluating the effect of native species diversity on resistance to invasion by exotic species in prairie restoration

Weber, Irene and Minchin, Peter; Southern Illinois University Edwardsville, Edwardsville, IL.

Preventing the spread of invasive plants is a complex problem facing biologists and land managers. The biotic resistance hypothesis states that invasion success decreases with increasing native plant richness. My objective is to determine the relationship between native species diversity in prairie restoration and invasion success of *Sericea lespedeza* (Lespedeza cuneata), a semi-woody perennial forb introduced from Asia. I will test the hypothesis that establishment and growth of S. lespedeza decreases with increasing native richness. The experimental design consists of five 6 x 10 m blocks, each containing four 4 x 2 m plots. In late fall 2012, three seed mixes of low diversity (6 species), medium diversity (11 species), and high diversity (29 species), were sown into one of the four plots in each block, with the fourth plot left unseeded as a control. Treatment positions were randomized within blocks. Plots were mulched using straw matting and a 1-m strip around the edge of each block was sown to annual rye to minimize edge effects. *Sericea lespedeza* will be seeded into all plots in spring 2013. Percent cover of species will be estimated visually every two months through summer and fall 2013. Stem counts will be recorded for *S. lespedeza* and in late fall it will be harvested for oven dry biomass analysis. Differences in density and biomass of *S. lespedeza* among treatments will be tested using analysis of variance. This research will increase knowledge of how biotic resistance prevents invasive species establishment in prairie restoration.

16. *Primary Production During Five Years of Succession in a Northwestern Illinois Old Field.

Killion , Alexander K. and Dziadyk, Bohdan; Biology Department, Augustana College, Rock Island, IL.

An abandoned agricultural field (old field), last cropped in 2007, has been studied each summer for the last five years to observe patterns of primary productivity. The half hectare old field is contiguous with the 40 ha Beling Ecological Preserve on the north shore of the Rock River in Rock Island County, IL. Three permanent study sites (15m X 20m) were established at varying distances and elevations from the adjacent forest margins. Abovegound net productivity was estimated by the biomass harvest method conducted at two week intervals during each growing season. Study sites and estimates of their peak standing crop (g/m2) in 2008/2010/2012 are: Site I – (the wettest and most prone to flooding) 258/420/847; Site II – 345/445/726; and Site III – (the highest and driest) 515/471/936. Due partly to extreme weather, varying from extensive flooding to extreme drought during the study period, the patterns of plant productivity do not form smooth increases from year to year as expected. Pocket gopher herbivory in the last two years has introduced an additional

difficulty in biomass estimates. Establishment of *Acer saccharinum* and *Fraxinus pennsylvanica* seedlings is also being influenced by unanticipated flooding effects.

17. *_In vitro_ germination and propagation of *Polygonatum canaliculatum*

Engelke, Aaron and Barry, Kelly; Southern Illinois University Edwardsville, Edwardsville, IL.

Polygonatum canaliculatum, or Solomon's Seal, is a perennial plant found throughout the North American woodlands and it is admired for its attractive fern-like foliage and flowers. Although established plants are hardy, plant growth is slow. Additionally, Solomon's Seal seeds exhibit morphophysiological dormancy and germination requires two seasons of cold, moist stratification interrupted by a warm period. For these reasons, Solomon's Seal is often harvested from natural areas by private collectors and reestablishment is poor. In vitro propagation techniques can increase plant material available for nursery use and reduce the time requirements for nursery stock development. We established a procedure for in vitro germination of surface sterilized seeds suitable for micropropagation. Seeds were stratified for 90 days at 4°C then surface sterilized with 0.6% sodium hypochlorate/0.1% Tween-20. After 30 days at room temperature, germinated seedlings were transferred to ½ Murashige Skoog (MS) media containing 0.2% Plant Preservative Mixture (PPM) and then maintained on ½ MS without PPM. This plant material is being used to develop shoot multiplication and somatic embryogenesis.

18. *Assessing Quality of a Regenerated Prairie Using Floral and Faunal Indices

Spagnolo, Sara, Bryant, Carol, Schulz, Kurt, Minchin, Peter, and Esselman, Elizabeth; Southern Illinois University Edwardsville, Edwardsville, IL.

In today's highly fragmented landscape, prairie communities are becoming more rare as they give way to invasions by woody encroachment, land development and agriculture. Less than 0.01 percent of Illinois' original tallgrass prairie remains and many of these remnants have been reduced to small, widely spaced patches surrounded by woodlands. Though this loss has led to attempts at prairie reconstructions via plantings and management techniques, there is a possibility that natural successional processes may also result in quality prairie communities. The purpose of this study was to ascertain the community structure and quality of an old growth field in Macoupin County, Illinois. The field is believed to have been a site of agricultural practice, though it has been laying fallow for over 40 years and has received minimal management within that time. Both vegetation surveys and insect surveys were conducted during the growing season of 2012. Through ordination of survey plots, two distinct plant communities were observed, each described by a small number of species dominating the composition. FQI (Floristic Quality Index) was calculated to be 34.48, and AQI (Auchenorrhyncha Quality Index) was calculated at 54.09. Both of these indices suggest that the field is of medium to high quality according to INAI grades.

Division: Cell, Molecular, and Developmental Biology

19. *Effects of Annetocin and Oxytocin/Vasopressin Related Peptides on the Receptor in *Lumbricus terrestris*

Vu, Christine and Krajniak, Kevin; Southern Illinois University Edwardsville, Edwardsville, IL.

Annelids possess many different neuropeptides including annetocin, a member of the Oxytocin/Vaspressin family of peptides. Annetocin has been shown to stimulate the contractility of the gut in the earthworm, *Eisenia foetida*. Our laboratory has developed an in vitro bioassay using the isolated crop/gizzard of the earthworm, Lumbricus terrestris. Previously we have shown that the vertebrate peptides oxytocin and vasotocin stimulates the crop-gizzard. Therefore we decided to examine the effects of the earthworm peptide annetocin. The crop-gizzard was removed from the earthworm and placed in a tissue bath. The organs were connected to a force transducer. Contractions were recorded using the Iworx Labscibe software. The data was used to create log-concentration response curves for the changes in contraction rate and amplitude. Annetocin caused an increase in contraction rate with a threshold of 10 nM and an increase in amplitude with a threshold of 1 nM. The maximum increase in contraction rate cause by annetocin was three fold greater that those caused by oxytocin and vasotocin. The effects of annetocin on *L. terrestris* are similar to those displayed in *E. foetida*. Interestingly, in *E. foetida* the maximum effect of the three peptides were similar. The differences we observed in *L. terrestris* suggest that the annetocin receptor may be different from the one in *E. foetida*.

20. The Effects of YIRFamide on the Isolated Crop-Gizzard of the Earthworm

McKibben, Tyler P., Volin, Christine, Jones, Kevin, and Krajniak, Kevin; Southern Illinois University Edwardsville, Edwardsville, IL.

Our laboratory has been examining the effects of FMRFamide-related peptides (FaRPs) on the digestive tract of the earthworm, *Lumbricus terrestris*. Many FaRP sequences have been isolated from annelids including the peptide GGNYIRFamide. Previously we have shown that FMRFamide causes a decrease in contraction amplitude of the isolated crop-gizzard, while causing a biphasic effect on the contraction rate of the tissue. Since GGNYIRFamide contains the C-terminal tetraptide YIRFamide, we decided to examine the effects of YIRFamide on the crop-gizzard preparation. The crop-gizzard was removed from the animal, placed in a tissue bath filled with earthworm saline and attached to a force transducer. The force transducer was connected to a computer. We used IWorx software to record the contraction rate and amplitude of the crop-gizzard. Increasing concentrations of YIRFamide were injected into the tissue bath and the resulting changes in contraction rate and amplitude were used to create log-concentration response curves. Preliminary results show that YIRFamide causes a biphasic effect on the amplitude causing a decrease with a threshold of 1 nM and an increase with a threshold of 0.1nM. YIRFamide causes a decrease in rate with a threshold of 1 μM. The differences between YIRFamide and FMRFamide suggest that YIRFamide may be acting on a separate receptor than FMRFamide.

21. *Targeted proline substitutions in a mating pheromone of *Schizophyllum commune* disrupt pheromone signaling

Link, Stephanie L. and Fowler, Thomas J.; Southern Illinois University Edwardsville, Edwardsville, IL.

This study focused on lipopeptide pheromones and pheromone-receptors of a fungus (*Schizophyllum* commune) and gives insight regarding molecular recognition between signaling molecules and their receptors. Sites within the pheromone were tested by substituting proline in eight amino acid positions and lysine in two positions to determine if the altered pheromones function in pheromone-receptor interactions. The program PEP-FOLD predicted structures of the altered pheromones. Proline introduces a new bend in these pheromones. A proline near the 11-mer pheromone's center near a critical aromatic residue was hypothesized to be detrimental to pheromone activity. Substitutions near each end of the pheromone were predicted to have no effect. Lysine was substituted into two positions for future protein crosslinking studies. Past studies of two single proline substitutions resulted in active pheromones. Yeast (*Saccharomyces cerevisiae*) heterologous mating assays tested each pheromone. Unexpectedly, each new proline substitution produced a negative mating result. One of the two lysine-substituted pheromones initiated mating. This suggests that these proline substitutions and one lysine change alter the pheromone expression in a way that precludes activation of the receptor. The change might affect processing, export, or receptor recognition. However, one of the lysine substitutions resulted in an active pheromone indicating that the pheromone could tolerate the change. The hypothesis that proline substitutions near the pheromones' ends are not critical was not supported.

22. *Quantitative Analysis Method for Heterologous *Schizophyllum commune* Mating Assays in Yeast

Drumm, Libby; Katchen, Hannah; and Fowler, Thomas, J.; Southern Illinois University Edwardsville, Edwardsville, IL.

Schizophyllum commune, a wood rotting fungus, makes dikaryons from compatible haploids through mating. In baker's yeast (*Saccharomyces cerevisiae*), also a fungus, modified pheromones and receptors from *S. commune* can be expressed and analyzed. Previous assays have only been qualitatively analyzed. In pursuit of a quantitative measure of pheromone activity, a technique is described and tested with yeast pheromones and receptors as well as wild-type and mutant pheromones from *S. commune*. Growth curves with colony counts of several strains of yeast were completed. The quantitative assay for mating was based on known numbers of pheromone-expressing and receptor-expressing cells mixed together in desired ratios, followed by filtering to place the cells in close proximity to each other. After the filtered cells were given time to mate on an appropriate medium, the cells were washed from the filters, serially diluted, and plated to determine how many diploid cell were formed by mating from a specified number of haploid cells. This quantitative method showed that a compatible wild-type pheromone and receptor pair from *S. commune* expressed in yeast

produced approximately 100 times fewer diploids than the natural pheromones and receptors of yeast produced when cells are mixed at a 1:1 ratio.

23. *Knockout strain of a WD40-like repeat protein in *Schizophyllum commune*

Dungan, Kyle, Hills, Jillian, P., and Fowler, Thomas, J., Southern Illinois University Edwardsville, Edwardsville, IL.

A common protein motif in eukaryotic proteins is the WD40 repeat, which can form a beta-propeller domain from the repeated motifs. These domains are involved in protein-protein interactions and may act as scaffolds for other proteins in some instances. *Schizophyllum commune*, an Agaricomycotina mushroom fungus has more than fifty predicted proteins that are true WD40 or WD40-like with a conservative search of the completed genome. We have chosen one WD40-like hypothetical protein from the genome (gene ID65584/protein ID XP_003035013.1) for reverse genetic exploration. mRNA expression of the gene was confirmed from cDNA databases available from the *S. commune* genome project (JGI-DOE). A knockout plasmid was constructed to delete the coding region of the gene and replace it with a selectable antibiotic marker. Six transformants were generated in a KU80-deleted strain and all six have the patterns of PCR products predicted for homologous replacement of the gene. No change in hyphal growth pattern or rate is apparent in the six primary transformants compared to their progenitor strain. With the large number of WD40-like repeat proteins in *S. commune*, it is possible that this one plays a very specific cellular role that does not affect hyphal growth or that a related protein is able to compensate for the loss due to the knockout.

24. The Effects of APKQYVRFamide on Intestinal Tissue from the Earthworm *Lumbricus terrestris*

McCullough, Kyle and Krajniak, Kevin Southern Illinois University Edwardsville, Edwardsville, IL.

The digestive tract of the earthworm *Lumbricus terrestris* responds to a variety of neurotransmitters including FMRFamide and its related peptides (FaRPs). Recently we identified the first earthworm FaRP, APKQYVRFamide, from the genes of *Lumbricus rubellus*. The goal of this project was to study the effects of this peptide on the crop-gizzard of *L. terrestris*. The intestine of the worm was excised and placed into a bath filled with worm saline. All responses of the intestine were recorded with a Grass force transducer and were displayed on a computer using iWorx LabScribe 2 software. Increasing concentrations of peptide were added to the bath and adequate time was allowed for each to take effect. The subsequent changes in contractions were used to create log-concentration response curves. APKQYVRFamide caused a concentration dependent increase in contraction rate with a threshold of 1μM, while FMRFamide caused the same response with a threshold of 10 nM. These results suggest that APKQYVRFamide may play a role in controlling the motility of the earthworm intestine.

25. The Effects of FNRFamide on the Isolated Crop-Gizzard of the Earthworm

Krajniak, Kevin, McCullough, Kyle, and Martineau, Mitchell; Southern Illinois University Edwardsville, Edwardsville, IL.

Our lab has been examining the effects of FMRFamide related peptides (FaRPs) on the isolated crop-gizzard of the earthworm *Lumbricus terrestris*. Recent advances in genomics have lead the discovery of many new FaRPs including those found in annelids. The peptide, FHINFNNQIFNRFamide, was predicted from cDNA sequences in the leech *Helobdella robusta*. It has the novel tetrapeptide C-terminal sequence, FNRFamide. Therefore we decided to examine the effects of FNRFamide on the isolated crop-gizzard of *L. terrestris*. The crop-gizzard was removed from the earthworm and placed in a tissue bath filled with worm saline. The mechanical movements of these organs were recorded by attaching one end to a force transducer. Iworx Labscribe was used to record and analyze the data on a computer. Increasing concentrations of FNRFamide were added to the tissue bath and the resulting changes in contraction rate and amplitude were used to construct log-concentration response curves. FNRFamide caused a decrease in contraction rate with a threshold on 1 nM, along with a slight increase in amplitude at a threshold of 1 nM. These results suggest that FNRFamide can interact with the same receptor that is activated by FMRFamide.

26. *Mitochondrial Bioenergetics in Response to Estrogen Therapy

Tofte, Austin J., Spenser, Willow G., Nathan, Britto, and Menze, Michael; Eastern Illinois University, Charleston, IL.

Most cellular energy is produced in a subcellular organelle which combusts the oxygen we breathe with electrons stripped form food molecules to produce energy that is used to power the cell. Mitochondrial dysfunction has been implicated as a main cause of many neurodegenerative disorders, such as Alzheimer's disease. Estrogen plays a key role in modulating mitochondrial function and it has been postulated that estrogen deficiency may be a contributing factor to neurodegenerative disorders. We examined the effects of estrogen on mitochondrial function in 4-6 months old mice (C57BL/6J). The effect of both low (50ng/g) and high (500ng/g) estrogen on mitochondrial function in isolated synaptosomes was measured by respirometry. We investigated contributions of the glycolytic and mitochondrial pathways by employing different experimental setups. The glycolytic pathway was examined by using non-permeabilized synaptosomes, pyruvate, and FCCP or oligomycin. The oxidative phosphorylation capacity of mitochondria was measured in permeabilized synaptosomes. Synaptosomes were permeabilized with digitonin following injections with malate, glutamate, pyruvate, 5 ADP, succinate, and FCCP, or oligomycin. Previous experiments have indicated that estrogen has neuroprotective mechanisms which may improve mitochondrial bioenergetics. Our study will allow a more detailed comparison of the impact of estrogen on glycolytic and mitochondrial energy production.

27. The Effects of FMRFamide and its Related Peptides on the Isolated Crop-Gizzard of the Earthworm *Lumbricus terrestris*

Cornwell, Fred and Krajniak, Kevin; Southern Illinois University Edwardsville, Edwardsville, IL.

The digestive tract of the earthworm *L. terrestris* responds to a number of neurotransmitters, including the neuropeptide FMRFamide and its related peptides (FaRPs). Recently the first earthworm FaRP, APKQYVRFamide, was found using a BLASTX search on the genes of *L. rubellus*. The aim of this project is to compare the effects of the earthworm peptide and other structurally similar peptides on the contractile activity of the crop-gizzard of *L. terrestris*. The crop-gizzard was removed and placed into a bath filled with worm saline. All movements of the crop-gizzard were recorded with a Grass force transducer and were displayed on a computer using Labscribe 2. Increasing concentrations of peptide were added to the bath and time was allowed for each to take effect. The resulting changes in contractions were used to create log-concentration response curves. APKQYVRFamide caused a concentration dependent decrease in contraction amplitude with a threshold of 1μM, while FMRFamide caused the same response with a threshold of 1nM. Since the earthworm peptide contains a tyrosine (Y) in place of the phenylalanine (F) in FMRFamide, we also challenged the tissue with YMRFamide, a FaRP found in leeches. YMRFamide caused a dose-dependent decrease in amplitude with a threshold of 1 μM, which was the same response observed with APKQYVRFamide. These results suggest that APKQYVRFamide and YMRFamide may play a role in controlling the contractile activity of the earthworm crop-gizzard. They also indicate the receptor prefers F instead of Y in the fourth position from the C-terminus.

28. Induction of Apoptosis in Human Leukemia Cells

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Hygromycin B (Invitrogen) is an aminoglycoside antibiotic that induces apoptosis by interfering with protein synthesis in sensitive mammalian cells. It has been reported to function in certain cell lines independently of the p53 protein[1]. It is unclear whether this chemical triggers apoptosis by the extrinsic or intrinsic pathway. Synchronized HeLa INT 407 cells were treated with 500 □ g/ml of hygromycin B for varying lengths of times. Apoptosis was assessed using the trypan blue exclusion test, DAPI staining, and phase contrast microscopy. As early as 8 hours post-treatment morphological changes were detected. Membrane blebbing was observed by phase contrast microscopy and chromatin condensation, visible as a decrease in nuclear volume, was revealed in treated cells by florescent microscopy. Preliminary data suggests the mechanism of apoptosis was via the intrinsic pathway. We gratefully acknowledge support from the Illinois Fraternal Order of Eagles. Dedicated to the memory of Richard Crowder.

[1]Chen, G., Branton P. E., and Shore G. C. (1995). Induction of p53-indepedant apoptosis by hygromycin B: suppression by Bcl-2 and adenovirus E1B 19-kDa protein. Experimental Cell Research. 221, 55-59.

29. A mutant *of Arabidopsis thaliana*, plastid protein import 2-1 that lacks Toc159 receptor accumulates polyunsaturated lipids and has high desaturase expression levels

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Toc159 is a major chloroplast receptor that is located on the outer envelope membrane and is required for the import of photosynthetic proteins. Plastid protein import (*ppi*2-1) mutant lacks Toc159 receptor and has an albino phenotype. We evaluated the ability of cold-acclimated mutant to accumulate polyunsaturated lipids and mRNA that encode fatty acid desaturases. The cold-acclimated mutant and wild type plants accumulated comparable levels of palmitic and linolenic acids. The mutant however, accumulated high levels of 18:0 and18:1, and reduced levels of 16:1, 16:3 and 18:2. The decrease in levels of 18:2 with a corresponding increase in levels of 18:1 suggests that Δ12 desaturase activities was limiting. The expression level of palmitoyl-MGDG Δ7 desaturase (Fad5), the ER localized Δ15 desaturase (Fad3) and chloroplast localized Δ15 desaturase (Fad8) were increased 3 to 4-fold in the cold-acclimated mutant compared to wild type. The data indicate that the lack of a major chloroplast receptor, Toc159 did not impair lipid synthesis and desaturation. However, there was overall reduction in total lipid content in the *ppi*2 mutant. Studies have shown that *ppi*2 have undeveloped plastids that lack thylakoid membranes. Therefore, the reduced lipid content in the mutant is indicative that lipid synthesis is a tightly regulated process that is linked to the developmental status of the plastids.

30. A mutant *of Arabidopsis thaliana*, toc132toc120 (+/-) accumulated reduced levels of linolenic acid and has repressed expression of the ER localized Δ15 desaturase

Afitlhile, Meshack. Workman, Samantha, Davis, Abigai,; and Fry, Morgan; Western Illinois University, Macomb, IL.

Exposure of plants to low temperatures favors the accumulation of polyunsaturated lipids, which maintain membrane integrity. We measured the accumulation of fatty acids and desaturases mRNA in wild type and toc132toc120 (+/-) plants. Cold-acclimated mutant plants accumulated increased levels of 18:0, 18:1 and 16:3, and reduced levels of linolenic acid (18:3). The reduced levels of 18:3 might result from the high turnover of chloroplast lipids, which are rich in 18:3. Alternatively, PC-derived diacylglycerol that is exported from the ER to plastids might not be rich in 18-carbon fatty acids. Increased levels of 16:3 in the mutant suggest that 16:0 in the lipid monogalactosyldiacylglycerol (MGDG) was preferentially desaturated, presumably to compensate for the reduced levels of 18:3. The expression level of stearoyl-ACP and palmitoyl-MGDG Δ7 desaturases were increased in cold-acclimated wild type and mutant plants. In the mutant however, the expression of chloroplast localized fad8 was increased two-fold compared to wild type. This

observation suggests that the reduced levels of 18:3 in the mutant might not result from reduced fad8 activity. Interestingly, the expression of ER localized fad3 was repressed in the mutant, raising the possibility that ER-derived DAG might not be enriched in 18-carbon fatty acids. It appears that a signal is sent from the defective plastids to the nucleus to repress a gene that encode for ER Δ15 desaturase.

31. A cold-acclimated mutant of Arabidopsis thaliana that is defective in the major chloroplast receptor, Toc159 has reduced levels of linolenic acid

Workman, Samantha and Afitlhile, Meshack; Western Illinois University, Macomb, IL.

Fatty acids are synthesized exclusively in the chloroplast and the resulting 16:0-ACP and 18:1-ACP are esterified to glycerol-3-phosphate to yield different lipids. When plants are subjected to cold stress, desaturation of membrane lipids favors the formation of polyunsaturated fatty acids, linolenic (18:3) and roughanic (16:3) acids, which increase membrane fluidity and allow plants to survive the cold spells. The synthesis of chloroplast lipids is dependent upon enzymes, which are synthesized in the cytoplasm and imported into plastids in a process that is facilitated by Toc159 family of receptors, which are located on the outer envelope membrane. A cold-acclimated mutant of *Arabidopsis thaliana* that is defective in Toc159 receptor (*ppi*2-2) has reduced levels of 18:3. However, levels of 18:2 are comparable in the mutant and wild type. This observation suggests that fad8 enzyme, which function in the cold to convert linoleic acid into 18:3 is functional in both the mutant and wild type. The decrease in 18:3 is likely a result of high turnover of chloroplast lipids, which are rich in 18:3. The candidate lipid is monogalactosyldiacylglycerol (MGDG), which is found in the thylakoid membranes and is rich in both 16:3 and 18:3. Separation of lipid classes and the determination of lipid content are being carried out in order to identify lipid classes with reduced levels of 18:3.

32. *Type-2 Diabetes: Does MitoNEET Impact Mitochondrial and Catalase Functions by Multiple Mechanisms?

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The American Diabetes Association reports millions of Americans have been diagnosed with Type-2 diabetes, making it the most common form of diabetes. Type-2 diabetes is often brought on by a sedentary life style, common in America, which causes an imbalance in the chemical reactions of the body that sustain life (metabolic disease). The exact pathology on how type-2 diabetes develops is extremely complex. The pivotal role of mitochondria in cellular energy production suggests that this organelle plays a crucial part in the pathology of type-2 diabetes. The protein MitoNEET has recently come into interest as possible drug target in diabetes treatment. MitoNEET was discovered in 2004 in a test to find physiological targets of Actos (pioglitazone hydrochloride), a drug that is commonly used to treat type-2 diabetes. However, MitoNEET was found to be part of the mitochondrion. Due to its location and interaction with anti-diabetic drugs, a role in diabetes

treatment and/or prevention is highly likely. Previous protein pull-down experiments suggested a direct interaction between mitoNEET and the enzyme catalase. Catalase is a detoxification enzyme that is also found in the mitochondria. My project is to explore multiple interactions between mitoNEET and catalase.

33. *Neuromuscular control of mastication and brux-like movements in the freely behaving rat.

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Our research seeks to address the specific gaps in our knowledge of a potentially devastating movement disorder called bruxism. Bruxism consists of involuntary rhythmic or spasmodic non-functional gnashing and grinding of the teeth. Bruxism can occur during wakefulness or during sleep. The main hypothesis is that the rhythmic central pattern generating (CPG) circuits in the brain stem producing bruxism might be shared with those that produce normal masticatory movements; and that the normal suppression of those rhythmic movements can become deregulated during certain pathological conditions and/or by commonly prescribed medications. Rats naturally exhibit tooth- sharpening behavior (thegosis) that resembles bruxism in humans. Our initial goal is to develop a freely behaving chronic animal model. Fine-wire electromyographic (EMG) data from the temporalis, and masseter muscles of freely behaving laboratory rats (*Rattus norvegicus*) were collected during mastication and bruxing/thegosis in order to characterize task-related motor patterns. Our preliminary data shows a significant difference in the cycle periods of the temporalis muscle between rhythmic bruxing and masticatory episodes ($p=0.05$). The long-term goal of our research team is to determine the mechanisms involved in the etiology of drug suppression and/or induction of bruxism. This is clinically relevant, because it will enable clinicians to choose a treatment that might suppress or even eliminate one or more of the underlying neurological factors that can perpetuate the disorder.

Division: Chemistry

34. *Development of a green chemistry oxidation experiment for undergraduate curriculum

Talluri, SriHarika, Kore, Naresh, and Vinod, Thottumkara K.; Western Illinois University, Macomb, IL.

Most, if not all, of the traditional oxidizing agents covered in an undergraduate lecture course are transition metal based reagents which are toxic and are also potential environmental pollutants. While the ease and efficiency (% yield) of the oxidation reactions using these reagents are highlighted during the lecture class, the deleterious health and environmental aspects of these reagents are often ignored or omitted in classroom discussions. A green oxidation procedure for oxidation of alcohols using catalytic amounts of in-situ generated *o*-iodoxybenzoic acid (IBX) in

presence of Oxone as a stoichiometric oxidant is developed. A catalytic amount of commercially available 2-iodobenzoic acid is used as the organoiodine precursor for IBX in the reaction. This convenient procedure for the oxidation of alcohols, completed in a 2.5 h laboratory period, is carried out in aqueous solvent mixtures. Students are introduced to several pedagogically relevant green chemistry principles including the use of aqueous reaction medium, a nonextractive product isolation procedure, and use of benign and catalytic reagents through this convenient oxidation experiment. Finally, this experiment also allow instructors to discuss the use of IBX and other hypervalent iodine reagents as benign alternatives to commonly used and frequently discussed transition metal based reagents.

35. *Component Variation in Ugi-Smiles Couplings

Meyers, Michael S., Richey, Bree, and Luesse, Sarah B.; Southern Illinois University Edwardsville, Edwardsville, IL.

The research to be presented is based on evaluating the scope of a multicomponent coupling process, the Ugi-Smiles reaction. Highly functionalized compounds that mimic naturally occurring compounds can be assembled through this process. This multicomponent coupling reaction uses inexpensive and readily available starting materials (aldehydes, phenols, amines, isocyanides). The work that will be described evaluates the use of chiral starting materials to obtain and isolate diastereomeric Ugi-Smiles products. Promising preliminary efforts towards a tandem Ugi-Smiles cyclization process will be summarized.

36. *Exploration of a Tandem Ugi-Smiles Diels-Alder Reaction

Richey, Bree L., Meyers, Michael S., and Luesse, Sarah B.; Southern Illinois University Edwardsville, Edwardsville, IL.

The Ugi-Smiles reaction is a multicomponent coupling reaction of a phenol, amine, aldehyde, and isocyanide used to generate highly functionalized amides. In the presence of a conjugated, heterocyclic aldehyde, a cyclization occurred to form an Ugi-Smiles Diels-Alder product. Work has focused on the optimization of reaction conditions and experiments providing insight into the possible mechanism of this process. Early studies support a reaction pathway that involves imine formation, Diels-Alder cyclization, and then completion of the Ugi-Smiles reaction. This synthetic route is significant for the efficient one-step formation of a complex molecular skeleton and the diverse products that can be rapidly assembled.

37. *Effects of Phenol and Isocyanide Variation on the Ugi-Smiles Reaction

Mason, Katelynn and Luesse, Sarah B.; Southern Illinois University Edwardsville, Edwardsville, IL.

Multicomponent coupling processes can be used in the development of new drugs. The Ugi-Smiles reaction can yield a small library of compounds which may prove useful as potential pharmaceuticals. This work evaluates the tolerance of an Ugi-Smiles reaction, a multicomponent

coupling process, to changes in the structures of the isocyanide and phenol reactants. A small library of compounds was prepared exhibiting a significant range of molecular diversity. The efficiency of the Ugi-Smiles reaction was shown to decrease with increased steric hindrance and functionalization of the reactants. These studies provide an understanding of the scope of this reaction along with access to diverse products that are being used for tandem reaction development.

38. *A Fluorescent Oscillating BZ Reaction

Behymer, Nicholas, J. Knox College, Galesburg, Illinois, USA

Oscillating chemical systems can be found throughout the natural world, from the processes responsible for fluctuating gaps in the ozone layer to cyclic biochemical processes such as the Krebs cycle. Since the Belousov-Zhabotinsky reaction was first discovered during an attempt to recreate the Krebs cycle in vitro, several modified versions of the classic BZ using different catalysts have been brought to light, one of which utilizes tris-(2, 2'-bipyridyl)ruthenium(II), abbreviated $Ru(II)(bipy)_3^{2+}$, as an indicator of the changing state of the system. Research has been centered around optimizing procedures to observe a modified Belousov-Zhabotinsky oscillating reaction using the visible absorbance and fluorescent properties of $Ru(II)(bipy)_3^{2+}$. Efforts are also underway to computationally model this reaction using Wolfram Mathematica.

39. *Synthesis of Allyl □ -Keto Esters for Use in Asymmetric Reaction Development

Rintz, Meredith, Summers, Chanté, and Luesse, Sarah B.; Southern Illinois University Edwardsville, Edwardsville, IL.

The development of new asymmetric bond-forming reactions is often influenced by the discovery of new catalysts and organic ligands. To demonstrate the effectiveness of novel catalysts, initial work aimed to explore a known allylic substitution reaction. Starting materials were prepared by the two-step reaction of a carboxylic acid to form an alcohol. Transesterification then provided an allyl □ -keto ester in moderate yields. With these compounds in hand, we have pursued initial studies into the asymmetric intramolecular Carroll rearrangement, forming a branched □ , □ –unsaturated ketone from an allyl □ -keto ester.

40. *Exploration of Intramolecular Carroll Rearrangements

Summers, Chanté, Rintz, Meredith, and Luesse, Sarah B.; Southern Illinois University Edwardsville, Edwardsville, IL.

Intramolecular Carroll rearrangements are important reactions for testing new asymmetric catalysts. In this reaction, a branched □ , □ –unsaturated ketone can be prepared from an allyl □ -keto ester. The required starting material, an allyl □ -keto ester, was synthesized through a three-step procedure. Beginning with a carboxylic acid, mixed anhydride formation was followed by reduction to produce an alcohol. The alcohol was used to synthesize the desired allyl □ -keto ester through AgOTf-

catalyzed transesterification. Preliminary studies have shown the potential to catalyze the Carroll rearrangement via novel organometallic complexes.

41. *Synthesis and Use of BAM Ligands for Reaction Development

Moutria, Julie and Luesse, Sarah B.; Southern Illinois University Edwardsville, Edwardsville, IL.

The development of new synthetic organic reaction methodology to promote bond-forming processes is in demand. Novel chiral organometallic complexes are instrumental in the discovery of new reactions. This work has focused on the synthesis of known BisAMidine (BAM) ligands and studies toward the preparation of new chiral catalysts. BAM ligands have been prepared on a small scale in good yields. Initial complexation studies have provided important structural information, guiding our proposed reaction development.

42. *Studying the Scope of the Passerini-Smiles Reaction

McClary, Kyle and Luesse, Sarah, B.; Southern Illinois University Edwardsville, Edwardsville, IL.

The Passerini-Smiles reaction is the efficient three-component coupling reaction of a phenol, aldehyde, and isocyanide. This work examines the range of substrates possible for use in the Passerini-Smiles reaction with efforts towards the production of a small library of compounds with a wide variety of molecular diversity. These studies include preliminary efforts towards a tandem Passerini-Smiles cyclization process.

43. *Caveman Chemistry: Looking at History Through the Eyes of Science

Gilbert, Kyle, Martin, Seth, and Iler, Darrell.; Greenville College, Greenville, IL.

Cavemen Chemistry is a laboratory intensive general education course that explores the introduction of important chemical based discoveries and innovations into human history. Through exercises, projects and lectures students learn how ancient cultures discovered and put to use various chemical technologies, the scientific principles that lie at the heart of these technologies and their impact on human history. Students discover how our ancestors used the natural resources around them (rocks, clay, sand, ash, etc.) to make materials and items that became the substance of civilization (pottery, glass, metals, explosives, etc.). The course has been running at Greenville College since the Fall of 2006 and has become a student favorite. Our most recent research, described through this poster, involves 1) building a bronze furnace that allows students to recreate the ancient lost wax bronze casting technique, 2) building a glass furnace, 3) developing an approach for making black powder from natural sources and 4) recreating ancient fire-making technologies.

Division: Computer Science

44. On the Stability of Banking Networks

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Threats on the stability of a financial system may severely affect the functioning of the entire economy, and thus considerable emphasis is placed on the analyzing the cause and effect of such threats. The financial crisis in the current and past decade has shown that one important cause of instability in global markets is the so-called financial contagion, namely the spreading of instabilities or failures of individual components of the network to other, perhaps healthier, components. This leads to a natural question of whether the regulatory authorities could have predicted and perhaps mitigated the current economic crisis by effective computations of some stability measure of the banking networks. Motivated by such observations, we consider the problem of defining and evaluating stabilities of both homogeneous and heterogeneous banking networks against propagation of synchronous idiosyncratic shocks given to a subset of banks. We formalize the homogeneous banking network model of Nier et al. in "Network models and Financial stability" in 2007 and its corresponding heterogeneous version; formalize the synchronous shock propagation procedures outlined by M.Eboli "Systemic Risk in Financial Network: a Graph Theoretical Approach" in 2004 and Nier et al. "Network models and Financial stability" in 2007, define two appropriate stability measures and investigate the computational complexities of evaluating these measures for various network topologies and parameters of interest. Our results and proofs also shed some light on the properties of topologies and parameters of the networks.

45. On communication protocols that compute almost privately

[1]Comi, Marco, [1]DasGupta, Bhaskar, [2]Shapira, Michael, and [1]Srinivasan, Venkatakumar; [1]University of Illinois at Chicago, Chicago, IL, USA and [2]School of Computer Science and Engineering, The Hebrew University of Jerusalem, Jerusalem, Israel.

In this paper, we further investigate and generalize the approximate privacy model recently introduced by Feigenbaum, Jaggard and Schapira (2010). We explore the privacy properties of a natural class of communication protocols that we refer to as "dissection protocols". Informally, in a dissection protocol the communicating parties are restricted to answering questions of the form "Is your input between the values □ and □ (under a pre-defined order over the possible inputs)?". We prove that for a large class of functions, called tiling functions, there always exists a dissection protocol that provides a constant average-case privacy approximation ratio for uniform or "almost uniform" probability distributions over inputs. To establish this result we present an interesting connection between the approximate privacy framework and basic concepts in computational geometry. We show that such a good privacy approximation ratio for tiling functions does not, in general, exist in the worst case. We also discuss extensions of the basic setup to more than two

parties and to non-tiling functions, and provide calculations of privacy approximation ratios for two functions of interest.

Division: Earth Science

46. Initial Response of Bed Morphology at a River Confluence to the Development of an Upstream Bend Cutoff on a Meandering Tributary

[1]Riley, James D. and [2]Rhoads, Bruce L. [1]Eastern Illinois University, Charleston, IL and [2]University of Illinois at Urbana-Champaign, Urbana, IL.

The response of bed morphology at river confluences to sediment fluxes resulting from upstream morphologic change in an approach channel has not been documented extensively in the field. This study examines the initial impact of influxes of sediment on channel morphology at a large river confluence due to the formation of a meander cutoff upstream of the junction on the tributary. Field measurements of three-dimensional velocity components and bed topography were collected at the confluence of the Wabash and Ohio Rivers with an acoustic Doppler current profiler prior to and following large, tributary-dominant discharge events that produced the cutoff and significantly rearranged spatial patterns of confluence bed morphology. Before these events, bed morphology consisted of a pool within the central region of the junction flanked by a broad point bar along the inner portion of the curving Ohio River and a long bar platform on the outer side of the channel protruding slightly into the confluence from the Wabash River and extending below the downstream junction corner. Increased penetration of tributary flow into the confluence deflected the Ohio River toward the inner bank and heavily scoured the point bar. A wedge of sediment extended from the mouth of the Wabash River to the center of the junction and bisected the pool.

47. Ecological stress in the evolution of fossil hominids in South Africa

Ruez, Jr., Dennis, R.; University of Illinois at Springfield, Springfield, IL.

The hominid fossils of Die Kelders Cave 1, South Africa, are of great interest to paleoanthropologists because they occur in discrete stratigraphic intervals and include the transition into anatomically-modern humans. Moreover, the deposits contain several hundred thousand identified mammalian fossils that yield insights to the interaction of fossil hominids and their environments. The entire mammalian fauna from Die Kelders Cave 1 was analyzed to determine whether the ecological position, based on body mass, of fossil hominids shifted with the derived behavioral change associated with the transition into anatomically-modern humans. Body-masses of mammals in an ecosystem are distributed discontinuously in clumps (Holling's textural discontinuity hypothesis), rather than spread evenly. The gaps between body mass clusters were calculated using a split moving-window analysis. The body-mass clusters for the Die Kelders Cave 1 faunas changed in number, boundary values, and taxonomic composition. However, the positions of the fossil hominids were static, consistently occurring near the upper boundary of a cluster. Modern herptiles, birds, and mammals which fall on the edges of these clusters have been suggested as more subject to

extirpation. If similar conclusions are applicable to Die Kelders Cave 1, southern African hominids may have evolved into anatomically modern humans in response to this ecological stress.

48. *A GIS Analysis of 80 Years of Channel Migration of the Little Wabash River in Clay County Southeastern Central Illinois

LaVeau, William J., Viertel, David C., and Burns, Diane M.l Eastern Illinois University, Charleston, IL.

This study examines changes within the channel of the Little Wabash River in East Central Illinois in regards to loss or gain of land on either side of the channel as the river migrates. This impacts ownership of agricultural acreage at minimum. Archival aerial images from July 5, 1938 were obtained for the section of the Little Wabash River that delineated the river's path throughout all of Clay County until its confluence with the Little Muddy River. Once all of the necessary images were collected and downloaded, they were then imported into ArcMap. The imported images were then georeferenced to their proper orientations. After all the images were georeferenced, the banks of the Little Wabash River from the 1938 images were digitized in along with the banks from the basemap pulled from the ARCGIS online catalog to represent the current channel. After the channel pathways from the various datasets were compiled and analyzed, six major deviations from the old channel of the Little Wabash River were found. Many were around 2 acres; however, one was rather significant at 12.11 acres. Although these seem rather small in size, the majority of the farms in the area are 10-49 acres and a loss or gain of 2+ acres has a large impact.

Division: Environmental Science

49. Preliminary findings of Epizoochory as a possible mechanism for garlic mustard (*Alliaria petiolata*) seed dispersal

Loebach, Chris and Anderson, Roger; Illinois State University, Normal, IL.

Garlic mustard, a native Eurasian species, has extensively invaded forested communities within northeastern North America. Little is known about its seed dispersal; however, epizoochory via small mammals has been proposed. To determine if there was a relationship between small mammal activity and garlic mustard abundance, first-year garlic mustard plants were counted in 0.25 m^2 quadrats adjacent to the base of 23 large trees in each of the four cardinal directions and also in eight 0.25 m^2 quadrats located 5m from the tree. Trees were ranked from 0 to 3 based on observable mammal activity in the tree and around its base. Garlic mustard abundance was significantly ($W(23, 23)=434$, $p=0.024$) higher in quadrats adjacent (3.19 ± 0.820) to trees than those 5m away (0.76 ± 0.136). The increased abundance around tree bases is likely due to greater mammal activity around the base, but other explanations are possible. Garlic mustard density in quadrats on north (4.0 ± 1.51) and east (5.4 ± 1.59) side of trees was significantly higher than those on the west side (1.0 ± 0.36). These results suggest more favorable microclimates for garlic mustard occur on north

and east sides of trees than the west side. No significant correlation was found between animal activity rank and garlic mustard abundance. These results are not unexpected because current first-year plants result from seed produced and dispersed the previous growing season.

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

Le, Paul T., Essner, Richard L., Minchin, Peter R., and Ballen, Lindley; Southern Illinois University Edwardsville, Edwardsville, IL.

Landscape change and degradation in our current world has resulted in diminished biodiversity and ecosystem structure and function. The alarming rate of degradation has led to the development of the field of restoration ecology, which seeks to reestablish original ecosystem services important to humans and wildlife. Birds offer an interesting dynamic to restoration ecology due to their interactions with their habitats. As a result, they are believed to be excellent indicators of environmental health. Using avifauna as model organisms, I plan to compare avian richness, diversity, and density among differing forest restoration age classes and create a predictive habitat model. The results of the research will aid in providing wildlife agencies and refuges appropriate recommendations of where to concentrate monetary resources towards restoration planning and management. Using primarily areas near the Chain of Rocks canal, I will randomly select sites in Madison, Calhoun, and St. Charles counties near the confluence of the Mississippi and Illinois Rivers and divide them into categories based on restoration age, to create plots. My preliminary data utilizes point counts for bird presence and quadrat sampling for vegetation. Through statistical analyses, I predict that prairie avifauna will be significant indicator species for restoration sites that are below 10 years of age and non-restored fields. Alternatively, forest avifauna will be significant indicator species for restoration sites that are greater than 10 years of age and remnant forested sites.

51. A Study in Lead: An Analysis of Human Lead Exposure in the Old Lead Belt of Southeastern Missouri

Finch, Jordan, Schulz, Kurt, Brugam, Richard, Lin, Zhi-Qing, and Kohn, Luci; Southern Illinois University Edwardsville, Edwardsville, IL.

This study examines lead exposure in adults and determines the routes of exposure in the Old Lead Belt (OLB) region of Missouri. Almost two centuries of mining in the OLB have made southeastern Missouri a prime area for lead contamination. Elevated levels of lead may be found in vegetables and in the surrounding soil, which can then be passed on to consumers. Chronic exposure to lead can have a number of detrimental effects on human health. The general lead exposure of individuals in the OLB and individuals from a control group in Madison County, Illinois has been assessed using a questionnaire. Preliminary analysis shows that individuals in the OLB seem to experience more neurological and respiratory issues than the control group. Environmental lead levels will be evaluated using hair, soil, dust, and vegetable samples. Samples will be processed by acid digestion method EPA 3050b, and inductively coupled plasma mass spectrometry (ICP-MS) will be used to

determine the concentrations of lead in the processed samples. This study tests whether OLB samples have higher lead concentrations than the control group. As a community health issue, it is important to note where individuals may come into contact with lead pollutants in their environment and also to be able to have a non-invasive measure of consumed lead.

52. *Remediation of Amoxicillin in wastewater using treated fly-ash

Barringer, Brandon and Acheson, Edward; Millikin University, Decatur, IL, USA.

A study by the USA Geologic Survey (USGS) published in 2002 found measurable concentrations of 95 organic compounds, including pharmaceuticals, in 139 streams across the USA. Even though amoxicillin was not identified in the USGS study, amoxicillin is the third most prescribed antibiotic in the USA. Since amoxicillin is so widely prescribed, we decided to make it the focus of our research. Water samples spiked with amoxicillin were passed through Solid Phase Extraction (SPE) cartridges packed with fly-ash treated with 0.1 M KH_2PO_4 pH 3 buffer. The column elutant was tested for amoxicillin using High Performance Liquid Chromatography (HPLC). Greater than 80% of amoxicillin in H_2O samples was retained by the fly-ash. Approximately 770 mg of amoxicillin is retained per gram of fly-ash. Further investigation needs to be done to determine if fly-ash can be used to remediate natural H_2O samples without inorganic matter coming off the column. We will describe our work to date on this project.

Division: Health Sciences

53. Antibacterial Antibiotics Stimulate DTH and Microbicidal Activity by Mice.

Babyak, Megan, Hurt, Mariah, Horn, Nicholas, Pullam, Kristopher, and Kitz, Dennis J.; Southern Illinois University Edwardsville, Edwardsville, IL.

We have long been interested in antibiotic effects on mouse macrophage and T cell immune responses. An array of antibacterial antibiotics were found to not only enhance macrophage microbicidal activity for candidal yeast targets, but to also boost DTH response to the chemical antigen DNFB (Sigma) using an ear-thickness assay described by Phanuphak, et al.Our current interests are in determining the mechanisms that boost DTH response and the mechanisms that enhance macrophage killing activity such as changes in cytokine production, nitrous oxide, digestive enzymes or toxic oxygen radicals. Methods are described and preliminary results are shown in our other poster. This work was funded in part by the Max Baer Heart Fund, FOE, and M.H. is an LS-AMP Research Scholar, NSF/HRD094024.

54. Mechanisms Involved in Antibacterial Antibiotic Enhanced Microbicidal Activity by Mouse Macophages and T Cell DTH.

Jones, Kevin, Curry, Shawn, McCracken, Vance, and Kitz, Dennis J.; Southern Illinois University Edwardsville, Edwardsville, IL.

We hope to define some of the mechanisms contributing to antibiotic enhancement of T cell-mediated DTH (delayed-type hypersensitivity) response and macrophage microbicidal activity. T cell behavior involves documenting thymus size over time and and inducement of T cell-mediated tolerance. Macrophages were thioglycolate-elicited from AKR/J mice and the cells coincubated with antibiotics to see if the drug changed levels of cytokines produced, nitrous oxide, digestive enzymes and toxic oxygen radicals. Assay protocals are described and premininary results shown. This work was supported in part by the Max Baer Heart Fund, FOE, and SC is an LS-AMP Research Scholar, NSF/HRD094024.

55. *Effects of Rolofylline on Respiration in Newborn Rats

Ferry, Blake W. and McGilliard, Kip L.; Eastern Illinois University, Charleston, IL.

Premature infants are given methylxanthines (MXs), such as theophylline or caffeine, to prevent recurrent apnea. By stimulating the respiratory center, MXs can help prevent apnea spells, but they also are known to increase the heart rate. It is thought that MXs act by antagonizing adenosine receptors, counteracting adenosine's depressant effects. Rolofylline (8-noradamantyl-1,3-dipropylxanthine) is a potent selective A1 adenosine receptor antagonist. Because of its actions on A1 receptors, it was our hypothesis that rolofylline would stimulate respiration in newborn rats. Various doses of rolofylline, ranging from 80 to 1280 μg/kg, were injected into unanesthetized 4- to 7-day-old rats and respiration was monitored. Due to its insolubility in water, rolofylline was dissolved in dimethyl sulfoxide (DMSO). Rats were placed in a body plethysmograph connected to a flow transducer for measurement of respiration prior to drug treatment. After a 10-min control period, the rats were injected subcutaneously at the base of the skull without removing them from the apparatus. Respiration was recorded for the next hour. Our results showed dose-related increases in minute ventilation (VE) in the dose range of 160 - 640 μg/kg, with a decrease at 1280 μg/kg. VE increased up to 30%, due primarily to increases in tidal volume and mean inspiratory flow, while respiratory rate was unchanged. Based on these results, we concluded that rolofylline stimulates respiration in newborn rats by antagonism of adenosine A1 receptors, thus supporting our hypothesis.

56. *Bond Strength of Repaired Resin Modified Glass Ionomer

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In order to treat dental caries, the defective tooth structure must be removed and replaced by a restorative material. A conservative approach necessitates the ability to repair the restorative material if it should become defective. Resin modified glass ionomer (RMGI) is a common type of restorative material currently used in dentistry. However, the optimal methods for repairing RMGI are poorly understood. The first group was repaired within five minutes of the initial placement of RMGI, and the second group was first placed in a chamber for one week prior. The second group was maintained at 37°C, 94% humidity, and thermocycled once from 5°C to 55°C. The additional thermocycle treatment was used to simulate the consumption of hot and cold food/beverages. Three surface treatments for both groups consisted of a combination of sanding, phosphoric acid etch, and/or bonding agent. Our hypothesis was that the shear bond strength of the five minute repair would be higher than those after one week. The preliminary data agrees with our predictions, except for the last treatment group, which received all three surface treatments. In this last condition, the shear bond strength of the one week samples were greater. We are currently investigating the effects of additional thermocycling and surface treatments. We believe that this investigation will lead to more effective dental treatments for defective RMGI repairs.

Division: Microbiology

57. Comparative Analysis of Alternansucrase Genes from *Leuconostoc*

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

Alternansucrase (ASR) from *Leuconostoc* makes alternan polymers from sucrose. Alternan variations are strain dependent due to differences in asr gene structure. The goal was to sequence two additional asr genes from *Leuconostoc* spp. and perform a comparative structural analysis with other known asr genes. asr genes from 1498 and 1501 were amplified by PCR, cloned, and sequenced. The asr seq. were analyzed by BLAST, ORF Finder, CDD, C-DART, and ClustalW2. All asr genes examined encode a 2057 aa protein with a mass of 229 KDa. Amino acid alignment among five known asr genes showed a high degree of residue conservation, however, there were less conserved regions within the catalytic core. ASRs possess similar domain structures but with distinctive features such as three N-terminal repeats, a single C-terminal A repeat, and seven C-terminal APY repeats. A domain architecture search indicated that *Leuconostoc* inulosucrase possesses similar C-terminal APY repeat domains. Function of APY repeat is unknown. ASRs also possess divergent aa residues in regions beta 5 and 7 within the highly conserved catalytic core region. In summary, less conserved regions within the catalytic domain may provide insight into why certain ASRs make different alternan products. C-terminal APY repeats seem to be associated with *Leuconostoc* sucrose

glycosyltransferases, although their function is unknown. Knowledge of asr structure will help understand structure function relationships among these enzymes.

58. Sucrase Production and Growth of *Leuconostoc* in Chemically Defined Media.
Holt, Scott M., Liles, Jordan L., McGlone, Megan A., Bauer, Matt D., and Andrew, Zac R.; Western Illinois University, Macomb, IL.

The goal of this project was to determine if a chemically defined medium is an alternative to complex medium for the study of growth and sucrase production by *Leuconostoc*. *Leuconostoc* strains were cultivated in complex and defined media. Growth was determined by absorbance (A) and plate count. Sucrase was assessed by in-situ detection of activity in SDS-PAGE gels. End-point growth results were comparable for each strain, however, A values were variable among the leuconostocs tested. Growth was also quantitatively assessed by growth rate and CFU/ml for two *Leuconostoc* strains (512F, 1355). Growth rates for 512F were higher on complex but CFU/ml was higher on defined. Growth rates for 1355 were higher on the defined compared to complex medium. For enzyme production, A few differences were detected in sucrase bands that appeared in SDS-PAGE. No sucrase band was detected when 742 was grown on defined-glucose but a band was observed on the complex-glucose. Three sucrase bands were detected for 1355 on complex-sucrose, however, only two bands were observed on defined-sucrose. Overall, end-point growth on the complex vs defined was comparable but A values were strain-dependent. Growth rates and CFU/ml counts had inverse relationships for each strain tested. A few differences in the number of sucrase bands were observed possibly due to unknown components in the complex medium. Defined medium was a suitable alternative to complex.

59. *The Role of Biofilms in Dreissenid Recruitment in Milwaukee Harbor – Ten Years Later
[1]McCormick, Deirdre S., [2]Maki, James S., and [1]Kavouras, Jerry H.; [1]Lewis University, Romeoville, IL and [2]Marquette University, Milwaukee, WI.

Dreissena polymorpha (zebra mussel) and *Dreissena bugensis* (quagga mussel) are invasive species in North American fresh waters that physically and chemically alter the integrity of the surfaces to which they attach. Biofilms positively influence the attachment of zebra mussel larvae to polycarbonate surfaces in the field. However, quagga mussels are displacing zebra mussels in the Great Lakes. They currently dominate the population of dreissenids in Milwaukee Harbor, where the study on zebra mussels was performed. The purpose of this study was to determine if biofilms influence the attachment of populations dominated by quagga mussels. A large sheet metal sampler containing randomly arranged, mesh covered, slides of polycarbonate and glass was deployed in Milwaukee Harbor to develop biofilms for two weeks. The mesh prevented dreissenid attachment. The sheet metal sampler was retrieved and the mesh was removed, exposing the biofilms to larvae. Clean glass and polycarbonate slides were added and the sampler was redeployed. After two weeks the sampler was removed from the water and the slides were collected. The attached larvae were

counted using a microscope at 30X magnification. Prefilmed slides were compared to their clean counterparts. The number of larvae on prefilmed and clean counterparts were not statistically different (ANOVA, P>0.05). The results indicate biofilms did not enhance attachment and that quagga mussel larvae may use different cues for attachment.

60. *I Brought Home a Coliform?

Colclasure, Victoria J. and Kavouras, Jerry H.; Lewis University, Romeoville, IL, USA.

Coliform bacteria inhabit the intestinal tract of animals and humans, are water quality indicators, and some are pathogens. Previous clinical studies have reported the viability of bacteria on common hospital fabrics and surfaces, but do not report on the quantity of microbes. This study focused on coliform bacteria isolated from unmonitored recreational sites. Specifically, the study examined viability, quantity, and competition. Three types of fabric (cotton, blended-cotton, and silk) were exposed to a mixture of three coliform species that varied significantly in colony morphology. The fabrics were incubated at 25°C or 37°C in the dark, or at room temperature in sunlight for 30, 60, 90, and 120 days. The number of coliform bacteria was estimated by most probable number using the Colilert assay. Viability was determined by pressing the fabric to an eosin methylene blue agar plate and examining colony morphologies. The results indicated that cotton supported the viability of coliforms when exposed to sunlight (>11, 000 bacteria/mL). The results indicated that coliform bacteria survive longer than 120 days on cotton exposed to sunlight and cotton and blended-cotton incubated at 25°C (>11, 000 bacteria/mL). Fabrics incubated at 37°C did not support coliform viability. It did not appear that one coliform dominated the other species. In conclusion, fabrics that retain liquids better, such as cotton, appear to improve the chances for coliform survival at numbers that could be infectious, and higher temperatures appear to reduce the chance of coliform viability on fabrics.

61. Formulating a Defined Growth Medium for the Acidophilic Archaeon *Ferroplasma acidarmanus*

Qu, Yudong and Hung, Kai.; Eastern Illinois University, Charleston, IL, USA.

Microbes differ from other organisms in their ability to thrive in many extreme conditions, such as heat and pH. *Ferroplasma acidarmanus* strain fer1 is an Archaeal species that thrives in environments as acidic as battery acid (pH 1). A bioinformatics approach to study this organism requires functional confirmation of the predictions, which cannot be carried out until a defined medium is obtained. The current medium (mfer) contains 0.1% (w/v) yeast extract and the objective of this study is to replace it with defined components. To determine the utilizable nitrogen sources, both organic (amino acids) and inorganic (nitrates) nitrogen will be tested. The vitamin requirement for fer1's growth will also be examined by assaying the impact of each of the 6 essential vitamins in groups and individually. Growth, quantified by optical density (520 nm) as well as visual inspection, will be monitored in serial passages to minimize nutrient carry over. Multiple independent trials with at least 2 repeats of each trial will be conducted for statistical analyses. A defined medium will enable

research into the metabolic capacities of fer1, which will enhance our understanding of how extremophiles exist at the boundaries of life and raise the accuracy of Bioinformatics predictions in order to contribute to the developing discipline of functional genomics.

62. *The Impact of Ferrous and Zinc Ions on the Growth of an Acidophilic Consortium
Amarh, Elizabeth, D.; Eastern Illinois University, Charleston, IL.

The Iron Mountain Superfund site in California is home to the most acidic water discovered, pH -3.6, with a pH range of 0.5-0.9 and concentrations of dissolved metals as high as 200 g/L. Despite this hostile condition, a group of organisms, comprising of a filamentous fungus and at least one prokaryote, has been found thriving in these caves and subsequently isolated. My hypothesis is that the success of this consortium is affected by various concentrations of the heavy metals found at the Iron Mountain site. To test this hypothesis, the consortium was grown in a liquid medium which contained different concentrations of dissolved metals. The basal minimal medium contains 0.1% (w/v) glucose and 0.1% (w/v) yeast extract (adjusted to pH 2.00 with sulfuric acid). Based on reported values and preliminary trials, twelve incremental concentrations for zinc and ferrous iron were tested, along with twelve controls of un-inoculated media, and media without heavy metal added. Growth in 24-well and 48-well plates was quantified using visual and spectrophotometric techniques. Statistical analyses of the results suggest that the upper and lower limits in which the consortium can grow in zinc and ferrous iron are between 2.0 g/L to 0.2 g/L, and between 5.0g/L to 2.5g/L, respectively. Optimal growth of consortium was observed at 0.2 g/L zinc and 1.25 g/L ferrous iron. The upper and lower limits of zinc and ferrous iron concentrations in which the consortium can successfully grow will be reported. These results will be useful in devising bioremediation plans at the Iron Mountain site.

63. *Pathogenesis of *Helicobacter canadensis*
Amirahmadi, Sara and McCracken, Vance.; Southern Illinois University Edwardsville, Edwardsville, IL.

Helicobacter is a genus of Gram-negative bacteria residing in the gastrointestinal tract of many mammalian and avian species. Many *Helicobacter* species cause gastric, intestinal, and hepatic disease. The bacterium *Helicobacter canadensis* is a newly emerging pathogen that has been isolated from 4 patients in Canada exhibiting enteritis as well as several common wild birds. Intestinal epithelial cells provide a first line of defense against pathogens by secreting cytokines that recruit immune cells to the site of infection and induce inflammation. Other events that frequently occur as a result of exposure to pathogens are apoptosis (controlled cell death) and/or necrosis (cell death as a result of injury). This study utilized ELISAs to investigate inflammatory cytokine production by colon epithelial cells in response to *Helicobacter canadensis*.

64. *Production Optimization of Two Putative Methionine-gamma-lyases from *Ferroplasma acidarmanus* strain fer1

Miller, Megan and Hung, Kai F.; Eastern Illinois University, Charleston, IL.

Richmond Mine in California has extremely acidic water, with pH's as low as -3.6. Despite the harsh conditions, these waters are home to millions of microorganisms, with the archaeon *Ferroplasma* acidarmanus strain fer1 being the most abundant. Previous work has shown that fer1 speeds up the conversion of pyrite to sulfuric acid, which makes fer1 a significant contributor to Acid Mine Drain (AMD), an environmental issue that affects the drinking water and the ecosystems surrounding the mine. Bioinformatics predictions have shown that fer1 contains 2 putative Methionine-gamma-Lyase (MGL) genes, which convert methionine to methanethiol (CH3SH). To obtain sufficient quantity of MGL for functional confirmation, protein expression will be optimized by altering the amount of IPTG, the duration, and temperature of induction. Nickel columns will be used to purify the expressed proteins and assays for a-keto compounds and thiol groups will be conducted to confirm functions. Multiple independent trials with controls involving known MGL producers will be carried out, and the results analyzed using appropriate statistical tools. This research is the first study to determine whether or not fer1 MGL exhibits the predicted function of converting methionine into methanethiol.

65. *Metal toxicity of nanoparticles in bacteria

Bright, Rebecca L., Theodorakis, Christopher, and McCracken, Vance J.**;** Southern Illinois University Edwardsville, Edwardsville, IL.

Nanoparticles are characterized as particles having at least one dimension less than 100 nm in size, which contributes to a high surface to volume ratio. This high surface area promotes contact with bacterial cells, which has shown to be problematic for native bacteria in the environment. Interaction of nanoparticles with bacterial cells leads to disruption of the cell membrane, which is thought to be caused by oxidative stress. This study examined the mechanisms of toxicity of silver nanoparticles on *Escherichia coli* ATCC 25922. Growth inhibition was recorded using minimum inhibitory concentration tests in the presence of ethylenediaminetetraacetic acid (EDTA), the antioxidant N-acetyl cysteine (NAC), and fulvic acid (a component of natural aqueous dissolved organic matter [DOM]). Silver nitrate was used as a control for the production of silver ions. Results were concentration dependent and EDTA showed no effect on the silver nitrate or nanoparticles. NAC prevented inhibition of bacterial growth, indicating that damage is caused by nanoparticle-induced oxidative stress. Fulvic acid decreased the toxicity of the nanoparticles, but had no effect on silver nitrate demonstrating that organic acids do affect nanoparticle toxicity. These results suggest a relationship between nanoparticle toxicity, oxidative stress, and DOM.

66. *Attenuated Immune Response in Neonate versus Adult Mice Infected with *Helicobacter felis*

Hoppenrath, Jean M. and McCracken, Vance J.; Southern Illinois University Edwardsville, Edwardsville, IL.

Infection with gastric *Helicobacter* can result in several gastric diseases, ranging from gastritis and ulcers to mucosa-associated lymphoid tissue (MALT) lymphoma and adenocarcinoma. Much of the *Helicobacter*-associated pathology is not a direct result of the infection, but rather from the resulting host immune response to the infection. Previous studies using a *Helicobacter felis* mouse model comparing adult-infected and neonate-infected mice showed that infected neonates had an attenuated immune response. This attenuation may be attributed to an immature immune system in neonates. The current study was undertaken to determine at which time point the infected neonates begin to exhibit an adult like response. Previous studies that have demonstrated a lack of adaptive immune response in neonatal infected mice were based on 8-week studies. This study focuses on 16-week infections. The immune response has been evaluated using serology and gastric histology. Serology showed a four-fold decrease antibody presence between adult infections and those infected as neonates. Histology showed mice infected as adults have an average gastric inflammation score of 7, while mice infected as neonates have an average score of 3. Thus, our results show that even at 16 weeks of infection, which is well past maturity in mice, neonates still have not matured to an adult like response.

67. The influence of phosphate on the growth of an acidophilic consortium.

Brown, April, M.; Eastern Illinois University, Charleston, IL

At the Iron Mountain Superfund site in California, extremely acidic seeps with pH values as low as -3.6 and total dissolved metal concentrations as high as 200g/L have been discovered. Given these harsh conditions it was very astounding to discover a consortium composed of a fungus and possibly a prokaryote was actually flourishing. The success of this consortium in these harsh environments brings up the question of what kind of macroelement, and how much, is needed. I hypothesized that this consortium's growth will improve with increasing amounts of one of the macroelements, phosphate, up to the maximum limit. To determine the optimum level of phosphate that this consortium needs, I experimented growth in a minimal medium containing 0.1% (w/v) glucose (pH of 2.0 with hydrochloric acid) supplemented with different concentrations of phosphate (0, 25, 50, 75, and 100mM). Serial passage was conducted to minimize nutrient carry-over. Growth was quantified in 24-well and 48-well plates both visually and by using a spectrophotometer. The results were compared to two controls, one being un-inoculated wells and the other being glucose/yeast wells, and have been analyzed with appropriate statistical tools. The results of this experiment suggest that this consortium can grow in different levels of phosphate. However, there seems to be no significant difference in growth at different levels of phosphate.

68. *Effect of Stress on Compatible solutes in *Pichia pastoris*

Alapati, Jyothirmai and Clutter, Blake; Bradley University, Peoria, IL, USA.

Pichia pastoris is a methylotrophic yeast that is used as an expression system for the production of recombinant proteins. We are characterizing the stress response of *P. pastoris* by measuring compatible solute levels in the organism after exposure to various stresses. Extracts from *P. pastoris* were analyzed by HPLC using a Shodex SUGAR cation-exchange size-exclusion column. Our preliminary results indicate that trehalose and arabitol levels increase significantly upon exposure to hyperosmotic stress or addition of citric acid, and decrease upon treatment with dithiothreitol (reductive stress). We are also comparing stress response in *P. pastoris* to that of *Pichia angusta*, a temperature resistant strain, and *Kluyveromyces lactis*, another commercially-available protein expression system. The results of our work should aid in the optimization of yield and quality of recombinant proteins obtained using these expression systems.

Division: Physics, Mathematics, & Astronomu

69. *Towards Generation of Asymmetric Dicke States

DeYoung, Daniel and Kapale, Kishor; Western Illinois University, Macomb, Illinois, USA;

Dicke class states are maximally entangled states of atoms or atom-like two-state entities involving a small number of excitations. It has been shown in the literature [Z.H. Peng, J. Zou, X.J. Liu, Eur. Phys. J. D 58, 403-407 (2010)] that so-called asymmetric Dicke states are more useful for quantum information processing tasks that the symmetric Dicke states. We are working on devising practical conceptual proposals for generation of asymmetric Dicke states based on a proposal to generate symmetric Dicke states [Thiel et al. arXiv:quant-ph/0703137].

70. Apoptosis and Quantum Mechanics

[1]Welch, Dan B., [1]Joy, Anita, [2]Wanda, Paul E.; [1]SIU-Dental Medicine and [2]SIUE-Biology, Edwardsville, Il, USA.

Human leukemia cells were induced to apoptosis via the extrinsic pathway by ultraviolet light irradiation (UVB 302nm). Apoptosis was determined by changes to membrane morphology, trypan blue exclusion, and chromatin condensation. Cells were spin labeled with 5-deoxylstearic acid and analyzed by Electron Spin Resonance (ESR) spectroscopy. Comparison of apoptotic spectral line-widths with those of healthy cells revealed an increase in membrane fluidity. Spin-spin exchange obeyed Heisenberg's Uncertainty Principle as seen by line broadening when spin-label concentrations were held constant. We propose that the possibility of this concentration is being associated with lipid rafts. We gratefully acknowledge support by the Illinois Fraternal Order of Eagles.

71. *Investigating the Dispersion of Conoscopic Interference Patterns

Olorunsola, Oluwatobi and Pengqian, Wang; Western Illinois University, Macomb, IL.

The conoscopic interference patterns produced by light propagating in anisotropic crystals are important in understanding the structure and properties of optical materials. In conventional interferometers the isochromatic interference fringes are observed by using a circular polarizer and a circular analyzer, both constructed by a linear polarizer and a quarter wave plate. However, due to the dispersion of the quarter wave plates, the phase-retardance between the two light waves inside the quarter wave plates is wavelength-dependent, which results in different conoscopic interference patterns when the wavelength of the illumination light is tuned. In this presentation we will investigate the details of the variation of the interference patterns in anisotropic crystals when the wavelength of the light source is changed. In addition, we also designed a spinning-polarizer and spinning-analyzer method to eliminate the dispersion of the interference patterns, which provides a new way to visualize the isochromatic interference fringes in conoscopy. Our method produces similar interference patterns for all colors without dispersion and without the use of additional optical elements.

72. *Magic Circle

Liu, Shufang; Western Illinois Univerity, Macomb, IL, USA.

This project is designed to help math teachers create geometric learning activities in classroom settings. By folding a circle into different geometry shapes, some basic questions can be prompted to students, such as definitions, names of the shapes, and formulas. Also, some calculations on length of segments, measurement of angles, and perimeter of a shape can be addressed. Furthermore, many challenging problems, such as computing area and volume related to the shapes can be done. Teachers may use the activity to review the concepts that have been taught in the previous lessons, or utilize a part of the activity to prompt some questions during a lesson. The reason why this activity is called Magic Circle is that we can create many different shapes with a range of questions by using one circle only. Students in the classrooms will be fascinated by folding a circle and creating a collection Geometry figures.

Division: Zoology

73. *The effect of rapid cold hardening on performance after a low temperature exposure
Davis, Cameron, Griffis, Nicole, and Williams, Jason; Southern Illinois University Edwardsville, Edwardsville, IL.

Certain insect greatly enhance their ability to survive severe low temperature if first subjected to brief, mild cold. This process, termed rapid cold hardening (RCH), will allow adult fruit flies raised at room temperature to survive a 2h exposure to -7°C if first exposed to 10°C. In addition to enhancing survival to non-ecologically low temperature, RCH may benefit insects in nature by allowing them to increase performance during a more relevant low temperature, although this has rarely been tested. To examine this we used chill coma recovery time (i.e.: time until an animals could right themselves) as a basic measure of low temperature performance in three day old adult *Drosophila melanogaster* females. Recovery time was assessed at 25°C after flies were either directly transferred from room temperature to 0°C for five hours, subjected to RCH at 10°C for two hours prior to the 0°C exposure, or subjected to 10°C and allowed to recover at 25°C for two hours before the 0°C treatment. Animals directly transferred to 0°C only took on average 10±1 min to right themselves. By contrast, flies subjected to a RCH treatment took over nine times longer to right themselves (93±23 min) than those that were directly transferred to 0°C. Recovery was even longer for those subjected to 10°C and 25°C prior to the low temperature treatment (230±10 min). Thus, it appears an exposure that induces RCH may negatively impact organismal performance at more ecologically relevant temperatures. We are currently using other metrics (vertical walking speed) to follow up this finding.

74. *Choice Between Light, Dark, & Visually Complex Substrate in the Spider, *Tigrosa helluo* (Araneae:Lycosidae)
Jerden, Meghann, Funao, Ayumi, Stork, Ryan, and Sztukowski, Russell; Greenville College, Greenville, IL.

The wolf spider, (formerly Hogna) *Tigrosa helluo* (Araneae: Lycosidae), is an ecologically important, nocturnal, and darkly colored predator and prey item in the eastern United States. We asked: does *T. helluo* show a preference for substrate brightness or complexity in the low light environment it inhabits? We predicted that *T. helluo* would show no preference toward light or dark backgrounds as well as no preference toward simple or complex patterned paper substrates. Female spiders were collected from Bond County, IL and run in two choice tests, which compared the locations that the spiders settled against the brightness and complexity of substrates. A corrected g-test was used to compare light and dark substrates as well as complex and simple substrates. The choice test between light and dark substrates showed that there was a significant preference for dark substrates ($p<0.001$). In the complexity choice test, no significant preference ($p>0.1$) toward pattern was shown but a significant preference ($p<0.001$) for dark substrates was shown, regardless of complexity. This test demonstrates a preference for substrates that more closely match the spider's

dark color. The reason for this preference needs further investigation. Future work will look at possible ancestral or current diurnal activity as well as potential interactions with predators during the nocturnal, active time of these spiders. Studies of conditional preference are also planned.

75. *Diverse effects of stress on immune function in four songbird species.
Knott, Madeline, Wilcoxen, Travis E, and Horn, David J.; Millikin University, Decatur, IL.

Immune function, both innate and acquired (or adaptive), is critical for vertebrate survival. Some research has demonstrated that each branch of the immune system can be affected by stress, specifically from a cascade of physiological changes that occur following the release of glucocorticoid hormones, such as corticosterone (CORT; the primary avian stress hormone). To examine the relationship between stress and immune function, we used birds as a vertebrate model. Four songbird species were studied to investigate the relationship between stress and (1) innate immunity (using a microbial killing assay), and (2) Interleukin-6 (IL-6), a cytokine measured to represent acquired immune function. Further, we assessed differences in the effects of chronic stress and acute stress on innate immunity. Chronic stress was associated with decreased innate immune function and an acute stress response was associated with increased innate immune function. Birds that had higher baseline CORT had greater IL-6 levels. IL-6 is associated with decreased inflammation, and therefore, may be released in response to an increase CORT. Overall, our results demonstrate that changes in immunocompetence associated with stress depend on the nature of the stressor.

76. *Using multiple measures of individual condition to examine the impact of commercial bird food on wild birds.
Hubble, Cody N., Wilcoxen, Travis E., and Horn, David J.; Millikin University, Decatur, IL.

Many metrics have been used to assess the health of free-living vertebrates, with conflicting findings and differential support for these metrics. We examined the impact of bird feeding activities on individual condition in Central Illinois feeder-using species of birds. Specifically, we examined hematocrit, total plasma protein, fat deposition, and a body condition index that incorporates multiple structural measurements and mass to examine effects of commercial bird food on the condition of birds relative to birds at similar, nearby sites without feeders. In this 18-month study, we captured approximately 1100 birds of 11 species that are known to regularly use feeders. We found that feeders had a positive or neutral effect when it came to each of the measures and there was no evidence of a negative effect relative to control sites, at least in these measures of condition. There were also differences between the sexes and among species and our findings lend some support to certain measures of condition over others. Understanding differences in individual condition among songbirds and using multiple measures of condition allow us to understand the complex effects of an abundant and predictable food source in the natural habitat of birds.

77. *Stress physiology of songbirds in response to bird feeding activities.
Huber, Sarah J., Wilcoxen, Travis E., and Horn, David J.; Millikin University, Decatur, IL.

The purpose of this study was to observe stress physiology and its interaction with reproductive endocrinology in relation to variation in food availability among communities of common feeder-using birds. Over an 18-month period, we observed two measures of stress physiology, heterophil to lymphocyte ratios and baseline corticosterone levels, and made comparisons among birds captured at natural areas with feeders of commercial bird food and similar sites without feeders. We also tested for correlations between the indicators of stress and the sex steroids testosterone and estradiol in males and females respectively. We hypothesized that in the presence of supplemental food, there will be a lower heterophil to lymphocyte ratio and lower corticosterone levels in birds, exemplifying stress-reducing effects of an abundant, predictable food source. Further, we predicted that greater stress would correlate with decreased levels of sex steroids. Overall, our findings offer new information on the relationship between variation in food availability, stress and reproductive physiology in a songbird community.

78. *The effect of food supplementation on feather growth and developmental stress in songbirds
Wassenhove, Samantha J., Wilcoxen, Travis E., and Horn, David J.; Millikin University, Decatur, Illinois, USA.

We used measures of feather quality (ptilochronology) and body symmetry to assess the effects of bird feeding activities on nutritional condition of feeder-using birds. Songbirds were captured at study sites with feeders and sites without feeders around Decatur, Illinois, in order to collect feathers for analysis and to take structural measurements of the birds to determine symmetry. Daily feather growth is a known indicator of nutritional health and birds at feeder sites showed greater growth. Fluctuating asymmetry offers a measure of minor changes from the standard development: bilateral symmetry, and is thought to be an indicator of nutritional stress during development. Asymmetry was greater at sites without feeders than sites with feeders. Our results demonstrate positive effects of readily available and predictable food sources on nutritional condition and feather growth in a community of avian species.

79. *Genetic structure patterns of two closely-related species of Topminnow (Order: Cyprinodontiformes) in a Southern Illinois Contact Zone
Koepp, Kate E., Scott, Jason M., and Duvernell, David D.; Southern Illinois University Edwardsville, Edwardsville, IL.

Habitat preference between closely related species in contact zones can result in differing genetic structure patterns. In the case of the *Fundulus notatus* species complex of topminnows, one species exhibits an upstream distribution relative to the other. The purpose of this research was to determine if distribution along a stream continuum in a contact zone influences population genetic

patterns in two species of topminnow (*Fundulus olivaceus* and *Fundulus notatus*). Fish were collected in summers of 2010-2012 within all major tributaries of the Saline River in southern Illinois. In total 523 fish were genotyped using seven microsatellite loci to assess genetic variation. The upstream distributed *F. olivaceus* showed a significant pattern of isolation by distance, while the downstream distributed *F. notatus* did not show a significant pattern. AMOVA analysis revealed that the majority of variation within both *F. olivaceus* and *F. notatus* metapopulations occurred between individuals within populations, suggesting low amounts of variation between populations within each species. Further analysis is ongoing, however data appears to indicate differing patterns of genetic variation between the two species. This work was supported in part by Illinois State Academy of Science Student Research Grant, the NGRREC summer internship program, SIUE Graduate School RGGS program and NSF DEB 0716985.

80. Sequential DNA Analysis of the Mediterranean mussel, *Mytilus galloprovincialis*
Meyer, Mary A. and Theodorakis, Chris; Southern Illinois University Edwardsville, Edwardsville, IL.

The purpose of this study was to analyze the genetic diversity of the Mediterranean mussels, *Mytilus galloprovincilias*, along the coasts of the Strait of Istanbul, which connects the Sea of Marmara to the Black Sea. We believe that during the Pleistocene era, which had several glacial periods when ocean water levels were lower than present day, the Sea of Marmara was isolated from the Mediterranean and Black Seas. Our hypothesis is that there is a potentially undescribed and unstudied mussel population with a unique evolutionary history. Based on our preliminary data of the mitochondrial DNA, we have found evidence of a unique population. In order to examine phylogenies based on DNA sequence information, our preliminary studies compared our DNA sequences with sequences published in GenBank. Based on this comparison, we found that there were two distinct haplotypes in the Strait of Istanbul which were distinct from other haplotypes in the Mediterranean. Possible explanations are an introduction of Atlantic haplotypes via ballast water or Pleistocene isolation of the Sea of Marmara. This research is significant because very little research has been published on populations of *Mytilus galloprovincialis* in the Strait of Istanbul, and in addition, if our hypothesis proves to be true, this research will provide insight into the influence of Pleistocene vicariance on population genetics.

81. *Blood parasite prevalence and plasma calcium levels in birds: a comparison between a migratory and a non-migratory species.
Guerra, Daniel F., Wilcoxen, Travis E., and Horn, David J.; Millikin University, Decatur, IL.

Parasitic infections have been known to have adverse effects on the overall health of host birds. During migration, birds may be exposed to increased parasite abundance and diversity and the energetic demands needed for migration could affect susceptibility of migrating species. Alternatively, the energetic demands of coping with a temperate-zone winter may also have physiological consequences. Additionally, parasitic infection of the blood could induce competition for nutrients, such as calcium, that are necessary for a variety of cellular and physiological processes

in both the avian host and parasite. Therefore, we used plasma calcium levels to better assess this host-parasite interaction. Birds were captured from nine study sites near Decatur, Illinois from April 2011 to November 2012. To determine blood parasite prevalence, blood smears from American Goldfinches (*Carduelis tristis*) and Indigo Buntings (*Passerina cyanea*) were examined via oil immersion microscopy. Calcium levels were measured using a calcium assay kit. We hypothesized that the non-migratory, American Goldfinch would have decreased blood parasite prevalence than the migratory Indigo Bunting, and that birds with more parasite species present would have lower plasma calcium levels. Collectively, our findings provide new information about the relationship between avian ecology and physiological responses to parasites.

82. *The effects of supplemental food on innate immunity to a *Staphylococcus aureus* challenge in songbirds.

Flamm, Joseph C., Wilcoxen, Travis E., and Horn, David J.; Millikin University, Decatur, IL.

Innate immunocompetence is a key first line of defense against pathogens. Variation in innate immune defense has been linked to survival in free-living animals, particularly when pathogen pressures increase. Little is known, however, about what environmental factors contribute to variation in innate immunocompetence within and among bird populations. In this study, we tested humoral immunocompetence to a *Staphylococcus aureus* challenge among 11 species of a songbird community. *S. aureus* is a common vertebrate pathogen that is likely found throughout bird populations. Maintaining immune defenses requires much energy and birds seemingly need an adequate food supply to provide that required energy. We captured feeder-using bird species at multiple natural areas near Decatur, IL and compared *S. aureus* resistance among 420 of these birds from a combination of sites with supplemental food and sites without feeders. We hypothesized that birds at sites where supplemental food is available would have greater innate immune defense against *S. aureus* than birds at sites without supplemental food; that is, supplemental feeding will aid in resistance to *S. aureus* infection. Collectively, our findings demonstrate not only an impact of human-provided food on the health of wild birds, but they also indicate how natural fluctuations in food availability may influence immunocompetence.

83. *The effects of supplemental feeding on forest bird populations in central Illinois

Commons, Kelly A., Carlson, Rebekah D., Lundstrom, Lisa A., Horn, David J., and Wilcoxen, Travis E.; Millikin University, Decatur, IL.

Over 50 million Americans over the age of 16 feed wild birds and other wildlife. However, the extent to which supplemental feeding impacts wild bird populations is not well understood. From spring 2011 to summer 2012, we examined how wild bird feeding influences the bird populations at forested sites in central Illinois. Specifically, we compared three forested sites where we provided supplemental food, three sites where supplemental food was provided and then removed, and three forested sites for which no supplemental food was available. We monitored changes in the population size of both feeder and non-feeder species using fixed-radius, 10-minute, double-

observer point counts. Among 17 species of migrant and resident birds, we found few changes in bird populations to the forested sites as a whole that could be attributed to bird feeding. In a companion study, we found that the number of birds that visited feeders increased from 2011 to 2012. Thus, the short term impact of supplemental feeding is most likely to occur at small spatial scales.

84. A Comparative Morphometric Analysis of Skull Shape in Evening Bats (Family: Vespertilionidae)

Wells, Ashley N. and Essner, Richard; Southern Illinois University Edwardsville, Edwardsville, IL.

Bats are one of the most diverse groups of mammals, with the Microchiropteran family Vespertilionidae (Evening Bats) exhibiting a particularly impressive dietary breadth. As such, this group represents an excellent model taxon for exploring the relationship between diet and morphology. Species within this group vary in diet from soft-bodied insects like moths and mosquitoes to hard-bodied insects like beetles (MacDonald, 1984). It is predicted that larger, more robust skulls will be found in species that are beetle specialists, requiring higher bite forces to crush through the carapace. Likewise, bats known to prey on largely soft-bodied insects will have more gracile skulls. Dietary generalists are expected to fall between these two extremes. A preliminary geometric morphometric study of cranial morphology in Illinois vespertilionids generally supported these predictions. However, this study included only five species and focused on a single view of the skull. The previous study has been expanded on to include additional vespertilionid species as well as an outgroup taxon from the family Molossidae (Free-tailed Bats). Additional landmarks from dorsal and lateral views of the skull, as well as, measurements from the mandible in order to estimate bite force are also being utilized. My goal is to map a suite of morphological features onto the vespertilionid phylogeny in order to infer evolutionary patterns within this diverse family.

85. Locomotor Response and Bioaccumulation of Heavy Metals via Mining Pollution in Rocky Mountain Tailed Frog Tadpoles (*Ascaphus montanus*)

Lybarger, Hollie, R. and Essner, Richard, L.; Southern Illinois University Edwardsville, Edwardsville, IL.

Pollution is one of the fastest growing environmental concerns in the world. Regardless of the use of permissible legal levels of heavy metals, the exact impacts of non-lethal levels on biological systems are minimally understood. Amphibians are currently the fastest declining group of vertebrates in world, yet receive very little attention. The population decline is manifold, and many studies indicate that we are in the midst of a mass extinction. Research on heavy metals and its adverse affects on amphibian populations are limited. This research seeks to collect tadpoles of a sensitive species, Rocky Mountain Tailed Frog (*Ascaphus montanus*) from the wild, in both a location contaminated by heavy metals via mining activities and a relatively low contaminated location. The objective is to analyze for increased concentrations of heavy metals of cadmium, copper, lead, and mercury and to determine if predator response is adversely affected in tadpoles. Three escape

variables include maximum velocity, escape time, and angle of escape. It is expected that specimens from the contaminated location will exhibit increased delayed predator response and a higher concentration of specified metals. Understanding the relationship between heavy metal pollution and biological systems will better protect globally declining amphibians and future conservation efforts for biological diversity.

86. *Seasonal and cumulative changes in the number of bird visits to feeders in central Illinois

Carlson, Rebekah D., Commons, Kelly A., Lundstrom, Lisa A., Horn, David J., and Wilcoxen, Travis E.; Millikin University, Decatur, IL, USA.

Bird feeding is one of the most popular hobbies in the USA; however, few studies have addressed the effects of supplemental feeding on bird populations. We examined how bird visits to feeders change seasonally and over time. For five seasons, from summer 2011 to summer 2012, we conducted 30, 45-minute feeder observations at three forested sites which previously had limited or no bird-feeding activity. Of the 12 species examined, 11 had significantly more bird visits at feeders during summer 2012 than summer 2011 (Black-capped Chickadee was the exception). Thus, as a feeding station becomes more established, the maximum number of birds visiting feeders increases. However, because two of the bird species with increased visits at feeders, Brown-headed Cowbird and House Sparrow, have negative ecological impacts, people who feed birds should consider using seed blends that are not attractive to these species.

87. *Effects of supplemental feeding on antioxidant capacity and baseline corticosterone in four common feeder-using bird species

Hogan, Brianna M., Wilcoxen, Travis E., and Horn, David J.; Millikin University, Decatur, IL.

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

88. Strategic territory defense in the black saddlebags dragonfly, *Tramea lacerata* (Odonata:Libellulidae)

Lojewski, Jeffrey A., Terzick, Jordan, Sherr, Kelsey, and Switzer, Paul V.; Dept of Biological Sciences, Eastern Illinois University, Charleston, IL.

The net benefit a territory resident receives from defending a territory will be affected by environmental factors (e.g. temperature or resource distribution) and social factors (e.g. number of intruders). A territory resident may alter its behavior in order to increase the benefit from defense under different environmental and social conditions. Specifically, a resident may adjust territory size and/or how they position themselves or patrol their territory to detect intruders. We examined territory defense in the black saddlebags dragonfly (*Tramea lacerata*), a dragonfly that defends linear mating territories on the edges of ponds and lakes. Specifically, we investigated whether factors such as body size, temperature, or the encounter rate with intruders were related to territory size or patrol speed.

89. Speed Effects on Serpentine Locomotor Kinematics in the Common Garter Snake (*Thamnophis sirtalis*)

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

Movement presents a unique challenge for snakes (suborder Serpentes), which utilize limbless locomotion to move in terrestrial and aquatic environments. Lateral undulation, the fastest and most commonly used type of snake locomotion, has been extensively studied in both contexts. However, speed effects have only been studied in aquatic conditions. During swimming, snakes are known to increase speed by increasing wavelength and maintaining constant frequency. We compared aquatic swimming to terrestrial locomotion, as the majority of colubrid species reside in predominately terrestrial areas. In this study, Common Garter Snakes, *Thamnophis sirtalis* (n=5), were filmed with high-speed video at 120 fps utilizing lateral undulation at three different speeds. We examined speed effects on locomotion by conducting detailed comparisons of key kinematic and performance variables including length, amplitude, and frequency of the waves created during lateral undulation. This study will provide insight into the mechanisms by which snakes generate locomotor complexity from a simple body plan.

90. Evolution of Jumping in Leiopelmatid and Lalagobatrachian Frogs: Comparison of Terrestrial and Aquatic Landing

Michael, Jamay L. and Essner Jr., Richard L.; Southern Illinois University Edwardsville, Edwardsville, IL.

Terrestrial jumping in frogs involves rapid hindlimb extension and loss of forelimb contact. During landing, forelimbs initially contact the substrate, forming a pivot helping with stabilization and support. Simultaneously, hindlimbs rotate under the body so the frog is in position to initiate another jump. However, the most primitive frogs of family Leiopelmatidae exhibit different landing

behaviors. They are characterized by a "bellyflop" landing, retracting forelimbs and delaying hindlimb recovery. It has been hypothesized that jumping evolved in a riparian context, with ancestral frogs leaping into water to flee terrestrial predators. Thus, the terrestrial bellyflop landing of leiopelmatids, which appears to be an aquatic diving behavior, may reflect the ancestral condition for the group. Comparison of aquatic landing locomotion will involve filming frogs jumping into water at 500 fps with an AOS X-PRI high-speed video camera positioned above the jumping arena. Landmarks will be digitized and a series of kinematic and timing variables will be taken from each sequence to describe and compare the 3D movements of the limbs and body. I hypothesize that bellyflop landing is primitive and is exhibited by Rocky Mountain Tailed Frogs, *Ascaphus montanus*, in both terrestrial and aquatic contexts. I hypothesize that lalagobatrachians (Bombina and Lithobates) have retained the ancestral bellyflop landing behavior when jumping into water, despite evolving derived controlled landing behavior during terrestrial jumping.

91. *Comparison of Whole and Sectioned Sagittal Otolith to Estimate Age in a Bluegill Population from a Thermally Altered Environment

[1]Lamb, Lindsey and [2]Porreca, Anthony P.; [1]Eastern Illionis University, Charleston, IL and [2]Southern Illinois University, Carbondale, IL.

Estimating age structure from fish populations is essential for population management. Various bony structures have been used to assess age in bluegill (*Lepomis macrochirus*) such as fin spines and scales; however, sagittal otoliths are often considered the most accurate and precise. Currently several states suggest sectioning otoliths from older bluegill for increased accuracy. We sought to assess whether age structure estimated from whole sagittal otoliths was similar to sectioned sagittal otoliths. We sampled 111 bluegill using three phase AC electrofishing from thermally altered lake. All fish were weighed (g), measured (mm), and the sagittal otoliths were removed by cranial dissection. Each whole otolith was aged using reflected light under 7-45 x magnification. Whole otoliths were then embedded in epoxy and a 450 mm cross section through its center was made using a Beuhler® low speed isomet saw. Average age as estimated by the whole otolith (1.8 years) was younger than the same sectioned otoliths (2.1 years) ($t110 = 4.18$, $p < 0.05$). Using whole otoliths bluegill age ranged from 0-3 years and 1-4 years using sectioned otoliths; however there was no difference in the age distribution ($K\text{-}S = 0.74$, $p > 0.05$). Although mortality as estimated using Heinke's method was higher using whole otoliths ($A = 88\%$) than otolith sections ($A = 79\ \%$) the results were not significant ($X2 = 0.51$, $p < 0.05$). These results suggest there is no need to section otoliths from bluegill from slow growing, short lived populations.

92. *Sprint speed and fitness in the wolf spider Tigrosa helluo (Araneae: Lycosidae)
Sztukowski, Russell, Funao, Ayumi, Jerden, Meghann, and Stork, Ryan J.; Greenville College, Greenville, IL

Measuring fitness can be challenging even in lab situations. Maximum sprint speed has been used as a proxy for fitness in many animals, including spiders because of its convenience and use across multiple different animal types. The assumptions involved with the use of this variable to represent fitness, are rarely tested. We hypothesized that maximum sprint speed would be variable, repeatable, and positively correlated with fecundity. Mature females of the wolf spider, *Tigrosa helluo* from Bond County IL, were captured. Sprint speed and fitness, as measured by the number of offspring in the first egg sack, were taken. We checked for correlation between speed and fecundity. Spiders were sprinted on a sprint track and timed for their splint times in 0.5-meter segments using infrared photo-gates. The spiders were encouraged with a prod but not pushed. The results did show variability, but no significant repeatability ($r=0.013$ $p>0.93$) or correlation with fecundity as a measure of fitness ($r=0.003$ $p>0.98$). This suggests sprint speed should not be used as a proxy for fitness in *T. helluo* and assumptions need to be tested before this proxy is used in other species as well. Future research will look for other fitness surrogates. Differences in ideal split distances and the biological significance of sprint distances between *T. helluo* and other species of spiders need exploration.

93. *Lateral Jaw Muscle Development and Metamorphosis in Tadpoles of *Bufo americanus* (Anura, Bufonidae)
Quiggins, Jessica and Jennings, David; Southern Illinois University Edwardsville, Edwardsville, IL.

During the development of a frog, a two-stage growth pattern occurs. The first stage of this development pattern usually includes an herbivorous aquatic tadpole (in some cases tadpoles are carnivorous). The second stage involves the metamorphosis of the tadpole into a terrestrial, carnivorous, adult frog. Some general characteristics of herbivorous tadpoles include an elaborate keratinized beak, denticles and a long coiled gut. The keratinized beak and denticles aid in food collection, while the elongated coiled gut allows for food processing. The objective of the current study is to describe and quantify changes in jaw muscle anatomy during larval stages and metamorphosis of tadpoles that are filter feeders (American Toad: *Bufo americanus*). This study focuses on the two main lateral jaw muscles the orbitohyoideus (OH) and levator mandibulae longus (LML). In tadpoles, these two muscles are active during peak jaw opening (OH) and throughout jaw closing (LML). In adults, both muscles play a primary role in jaw closing. Muscles from larval and metamorphic stages were stained using antibodies to myosin, allowing visualization of individual muscle fibers. The length, width, and orientation angle of both muscles was quantified throughout development and metamorphosis. During the larval period both muscles grew substantially. The angle between the two muscles did not change until the onset of jaw remodeling that occurs during metamorphosis.

94. *Ventral Jaw Muscle Development and Metamorphosis in Tadpoles of *Bufo americanus* (Anura, Bufonidae)

Barnfield, Rayla and Jennings, David; Southern Illinois University Edwardsville, Edwardsville, IL, USA.

Most frogs have two distinct phases in their life history; tadpoles that are aquatic herbivores become terrestrial carnivores when they metamorphose to form an adult frog. During the larval period, tadpoles have keratinized beaks and rows of denticles used to filter feed on algae. The current study examines jaw development in tadpoles of *Bufo Americanus* (American toad), as they grow and mature. This study focuses on three ventral jaw muscles , the interhyoideus (IH), intermandibularis (IM), and the geniohyoidieus (GH). In tadpoles, the IH and IM function in jaw closing. The IH plays a role in both respiration and feeding, while the IM only functions in feeding. The GH functions in jaw opening during feeding and respiration. To examine the development of these muscles, muscles from larval and metamorphic stages were stained using antibodies to myosin. This immunohistochemical approach allows visualization of individual muscle fibers. The length, width, and orientation angle of each of the three muscles was quantified throughout development and metamorphosis. During the larval period, the IM was very small and not visible in the earliest stages examined. The other two muscles (IH and GH), both grew substantially across the stages examined. The angles between the two muscles did not change during the stages examined.

95. *The effect of exercise induced oxidative stress and age on mitochondria damage in the honey bee, *Apis Mellifera*

Oyler, Jennifer, Curry, Shawn, and Williams, Jason B.; Southern Illinois University Edwardsville, Edwardsville, IL.

Reactive oxygen species (ROS) can profoundly impact tissues and are the basis for the "oxidative stress" theory of aging. ROS generation may be the greatest in metabolically active tissue, such as exercising muscle, and may preferentially damage mitochondria, the major site of ROS formation. However, few studies have examined exercise induced mitochondrial damage and none have done so over the course of an animal's life. Flying honey bees produce the highest mass-specific metabolic rate measured; suggesting their flight muscles and mitochondria may experience high levels of oxidative stress during normal activities. The purpose of this study is to determine if life long flight activity induces mitochondrial damage in flight muscle of forager bees which fly up to 8km a day compared to age-matched nurse bees which rarely fly. Surprisingly, mitochondria isolated from old foragers (19-20 days of adult age; that had actively foraged for 10 days prior to collection) produced similar levels of hydrogen peroxide (a marker of ROS production) as age-matched nurses, age-matched foragers with little flight history, young nurses (8-10 days of adult age) and young foragers with little flight history (averaging 371 $\pm$ 6.8 pmol•min-1•mg protein-1). In this ongoing study we are currently measuring indicators of oxidative stress, protein carbonyls, lipid peroxidation, and ratio of citrate synthase to aconitase activity, on isolated mitochondria from the above groups.

96. *The effect of social environment on the pursuit of heterospecific targets by territorial black saddlebags dragonflies, *Tramea lacerata* (Odonata: Libellulidae)

Terzick, Jordan, Sherr, Kelsey, and Switzer, Paul V.; Dept. of Biological Sciences, Eastern Illinois University, Charleston, IL.

Effective territory defense involves the detection, identification, and expulsion of appropriate intruders. Benefits to quick expulsion, however, may lead territory residents to pursue mistakenly intruders that are not a threat, e.g. heterospecifics that resemble their species. Because of possible costs from these mistakes, residents may benefit from modifying their responses based on their social environment. We tested this hypothesis with territorial male black saddlebags dragonflies (*Tramea lacerata*). We found that males did alter their response to intruders based on their social environment, but the change depended on the species of intruder. Specifically, males decreased their likelihood of responding to a heterospecific in response to an increase in the absolute number of intrusions by male *Tramea carolina/onusta* but not intrusions by male *Libellula luctuosa*. Conversely, they decreased their likelihood of response as the relative number of intrusions (i.e. number of heterospecific intrusions/number of conspecific intrusions) by *L. luctuosa* increased but not the relative number of *T. carolina/onusta* intrusions. Interestingly, the likelihood of response was not significantly altered in response to changes in intrusions by conspecifics. We also found a spatial effect: resident males were more likely to respond to intrusions by all species near the border of their territory as compared to the middle of their territories. Thus, male *T. lacerata* seem to make adaptive changes in their territorial behavior as a consequence of their social environment and location.

97. Functional and ecological aspects of the mucus trails of the freshwater gastropod *Elimia potosiensis*

Skiold-Hanlin, Sarah N., and Brunkow, Paul E.; Southern Illinois University Edwardsville, Edwardsville, IL.

Elimia potosiensis is a common freshwater and ecologically important snail found in rivers and streams of Missouri and Arkansas. *E. potosiensis*, like most snails, employ a single muscular foot, which secretes adhesive mucus (pedal mucus), to locomote over various surfaces. As these snails are common and can be locally extremely abundant, mucus deposited by snails may be an important ecological component of lotic systems. Research in marine habitats has suggested that mucus trails secreted by certain species of gastropods serve as adhesive traps for microalgae and bacteria, thus serving as an important substrate for biofilm formation. However, research on freshwater snails and the function of their mucus trails is discouragingly incomplete. The present research seeks to fill in this gap by examining properties of mucus trails deposited by *E. potosiensis*. In a field study, mucus trails of *E. potosiensis* were incubated for one hour at two different locations within their habitat: high water velocity (>10cm/s) and slow water velocity (<10cm/s). A higher density of microalgae was found trapped in the pedal mucus of samples located in the higher velocity water. Laboratory experiments yielded no difference in the thickness of mucus trails laid by snails in differing water

velocities, suggesting that adhesion in the field experiment was related potentially more to volume of microalgae which passed over the trail.

98. Demography and Habitat Use in the Southern Flying Squirrel, *Glaucomys volans*, in Southwestern Illinois

Dunham, Loren N., Essner, Jr., Richard L., and Minchin, Peter R.; Southern Illinois University Edwardsville, Edwardsville, IL.

The once predominant oak-hickory forests of southwestern Illinois are becoming highly fragmented due to increased agriculture and urbanization in the area. Presence of the Southern Flying Squirrel, *Glaucomys volans*, is an indicator of forest quality, as this species prefers mature and relatively open forest stands. Previous research indicates that populations of southern flying squirrels are declining due to this increased habitat fragmentation and destruction. Our primary objective in this study is to create a predictive habitat model for the southern flying squirrel using both demographic and habitat data. Study sites consist of 140 randomized plots in forest patches located within the SIUE campus and Bohm Woods Nature Preserve; some plots have existing nest boxes and others will have nest boxes installed in Spring 2013. Data collected from nest box and Sherman live trap captures will be used to examine the demographics and movement patterns of this population. Squirrel population data will be used in conjunction with vegetation data to generate a predictive model relating the composition and structure of forest growth to the suitability for flying squirrel habitat.

99. Effects of Prescribed Burning on Grassland Avifauna at Riverlands Migratory Bird Sanctuary

Wood, Travis J., Essner, Jr., Richard L., and Minchin, Peter R.; Southern Illinois University Edwardsville, Edwardsville, IL.

North American grassland habitat has nearly disappeared since European settlement, with much of the remaining habitat severely degraded. As suitable habitat has vanished, many native grassland bird species have experienced pronounced population declines. Despite the widespread use of prescribed fire as a management tool to maintain grassland habitat, little is known about the definitive impacts of frequent burning on grassland bird populations. We examined the impact of prescribed fire on the vegetative structure and bird community at Riverlands Migratory Bird Sanctuary in West Alton, Missouri. Bird abundance and habitat characteristics were measured at 105 sampling plots, with 35 plots burned 0-1 year prior to sampling, 35 plots burned 2-4 years prior to sampling, and 35 plots burned ≥5 years prior to sampling. Plots burned 2-4 years prior to sampling exhibited the greatest total species richness. Mean species richness, Shannon's diversity index, and Hill's diversity index did not differ among burn groups. Ten species had significant indicator values for one of three burn groups and seven species had estimated densities that differed based on burn group. Forb coverage, woody vegetation coverage, ground litter coverage, ground litter depth, and distance to the nearest edge differed among burn groups. The presence of woody vegetation was associated with high levels

of structural heterogeneity within those plots burned 2-4 years prior to sampling. These areas supported species associated with both disturbed and undisturbed habitat.

100. Influence of relatedness on cannibalism in successive instars of *Phidippus audax* (Araneae: Salticidae)

Delaney, D. M., Robertson, M. W., and Watson, C.; Millikin University, Decatur, IL.

Kin selection is a common occurrence in nature in cannibalistic organisms that have a high kin encounter rate. The jumping spider *Phidippus audax* (Araneae: Salticidae) has a high localized population density and is widely distributed. We studied the effects of kinship on cannibalism in the second through the seventh instars of this species. There was a differential effect of kinship in various stages of the life cycle that correlated with the spatial distribution model of kin selection. Cannibalism was avoided in the second instar as a product of indirect inclusive fitness; likewise, cannibalism of kin was avoided in the third instar as a product of indirect inclusive fitness.

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Sincerely yours,

Laura Corey,
Vice-President, 2013 Annual Meeting

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