

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

Supplement to Volume 109



**108th Annual Meeting
April 15-16, 2016**

**Southern Illinois University Edwardsville
Edwardsville, Illinois**

Illinois State Academy of Science

Founded 1907

**Affiliated with the Illinois State Museum
Springfield, IL**

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108th ISAS Annual Meeting

April 15-16, 2016

Southern Illinois University Edwardsville

Hosts: Tom Fowler & Bill Retzlaff

MEETING SCHEDULE

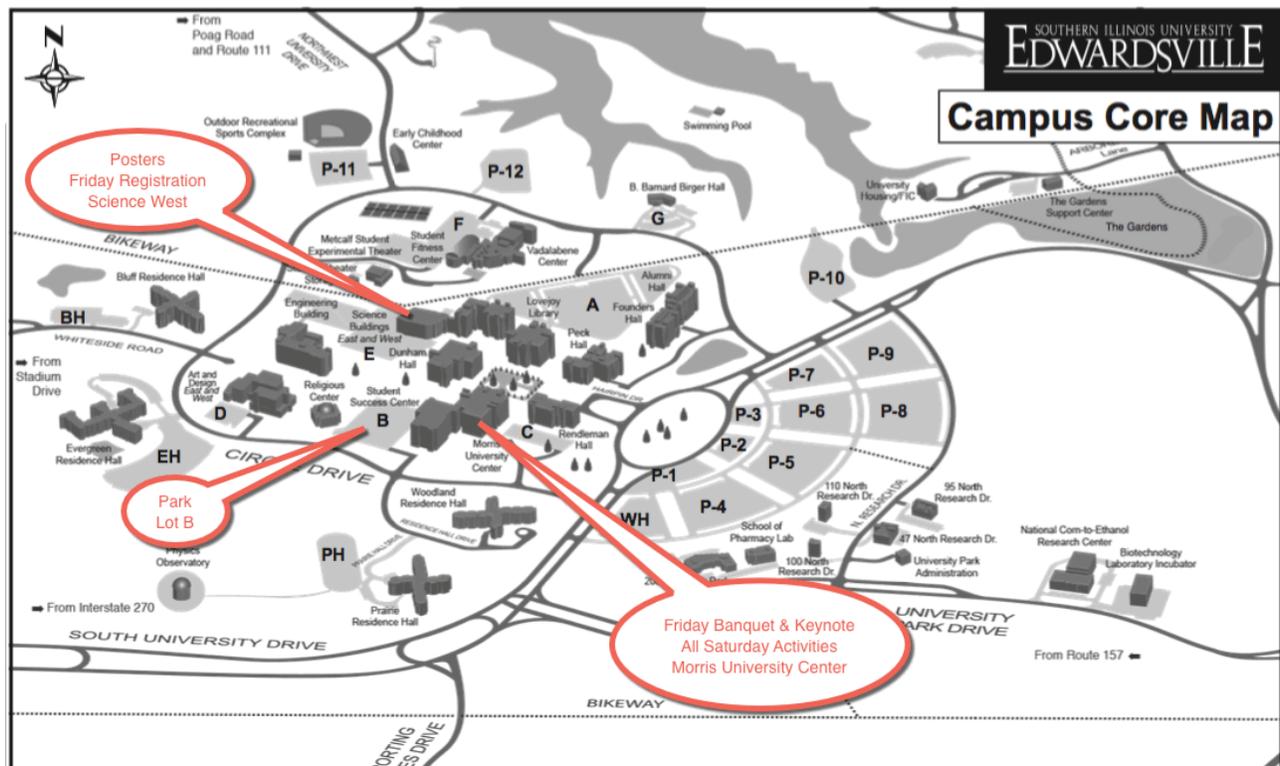
Friday, April 15th

- 12noon – 2pm, ISAS Council Meeting (Science West 2075 Conference Room, lunch provided)
- 1-5:30pm Registration (Science West Lower Level Lounge)
- 1:00-3:00pm Poster setup (Science West: 1st, 2nd, & 3rd floors)
- 3:00-4:15pm Poster Session A (Science West: 1st, 2nd, & 3rd floors)
- 4:15-5:30pm Poster Session B (Science West: 1st, 2nd, & 3rd floors)
- 6:00-7:30pm, Dinner Banquet (Morris University Center, 2nd level Conference Center)
- 7:30-9:00pm, Keynote Address – Captain James Lovell (Morris University Center, Meridian Ballroom)

Saturday, April 16th

- 8:00-9:00am Continental Breakfast (Morris University Center, 2nd level Conference Center atrium)
- 8:00am-12noon Registration (Morris University Center, 2nd level Conference Center)
- 9:00am-12noon Oral Presentations (Morris University Center, 2nd level)
- 12:30-1:30pm Lunch and Awards (Morris University Center, room TBA)

Parking: The SIUe Graduate School has provided free parking for ISAS Annual Meeting participants in Lot B beginning 10:30am on Friday. Metered parking other than Lot B requires payment as directed on the meter. All general parking is free beginning 4:30pm on Friday and all day Saturday. While on campus please drive slowly (10-25 mph limits), watch for and yield to pedestrians, and observe all special parking signs (handicap, university vehicle, loading zones).



POSTER PRESENTATION SCHEDULE – FRIDAY, APRIL 15, 2016

All Poster Presentations in Science Building West

Session A 3:00-4:15pm				Session B 4:15-5:30pm			
1	Environmental Science	59	Cellular Biology	20	Science Education	93	Cellular Biology
2	Environmental Science	60	Cellular Biology	21	Science Education	94	Cellular Biology
3	Environmental Science	61	Cellular Biology	22	Science Education	95	Cellular Biology
4	Environmental Science	62	Cellular Biology	23	Science Education	96	Cellular Biology
5	Environmental Science	63	Cellular Biology	24	Physics & Astronomy	97	Cellular Biology
6	Environmental Science	64	Cellular Biology	25	Physics & Astronomy	98	Cellular Biology
7	Health Sciences	65	Chemistry	26	Physics & Astronomy	99	Cellular Biology
8	Health Sciences	66	Chemistry	27	Physics & Astronomy	100	Cellular Biology
9	Health Sciences	67	Chemistry	28	Health Sciences	101	Cellular Biology
10	Health Sciences	68	Chemistry	29	Health Sciences	102	Cellular Biology
11	Health Sciences	69	Chemistry	30	Health Sciences	121	Zoology
12	Physics & Astronomy	70	Chemistry	31	Health Sciences	122	Zoology
13	Physics & Astronomy	71	Chemistry	32	Environmental Science	123	Zoology
14	Physics & Astronomy	72	Chemistry	33	Environmental Science	124	Zoology
15	Physics & Astronomy	73	Microbiology	34	Environmental Science	125	Zoology
16	Physics & Astronomy	74	Microbiology	35	Environmental Science	126	Zoology
17	Physics & Astronomy	75	Microbiology	36	Environmental Science	127	Zoology
18	Science & Tech Ed	76	Microbiology	38	Botany	128	Zoology
19	Science & Tech Ed	103	Engineering Tech	40	Botany	129	Zoology
37	Botany	104	Engineering Tech	42	Botany	130	Zoology
39	Botany	105	Engineering Tech	44	Botany	131	Zoology
41	Botany	106	Zoology	77	Microbiology	132	Zoology
43	Botany	107	Zoology	78	Microbiology	133	Zoology
45	Cellular Biology	108	Zoology	79	Microbiology	134	Zoology
46	Cellular Biology	109	Zoology	80	Chemistry	135	Zoology
47	Cellular Biology	110	Zoology	81	Chemistry	136	Zoology
48	Cellular Biology	111	Zoology	82	Chemistry	137	Zoology
49	Cellular Biology	112	Zoology	83	Chemistry	138	Health Sciences
50	Cellular Biology	113	Zoology	84	Chemistry		
51	Cellular Biology	114	Zoology	85	Cellular Biology		
52	Cellular Biology	115	Zoology	86	Cellular Biology		
53	Cellular Biology	116	Zoology	87	Cellular Biology		
54	Cellular Biology	117	Zoology	88	Cellular Biology		
55	Cellular Biology	118	Zoology	89	Cellular Biology		
56	Cellular Biology	119	Zoology	90	Cellular Biology		
57	Cellular Biology	120	Zoology	91	Cellular Biology		
58	Cellular Biology			92	Cellular Biology		

ORAL PRESENTATION ROOM SCHEDULE – SATURDAY, APRIL 16, 2016

All Oral Presentations in Morris University Center: Dogwood, Hickory, Maple, Oak, & Redbud Rooms

	Hickory	Dogwood	Oak	Maple	Redbud
9:00am	Zoology			Environmental Science	
9:15am	Zoology	Cellular Biology	Science & Tech Ed	Environmental Science	
9:30am	Zoology	Cellular Biology	Science & Tech Ed	Environmental Science	Botany
9:45am	Zoology	Cellular Biology	Science & Tech Ed	Environmental Science	Botany
10:00am	Coffee Break				
10:15am	Coffee Break				
10:30am	Zoology	Cellular Biology	Science & Tech Ed	Environmental Science	Botany
10:45am	Zoology	Cellular Biology	Health Sciences	Environmental Science	Botany
11:00am	Zoology	Cellular Biology	Microbiology	Engineering Technology	Botany
11:15am	Zoology	Cellular Biology	Microbiology	Engineering Technology	
11:30am	Archeology & Anthropology	Chemistry	Microbiology	Engineering Technology	
11:45am	Division Meetings and Student Award Determinations				

Division Abbreviations

Cellular Biology	Cellular, Molecular, & Developmental Biology
Engineering Tech	Engineering & Technology
Physics & Astronomy	Physics, Astronomy, & Mathematics
Science & Tech Ed	Science, Mathematics, & Technology Education

Participant Abbreviations

Grad	Graduate Student
UG	Undergraduate Student
None	Regular/Faculty Member

School and Organization Abbreviations

Aurora	Aurora University	Museum	Illinois State Museum
Bradley	Bradley University	Northwestern	Northwestern University
EIU	Eastern Illinois University	Pacific Marine	Pacific Marine Mammal Center
Greenville	Greenville College	SIUC	Southern Illinois University Carbondale
IC	Illinois College	SIUe	Southern Illinois University Edwardsville
Knox	Knox College	SIU-Dental	Southern Illinois University School of Dental Medicine
Lindenwood	Lindenwood University-Belleville	Southwestern	Southwestern Illinois College
McKendree	McKendree University	UIC	University of Illinois Chicago
Millikin	Millikin University	WIU	Western Illinois University

POSTER PRESENTATIONS – FRIDAY, APRIL 15, 2016 – SCIENCE WEST

Time	#	Presenter	Title of Presentation (Posters)
Botany			
3:00pm	37	Brooke Bryson (Grad, SIUe)	Growth and Morphological Impacts of Copper Contamination on <i>Acer negundo</i> (Sapindaceae)
4:15pm	38	Jenelle Mathias (Grad, SIUe)	Optimization of Medium Composition for Growth of Axenic <i>Stanleya pinnata</i>
3:00pm	39	Jessica Kerr (UG, Millikin)	Effects of a Living Roof Ecosystem on the Stress and Success of a Variety of Illinois Native Plant Species and Benefits on the Environment
4:15pm	40	Jessica Westerhold (UG, SIUe)	Analysis of the Gravity Persistent Signal 5 (gps5) Mutant in <i>Arabidopsis thaliana</i>
3:00pm	41	Kelly Barry (SIUe)	Establishing Sterile Explants of <i>Trillium viride</i> for Multiplication via Micropropagation
4:15pm	42	Lafisu Lasisi (UG, SIUe)	Does the Invasive Shrub <i>Lonicera maackii</i> (Caprifoliaceae) have a Stratification Requirement?
3:00pm	43	Ummul Vara Qurratul NLN (Grad, SIUe)	Chromosome Number of <i>Euphorbia rosescens</i> (Euphorbiaceae) or Scrub Spurge a Florida State Endangered Species
4:15pm	44	Sarah Simms (UG, Millikin)	The Effect of Various Levels of Herbivory by the Painted Lady Caterpillar (<i>Vanessa cardui</i>) on the Photosynthetic Rate of Soybeans (<i>Glycine max</i>)
Cellular, Molecular, & Developmental Biology			
3:00pm	45	Allison Newton (UG, SIUe)	Analysis of Berberine Family Genes Potentially Involved in Chlorophyll and Carotenoid Synthesis
3:00pm	46	Ammar Al-Furaiji (Grad, WIU)	Effects of Elevated Peroxidase Levels and Corn Earworm Feeding on Gene Expression in Tomato Fruits
3:00pm	47	Brandon McFarlin (UG, Bradley)	Construction and Characterization of q Double Deletion Mutant of <i>Fusarium xerticillioides</i> Lacking Two Putative Trehalose-6-Phosphate Phosphatase Genes
3:00pm	48	Brittany Mersman (UG, SIUe)	Use of RNAi Knockdown of Three Nervous System Genes to Determine Effects on Memory in Planarians
3:00pm	49	Richard L. Essner, Jr. (SIUe)	The Relationship Between Feeding and Jumping of the Northern Leopard Frogs, <i>Lithobates pipiens</i>
3:00pm	50	Daccu Sonubi-ishaq (Grad, WIU)	Effects of Biological Inoculants on the Gene Expression of Maize Roots and Leaves under Heat Stress
3:00pm	51	Daniel Karcher (UG, SIUe)	Lethality or Other Severe Consequences May Accompany Deletion of the <i>Schizophyllum commune</i> G-gamma protein
3:00pm	52	Daniel Webster (UG, EIU)	LEA Proteins Provide Protection to Cells and Enzymes During Water Stress
3:00pm	53	Deanna Musaitif (Grad, Bradley)	Investigating the Underlying Mechanism for a Cold Stress Response in the Zebra Mussel
3:00pm	54	Donald Bath (Grad, WIU)	Comparative Analysis of <i>Helicoverpa zea</i> Gene Expression and Growth Based on Host Plants and Their Tissues
3:00pm	55	Drew Baltzell (Grad, EIU)	Acute Effects of Estrogen Receptors Using Specific Agonists on Neuronal Regeneration in the Primary Olfactory Pathway of Ovariectomized Mice
3:00pm	56	Elizabeth Smits (UG, Bradley)	Antibiotic Resistant <i>Acinetobacter</i> Harbored in the Intestines of Asian Carp
3:00pm	57	Emily Ehrhardt (UG, SIUe)	Analysis of Circumnutation in Gravitropism Mutants of <i>Arabidopsis thaliana</i>

Time	#	Presenter	Title of Presentation (Posters)
3:00pm	58	Ivan Ayala (Grad, SIUe)	The NuA4 Histone Acetyltransferase Complex Affects Epigenetic Regulation of Regeneration in <i>Schmidtea mediterranea</i>
3:00pm	59	Jeffrey Iverson (UG, SIUe)	Construction, Purification and Characterization of Blue and Cyan Fluorescent Protein-Fused Ca ²⁺ Sensing Protein Calmodulin
3:00pm	60	Jhunnelle Walters (UG, SIUe)	The Impact of Abscisic Acid on the Variegation Patterns of the <i>Arabidopsis thaliana</i> ggps1 Mutant
3:00pm	61	Jill La Rue (Grad, SIUe)	Bioinformatic and Knockout Analysis of Two Dicer Genes in <i>Schizophyllum commune</i>
3:00pm	62	Jordan Bolletta (UG, SIUe)	Transformation Rescue of the gps5 Mutant in <i>Arabidopsis</i>
3:00pm	63	Kevin Krajniak (SIUe)	The Effects of NFVRFamide on the Crop-Gizzard of Earthworm, <i>Lumbricus terrestris</i>
3:00pm	64	Kyle Lincoln (UG, SIUe)	Bioinformatic Analysis and Knockout Targeting of a Methyltransferase Gene in <i>Schizophyllum commune</i>
4:15pm	85	Kyle Schafer (UG, SIUe)	The Conformational Changes of the 3rd and 4th EF-Hands of Calmodulin are Important for the Recognition of Fas-Associated Death Domain
4:15pm	86	Leah Welker (Grad, EIU)	Metabolic and Morphologic Shifts in Neuro2a Cells Cultured in Galactose-Based Medium
4:15pm	87	Luke Brown, (UG, SIUe)	Rescue of the <i>Arabidopsis</i> ggps1-1 Mutant with Meristem-Specific Promoters
4:15pm	88	Melinda Schnietz (UG, SIUe)	The Effects of GFMRFamide on the Crop and Gizzard of <i>Lumbricus terrestris</i>
4:15pm	89	Nicholas Horn (Grad, SIUe)	Evaluating the Effects of Silver Nanoparticles on Planarians
4:15pm	90	¹ Nicole Oberlie (UG, Bradley)	Exploring the Role of Trehalose Metabolism in Resistance to Oxidative and Desiccation Stress in <i>Fusarium verticillioides</i>
4:15pm	91	Noor Sairafi (Grad, WIU)	Gene Expression of Bacteria-Inoculated Soybean <i>Glycine max</i> in Response to Heat Stress
4:15pm	92	Peyton Crowe (UG, SIUe)	Characterization of Smed-htt, the Planarian Homolog of the Human Huntington's Disease Gene
4:15pm	93	Rachel Rodgers (Grad, SIUe)	Phylogenomic Analysis of 16 <i>Fundulus</i> Species Using RNA-seq Data
4:15pm	94	Robb D. VanPutte (McKendree)	Algae as a Source of Renewable Energy
4:15pm	95	Ruchi Ojha (Grad, WIU)	Growth Profile and Gene Expression of <i>Helicoverpa zea</i> Infected by <i>Bacillus thuringiensis</i> Krustaki and Israelensis
4:15pm	96	Samuel Keck-Flory (Grad, SIUe)	Enzymatic Activity of GGPS-1
4:15pm	97	Shannon Henry (UG, Knox)	Effects of Alcohol on Macrophage Morphology
4:15pm	98	Shannon Payne (UG, SIU-Dental)	Active TGF-β1 Signaling in Salivary Gland Cells
4:15pm	99	Simeon Ogundiran (Grad, WIU)	Gene Expression of Soybean (<i>Glycine max</i>) in Response to <i>Trichoderma</i> and <i>Rhizobium</i> Inoculants Under Heat Stress Condition
4:15pm	100	Spencer Jaquet (UG, Greenville)	Examining the Neurodegenerative Effects of Ozone Using <i>C. elegans</i>
4:15pm	101	Toria Trost (UG, SIUe)	Characterization of the Planarian SWI/SNF-Related Chromatin Remodeling Complexes

Time	#	Presenter	Title of Presentation (Posters)
4:15pm	102	William Schryver (UG, SIUe)	RNA-seq Analysis of the Variegated Phenotype of the <i>Arabidopsis thaliana</i> ggps1 Mutant
Chemistry			
3:00pm	65	Bethany Esterlen (UG, WIU)	Forensic Analysis of Lipstick Samples by Three Different Analytical Techniques
3:00pm	66	Dallas Wright (Grad, SIUe)	Synthesis of Potential In Vivo Activity-Based Probes for Dimethylarginine Dimethylaminohydrolase-1 Based on Halopyridine Substitutes
3:00pm	67	Dillon Huff (Grad, WIU)	Trace Detection of Isoeugenol in Local Water Samples via GC Analysis
3:00pm	68	Elizabeth Honeycutt (UG, Greenville)	Numerical Analysis of the Molecular Weight Distributions of Polymers in a Free-Radical Addition Polymerization System
3:00pm	69	Erik Sarnello (Grad, WIU)	Optical Microscopy of Solid State Materials
3:00pm	70	Hannah Drake (UG, WIU)	Synthesis and Single Crystal Structure of $(OC)_5W(Ph_2CH_2CH_2PPh_2)W(CO)_5$
3:00pm	71	Mattea Scanla (UG, WIU)	Synthesis of Iron-Copper-Chalcogenidostannates
3:00pm	72	Philip Alabi (Grad, SIUe)	Epimerization and Substitution of Ugi-Smiles Diels-Alder Products
4:15pm	80	Rebecca Corbett (Grad, WIU)	Exploratory Chemistry of Selenostannates
4:15pm	81	Robert Ayres (Grad, SIUe)	Analysis of Imine-Based Ugi-Smiles Reactions
4:15pm	82	Samson Adeleke (Grad, WIU)	Development of a Green Chemistry Laboratory Experiment for Undergraduate Curriculum
4:15pm	83	Shashidhar Poreddy (Grad, WIU)	Oxidative Transformations of β -Dicarbonyl Compounds using Hypervalent Iodine Reagents
4:15pm	84	Shelby Crawford (Grad, WIU)	Analytical Detection of Atrazine: Method Development and Implementation
Engineering & Technology			
3:00pm	103	WITHDRAWN	
3:00pm	104	Kyle DeProw (UG, SIUe)	Force-Feedback Incorporation into a Teleoperative Glove
3:00pm	105	Robbie Carter (UG, SIUe)	Job Shop Scheduling Research
Environmental Science			
3:00pm	1	Amanda Henderson (UG, SIUe)	Evaluation of Irrigation Methods on <i>Sedum</i> spp. in Established Midwestern Green Roofs
3:00pm	2	Ashley Keely (Grad, SIUe)	Effects of Pyrethroid Insecticides on Tight Junctions Using an In Vitro Blood-Brain Barrier Model
3:00pm	3	Blaine Johnson (UG, SIUe)	Fitness Disadvantage of the DDT Resistant 91-R Strain of <i>Drosophila melanogaster</i>
3:00pm	4	Caleb Mau (UG, SIUe)	Thermal Benefits of Different Weeding Methods of Green Roof Systems
3:00pm	5	Joy Hodge (Grad, SIUe)	Long-Term Success of Sedums on a Midwestern Green Roof
3:00pm	6	Kimberly Shoemaker (Grad, SIUe)	Bioaccumulation of Mercury and Selenium in Fish in the Lower Illinois River
4:15pm	32	Lalita Mazgaeeen (Grad, SIUe)	Differential RNAi Approaches to Enhance Knockdown Efficiency of Target Gene Transcripts in the Highly DDT-Resistant 91-R Strain of <i>Drosophila melanogaster</i>
4:15pm	33	M. Yusuf Ali (Grad, SIUe)	Molecular and Biochemical Characterization of the Wild-Type <i>Drosophila melanogaster</i> that Produces Enhanced Levels of ROS After Exposures to Sub-Lethal Amounts of Ivermectin

Time	#	Presenter	Title of Presentation (Posters)
4:15pm	34	Mackenzie Peck (UG, Millikin)	The Effect of Water Acidification on the Growth, Development and Immune Defense of Cuban Tree Frogs, <i>Osteopilus septentrionalis</i> , in the Presence of a Pathogen
4:15pm	35	Rebecca Ngo (UG, SIUe)	Study of Interaction between Neutral Coomassie Brilliant Blue Species and Bovine Serum Albumin
4:15pm	36	Vineet Garlapally (Grad, SIUe)	Studying the Endocrine Disruption Activity of Environmentally Relevant ZnO Nanoparticles on <i>Xenopus laevis</i> Tadpoles
Health Sciences			
3:00pm	7	Branden Bennet (Grad, SIUe)	Characterization of Brux-Like Motor Patterns: Simultaneous Electromyography and Sonomicrometry
3:00pm	8	Callie Mincy (UG, SIUe)	Effects of Cancerous Matrix on Normal Salivary Gland Cells
3:00pm	9	Dan Welch (SIU-Dental)	A Resin Coating Protects Resin Modified Glass Ionomer (RMGI) from Moisture and Temperature Induced Damage
3:00pm	10	Dennis Kitz (SIUe)	Mouse Immune Response Can Be Stimulated by Cubicin
3:00pm	11	Juliana Phillips (UG, Greenville)	Effect of Kava (Kavalactones) on Presynaptic and Postsynaptic Cholinergic Neurotransmission In <i>C. elegans</i>
4:15pm	28	Dennis Kitz (SIUe)	Mouse Immune Response Can Be Stimulated by Antibacterial Antibiotics
4:15pm	29	Kathryn Carter (Grad, SIUe)	Osteopontin (OPN) Enhances Migration in Human Salivary Gland (SG) Cancer
4:15pm	30	Kellie Steele (UG, Greenville)	Modulation of GABAergic Neurotransmission by Kavalactones in <i>C. elegans</i>
4:15pm	31	Lainie Barron (Grad, SIUe)	The Effect of Parent Education Levels on Parenting Styles and Cultural Values
4:15pm	138	Jacob Krisher (Grad, SIUe)	Cell-Matrix Interaction: Activation of MAP kinase Signaling Pathway in Salivary Gland Cells
Microbiology			
3:00pm	73	Adeyemi Olanrewaju (Grad, WIU)	Detection of Thermophilic Fungi In Corn-Based Food Products and Corn Fields and Their Potential Role in Mycotoxin Production
3:00pm	74	Andrew Wall (UG, Lindenwood)	Isolation of Human Oral and Intestinal Bacteria and In Vitro Growth with Roundup™ Added to Nutrient Media
3:00pm	75	Eliese Potocek (UG, WIU)	Bacterial Diversity Associated with Novel Mucoromycotina Species
3:00pm	76	Kennen Hutchison (UG, WIU)	Mosquito Mayhem: Are Illinois <i>Aedes</i> Mosquitoes Ready for <i>Chikungunya</i> Virus?
4:15pm	77	Riley Schmid (UG, EIU)	Commensal or Pathogen? <i>Escherichia coli</i> Diversity in a Rural Creek in Illinois
4:15pm	78	Ryan Momenteller (UG, SIUe)	Construction of a Timeline for Morphogenesis and Sporulation in <i>Schizophyllum umbrinum</i>
4:15pm	79	Scott Holt (UG, WIU)	Enhanced Electrotransformation of <i>Leuconostoc citreum</i>
Physics, Astronomy, & Mathematics			
3:00pm	12	Braxton Kilmer (Grad, SIUe)	The Effects of Doped Nanoparticles on Nematic Liquid Crystal with Negative Dielectric Anisotropy
3:00pm	13	Dongxue Zhao (Greenville)	Lithium Diffusion in TiO ₂ Nano Particles
3:00pm	14	Jordan Disch (UG, Greenville)	An Experimental Study of Quantum Eraser
3:00pm	15	Joseph Smith (UG, SIUe)	A Linear and Non-linear Optical Characterization of Europium Doped Phosphate Glass

Time	#	Presenter	Title of Presentation (Posters)
3:00pm	16	Justin Deterding (UG, SIUe)	Measurement of the Two-Photon Absorption Coefficient and Nonlinear Index of Refraction in Si-Photodetector Using an Electrically Focused- Tunable Lens at 1.5 μ m
3:00pm	17	Kasey Barrington (UG, SIUe)	Ultraintense Laser-Cluster Interactions: Effects of the Cluster Shape
4:15pm	24	Philip Chrostoski (UG, SIUe)	The Study of Thermal Lensing, Photochemical Reaction, and Soret Effect in Castor Oil Using Collinear Pump-Probe Technique
4:15pm	25	Shuto Osawa (UG, Greenville)	Experimental Production of Two Entangled Photons Using Spontaneous Parametric Down Conversion Type-II and Evaluation of a Quantum System
4:15pm	26	Tyler Kelso (UG, SIUe)	Interferometric Autocorrelation of Ultrafast Light Pulses Using an Electrically Focus Tunable Lens
4:15pm	27	Xiaotong Zheng (UG, Greenville)	Memristor
Science, Mathematics, & Technology Education			
3:00pm	18	Elaine AbuSharbain (SIUe)	Teachers Misconceptions about Climate Change Knowledge
3:00pm	19	Mallory Maves (Grad, SIUe)	Recruiting East St. Louis: Strategies for STEM Student Program Retention In an At-Risk Community
4:15pm	20	Brooke Kottkamp (UG, SIUe)	Assessment of Climate Change Misconceptions along with Teaching Practices and Student Responses which Aid in Climate Change Education
4:15pm	21	Kelly Cusack (UG, SIUe)	The Effects of the Container, Aeration and Inoculation Optimization of <i>Chlamydomonas reinhardtii</i> Culturing for Use in Biodiesel Research in Introductory Biology Research Laboratories
4:15pm	22	Mallory Maves (Grad, SIUe)	Coding for Community
4:15pm	23	Sudhamadhuri Arvapally (Grad, SIUe)	Developing Coding Tutorials for Educators and Middle School Students
Zoology			
3:00pm	106	Alexa Kinney (UG, SIUe)	Morphology of Canid and Felid Scapula Form
3:00pm	107	Alexander Smith (UG, SIUe)	Food Limitation as a Hypothesis Explaining Stream Gradients in Morphology in a Freshwater Snail
3:00pm	108	Alexis King (Grad, SIUe)	Population Demography and Movement Patterns of the Illinois Chorus Frog, <i>Pseudacris illinoensis</i> , in Southwestern Illinois
3:00pm	109	Alexis Ronan (UG, SIUe)	The Effect of Elevated and Variable Winter Temperatures on Metabolic Rate, Body Mass and Water Content of the Goldenrod Gall Fly, <i>Eurosta solidaginis</i>
3:00pm	110	Amanda Brink (UG, SIUe)	Comparative Pituitary Growth Hormone Immunostaining in <i>Anolis</i> Lizard Species (Sauria: Iguanidae) that Vary in Body Size
3:00pm	111	Ann Fritz (EIU)	Fire Ants Fly High for Love
3:00pm	112	Ashley Hackl (UG, Millikin)	Habituation and Dishabituation to a Heat Stimulus by Woodlice, <i>Armadillidium vulgare</i> (Isopoda: Armadillidiidae)
3:00pm	113	Benjamin Wedeking (UG, SIUe)	Skeletal Correlates of Stream Gradient Morphological Variation in Largescale Stonerollers (<i>Campostoma oligolepis</i>) (Cypriniformes: Cyprinidae)
3:00pm	114	Breanna Olliges (UG, SIUe)	Predator Induced Differences in Tail Morphology and Muscle Fiber Composition in Gray Treefrogs (Anura: <i>Hyla chrysoscelis</i> and <i>H. versicolor</i>)
3:00pm	115	Cara Kuehl (UG, Millikin)	Habituation of the Goldfish <i>Carassius auratus</i> (Cypriniformes: Cyprinidae) to White Noise
3:00pm	116	Christine Olson (UG, SIUe)	Investigating the Use of 3D Technology to Create a Taxon that Does Not Exist: Generating Morphological Variation in the Pleuroceridae

Time	#	Presenter	Title of Presentation (Posters)
3:00pm	117	Courtney Brewer (UG, SIUe)	Cranial Morphology Distinguishing Two Closely Related Canidae Species
3:00pm	118	Daniel Miller (UG, SIUe)	Sexual Dimorphism in Gray Wolf (<i>Canis lupus</i>) Mandible Form
3:00pm	119	Daniel Sinclair (UG, Millikin)	Development, Growth, and Survival of a Web-Building Funnel Web Spider When Scavenging
3:00pm	120	Drew Merideth (UG, SIUe)	Detecting Incremental Growth Markers in the Shells of Lotic Snails
4:15pm	121	Dustin Smith (UG, Southwestern)	Inheritance of Pigmentation in <i>Physa</i> sp. (Gastropoda) from Camp Vandeventer Spring, Monroe County, Illinois
4:15pm	122	Haley Kutosky (UG, SIUe)	Using 3D Printed Models to Evaluate the Effect of Spines on Hydrodynamic Performance of Snail Shells
4:15pm	123	Jessica Brinegar (UG, Millikin)	Effect of Green Fluorescent Body Coloration on Shoaling Behavior of Zebrafish, <i>Danio rerio</i> (Cypriniformes: Cyprinidae)
4:15pm	124	Kelsey Going (UG, Millikin)	Innate Immune and Antioxidant Costs of Low Temperatures in Native <i>Hyla cinerea</i> and Invasive Tropical <i>Osteopilus septentrionalis</i>
4:15pm	125	Lisa Hebenstreit (Grad, SIUe)	Amphibian Diversity and Abundance in Old Artificial Ponds on the SIUE Campus
4:15pm	126	Lucas Meyer (UG, SIUe)	Relationships between Shell and Soft Body Characters in Two Syntopic Snails
4:15pm	127	Maya Habibi (UG, SIUe)	Comparing Laser Scanning to Photogrammetry for Capturing 3D Surface of Snail Shells
4:15pm	128	Miles Herr (UG, SIUe)	Gradient in Shell Density in a Riverine Snail, <i>Elimia potosiensis</i>
4:15pm	129	Morgan Kincheloe (UG, Millikin)	A Comparison of Admission and Post-Rehabilitation Hematological Metrics for Six Species of Raptors at the Illinois Raptor Center
4:15pm	130	Nicole Brueggemann (UG, SIUe)	The Effect of Cholesterol and Tocopherol Supplementation on Rapid Cold Hardening and Low Temperature Tolerance
4:15pm	131	Nicole Koch (UG, Millikin)	The Effects of Tail Damage on Tadpole Development and Leaping and Swimming Abilities In Cuban Tree Frogs (<i>Osteopilus septentrionalis</i>) after Metamorphosis
4:15pm	132	Parminder Singh (UG, SIUe)	Relationship Between Growth Hormone Receptors and the Body Size Differences in <i>Anolis</i> Lizards (Sauria: Iguanidae)
4:15pm	133	Shelby Chesko (UG, SIUe)	Quantification of Lead in Central Illinois Birds of Prey
4:15pm	134	Taylor Inboden (Grad, EIU)	Male Genitalia Morphology and the Role it Plays in Sperm Transfer in <i>Anastrepha auspensa</i> (Diptera: Tephritidae)
4:15pm	135	Tyler McGowan (UG, SIUe)	Karyotype of Topminnows in the <i>Fundulus notatus</i> Species Complex
4:15pm	136	Victoria Goodwin (Grad, SIUe)	Experimental Inhibition of Corticosterone in Gray Treefrog Tadpoles (Anura: <i>Hyla chrysoscelis</i> and <i>H. versicolor</i>)
4:15pm	137	Zack Ladson (UG, SIUe)	Swimming Kinematics in Gray Treefrog Tadpoles (Anura: <i>Hyla chrysoscelis</i> and <i>H. versicolor</i>) with Predator-Induced Tail Morphology

ORAL PRESENTATIONS – SATURDAY, APRIL 16, 2016 – MORRIS UNIVERSITY CENTER

Time	Room	Presenter	Title of Presentation
<i>Anthropology & Archeology</i>			
11:30am	Hickory	Dennis Lawler (Museum)	Implications of Shoulder Pathology in Aged Grey Wolves
<i>Botany</i>			
9:30am	Redbud	Amanda Wood (UG, IC)	Collection, Transport, and Isolation of Orchid Mycorrhizal Fungi from Afar: Techniques Aimed at Effective Recovery of Viable Pelotons from Roots of Epiphytes, Terrestrials and Lithophytes in Remote Areas
9:45am	Redbud	Hana Thixton (Grad, SIUe)	Genetic Diversity of Northern and Southern Orchid Mycorrhizae Found in the Federally Threatened Eastern Prairie Fringed Orchid (<i>Platanthera leucophaea</i>)
10:30am	Redbud	Jessa Finch (Grad, Northwestern)	City Living: The Potential of Urban Milkweed Ecotypes for Monarch Conservation
10:45am	Redbud	WITHDRAWN	
11:00am	Redbud	Justin Mably (UG, IC)	Ghost Orchid (<i>Dendrophylax lindenii</i>) Habitats in Florida and Cuba: Differences and Similarities
<i>Cellular, Molecular, & Developmental Biology</i>			
9:15am	Dogwood	Donald Bath (Grad, WIU)	Comparative Analysis of <i>Helicoverpa zea</i> Gene Expression and Growth on the Host Plant
9:30am	Dogwood	Eliana Toren (UG, Bradley)	Differentiation of Human Adipose Mesenchymal Stem Cells into Parathyroid Hormone Synthesizing Cells
9:45am	Dogwood	Kayleigh Diveley (Grad, WIU)	Gene Expression Observed from the Interaction between Corn Earworm (<i>Helicoverpa zea</i>) Caterpillars and Corn (<i>Zea mays</i>) Tissues
10:30am	Dogwood	Kaysaw Tuy (UG, Bradley)	Enhancing Human Umbilical Cord Wharton's Jelly Mesenchymal Stem Cell Chemotaxis towards Ovarian Cancer as a Putative Cell-Based Therapy
10:45am	Dogwood	Luke Revelt (UG, SIUe)	Analysis of the Geranyl Geranyl Diphosphate Synthase Family in <i>Arabidopsis thaliana</i>
11:00am	Dogwood	Nikolaos T. Polizos (UG, Knox)	The Effects of Nicotine on the Development of Monoaminergic Neurons in <i>Danio rerio</i>
11:15am	Dogwood	Thomas Teague (UG, SIUe)	Have We Seen Enough? Quantifying the Extent of Behavior Displayed by Serine Proteases in a Molecular Dynamic Simulation
<i>Chemistry</i>			
11:30am	Dogwood	Abbie Fox (UG, SIUe)	Qualitative Rate Study of Variations on the Ugi-Smiles Reaction
<i>Engineering & Technology</i>			
11:00am	Maple	WITHDRAWN	
11:15am	Maple	Kenneth Blank (Grad, UIC)	Biomechanical Assessment of a Mobile Axis of Rotation Cervical Disc
11:30am	Maple	WITHDRAWN	
<i>Environmental Science</i>			
9:00am	Maple	Allyssa Decker (Grad, SIUe)	Evaluating Native Plant Survival on a Mid-Western Green Roof
9:15am	Maple	Chris Theodorakis (SIUe)	Effect of Anthropogenic Contamination on Genetic Diversity in Mediterranean Mussels from the Strait of Istanbul
9:30am	Maple	Hannah Fyfe (Grad, SIUe)	Examining Metropolitan Communities to Assess Disparities in Air Pollution and Asthma Using Spatial and Statistical Analyses

Time	Room	Presenter	Title of Presentation
9:45am	Maple	Jun Wang (Grad, SIUe)	Microbial Transformation and Volatilization of Elemental Selenium Nanoparticles
10:30am	Maple	Kayla Tatum (UG, SIUe)	Weeding Maintenance of Green Roof Systems
10:45am	Maple	Ranjitha Uppala (Grad, SIUe)	Effects of Chemical Speciation on Selenium Accumulation in Fungal Mycelia
Health Sciences			
10:45am	Oak	Dennis Lawler (Pacific Marine)	Antimicrobial-Resistant <i>Klebsiella</i> : 11-yr Survey of Pinnipeds
Microbiology			
11:00am	Oak	Cedric Ndinga Muniania (Grad, WIU)	Seasonal Variation of Dark Septate Fungi in an Arid Grassland and their Potential Role on Plant Growth
11:15am	Oak	Lisa Adden (Grad, SIUe)	Characterization of Molecular Mechanisms of Silver Nanoparticle Toxicity in <i>Escherichia coli</i> (<i>E. coli</i>)
11:30am	Oak	Terry Torres Cruz (Grad, WIU)	Novel Early Lineage in the <i>Mucoromycotina</i>
Science, Mathematics, & Technology Education			
9:15am	Oak	K. Charles Knoth (Grad, SIUe)	Analysis of a Pilot Phase CURE Implementation in an Introductory Biology Course for Science Majors
9:30am	Oak	Anna Valeva (WIU)	Teaching Undergraduate Statistics: What is a p-Value Truly Worth?
9:45am	Oak	Brenna McIlvoy (UG, SIUe)	Developing a More Engaging and Safer Demonstration Apparatus for Combustible Dust Explosions
10:30am	Oak	Johnny Lloyd (Aurora)	Discovering A.P.E. and the Selection of a Health Profession
Zoology			
9:00am	Hickory	Aubree Dahler (Grad, SIUe)	Comparative Functional Osteological Morphology of the Forelimb in Mustelidae
9:15am	Hickory	Benjamin Jellen (McKendree)	Spatial Ecology of Northern Copperheads (<i>Agkistrodon contortrix</i>) in St. Clair and Monroe Counties, Illinois
9:30am	Hickory	Christopher Huff (Grad, SIUe)	The Effect of Hunter-Derived Offal Piles on Local Scavengers
9:45am	Hickory	Jennifer Jost (Bradley)	AMPK Activity Increases in Response to Acute Cold Stress in the Zebra Mussel
10:30am	Hickory	Maximillian A. Dorsey (UG, Knox)	Effect of Habitat Fragmentation on Mantled Howler Monkey (<i>Alouatta palliata</i>) Behavior and Diet, in the Occidental Central Plateau of Costa Rica
10:45am	Hickory	Sally Ayoob (Grad, SIUe)	Comparative Morphology of the Mandible within Canidae
11:00am	Hickory	Sarah Giacomini (Grad, SIUe)	Comparative Mandibular Morphology in Cervidae
11:15am	Hickory	Travis Wilcoxon (Millikin)	Antibodies against Avian Pox and <i>Mycoplasma gallisepticum</i> in Birds of Prey in Central Illinois

KEYNOTE ADDRESS – CAPTAIN JAMES LOVELL

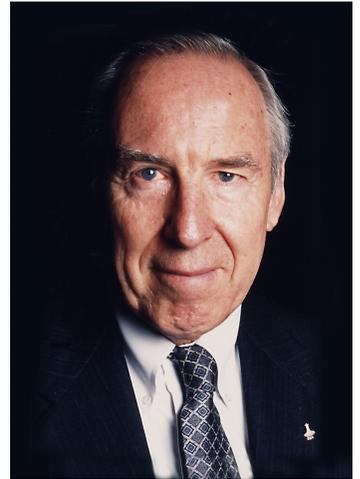
(Friday, April 15th at 7:30pm, Meridian Ballroom, Morris University Center)

Apollo 13: A Successful Failure

A great American hero, astronaut Capt. Jim Lovell is most famous for his role in the American space age, specifically for his calm and careful command of Apollo 13. Lovell stoically articulated the five-word message, “Houston, we have a problem,” which quickly became a part of the American lexicon. The infamous problem was the explosion of the oxygen system inside the Apollo 13 spacecraft—a malfunction that seemingly doomed the NASA team. Through teamwork and decisive leadership, Lovell and his crew modified the lunar module into an effective lifeboat to safely return to Earth. As captain, he was instantly transformed into a national hero, and received the nation’s most distinguished honors including the Congressional Space Medal of Honor and the Presidential Medal of Freedom.

Lovell’s inspirational story is a testament to the essential elements of heroism: a courageous spirit, quick and well-reasoned thinking, and meticulous attention to every detail. An unforgettable motivational speaker with an unforgettable story, Lovell inspires his audiences with his valiant and courageous journey.

Presented in conjunction with the SIUE Department of Physics’ Shaw Lecture Series and Arts & Issues with additional sponsorship by the SIUE Graduate School and the Madison County Regional Office of Education.



POSTER PRESENTATION ABSTRACTS

3:00-4:15pm or 4:15-5:30pm, Friday, April 15, 2016, in Science West (1st, 2nd, 3rd floors)

*presenter, [school] with differences noted by superscript, UG = undergraduate, Grad = graduate student, others are faculty/regular

BOTANY

- 37 3:00pm Grad Growth and Morphological Impacts of Copper Contamination on *Acer negundo* (Sapindaceae)**
 *Brooke Bryson, Kurt Schulz [Southern Illinois University Edwardsville]
 Heavy metals are released into the environment by natural processes, such as erosion or volcanic eruption, and also by human activities. Heavy metals can be measured in the soil and plant tissue, but in the absence of stunting or death, it is not immediately clear if the contaminant load affects organisms' development and metabolism. Fluctuating asymmetry, which consists of random deviations of morphological traits from perfect bilateral or radial symmetry in living organisms, has been used to screen for sublethal impacts of contaminants. The aim of my study is to determine if boxelder (*Acer negundo*), a ubiquitous and adaptable tree in southeastern North America, exhibits fluctuating asymmetry in response to Cu⁺⁺ contamination. Seedlings were allowed to grow outdoors for approximately 4 weeks before being dosed with CuSO₄ (0, 5, 10, and 5/15 ppm) every 3 days for 56 days. Preliminary statistical analysis of leaves formed during treatment indicates no statistically significant response to Cu treatment, although some suggestive patterns were present. Leaf, root, and stem tissue will be harvested to evaluate tissue copper concentrations across the treatments. This study will contribute to a better understanding of the use of fluctuating asymmetry as a bio-indicator of heavy metal contamination among ecosystems surrounding copper smelting sites in the upper Midwest, Europe, and Asia.
- 38 4:15pm Grad Optimization of Medium Composition for Growth of Axenic *Stanleya pinnata***
 *Jenelle Mathias, Kelly Barry [Southern Illinois University Edwardsville]
 Phytoremediation is a mechanism that uses plants to rehabilitate soil contaminated with substances such as the micronutrient selenium (Se). To reduce excess Se from the soil, Se can be volatilized by plants during phytoremediation or stored in the plants' shoots. A potential phytoremediation candidate, *Stanleya pinnata* is classified as a primary Se hyperaccumulator. However, the Se uptake properties of *S. pinnata* grown axenically, or without microbes, has not been extensively studied. Axenic *S. pinnata*'s uptake of Se could serve as a control to better recognize the interactions between plant and microbial symbionts, as well as aid in discovering the maximum tolerance level of Se in plants lacking microbial symbionts. It could also provide a framework for applications of other hyperaccumulators to be used for phytoremediation. In this study, axenic *S. pinnata* will be grown using ½ MS. Growing conditions will be optimized through examination of pH, gibberellic acid (GA), and selenium type and amount. This project will provide information on optimization of a reproducible synthetic media for germination and early plant development of axenic *S. pinnata*.
- 39 3:00pm UG Effects of a Living Roof Ecosystem on the Stress and Success of a Variety of Illinois Native Plant Species and Benefits on the Environment**
 *Jessica Kerr, Judith Parrish [Millikin University]
 We constructed rooftop boxes of two depths of rooflite™ soil, 10-12 and 18-20 cm, to examine the responses of four native prairie species (*Rudbeckia hirta*, *Echinacea purpurea*, *Sporobolus aspera*, and *Bouteloua gracilis*) and two garden produce species, cherry tomatoes and bush beans (*Solanum lycopersicum* and *Phaseolus vulgaris*) over two years. We measured anthocyanin and chlorophyll content and photosynthetic rates of the prairie species. In the produce species, we measured anthocyanin content, yield, and biomass. We analyzed data using SPSS with multiple one-way ANOVAs over two time points. In year one, anthocyanin content was significantly higher in shallow boxes for the prairie species, yet there was no significant effect in year two. There was a significant effect of box depth on photosynthetic rates in year two, but not in year one. Both native grasses had increased chlorophyll content, though there was no significant effect for either box depth or species in either year. There was an effect of soil depth on anthocyanin content of tomatoes during the first year, but bush beans had significantly lower anthocyanin content and higher yield in deeper soil. During the second year, there was also a higher yield of tomato produce in the deep soil media. Biomass for the tomato and bush bean plants were significantly higher in deeper soil for both years.

Thus far, our hypothesis of reduced stress in deeper soil is supported by reduced anthocyanin content for *R. hirta*, *E. purpurea*, and bush beans, and biomass data for both produce vegetables. Winter survivorship and a second growing season's data of stress analysis, with a greater rate of survival in the deeper boxes for *R. hirta* and *E. purpurea*, suggest that we could construct a successful roof environment using the shallower depth, resulting in lower weight loads and reduced cost for the rooftop mix soil.

40 4:15pm UG

Analysis of the Gravity Persistent Signal 5 (gps5) Mutant in *Arabidopsis thaliana*

*Jessica Westerhold, Michael Vierling, Elisa Morales, Jared Ross, Darron Luesse [Southern Illinois University Edwardsville]

Gravity plays a critical role in plant growth and development, providing information for the direction of root and shoot growth, as well as the positioning of leaves. After a re-orientation with respect to gravity, plants will initiate the process of gravitropism by establishing asymmetric concentrations of the hormone auxin across roots and shoots, leading to a new direction of growth. The result is curvature of the root and stem to reflect the plant's new position. However, when plants are given a 90 degree reorientation at 4°C, they do not initiate gravitropism. Once returned to room temperature in the vertical position, plants will bend as if they were on their side. This is known as the Gravity Persistent Signal (GPS) response. Under these conditions, the the inflorescence stem of the *gps5* mutant shows a hypergravitropic response, bending faster and further than wild-type plants. Deep sequencing of *gps5* found 5 candidate mutations that could be causing this unusual response. T-DNA insertion mutants were obtained for each of the candidate mutations. Currently we are confirming homozygosity in each of the candidate lines. GPS and room temperature gravitropism are being compared in these lines to determine if any show an enhanced response. We have also initiated work for transformation rescue of *gps5* using these five genes.

41 3:00pm

Establishing Sterile Explants of *Trillium viride* for Multiplication via Micropropagation

*Kelly Barry [Southern Illinois University Edwardsville]

Trillium viride, or green trillium, is a slow growing spring ephemeral mostly restricted to the rocky regions of the Mississippi bluffs. It is restricted to Missouri, New York, endangered in Illinois, and extirpated in Michigan. Green trillium grows slowly from a deep rhizome and is only visible above ground for less than two months in the spring. In 2015, ten rhizomes were collected from a Missouri location. The rhizomes were trimmed, washed, and treated with sodium hypochlorate for surface sterilization. Rhizomes were cut into cylindrical sections of approximately one centimeter and placed individually under 18 hours light conditions at room temperature. Rhizomes were transferred to fresh media every 4-8 weeks. Two apical meristems are now growing vigorously and two additional meristems are developing.

42 4:15pm UG

Does the Invasive Shrub *Lonicera maackii* (Caprifoliaceae) have a Stratification Requirement?

*Lafisu Lasisi, Rebecca Ngo, Kurt Schulz [Southern Illinois University Edwardsville]

Amur honeysuckle (*Lonicera maackii*) is a ubiquitous forest invader throughout much of the northeastern U.S. It relies on seed dispersal by frugivorous birds for establishment. It is especially abundant in damaged or early successional forests, which feature thinner litter layers, higher understory light intensity, and probably higher bird traffic. Seed germination characteristics of Amur honeysuckle are an essential element in its establishment, but these have received little research attention. We evaluated whether honeysuckle had a requirement for cold stratification, as is characteristic of many temperate zone species which encounter cold winters. Fruits were collected on the Southern Illinois University Edwardsville campus from an array of honeysuckle shrubs, separated by > 475 m. After collection, seeds were extracted from the berries and disinfected with 0.5% sodium hypochlorite solution for 10 minutes. Seeds from individual mother shrubs were stored separately. Randomly selected seeds were planted into petri plates containing sterile silica sand and distilled water at intervals of 20 days over a period of 0-80 days (10 seeds x 10 plates per date). Unplanted seeds were moist stratified at 4°C until planting. Planted seeds were incubated under cool white fluorescent light (125 $\mu\text{mol m}^{-2} \text{s}^{-1}$ PAR) at ca. 23°C, with a 14:10 hour day: night cycle. Plates were monitored every 2-4 days for germination. The stratification period affected the rate of germination, but did not ultimately affect the number of seeds to germinate: all treatments reached 60-70% germination after the elapse of 80 d. Seeds planted with a stratification period ≤ 40 d delayed germination ca. 35 d. Seeds planted ≥ 60 d germinated within a few days. The data suggest that Amur honeysuckle has a mixed germination strategy which might allow it to capitalize on unseasonably warm weather without risking the larger seed population.

- 43 3:00pm Grad **Chromosome Number of *Euphorbia roscens* (Euphorbiaceae) or Scrub Spurge a Florida State Endangered Species**
 *Ummul Vara Qurratul NLN, Maggie Erdmann, Elizabeth Esselman [Southern Illinois University Edwardsville]
Euphorbia roscens (Euphorbiaceae) or Scrub Spurge is a Florida state endangered species. The species has a narrow range. It is restricted to an area of 50 km on xeric white sand in the Lake Wales Ridge of Highlands County, Florida. Previous studies over a ten year period reported the production of only one viable seed and no seedlings have been observed in the field. Christy Edwards at the Missouri Botanical Garden is currently investigating if the species is clonal by examining microsatellite markers. The inheritance patterns of her work indicate that the species is a polyploid. What is unknown is if the species is an autopolyploid or higher order allopolyploid. The purpose of our study is to examine chromosome counts from pollen mother cells to determine the chromosome number of the species and investigate whether this taxon has an auto or allopolyploid origin.
- 44 4:15pm UG **The Effect of Various Levels of Herbivory by the Painted Lady Caterpillar (*Vanessa cardui*) on the Photosynthetic Rate of Soybeans (*Glycine max*)**
 *Sarah Simms, Judy Parrish, Travis Wilcoxon [Millikin University]
 Crop plants, such as the soybean (*Glycine max*) are able to convert solar energy into chemical energy that can be stored for use at a later time. While there are several factors that may affect photosynthetic rate, herbivory commonly occurs in soybeans. In this study, we sought to determine if the photosynthetic rate of the soybean would be significantly affected by various levels of herbivory of the Painted Lady caterpillar (*Vanessa cardui*) at two developmental stages, one vegetative and one reproductive. Plants received one of three treatments: no caterpillars, two caterpillars, or four caterpillars. Photosynthetic rate was measured prior to and after herbivory to obtain initial and final values. We hypothesized that plants will be less affected by herbivores during reproductive phases, as the plant will be larger and more developed. We also hypothesized that as the number of herbivores increases, the plant will be less successful in its ability to photosynthesize. Results revealed that photosynthetic rate is not significantly different between developmental stages, and that there is a significant difference among caterpillar treatments. Plants fed on by two caterpillars had a significantly higher increase in photosynthetic rate than those with no caterpillars. In addition, plants with four caterpillars had a significantly higher increase in photosynthetic rate than those with two caterpillars. Herbivory can significantly increase the photosynthetic rate of soybeans as leaf damage causes the plant to increase its photosynthetic rate within the levels of herbivory tested.

CELLULAR, MOLECULAR, & DEVELOPMENTAL BIOLOGY

- 45 3:00pm UG **Analysis of Berberine Family Genes Potentially Involved in Chlorophyll and Carotenoid Synthesis**
 *Allison Newton, William Schryver, Darron Luesse [Southern Illinois University Edwardsville]
 In plants, the synthesis of isoprenoids and isoprenoid-related compounds such as chlorophyll, carotenoids, tocopherols, phytoalexins, and gibberellins require the geranylgeranyl diphosphate synthase (GGPS) gene family. In *Arabidopsis thaliana*, a point mutation in one member of this family, *ggps1*, results in variegated rosette and cauline leaves. The variegation patterning is typically reproducible, with the center of the leaves being albino and the periphery phenotypically wild type. We have compared the transcriptome of wild type, *ggps1* white sectors, and *ggps1* green sectors. This analysis revealed a group of twelve Berberine proteins which are differentially regulated between the two mutant tissues. To identify how these genes are involved in isoprenoid biosynthesis, T-DNA lines with individual mutations in eight of these Berberine genes were identified and obtained as segregating populations from the Arabidopsis Biological Research Center. We have used PCR analysis to identify homozygous mutant lines. To determine if the Berberine mutations cause a phenotype, the confirmed lines are being analyzed for morphological and developmental changes as well as chlorophyll and carotenoid levels. We have also determined phylogenetic relationships between Berberine family genes and are using the information to create double mutants between the most closely related pairs.

- 46 3:00pm Grad Effects of Elevated Peroxidase Levels and Corn Earworm Feeding on Gene Expression in Tomato Fruits**
 *Ammar Al-Furaiji, Alanna Griffin, Richard O. Musser [Western Illinois University]
 Plants can form defenses to caterpillar feeding. Most research has focused on the leaves of plant versus their fruits. I am investigating the response of tomato fruits (*Solanum lycopersicum*). In addition, I am looking at tomato plants that have elevated peroxidase levels due to a transgene added. I will initially investigate well known plant defense genes such as proteinase inhibitors, polyphenol oxidase, arginase and threonine deaminase with quantitative real time PCR to determine differences in gene expression in tomato fruits in wild type tomato plants versus transgenic plants and with and without caterpillar (*Helicoverpa zea*) feeding. I expected to see the highest amount of gene expression difference due to caterpillar herbivory and for the transgenic tomato to alter these responses in both a positive or negative manner. The exceptional high peroxide activity in transgenic plants appear to up-regulate pathogenesis-related (PR) genes as well growth and flowering genes. Suggesting multiple regulatory pathways are interacting due to the treatments. Additional studies I will use the microarray analysis to understand the global changes that are altered.
- 47 3:00pm UG Construction and Characterization of q Double Deletion Mutant of *Fusarium verticillioides* Lacking Two Putative Trehalose-6-Phosphate Phosphatase Genes**
 *¹Brandon McFarlin, ²Christopher McGovern, ²Daren Brown, ¹Kristi McQuade [¹Bradley University; ²USDA-ARS-NCAUR, Peoria IL]
Fusarium verticillioides is a fungal pathogen that commonly infects the stalk, ear, and kernels of corn and can produce fumonisins, a family of mycotoxins linked to disease in livestock and humans. Our goal is to characterize the role of the disaccharide trehalose in growth and stress response in *F. verticillioides*. Understanding this pathway might provide new targets for controlling *Fusarium* disease. Trehalose synthesis in fungi occurs via two steps, the first catalyzed by trehalose-6-phosphate synthase (TPS), and the second catalyzed by trehalose-6-phosphate phosphatase (TPP). Previously, we found that trehalose synthesis is completely abolished in a strain lacking TPS. We report here that a mutant strain lacking the *TPS2* gene, thought to encode a TPP, retains the ability to produce trehalose, albeit at reduced levels. A search of the *F. verticillioides* genome identified a second possible TPP encoding gene, with homology to *TPS2*, referred to as *TPS3*, suggesting that synthesis of trehalose in the *TPS2* mutant may be due to the presence of a second TPP activity. To test this possibility, we are working to generate a double deletion mutant ($\Delta TPS2/\Delta TPS3$) lacking both putative TPPs. Methods for construction of this mutant as well as preliminary characterization will be described. We will also report preliminary data on the effects of salt stress on several strains carrying deletions for genes of trehalose metabolism.
- 48 3:00pm UG Use of RNAi Knockdown of Three Nervous System Genes to Determine Effects on Memory in Planarians**
 *Brittany Mersman, Amy Hubert [Southern Illinois University Edwardsville]
 Repeated exposure of an organism to an unfamiliar stimulus can familiarize the organism with the stimulus in a process called habituation, and this process has been demonstrated in the freshwater planarian *Schmidtea mediterranea*. Planarians are ideal organisms to study the processes of learning and memory by habituation due to their relatively simple central nervous system (CNS) and the ability to inactivate genes via RNA interference (RNAi). The objective of this experiment was to determine which regions of the central nervous system are most important in long-term memory in planarians: the outer cephalic ganglion, inner cephalic ganglion, or the ventral nerve cord. Planarians were habituated to an unfamiliar stimulus, underwent RNAi to knock down expression of a gene expressed in each CNS region, and then were later re-exposed to the stimulus. The expression category most critical to long-term memory was determined by the amount of time required for planarian RNAi knockout groups to swim across a previously habituated rough surface to reach food on the opposite side of a petri dish. Knockout of genes expressed in the inner and outer cephalic ganglia was found to have a significant impact on the long-term memory of planarians, although limitations of this finding exist. Quantitative-PCR was used to verify the reduction in expression of the targeted genes in experimental planarians, and antibody staining allowed us to look for changes the anatomy of the CNS in experimental animals after treatment.

- 49 3:00pm **The Relationship Between Feeding and Jumping of the Northern Leopard Frogs, *Lithobates pipiens***
 *Richard L. Essner, Jr. Candice Johnson [Southern Illinois University Edwardsville]
 Anuran jumping is an explosive movement that requires rapid and synchronous hindlimb extension. However, the ancestral tetrapod bauplan is designed around asynchronous locomotion (i.e., lateral undulation). This raises the question as to the origin of synchronous locomotor behavior. Lunge feeding has been proposed as a possible precursor to jumping in anurans, since it too involves rapid, synchronous hindlimb extension and is the ancestral feeding condition for both frogs and salamanders. In order to elucidate the relationship between jumping and feeding, we will use high speed video and electromyography to quantify kinematics and motor patterns during jumping and feeding behavior in the Northern Leopard Frog, *Lithobates pipiens*. A previous study (Essner et al., 2008) examined six muscles from the forelimbs, hindlimbs, back, and pelvis during feeding and jumping. Muscles included the semimembranosus (hip extensor), gracilis major (hind limb extensor), plantaris longus (hind limb extensor), coccygeiliacus (epaxial), longissimus dorsi (epaxial), and anconeus (forelimb extensor). The results of this study indicated that modulation of muscle amplitude rather than timing was key in differentiating between jumping and feeding. The present study will test this further using a wider array of muscles, including the iliacus externus (femoral protraction), triceps femoris (thigh flexor), sartorius (thigh flexor), and coccygeosacralis (epaxial). The addition of these muscles, and hindlimb flexors in particular, should provide a more comprehensive understanding of muscle function during anuran jumping and feeding.
- 50 3:00pm Grad **Effects of Biological Inoculants on the Gene Expression of Maize Roots and Leaves under Heat Stress**
 *Daccu Sonubi-ishaq, Morgan Hare, Dung Nguyen, Josh Connor, Nick Emory, Ammar Al-Furaiji, Richard Musser, Sue Hum-Musser [Western Illinois University]
 Plant growth promoting rhizobacteria (PGPR) are beneficial microorganisms that can help plant growth and tolerance to abiotic and biotic stresses. PGPR can help plants directly by providing phytohormones and indirectly by keeping the plant safe from other pathogenic bacteria. Some of these microbes include *Azospirillum*, *Bacillus*, *Bradyrhizobium*, *Rhizobium* and *Pseudomonas*. This study examines the effect of these biological inoculants on corn root and leaves when exposed to heat stress. Sterilized corn seeds were inoculated with the bio-inoculants and grown in soil pot for two weeks. Corn seedlings were exposed to 16 hours of 35°C or kept at room temperature 25°C. Total RNA was extracted separately from plant roots and leaves. Gene expression of specific genes was determined using real-time quantitative polymerase chain reaction. The expression of various plant defense genes, genes related to antioxidation, detoxification and heat tolerance was examined. We determined that there was a different pattern of gene expression based on the plant tissue, bio-inoculant used and heat treatment compared to the control. This particular research would allow us to determine the effects of these inoculants on plants under heat stress and potentially provide some insight on the use of these biological inoculants in enhancing heat tolerance in plants.
- 51 3:00pm UG **Lethality or Other Severe Consequences May Accompany Deletion of the *Schizophyllum commune* G-gamma protein**
 *Daniel Karcher, Sam Trettenero, Kyle Lincoln, Lesly Wegrzyn, Morgan Shanahan, Thomas Fowler [Southern Illinois University Edwardsville]
 G protein-coupled receptors (GPCRs) receive extracellular signals and initiate responses in many eukaryotic cells. Some *Schizophyllum commune* GPCRs are utilized in mate recognition. After binding pheromones, these GPCRs are presumed to interact with heterotrimeric G proteins, which activate signaling cascades eventually leading to a mating response. These G proteins consist of three subunits: a membrane-associated alpha subunit, which dissociates from the other subunits upon activation of the GPCR, a membrane-anchored gamma subunit, and a beta subunit which remains closely bound to gamma. Analysis of the *S. commune* genome revealed one gene predicted to code for a G protein gamma subunit. The predicted protein contains a GGL domain, which is conserved in G gamma subunits and regulators of G protein signaling. BLAST analysis did not identify paralogs to the gene, although closely related orthologs were found in other Basidiomycetes. Expressed sequence tags for the gene were identified in 4-day-old hyphae by the *S. commune* genome project. Deletion of the gene was predicted to affect mating interactions in *S. commune*. A knockout plasmid was constructed from *pXHAgt*, which contains a phleomycin resistance gene, using DNA from upstream and

downstream of the G-gamma gene. This plasmid was introduced into the *S. commune* genome, yielding four phleomycin-resistant potential knockouts that were analyzed by PCR. This revealed that none of the transformants were likely to be knockouts of the targeted gene, despite a knock-out rate of ~70% across all genes in previous reports. The ability of the transformants to grow on the selective medium indicates DNA was incorporated into the genome. A lack of knockout transformants suggests that the G-gamma protein may be essential for *S. commune*, or that its loss resulted in repressed growth to the extent that colonies were unrecognized within the background growth.

52 3:00pm UG

LEA Proteins Provide Protection to Cells and Enzymes During Water Stress

*Daniel A. Webster, Robert A Skolik, Michael M Menze [Eastern Illinois University]

LEA proteins are a group of hydrophilic polypeptides and have been linked to the survival of plants and animals during prolonged periods of water stress such as freezing and drying. LEA proteins occurring in the brine shrimp (*Artemia franciscana*) can be classified into 3 different groups (group 1, 3 and 6). The exact function of these proteins is still poorly defined. The aim of our study was to assess the impact of LEA proteins from *A. franciscana* on both enzyme activity and cellular function under water stress. The group 6 LEA protein AfrSMP, protected activity of the enzyme lactate dehydrogenase (LDH) in bacterial extracts during multiple freeze-thaw cycles, and about 12% higher activity was observed in extracts that contained AfrSMP compared to extracts lacking the protein. *Drosophila melanogaster* (Kc167) cells that concurrently express two different LEA proteins (AfrLEA3m and AfrSMP; tagged with fluorescence marker proteins), were challenged with NaCl concentrations ranging from 0.1 to 1 M and oxygen consumption was measured. Acute reduction in respiration with increasing salt concentration were similar in control and LEA expressing cells, and extracts of these cells did not exhibit LDH activity above non-transfected control cells when dehydrated. Our result may suggest that the large fluorescent tags hinder the function of LEA proteins. Cell lines expressing AfrLEA3m-GFP and AfrSMP-mCherry concurrently, showed about 12% higher proliferation rates than control cells when challenged with increasing sucrose concentrations over 48 h. While LEA function may be inhibited by GFP and mCherry, the fluorescent-tagged LEA proteins might still provide some cellular protection during prolonged water stress. Constructs to express untagged LEA proteins are currently being developed. Supported by NSF IOS-1457061/IOS-1456809.

53 3:00pm Grad

Investigating the Underlying Mechanism for a Cold Stress Response in the Zebra Mussel

*Deanna Musaitif, Jennifer Jost [Bradley University]

For sessile ectotherms, fluctuations in environmental temperature are unavoidable. Yet, these changes can have deleterious effects, often resulting in reduced performance or survival for these species. For the invasive zebra mussel (*Dreissena polymorpha*), little is known about their thermal physiology on a cellular level. Furthermore, the majority of studies have focused on high temperature stress, even though these animals spend several months each year exposed to cold water temperatures. A recent study showed a significant increase in the activity levels of a stress protein, AMP-activated protein kinase (AMPK) during exposure to cold, but biologically relevant, water temperatures. These results were consistent for animals collected over multiple seasons and for experiments ranging from hours to weeks of cold exposure. Since AMPK activity reflects changes in metabolic processes, these results suggest cold exposure increases energy demands. However, the underlying physiological changes and cellular mechanisms are poorly understood. One possible explanation is that the processes associated with seasonal thermal acclimation, which can involve changes in biochemical reaction rates and gene expression, may be stressful. Another possible explanation is that exposure to cold water temperatures results in cellular damage, therefore increasing the metabolic demands necessary for repair. The aim of this project is to investigate this response further by (a) determining the duration of exposure necessary to elicit an increase in AMPK activity, (b) the duration of increased AMPK activity levels, and (c) whether this response results in altered thermal tolerances. Another objective is to measure additional cellular and molecular parameters in order to determine whether this response is associated with seasonal acclimation.

54 3:00pm Grad

Comparative Analysis of *Helicoverpa zea* Gene Expression and Growth Based on Host Plants and Their Tissues

*Donald Bath, Kayleigh Diveley, Richard O. Musser [Western Illinois University]

Helicoverpa zea, commonly known as the 'corn earworm' or 'tomato fruitworm', is a serious economical pest moth species whose caterpillar stages feed on a variety of plants. Plants are loaded with chemical defenses

that reduce the caterpillars' ability to digest protein. In addition, as caterpillars feed on plants, the plants stimulate even more defenses. However caterpillars often have varying levels of compensatory abilities based on their adaptations to the variety of plant defenses as well as the varying levels of nutritive qualities of the plant tissue. This research aims to understand how these caterpillars may grow and compensate on the variety of plants with different defense and nutritive qualities. A series of growth assays were performed with *Helicoverpa zea* on several plants: control diet and leaves from corn (*Zea mays*), tomato (*Solanum lycopersicum*), soybeans (*Glycine max*), and tobacco plants (*Nicotiana tabacum*). In addition, we compared the leaves of tomato and corn to their respective fruits. The results compared initial 3rd instar caterpillars with final weights taken 72 hours after herbivory on their respective plants. Additional testing was performed under conditions where tomato and tobacco plant defenses were altered using plant hormones jasmonate and salicylate. Results from the bio assay were quantified and compared to molecular data obtained through real-time qualitative PCR analysis with data focusing on similarities and differences between growth and digestive genes. Our bioassays demonstrated caterpillars grew the greatest on the tomato fruit and corn ear in comparison to their respective leaves. In regards to leaf tissues, caterpillars grew better on tomato leaves than any other leaves. Also caterpillars that fed on salicylate treated tomato leaves grew better than caterpillars that fed on jasmonate treated leaves. Gene expression correlated well to these growth assays where caterpillars that grew the least stimulated higher gene expression for both digestive genes and juvenile hormone related genes that keep the caterpillar in a larval state. This study provides additional understanding of gene expression across a wider range of host plants and their tissues.

55 3:00pm Grad Acute Effects of Estrogen Receptors Using Specific Agonists on Neuronal Regeneration in the Primary Olfactory Pathway of Ovariectomized Mice

*Drew Baltzell, Britto Nathan [Eastern Illinois University]

Previous studies in human and animal models suggest that estrogen promotes neuronal survival and growth and protects against neurodegeneration. In epidemiological studies estrogen treatment reduced the risk of neurological diseases, such as Alzheimer's Disease (AD). In contrast, in prospective studies estrogen therapy either had no effect on AD risk or slightly increased the risk. A better understanding of estrogen's action is needed to resolve the conflicting results. We found that treatment of 17 β -estradiol in ovariectomized mice significantly increased apolipoprotein E (apoE) expression, cell proliferation, number of mature neurons and total cells in the olfactory epithelium, and reactive astrocytes and synaptogenesis in the olfactory bulb. Estrogen primarily uses two major receptors in the brain to achieve its various functions: estrogen receptor alpha (ER α) and estrogen receptor beta (ER β). Our hypothesis is that ER α and ER β have distinct roles in neuronal regeneration. To test this hypothesis, we examined the effects of estradiol, propyl pyrazole triol (PPT, an ER α agonist), and 2,3-Bis(4-hydroxyphenyl) propionitrile (DPN, an ER β agonist) in the primary olfactory pathway of ovariectomized wild-type (WT) mice. Mice were ovariectomized using a dorsal bilateral incision and randomly assigned to one of the four treatment groups: vehicle, 17 β -estradiol (3 mg/kg/day), PPT (3 mg/kg/day), or DPN (3 mg/kg/day). Test reagents were administered subcutaneously for 3 days. Following treatment, mice were perfused with 4% paraformaldehyde, the olfactory bulb and turbinate were harvested, and sectioned using a cryostat. Sections were stained using cresyl violet and immunohistochemistry was performed to examine the effects of PPT and DPN on apoE expression, cell proliferation, neuronal maturation, reactive gliosis, and synaptogenesis in the primary olfactory pathway. The results from this study will help improve understanding of the functions of estrogen receptors in the primary olfactory pathway.

56 3:00pm UG Antibiotic Resistant *Acinetobacter* Harbored in the Intestines of Asian Carp

*Elizabeth Smits, Keith Johnson [Bradley University]

The abundant use of antibiotics within the past few decades has played a significant role in the widespread emergence of antibiotic resistant bacteria. These bacteria have been found in a variety of animals, including the invasive species bighead and silver Asian carp found in the Illinois River. The growth of antibiotic resistance may in part be due to the over use of antibiotics but also due to the co-selection of resistance in the presence of genetic resistance mechanisms for environmental pollutants, such as heavy metals. Prior work in our laboratory has identified three types of bacteria that have demonstrated resistance to one heavy metal (mercury) and an number of different antibiotics, including florfenicol, chloramphenicol, ampicillin, and various aminoglycosides. In this research study, 6 different isolates harbored from the intestines of Asian carp were sequenced and identified as *Acinetobacter*. These isolates were used to determine the minimal

inhibitory concentration for a number of antibiotics, as well as determine the mechanism of florfenicol resistance, a relatively new antibiotic, through detection of known resistance genes, including efflux pumps and determining potential mechanisms of transfer of resistance.

57 3:00pm UG

Analysis of Circumnutation in Gravitropism Mutants of *Arabidopsis thaliana*

*Emily Ehrhardt, Michael Buzzard, Kori Klover, Darron Luesse [Southern Illinois University Edwardsville]

For plants to thrive in their sessile state, they need to be able to sense and respond to external stimuli. While such responses are easily visible, other changes in growth are less obvious and require time-lapse photography to reveal their existence. Circumnutation is the helical pattern of movement made by plants as they grow as a result of asymmetric growth rates along the hypocotyl or inflorescence stem. Circumnutations can occur in a circular, elliptical or pendulum, clockwise or counterclockwise, pattern that is followed by the tip of the plant. While previous research has shown that some gravitropism mutants have altered circumnutation, it is unclear if these fit into a certain profile. The goal of this work is to examine inflorescence stem circumnutation in a wide variety of gravitropism mutants. Specifically, we will examine mutants that are altered in gravitropic sensing, signaling, auxin transport, and differential growth with the goal of better understanding the relationship between circumnutation and the gravity response. There are two phases of this project. The first required identification of candidate mutations in these categories, obtaining those from the stock center, and subsequent PCR analysis of these often segregating lines to isolate homozygous mutants for each. In the analysis phase, time-lapse images of mutant and wild-type plant growth were captured simultaneously from the side and above. The direction, period, diameter and velocity were calculated based off the top images. We hope results from this will allow us to better understand the causes and regulation of the circumnutation response in plants.

58 3:00pm Grad

The NuA4 Histone Acetyltransferase Complex Affects Epigenetic Regulation of Regeneration in *Schmidtea mediterranea*

*Ivan Ayala, Amy Hubert [Southern Illinois University Edwardsville]

The NuA4 histone acetyltransferase complex is highly conserved across species and regulates multiple crucial nuclear functions in eukaryotic cells, such as cell cycle progression, DNA repair and transcription. The complex acts as an epigenetic regulator of gene expression, adding acetyl groups to lysine residues on histone H4, which affects expression of genes in the regions of the chromosome where the modification occurred. The planarian flatworm *Schmidtea mediterranea* is thought to be effectively immortal due to its remarkable ability to regenerate and maintain pluripotent stem cells throughout its life time. The genes that control pluripotency and differentiation of planarian stem cells are just beginning to be understood, and since many of these genes have human homologs, it is possible to use what we learn from these worms to better understand human stem cells. We have identified planarian homologs of eleven proteins in the human NuA4 complex (Ruvbl2, Morf4l2, Mra, Epc1, Tip60, Trrap, Gas41, Ruvbl1, Brd8, Yl-1, and Baf53a) and plan to silence them by RNA interference (RNAi) to examine the role of the complex in stem cell maintenance and regeneration. The RNAi method involves feeding the worms double-stranded RNA with a sequence matching the gene of interest to target the destruction of the mRNA expressed from that gene, thus knocking down its expression. We will cut the worms following knockdown to observe how well they regenerate and then fix and stain them to mark mitotic cells and find out if the stem cells are dividing normally. I hypothesize that knockdown of these important regulatory complex genes will result in reduced regenerative ability and that the worms' stem cell population will not be properly maintained.

59 3:00pm UG

Construction, Purification and Characterization of Blue and Cyan Fluorescent Protein-Fused Ca^{2+} Sensing Protein Calmodulin

*Jeffrey Iverson, Kyle Schafer, Chin-Chuan Wei [Southern Illinois University Edwardsville]

Calcium ion (Ca^{2+}) is the most abundant mineral ion in humans. Ca^{2+} influences a number of signaling and metabolic reactions. Ca^{2+} sensing protein, or Calmodulin (CaM), aids in signal delivery and initiation of processes like muscle contraction, cell division, cell death, and fertilization. CaM is located on eukaryotic cytoplasts, organelles, and on plasma membranes. CaM consists of four high affinity Ca^{2+} binding sites, two on the carboxyl-terminus and two on the amino-terminus. CaM binds and regulates more than hundreds of target proteins and enzymes. Its versatile molecular mechanism is still not understood. Therefore, the research in CaM regulated signaling remains under further investigation. To study the interactions, our lab

has successfully fused Cyan Fluorescent Protein (CFP) and Blue Fluorescent Protein (BFP) to CaM (termed as CFP-CaM and BFP-CaM), serving as a vital step to help visualize CaM/target enzyme interaction using fluorescence resonance energy transfer (FRET). FRET provides not only information about the possible complex formation, but also the orientation of ligand binding. Furthermore, FRET allows to determine the distance between two specific pairs of fluorescence probes. Our lab has studied CaM-target enzymes, including nitric oxide synthases (NOSs), NADPH oxidases (NOXs), Orai channel protein, Fas-FADD induced apoptosis. An application using fluorescent protein fused CaM and NOX 5 is presented here.

60 3:00pm UG

The Impact of Abscisic Acid on the Variegation Patterns of the *Arabidopsis thaliana* ggps1 Mutant

*Jhunnelle Walters, Kelsey Kropp, Darron Luesse [Southern Illinois University Edwardsville]

The biosynthesis of chlorophyll is a tightly regulated process that utilizes a series of enzymatic reactions to build the final molecule. Geranylgeranyl Diphosphate Synthase 1 is a key early component of this process, catalyzing the formation of GGPP, which is a branchpoint compound utilized for chlorophyll production as well as carotenoids and gibberellins. In *Arabidopsis thaliana*, a point mutation in ggps1 leads to a distinct variegated pattern, with pale sectors near the center of leaves, and green at the periphery. In addition, this phenotype is temperature sensitive. Higher temperatures (27°C) lead to larger white sectors, while cooler growth temperatures (12°C) produce leaves that are completely green. We hypothesize that while the initial green and white sectors are patterned in the meristem, the severity of the white sectors is exacerbated by a lack of photosynthetically-induced stomata opening. Under these conditions, the stomata will remain closed, increasing the temperature in that area of the leaf and further reducing ggps1 function. To determine if this is the case, we have utilized the impact of Abscisic Acid (ABA) on stomata opening. Exogenous treatment of ABA has been shown to close stomata, while ABA-sensing mutants display stomata that are more open than wild type. We have grown wild-type and ggps1 seedlings on media containing 50µM ABA. Under these conditions, the white areas decreased in size, producing the opposite of the anticipated impact. We are currently studying exogenous application of ABA to adult plants, as well as crossing ggps1 with ABA insensitive mutants.

61 3:00pm Grad

Bioinformatic and Knockout Analysis of Two Dicer Genes in *Schizophyllum commune*

*¹Jill La Rue, ²Allison Germann, ¹Thomas Fowler [¹Southern Illinois University Edwardsville, ²Washington University]

RNA interference is a conserved silencing mechanism of eukaryotes that is involved in a wide array of cellular functions. RNAi involves an endonuclease Dicer that binds and cleaves dsRNA into small, nearly uniform fragments. Analysis of *S. commune* genome identified two potential *dicer* genes. BLAST analysis using protein sequences of two *dicer* genes yielded self-identification and identification of each other. Two *S. commune* Dicer protein sequences were identified using JGI and several domains were identified, however no PAZ domains were found. BLAST was used to search for expressed sequence tags and matches were found for both *dicer* genes indicating the genes are expressed. Phylogeny.fr was used to design a phylogenetic tree using 25 BLAST hits. It was found that the two *S. commune* Dicers fell into separate clades of previously classified Dcl-1 and Dcl-2 proteins and were therefore named accordingly. Extending from these analyses, modified plasmids were designed for knocking out each of the *dicer* genes. These modified plasmids were constructed from the plasmid *pXHAgt*, which contains a phleomycin resistance gene, and verified. Regions flanking each *dicer* gene were amplified and restriction sites were added to allow for digestion and subsequent ligation into plasmid *pXHAgt*. The knockout plasmids are designed for homologous replacement of each flanking region for each *dicer* gene. The homologous recombination events should replace *dicer* with the plasmid's phleomycin resistance gene upon transformation into an *S. commune* ΔKu80 strain. Non-homologous end joining has been abolished in the ΔKu80 strain, allowing more efficient detection of homologous recombinants. Transformation yielded four knockouts for *dcl-1* and two knockouts for *dcl-2*, and transformants were confirmed by PCR and gel electrophoresis. Future work will involve phenotypic analysis of double knockouts to determine the roles of the two *dicer* genes in *S. commune* and how they function in the RNAi pathway.

62 3:00pm UG

Transformation Rescue of the *gps5* Mutant in *Arabidopsis*

*Jordan Bolletta, Matthew Egan, Erica Bohmer, Darron Luesse [Southern Illinois University Edwardsville]

Gravity is important for plant growth because it allows tailored development of different organs. After a reorientation, plants perform gravitropism which is a change in the growth direction of shoots and roots to reestablish the previous orientation. In *Arabidopsis thaliana*, reorientation in the cold (4°C) does not produce gravitropism, however, after return to room temperature the inflorescence stem curves to the side, in the direction established in the cold. This process is called the Gravitropic Persistent Signal (GPS). The *gravity persistent signal 5 (gps5)* mutant was identified because of its hypergravitropic phenotype under these conditions. This work seeks to identify the molecular cause of this phenotype. Next generation sequencing has identified a candidate deletion in *gps5* within a glycosyl transferase gene. To determine if this gene is responsible, we are attempting transformation rescue of the mutant. The glycosyltransferase is being cloned into pCR8 and will be transferred into the plasmid pEARLEYGATE100 for expression within plants. Successful rescue of the hypergravitropic phenotype will indicate that this glycosyltransferase is involved in production of the GPS response, and possibly in the signal transduction of gravitropism.

63 3:00pm

The Effects of NFVRFamide on the Crop-Gizzard of Earthworm, *Lumbricus terrestris*

*Kevin Krajniak, Whitney Holdener [Southern Illinois University Edwardsville]

Previous work in our lab has shown that members of the FMRFamide-related peptides (FaRPs) inhibited spontaneous contractions in the isolated crop-gizzard of the earthworm, *Lumbricus terrestris*. Many other FaRPs have been found in annelids including NFVRFamide which has been found in the leech *Helobdella robusta*. Therefore we decided to examine the effects of this peptide on the isolated crop-gizzard of *L. terrestris*. 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 either FMRFamide or NFVRFamide were added to the tissue bath and the resulting changes in contraction rate and amplitude were used to create log-dose response curves. Both FMRFamide and NFVRFamide caused a concentration dependent decrease in contraction amplitude with a threshold, 10 nM. This is surprising since previous work showed that other small peptides containing valine, FVRFamide and YVRFamide, caused different effects on the amplitude. FVRFamide caused a small decrease in amplitude with a threshold of 10 nM and an increase with a threshold of 10 µM, while YVRFamide caused only an increase in amplitude with a threshold of 1 nM. Like NFVRFamide the native *Lumbricus* peptide, APKQYVRFamide also only inhibits the amplitude with a threshold of 1 µM. The asparagine residue (N) in NFVRFamide and the glutamine residue (Q) in APKQYVRFamide have long uncharged polar R groups which may allow these peptides to interact with the receptor that also binds FMRFamide.

64 3:00pm UG

Bioinformatic Analysis and Knockout Targeting of a Methyltransferase Gene in *Schizophyllum commune*

*Kyle Lincoln, Lesly Wegrzyn, Daniel Karcher, Sam Trettenero, Morgan Shanahan, Thomas Fowler [Southern Illinois University Edwardsville]

Methylation of DNA is often used by cells to control gene expression. DNA methyltransferases catalyze the transfer of methyl groups, typically onto cytosine bases. Methylation in the promoter region of a gene can lead to reduced or silenced transcription. Analysis of the *S. commune* genome revealed the potential methyltransferase coding gene SCHODRAFT_255903. Its predicted protein contains three domains common in methyltransferase proteins: a DNMT1-RFD domain allowing targeting of methylation to correct residues, a BAH domain that is often found in proteins involved in transcriptional regulation, and a DNA methylase domain catalyzing the transfer of methyl groups onto DNA. An expressed sequence tag (EST) database search showed that this gene is transcribed in hyphae cultured under several conditions. BLAST analysis identified one other predicted methyltransferase gene in the *S. commune* genome, although its transcription was not confirmed by the EST database. It might be expected that deleting a methyltransferase gene in haploid *Schizophyllum commune* would result in increased transcription and expression of some genes, leading to an altered phenotype. To delete the gene coding for the first methyltransferase, a knockout plasmid was constructed from the plasmid *pXHAgt* using DNA regions from upstream and downstream of the methyltransferase gene to surround a phleomycin resistance gene. This DNA was introduced into *S. commune* by PEG-based transformation of protoplasts. The transformation yielded two antibiotic-resistant

colonies as potential knockouts of the methyltransferase gene. PCR analysis has not shown that either of the transformants has the DNA rearrangement expected for a knockout of the methyltransferase gene generated by homologous recombination. The number of antibiotic-resistant transformants was only two, leaving open the possibility that a knockout may be viable and was not produced by these attempts at replacement.

85 4:15pm UG

The Conformational Changes of the 3rd and 4th EF-Hands of Calmodulin are Important for the Recognition of Fas-Associated Death Domain

*Kyle Schafer, Drake Jenson, Nichole Kaufman, Emily Fabry, Chin-Chuan Wei [Southern Illinois University Edwardsville]

Calmodulin (CaM) plays an important role in calcium (Ca^{2+})-dependent signal transduction. The Fas receptor (FasR)-mediated apoptotic pathway has recently been shown to be regulated by Ca^{2+} fluctuations in the cell, specifically through CaM.1 However, its mechanism is not clear. Here, we used two synthetic Fas-associated Death Domain peptides (FADD-pep1 and FADD-pep2) to explore binding to CaM via isothermal titration calorimetry (ITC) and fluorescence. Four Troponin C (TnC) chimeras, where one of the four EF-hands (EFs) of CaM was replaced with the corresponding EF-hand in TnC, were also investigated since TnC has opposite activation effects compared with CaM. Their hydrophobic exposure upon Ca^{2+} binding was assessed by fluorescence, modeling calculations, and heat capacity changes (ΔC_p) that is correlated with structural changes. Our results revealed that CaM structure is substantially different when the 3rd and 4th EFs are exchanged. These changes impaired the binding to FADD peptide. Our ITC data also indicated relatively weak binding of CaM to a shorter FADD-pep1 with ($K_a=5.5 \times 10^4 \text{ M}^{-1}$) and moderate binding to the longer FADD-pep2 ($K_a=3.9 \times 10^5 \text{ M}^{-1}$). Our data indicated that the driving force for FADD-pep1 binding to CaM, 1TnC, and 2TnC is enthalpic-entropic while that for 3TnC and 4TnC are purely enthalpic.

86 4:15pm Grad

Metabolic and Morphologic Shifts in Neuro2a Cells Cultured in Galactose-Based Medium

*Leah Welker, Aishah Asiri, Dan Webster, Leonardo Altamirano, Michael Menze, Britto Nathan [Eastern Illinois University]

Previous studies have shown that highly-proliferating cells, such as cancer cells, rely mainly on glycolysis for ATP production, even in the presence of oxygen. However, when cancer cells are grown in medium containing galactose as the only source of sugar, then they use glutamine to produce ATP using mitochondrial oxidative phosphorylation (OXPHOS). This phenomenon has been established in many cell lines, including HeLA, HepG2, and skeletal muscle cells. In this study we examined the effects of culturing Neuro2a cells, a murine neuroblastoma cell line, in a media containing galactose on neurite outgrowth, cell proliferation, and oxygen consumption. Cells were plated at a concentration of 250,000 cells/well in either DMEM + 10 mM glucose or DMEM + 10 mM galactose. Following 2 days in vitro (DIV) cells were counted. Doubling time was significantly slower ($p<0.05$) in cells grown in galactose media versus glucose media. Neurite outgrowth was measured at 3 DIV using NeuronJ software. The results revealed that the percent of neurite bearing cells were significantly higher in Neuro2a cells grown in galactose medium as compared to those grown in glucose medium ($p<0.05$). The combined length of all neurites present in a single neuron was significantly higher in cells grown in galactose media ($p<0.0001$). Oxygen consumption, measured using an oxygraph, was significantly higher in cells grown in galactose media as compared to those grown in glucose media ($p<0.002$). In addition, oxygen consumption was similar in cells grown in a medium containing both glucose and galactose at 10 mM each to that in cells grown in glucose media. This indicates that there is indeed a change in metabolism in the galactose-grown Neuro2a cells that only occurs in the absence of glucose.

87 4:15pm UG

Rescue of the Arabidopsis *ggps1-1* Mutant with Meristem-Specific Promoters

*Luke Brown, Darron Luesse [Southern Illinois University Edwardsville]

Chlorophyll is an important biomolecule produced by plants for use in photosynthesis. The presence of chlorophyll allows the plant to absorb energy available from the sun, and use it for the production of fixed carbon in the form of sugar. Chlorophyll biosynthesis is a complex process which utilizes a series of enzymes performing stepwise rearrangement or condensation reactions. One step early in this pathway is the formation of a sixteen carbon molecule, termed geranyl geranyl diphosphate (GGPP). The enzyme responsible for catalyzing the formation of GGPP is geranyl geranyl diphosphate synthase (*ggps-1*). In Arabidopsis, a point mutation altering one amino acid in this this enzyme results in a variegated phenotype with the albino tissue localized to the middle of the leaves. It has been shown, however, that this mutation is

temperature sensitive: that the phenotype is lessened in colder temperatures. Developmentally, the inner portion of the leaf, which appears white in the *ggps1-1* mutant, forms from the L3 layer of the shoot apical meristem. We hypothesize that the variegated phenotype traces its origins to patterning in the meristem. We investigate this by attempting transformation rescue with wild-type GGPS1 driven behind two tissue-specific promoters. The WUS promoter has been shown to be active within the L3 layer of the meristem, while STM has been shown to express in the L1 layer. Rescue by either of these constructs will provide evidence that the variegated patterns in *ggps1* can be traced to the meristem.

88 4:15pm UG

The Effects of GFMRFamide on the Crop and Gizzard of *Lumbricus terrestris*

*Melinda Schnietz, Kevin Krajniak [Southern Illinois University Edwardsville]

Previous work in our lab has shown that members of the FMRFamide-related peptides (FaRPs) inhibited spontaneous contractions in the isolated crop-gizzard of the earthworm, *Lumbricus terrestris*. Many other FaRPs have been found in annelids including GFMRFamide which is in the polychaete, *Capitella teleta*. Therefore, we chose to examine the effects of GFMRFamide on the isolated crop-gizzard of the earthworm, *Lumbricus terrestris*. 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 FMRFamide or GFMRFamide were added to the tissue bath and the resulting changes in contraction rate and amplitude were used to create log-dose response curves. GFMRFamide caused a concentration dependent decrease in contraction rate with a threshold of 0.1 μ M, while FMRFamide had no effect on rate. GFMRFamide had no effect on amplitude of the contraction, while FMRFamide caused a decrease in amplitude with a threshold of 10 nM. These results suggest that adding the glycine residue to the N-terminal of FMRFamide either alters the way the peptide interacts with the FMRFamide receptor or that GFMRFamide acts on a FaRP different receptor. Since GFMRFamide is found in a polychaete and the earthworm is a clitellate the response differences may be due to the evolutionary distance between *C. teleta* and *L. terrestris*.

89 4:15pm Grad

Evaluating the Effects of Silver Nanoparticles on Planarians

*Nicholas Horn, Morgan Rakers, Chris Theodorakis, Amy Hubert [Southern Illinois University Edwardsville]

Silver nanoparticles (AgNPs) are small elemental silver clusters ranging from one to 100 nanometers in diameter. Primarily desired for their inexpensive synthesis and oligodynamic properties, colloidal AgNPs have continued to be used in various novel applications such as cosmetics, clothing, and especially medicine. Only within the past few decades have concerns surrounding the discharge of AgNPs into the environment been under scientific and environmental scrutiny, making an immediate challenge of collecting data and drawing accurate conclusions regarding their toxicity. Therefore, the objectives of this study are to determine toxicity of AgNPs to planarian flatworms. Toxicity will be assessed by measuring acute toxicity, effects on stem cell mitotic activity, and the ability of AgNPs to induce oxidative stress-responsive genes. The planarian model we use, *Schmidtea mediterranea*, expresses observable genotypic and phenotypic sensitivity toward changes in toxicants in water. This facile and inexpensive system is also predictive of related taxa of potential pathogenicity as well as higher taxa. We have observed lethality within as short as 24hrs in concentrations as low as 3ppm (ng/ μ L) with visible effects on motility as low as 0.1 ppm. We are currently conducting qPCR to examine potential changes in expression of select oxidative stress-induced genes (including Cat2, GPx, Glut, Hsp family chaperones, Thio, and P53) in the worms following nanoparticle exposure. Several further studies involving nanomaterials are required so that society can continue to make safe and educated decisions to minimize and mitigate any adverse effects.

90 4:15pm UG

Exploring the Role of Trehalose Metabolism in Resistance to Oxidative and Desiccation Stress in *Fusarium verticillioides*

*¹Nicole Oberlie, ¹Sarah McMillan, ¹Nicholas Bonich, ²Daren Brown, ¹Kristi McQuade [¹Bradley University; ²USDA-ARS-NCAUR, Peoria IL]

Fusarium verticillioides is a pathogenic filamentous fungus that primarily affects maize. We are exploring stress response mechanisms in *F. verticillioides*, particularly the role of trehalose, a disaccharide known to be involved in the ability of several organisms to withstand desiccation or drought. To determine the role of trehalose in the response of *F. verticillioides* to oxidative or desiccation stress, we performed viability assays on strains of the fungus lacking one or more genes coding for enzymes involved in trehalose synthesis or

degradation. Both germinating and non-germinating spores were treated with menadione, a compound known to induce oxidative stress. Exposing non-germinating spores to 100 mM menadione for 1 hour causes a dramatic decrease in viability across all strains tested. Unexpectedly, treatment with 10 mM menadione increases spore viability in some strains. Preliminary results suggest that delaying the 10 mM menadione treatment until after germination has already begun yields different results. In addition, desiccation of non-germinating spores leads to a dramatic loss in viability of all strains tested, with a trehalose-deficient mutant being most susceptible. After two days of desiccation, about 50% of wild-type spores are viable, whereas less than 5% of spores from a strain unable to produce trehalose remain viable, indicating an important role for trehalose in desiccation tolerance in *F. verticillioides*.

91 4:15pm Grad Gene Expression of Bacteria-Inoculated Soybean *Glycine max* in Response to Heat Stress

*Noor Sairafi, Sue Hum-Musser [Western Illinois University]

Several microorganisms have the ability to promote plant growth and can also produce compounds, which are known to stimulate plant defenses by inducing systemic resistance in attacked plants. *Bacillus* species are commonly used in microbial fertilizers due to their rapid beneficial effects in colonizing plant root and establishing *Rhizobia* bacteria mutualism inside their root structure. The objective of this research project is to determine the gene expression of soybean, *Glycine max* seedlings inoculated with bacteria exposed to heat stress. Sterilized seeds were inoculated with the biological inoculants--Defensor, Rhizoboost, combined Defensor and *Rhizobium*, and combined Rhizoboost and *Rhizobium*, or uninoculated control. The inoculum contain various species of beneficial bacteria. Once the seeds germinated, seedlings were incubated at 25 °C or 35 °C for approximately 16 hours. Total RNA was extracted and levels of gene expression were examined using real-time quantitative polymerase chain reaction. We found different levels of several stress genes dependent on the heat treatment and type of inoculant used. While some information is known about the effects of these inoculants at the organismal level, the significance of this study is that it provides information on the effect of bacterial fertilizers in response to heat stress at the molecular level.

92 4:15pm UG Characterization of *Smed-htt*, the Planarian Homolog of the Human Huntington's Disease Gene

*Peyton Crowe, Amy Hubert [Southern Illinois University Edwardsville]

Huntington's disease is an incurable, genetically-inherited neurodegenerative condition that affects 1 in every 10,000 humans. The disease causes death of cells in the brain, which results in reduced cognitive function. The abnormal expansion of a trinucleotide repeat sequence in a gene called HTT leads to these symptoms in affected individuals. Little is known about the normal function of the HTT gene product, but it is thought to be involved in neuronal function. *Schmidtea mediterranea*, a species of freshwater planarian, could make an excellent model system in which to study the HTT gene and the role it plays in the central nervous system (CNS). Planarians have a relatively simple CNS, and they are able to regenerate portions of their bodies following amputation using a collection of stem cells called neoblasts. The aim of this study was to identify the planarian homolog of HTT and characterize its function using RNA interference (RNAi). A BLAST search comparing the human HTT protein to a database of translated planarian cDNAs identified *smed14882* (which we have renamed *Smed-htt*) as the closest match. We have amplified a portion of this gene by PCR and cloned it into a vector from which we can express double-stranded RNA to induce specific knockdown of the gene. By cutting the worms and allowing them to regenerate following knockdown of *Smed-htt*, we will be able to witness any regenerative or behavioral changes caused by loss of HTT function. We also plan to stain the planarians with an antibody that labels the CNS following knockdown in order to observe any structural abnormalities in the regenerated nervous system. Through this work, we hope to learn about the role HTT plays in normal neurons and gain further insight into its role in causing Huntington's disease.

93 4:15pm Grad Phylogenomic Analysis of 16 *Fundulus* Species Using RNA-seq Data

*Rachel Rodgers, David Duvernell [Southern Illinois University Edwardsville]

Phylogenies provide researchers with a tool for forming predictions and testing hypotheses within an evolutionary framework. As emerging models for evolutionary studies, fishes of the *Fundulus* genus are receiving increased attention in phylogenetic analyses. Proposed relationships among the fundulids have been based on a variety of characters including morphology, developmental sequences, and protein comparisons. Recent molecular studies have generated phylogenies based on gene sequence comparisons for one to four genes. Phylogenies derived from molecular data are in broad agreement with those based on

traditional characters such as morphology. However, deeper evolutionary relationships among clades remain poorly understood. The lack of a well-resolved deep phylogeny for *Fundulus* remains a major impediment to a variety of studies. This study will add support to weakly supported and unresolved interspecies relationships using a multi-gene approach based on RNA sequencing data. The data are available from a separate gene expression study by Whitehead and Duvernell (unpublished). The analysis pipeline starting from sequencing data to phylogenetic tree construction will be repeated on a species and individual level. Currently, species-level analysis has moved through read filtering and trimming, *de novo* transcriptome assembly, and orthologous gene identification. Ninety-eight orthologous genes have been identified for 16 species and four outgroups. Multiple sequence alignment and Bayesian phylogenetic inference, as well as individual analysis, is in progress.

94 4:15pm

Algae as a Source of Renewable Energy

*¹Robb D. VanPutte, ²Timothy P. Devarenne [¹McKendree University, ²Texas A&M University]

Algae have the potential to be an excellent source of renewable energy, in particular for the production of biodiesel. Many algae are excellent oil producers, contributing as much as 80% to their total biomass. However, before an algal-based biofuel can reach the marketplace, much basic research needs to take place. For example, we must identify and characterize the genes that are involved in oil production. Using cultured *Tetraselmis suecica* cells, both genomic DNA and total RNA was isolated from homogenized cells. Degenerate primers designed using sequence information from the highly conserved domains of known squalene synthases were used to amplify a 300 bp DNA product using the polymerase chain reaction (PCR) technique from both genomic and cDNA templates. The amplified DNA was then sequenced and positively determined to be part of the *T. suecica* squalene synthase gene (TsSS300) by performing a BLASTx search of the NCBI database. Using the sequence information, additional primers were designed for use in 3' and 5' RACE (rapid amplification of cDNA ends). This technique allowed for the amplification of the entire *T. suecica* squalene synthase gene. This amplified DNA was once again sequenced and positively confirmed to be squalene synthase by performing a BLASTx search of NCBI's database. This research forms the basis for identification and characterization of additional genes involved in oil production.

95 4:15pm Grad

Growth Profile and Gene Expression of *Helicoverpa zea* Infected by *Bacillus thuringiensis* Krustaki and Israelensis

*Ruchi Ojha, Mobayode Desmond Osatuyi, Richard Musser, Sue Hum-Musser [Western Illinois University]

The corn earworm, *Helicoverpa zea*, is a well-documented voracious pest of agricultural crops throughout most of North and South America. In addition to causing severe plant tissue damage, the damage can also result in infection especially molds in seed corn, ultimately leading to yield loss. *Bacillus thuringiensis* (Bt.) is an insect pathogen due to the secretion of toxic crystal proteins that destroy the gut wall of insect. Different strains of Bt. have varying effects on the groups of insects (e.g. gnats, mosquitoes, caterpillars). Caterpillars infected with Bt. Krustaki have a high mortality rate compared to larvae infected with Bt. Israelensis. I examined the effect of different bacterial strains on insect growth, survival and gene expression. *Helicoverpa zea* larvae fed on artificial diet containing Bt. Krustaki, Bt. Israelensis and bacteria-free diet for three days. The larvae growth and survival were different depending on the bacterial strains. Gene responses of the caterpillar to the bacteria was determined using real-time qualitative polymerase chain reaction. The expression of various insect genes was different depending on different strains of Bt. This information in determining the defense mechanism of the insect and may be important in potentially developing more effective insect control methods.

96 4:15pm Grad

Enzymatic Activity of GGPS-1

*Samuel Keck-Flory, Darron Luesse [Southern Illinois University Edwardsville]

Isoprenoids are synthesized in plants and are the basis for over 60% of natural products as well as vitamins necessary to humans. Plant isoprenoids are critical for development, serving as the foundation for molecules such as carotenoids, gibberellins, and most importantly, chlorophyll (Rodríguez-Concepción). The regulation of the synthesis of these molecules is a tightly controlled, multi-step process. A key enzyme required for the biosynthesis of many isoprenoid derivatives is geranyl diphosphate synthase (GPPS) (Vranova, et al., 2012). In the plant *Arabidopsis thaliana*, a mutation in this gene leads to a temperature sensitive variegated phenotype. At room temperature, *gpps1* mutants have a variegated pattern with white sectors in the center,

and green tissue near the periphery. When grown in warm temperature, the white areas become much larger, while growth in cool temperatures leads to completely green leaves (Ruppel, et al., 2013). The work presented here is designed to test the hypothesis that the temperature sensitivity displayed in the mutant is caused directly by decreased activity of the mutated enzyme. To do this, both wild-type and mutant GGPS1 protein will be expressed in *E. coli*, and the activity of these purified enzymes will be investigated under a variety of temperature and pH conditions.

- 97 4:15pm UG Effects of Alcohol on Macrophage Morphology**
 *Shannon Henry, Martin Salazar, Brian Cole [Knox College]
 Several studies have documented that ethanol alters cytokine secretion in macrophages by affecting the ERK 1/2 activation pathway. Specifically, ethanol targets NF- κ B activation, p38 activation, and alters TNF- α mRNA activity. A suggested mechanism for these activities is that ethanol affects the cytoskeleton structure and therefore membrane structure of the macrophage. This study examines the effect of ethanol on the J774A.1 mouse macrophage cell surface morphology by comparing the stimulating effect of LPS alone to the effects of LPS and ethanol on the cells. Effects were observed with scanning electron microscope (SEM) analysis. Results showed that ethanol had little effect on the inhibition of macrophage stimulation by LPS but did compromise membrane integrity.
- 98 4:15pm UG Active TGF- β 1 Signaling in Salivary Gland Cells**
 *Shannon Payne, Callie Mincy, Asha Eapen [Southern Illinois University School of Dental Medicine]
 Salivary gland cancer is the most common malignancy of the oral cavity. Molecular mechanism underlying the differentiation, invasion and migration of salivary gland cancer cells remains unclear. Dentin Matrix Protein 1 was initially expressed in tooth and bone. We have previously demonstrated that upregulation of Dentin Matrix Protein 1 (DMP1) in salivary gland cancer cells can activate known cancer specific markers. However, the mechanism by which DMP1 transduces this activation still remains a mystery. In this study, we determine the mechanism by which transforming growth factor beta1 (TGF- β 1) enhances the activation of cancer specific markers in DMP1 overexpressed salivary gland cells. Results from this study suggest that TGF- β 1 stimulates the activation of cancerous markers through the Smad2/3 signaling cascade.
- 99 4:15pm Grad Gene Expression of Soybean (*Glycine max*) in Response to *Trichoderma* and *Rhizobium* Inoculants Under Heat Stress Condition**
 *Simeon Ogundiran, Sue Hum-Musser, Richard Musser, Ammar Al-Furaiji [Western Illinois University]
 Many fungi are known to colonize plant roots. Some of these fungi are non-pathogenic and even beneficial such as *Trichoderma* spp. *Trichoderma* spp. is an endophytic plant symbiont. It is widely used as biocontrol for plant diseases. Similarly, *Rhizobium* spp., a nitrogen fixing bacteria is present in the root nodules of leguminous plant and increase availability of nutrients in the soil, enhance growth of plant and it is use as bio-fertilizer as well as biocontrol for plant disease. In this research project, I examined individual and combined effects of *Trichoderma* and *Rhizobium* inoculants on gene expression in soybean (*Glycine max*) under heat stress condition. I inoculated soybean seeds with the two different inoculants (*Trichoderma* spp. and *Rhizobium* spp.) and an equal amount of the two inoculants combined together. The seeds were germinated on damp cotton pads for six days. They were placed in heat at 35 °C or at room temperature (25 °C) for 16 hours in the dark. Gene expression was examined using real-time quantitative polymerase chain reaction. We determined that the inoculants affected the expression of several genes related to antioxidation, stress and heat response. This research work will give insight into the individual and combined effects of bio-inoculants on gene expression in soybeans under abiotic stress condition.
- 100 4:15pm UG Examining the Neurodegenerative Effects of Ozone Using *C. elegans***
 *Spencer Jaquet, Shuto Osawa, Mark Eschbach, Bwarenaba Kautu [Greenville College]
 Ozone is a toxic gas that can cause serious damage even at concentrations as low as 5 ppm. Using *C. elegans* as our model organism, we subject mutant strains expressing GFP in specific neurons to high concentrations of ozone. Using these strains, we observe the neurodegenerative effects ozone has with respect to exposure time with confocal microscopy. Early examinations performed with a dissecting microscope resulted in the death of worms after moderate exposure to ozone flow. These worms were analyzed using touch stimulus to determine responsiveness immediately after ozone exposure.

101 4:15pm UG

Characterization of the Planarian SWI/SNF-Related Chromatin Remodeling Complexes

*Toria Trost, Peyton Crowe, Brittany Mersman, Mallory Robbins, Austin Dillon, Amy Hubert [Southern Illinois University Edwardsville]

Epigenetic regulation of gene expression through modification and rearrangement of the histone proteins associated with DNA is important for controlling stem cell pluripotency and differentiation in many species. However, many of the proteins that mediate this type of regulation have yet to be fully characterized in planarians, an emerging model for the study of stem cells and regeneration. We identified sixteen planarian proteins (*ARID1A/B*, *ARID2-1*, *ARID2-2*, *ACT6A/B*, *SMARCA2/4-1*, *SMARCA2/4-2*, *SMARCB1*, *SMARCC2-1*, *SMARCD1/2/3*, *SMARCE1*, *polybromo*, *BAZ1B*, *SUPT16H-2*, *TOP2B*, *PHF10*, and *DPF1/3*) homologous to members of the mammalian SWI/SNF-related chromatin remodeling complexes and have begun characterizing their roles in planarian regeneration and stem cell function by whole-mount in situ hybridization and RNAi. The majority of the genes are expressed in the central nervous system and throughout the mesenchyme of the worm where the stem cells reside. Knockdown of fourteen of the genes (all except *SMARCA2/4-1* and *PHF10*) resulted in regeneration defects, including delayed/absent photoreceptors and reduced blastema size. Phenotypes typically associated with stem cell loss (head regression, ventral curling and lysis) were also observed following knockdown of several of the genes. Staining to label mitotic cells revealed a reduction in their number following knockdown of *SUPT16H-2* and *TOP2B*, whereas there was an apparent increase in the number of mitotic cells following knockdown of some of the core complex proteins. Future directions for this project include quantifying the mitotic cell number in each knockdown group and performing fluorescent in situ hybridization to each gene in combination with a stem cell marker to look for co-expression.

102 4:15pm UG

RNA-seq Analysis of the Variegated Phenotype of the *Arabidopsis thaliana* ggps1 Mutant

*William Schryver, Darron Luesse [Southern Illinois University Edwardsville]

Geranylgeranyl Diphosphate Synthase 1 (GGPS1) is an enzyme in *Arabidopsis thaliana* that catalyzes the conversion of isopentenyl diphosphate (IPP) and dimethylallyl diphosphate (DMAPP) to geranylgeranyl diphosphate (GGPP) downstream of the mevalonate (MVA) and the 2-C--methyl-D-erythritol 4-phosphate (MEP) pathways. These pathways are responsible for the production of many hormones, vitamins, and pigments, including chlorophyll. In *Arabidopsis*, a point mutation in *ggps1* results in a variegated phenotype. It is currently unclear why this mutation results in variegation rather than a standard albino phenotype. To identify candidate genes that are involved in this process, transcriptome analysis was performed using RNA-seq to compare wild type, *ggps1* green sectors, and *ggps1* white sectors. From the results, 634 candidate genes were selected based on their function and level of expression, and 42 T-DNA mutant lines were ordered from the Arabidopsis Biological Research Center. Work with these mutants has focused in two primary areas. First, homozygous lines for each mutant had to be isolated from a segregating population using PCR. After confirmation, homozygous lines are grown and observed for major developmental abnormalities, especially related to chlorophyll production. N-Terminal Protein Myristoylation knockout mutant was found to have a visibly lighter color than other lines, suggesting lowered chlorophyll production. Two lines with mutations in Atisopentenyl Diphosphate Isomerase 2 and Variegated 2, respectively, were found to have variegated phenotypes. We suspect that these genes have roles in chlorophyll synthesis and in the organelle stress response. Future work will involve measuring chlorophyll content in the mutant lines.

CHEMISTRY

65 3:00pm UG

Forensic Analysis of Lipstick Samples by Three Different Analytical Techniques

*Bethany Esterlen [Western Illinois University]

Ongoing research in our labs is focused on developing a method for extracting and separating lipstick samples that are left on different mediums at the scene of a crime. Forty different lipsticks, of various colors and brands, were analyzed using thin layer chromatography (TLC), gas chromatography (GC), and high performance liquid chromatography (HPLC). The residues are extracted in a two-part process. The first step is addition of petroleum ether to remove some oils and waxes. The second step is addition of a methanol-ammonium hydroxide mixture to dissolve any dyes or other residue. After further purification the resulting mixture is filtered using a 0.20 micron syringe filter and a TLC sample is removed. The resulting solution is split into two fractions. One fraction is subject to GC analysis and the second fraction is subjected to HPLC

analysis. Results will be presented on which method produces the most consistent results TLC, GC, or HPLC.

- 66 3:00pm Grad Synthesis of Potential In Vivo Activity-Based Probes for Dimethylarginine Dimethylaminohydrolase-1 Based on Halopyridine Substitutes**
 *Dallas Wright, Brian Kamusinga, Robert Dixon [Southern Illinois University Edwardsville]
 Nitric Oxide (NO) is an important molecule in human physiology. The function of NO include the following as examples; immune response, homeostatic regulator, and control of cardiovascular function. Many disease states can be caused by poor regulation of NO such as multiple sclerosis, septic shock, and transplant rejection. The body uses NO as a messenger molecule to elicit a cellular response. However at high concentrations NO has been reported to increase growth of cancer cells and in contrast activate proapoptotic pathways in cancer cells. This indicates that further studies on the effect of NO on cellular pathways are need. The research presented today focuses on the synthesis of an Asymmetric Dimethylarginine (ADMA) derivative as a possible inhibitor of the enzyme Dimethylarginine Dimethylaminohydrolase-1 (DDAH-1). ADMA is used in the body to regulate concentrations of NO.
- 67 3:00pm Grad Trace Detection of Isoeugenol in Local Water Samples via GC Analysis**
 *Dillon Huff, Brian Bellott [Western Illinois University]
 The detection of contaminants in water samples and biological samples is a primary function of a clinical or forensic toxicology lab. Water samples collected from local sources are often contaminated with trace amounts of compounds. The compounds that are present and their concentration can be determined by means of gas chromatography (GC) and mass spectrometry (MS). A reproducible signal appeared in all of the water samples, but the identity of the compound responsible for the signal was unknown. Liquid Chromatography/Mass Spectrometry (LC/MS) analysis was carried out on the water samples at Bradley University. The unknown signal was confirmed to be isoeugenol by comparison to an isoeugenol analytical standard. A common technique used in trace detection analysis is solid-phase extraction (SPE). SPE is a sample preparation process that separates compounds that are dissolved or suspended in a liquid mixture via their physical and chemical properties. For this research, samples were collected from Spring Lake in Macomb, IL, based upon the EPA certified collection method using SPE to extract the samples and utilize GC for analysis of the samples. Development of an optimized GC method was conducted by adjusting variables to effectively detect the isoeugenol standard signal to ensure calibration of the instrument. The limit of detection for isoeugenol in lake water was determined and the reported coefficient of variation (r^2) was determined to be 0.992. Results will be presented on the optimization of the extraction procedure and development of the GC method. Further statistical analysis will provide information regarding the variation among sample sites of the lake and additional contaminants that may be present in the collected samples.
- 68 3:00pm UG Numerical Analysis of the Molecular Weight Distributions of Polymers in a Free-Radical Addition Polymerization System**
 *Elizabeth Honeycutt, Mark Eschbach [Greenville College]
 Free radical addition polymerization (FRAP) is one of the more common techniques for synthesizing polymers. The FRAP kinetic model that has been used by polymer chemists and engineers for over 50 years incorporates a simplifying approximation. That is, the *steady state approximation* is used to reduce the mathematical complexity of the problem. Our initial research involved the numerical analysis of the complete FRAP mechanism without the steady state approximation. Computer simulations of polymethyl methacrylate (PMMA) polymerization based on these techniques gave a more complete understanding of the reaction dynamics as well as the prediction of a wide range of the system and resulting polymer properties such as induction time, extent of reaction, and average molecular weight. However, molecular weight distribution prediction and control are very important to the polymer synthesis industry because the final polymer properties of strength, toughness, elasticity, and others are directly related to molecular weight and its distribution. Therefore our most recent research involved extending the applicability of this numerical analysis by solving the degree of polymerization distribution function for the FRAP system. This has allowed us to predict the distribution of polymer molecular weight and any of the molecular weight averages (M_n , M_w , M_z , etc.). Unlike the basic kinetic numerical solutions that provided information not accessible through the steady state approach the numerical analyses of molecular weight distribution did not provide any new information that was not already accessible through a steady state analysis. We are also in the process of developing a laboratory exercise in which students would make polymers and compare

their properties and molecular weight distributions to those predicted from our numerical analysis simulations.

- 69 3:00pm Grad Optical Microscopy of Solid State Materials**
 *Erik Sarnello [Western Illinois University]
 This research utilizes the visualization and photographic capabilities of optical microscopes to investigate crystalline solid-state materials. There has been a great deal of interest in tin-tellurium metal compounds due to their distinct photoelectric properties. In order to best identify and quantify these properties, single crystals of these materials must be obtained. Using carbon coated fused quartz tubing to house the reactions, various metals (V, Fe, Co, Cr, Mn) were combined with tin and tellurium in various stoichiometric ratios and sealed within the quartz tubing at a pressure of 40-60 microns of Hg. These reactions were placed in a furnace and allowed to take place for two weeks while undergoing a temperature program which tops out at 750°C. Each sample was then opened and sorted.
- 70 3:00pm UG Synthesis and Single Crystal Structure of $(OC)_5W(Ph_2CH_2CH_2PPh_2)W(CO)_5$**
 *Hannah Drake, Brian J. Bellott [Western Illinois University]
 The synthesis and single crystal structure of $(OC)_5W(Ph_2PCH_2CH_2PPh_2)$ will be presented. The complex was prepared by treating a dichloromethane solution of $W(CO)_5(\text{aniline})$ with one equivalent of $Ph_2PCH_2CH_2PPh_2(\text{dppe})$ at room temperature. The single crystal was grown from a 1:1 mixture of $CH_2Cl_2:CH_3OH$ at -20 degrees Celsius. The single crystal structure, FTIR spectrum, and NMR spectra will be presented.
- 71 3:00pm UG Synthesis of Iron-Copper-Chalcogenidostannates**
 *Mattea Scanlan, Brian Bellott [Western Illinois University]
 Solid state chemistry has important applications in technology. It is used in the creation of new materials with unique structures and electrochemical properties that offer the potential for better energy conversion and memory devices. One type of solid state synthesis is that of chalcogenides, which are not as well studied as other inorganic materials. In this chalcogenide synthesis, a reaction mixture of iron powder, copper powder, tin powder, and selenium were combined in discrete stoichiometric ratios in glass tubes coated with carbon. The sample was then sealed under vacuum and heated using a computer controlled furnace from room temperature to 750 °C over the course of 2 days. The sample was left at 750 °C for 10 days and then slow cooled from 750 °C to 550°C at a rate of 10 °C per hour, held at 550 °C for 24 hours, and finally cooled to room temperature. The resulting reaction mixture was examined under a microscope to reveal single crystals. The crystals were hand selected and placed on a SEM stub. Using SEM-EDS, the qualitative ratios of the elements were determined. A poster will be presented discussing this process and the results obtained from the SEM-EDS studies of the crystals.
- 72 3:00pm Grad Epimerization and Substitution of Ugi-Smiles Diels-Alder Products**
 *Philip Alabi, Sarah Luesse [Southern Illinois University Edwardsville]
 Organic synthesis continues to seek better ways of synthesizing molecules that find relevance as pharmaceuticals, insecticides, and growth stimulators. One such method is the Ugi-Smiles Diels-Alder (US-IMDA) reaction, a multicomponent coupling reaction (MCR) that involves formation of multiple new bonds in a single synthetic step. An epoxyisoindoline moiety is produced and the reaction currently yields two diastereomeric products. This work seeks effective ways of epimerization and substitution of the products of the Ugi-Smiles Diels-Alder reaction. Preliminary studies have shown significant and preferred epimerization for one diastereomer over the other. Methods for straightforward product modification will provide access to synthetic derivatives with potential as pharmacologically-active agents.
- 80 4:15pm Grad Exploratory Chemistry of Selenostannates**
 *Rebecca Corbett, Brian J. Bellott [Western Illinois University]
 Exploratory solid state chemistry offers the potential for innovation in technology through the creation of new materials with unique electrochemical, magnetic, and thermoelectric properties. Present research is focused on incorporation of the complex tin selenide anion $[Sn_4Se_9]^{2-}$ into crystal structures containing a variety of transition metals. The unique structure of this anion imparts greater thermoelectric efficiency to the overall crystal structure, allowing for the more efficient conversion of waste heat into useful electrical

energy. Incorporation of the anion into structures of diverse metallic character may allow for the creation of materials with improved semiconducting characteristics. Because solid state reactions are diffusion limited, the flux-based method of crystal synthesis was employed in this research. Salts, with lower melting temperatures than the solid state reactants, used as flux serve to enhance the diffusion of reactants at lower temperatures. Reaction preparation consisted of loading reaction tubes with stoichiometric amounts of various transition metals, selenium, tin, and a eutectic flux mixture comprised of NaBr and NaCl. Reaction vessels were then vacuum sealed and heated in accordance with a temperature program for two weeks at 750°C. Resulting crystals will then be characterized via optical microscopy, SEM, SEM-EDS, and single crystal X-ray diffraction in order to elucidate crystal structure and overall physical properties.

- 81 4:15pm Grad Analysis of Imine-Based Ugi-Smiles Reactions**
 *Robert Ayres, Sarah Luesse [Southern Illinois University Edwardsville]
 Multicomponent reactions (MCR) involve three or more reactants coming together to form a complex products in a one-pot process. MCRs are very appealing methods for synthetic chemistry as they efficiently combine inexpensive starting materials and are easily diversified. An imine-based MCR, the Ugi-Smiles Diels-Alder (US-IMDA) tandem process, produces epoxyisoindolines. This work examines the effect of preformed imines on reaction conversion. Preliminary results indicate that formation of imines prior to addition of the other components provide direct access to diverse heterocyclic oxatricycles.
- 82 4:15pm Grad Development of a Green Chemistry Laboratory Experiment for Undergraduate Curriculum**
 *Samson Adeleke, Thottumkara Vinod [Western Illinois University]
 Most, if not all, of the traditional oxidizing agents covered in an undergraduate lecture course are transition metal based reagents which are toxic and are also potential environmental pollutants. While the ease and efficiency (% yield) of the oxidation reactions using these reagents are highlighted during the lecture class, the deleterious health and environmental aspects of these reagents are often ignored or omitted in classroom discussions. A green oxidation procedure for oxidation of alcohols using catalytic amounts of in-situ generated *o*-iodoxybenzoic acid (IBX) in presence of Oxone as a stoichiometric oxidant is developed. Catalytic amount of commercially available 2-iodobenzoic acid is used as the organoiodine precursor for IBX in the reaction. This convenient procedure for the oxidation of alcohols, completed in a 2.5 h laboratory period, is carried out in aqueous solvent mixtures. Students are introduced to several pedagogically relevant green chemistry principles including the use of aqueous reaction medium, 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.
- 83 4:15pm Grad Oxidative Transformations of β -Dicarbonyl Compounds using Hypervalent Iodine Reagents**
 *Shashidhar Poreddy [Western Illinois University]
 The use of hypervalent iodine reagents have seen a dramatic increase in their use in synthetic organic chemistry over the past two decades due to their mild and selective oxidative properties. Hypervalent iodine reagents are known to effect a plethora of oxidation reactions including oxidation of alcohols, α -oxidation of ketones and spirocyclization of phenols. The α -oxidation of β -dicarbonyl compounds described herein is believed to occur as follows. Oxidation of alkali halides with IBX generates an hypohalide intermediate which reacts with the enol tautomer of the prototypical β -dicarbonyl substrates to provide the α -halogenated derivatives. Oxidative transformations of a series of 1,3-dicarbonyl compounds in various solvent systems have been carried out and products identified. The ease of this oxidative transformations depends on the dicarbonyl substrate and the nucleophile employed. These parameters and the role of the solvent and the mechanistic details of the reaction will be discussed. These oxidative transformation reactions of 1,3-dicarbonyl compounds feature mild reaction conditions, use of readily available oxidizing agent, IBX, metal free conditions, higher yields, and can be carried out in both milligram and gram scale quantities.
- 84 4:15pm Grad Analytical Detection of Atrazine: Method Development and Implementation**
 *Shelby Crawford, Brian J. Bellott [Western Illinois University]
 Improvement of agriculture yields in the Midwest is greatly dependent on pesticide use. Residue from cropland treated with these chemicals can cause water contamination, leading to hazards throughout the food chain. Depending on the class and properties of the pesticide formulation used, the level of toxicity and

routes of prevention can be accurately hypothesized. Atrazine is a pre- and post-emergent pesticide used to eradicate broad leaf weeds like clover and dandelions. Commonly used on corn crops in our area, it is the most popular active ingredient not only in the Midwest, but in the US. The Environmental Protection Agency (EPA) sets standards and methods to determine legal limits for drinking water in the area. For this study, I am interested in determining the amount of atrazine contained in Spring Lake during the high-range summer months and if it is above a legal limit set by the EPA. In order to determine the necessary steps to take in protecting the health of the environment and people in it, proper sampling and analysis is important. Water samples for this research were collected using a standard method from the US Geological Survey (USGS) and analysis methods were developed in the research lab by a number of students. This study utilized numerous analytical instruments including gas chromatography (GC), high-performance liquid chromatography (HPLC), ultraviolet-visible spectroscopy (UV-Vis), and mass spectrometry (MS). Optimization and implementation of each unique method will be discussed along with any results obtained. Reported data includes method development techniques, chromatograms, and detection limits.

ENGINEERING & TECHNOLOGY

103 3:00pm

WITHDRAWN

104 3:00pm UG

Force-Feedback Incorporation into a Teleoperative Glove

*Kyle DeProw, Ryan Krauss [Southern Illinois University Edwardsville]

This study will focus on the application of force-feedback to wearable haptic devices. More specifically, we will focus on the effect of applying a force-feedback system to a teleoperation glove. The Greek term “tele” translates to “a distance”, and a teleoperation device simply implies that a device indirectly operated by an operator from a distance. These devices are incredibly useful in sensitive environments such as bomb disposal, radioactive waste processing, and surgical procedures as they allow an operator control over equipment without actually requiring a physical presence. To adequately operate a teleoperative device, one requires substantial amounts of feedback to be able to maneuver the device. Largely, this feedback is visual when discussing common teleoperation devices; however, we propose adding a supplemental low-cost force-feedback system that will allow the operator to “feel” the environment the robot is operating within in addition to seeing it.

105 3:00pm UG

Job Shop Scheduling Research

*Robbie Carter [Southern Illinois University Edwardsville]

This research has the purpose of enhancing a heuristic for solving a job shop scheduling problem involving multiple machines and processes. This type of scheduling is used in many industries such as the industries of manufacturing, medical care, and logistics. There are currently many heuristics for solving such a scheduling problem such as the Johnson’s method, the branch and bound method, and the Campbell, Dudek, Smith algorithm. The first phase of this research study is designed to develop a different method built on several of the concepts within current job shop scheduling heuristics resulting in the shortest makespan. As the reduction in lead times is becoming an ever growing need in every industry, solving for the least total amount of time possible to complete the task is critical to the success of reducing the project time. The second phase of this research study is to create a program using the method developed in phase one. This research will enhance the understanding of job shop flow scheduling with the hopes of creating a working program that can assist companies to eliminate waste within their scheduling process.

ENVIRONMENTAL SCIENCE

1 3:00pm UG

Evaluation of Irrigation Methods on *Sedum* spp. in Established Midwestern Green Roofs

*¹Amanda Henderson, ²V. Jost, ³K. Lockett, ¹S. Morgan, ¹W. Retzlaff [¹Southern Illinois University Edwardsville, ²Jost Greenhouses, ³Green Roof Blocks]

Across the United States, green roof, or vegetative systems have become important environmental and technological infrastructure resources to lower stormwater runoff, reduce heat island effect in populated areas, and decrease energy costs for commercial, public, and residential buildings. One way to accomplish

such advances is to properly develop maintenance irrigation methods for established vegetative green roofs. This study focuses on the examination of *Sedum* spp. green roof coverage success in comparison with varying frequency of irrigation applications. The study is located on the 16,000 sq. ft. roof atop the Student Success Center (SSC) at Southern Illinois University Edwardsville. Three original test areas were prepared for this irrigation study, an east edge plot, a middle plot, and a west edge plot, each presented with treatments of weekly irrigation, biweekly irrigation, and no supplemental irrigation. It was hypothesized that in established midwestern green roof systems, weekly irrigation conducted through sprinkling approach would result in greater *Sedum* spp. roof coverage compared to biweekly sprinkling irrigation or no supplemental irrigation. However, findings showed that treatment plots without supplemental irrigation on the established green roof system had the largest roof coverage success compared to weekly and biweekly irrigation plots.

2 3:00pm Grad Effects of Pyrethroid Insecticides on Tight Junctions Using an In Vitro Blood-Brain Barrier Model

*Ashley Keely, Kyong-Sup Yoon, Melissa Chan, Yusuf Ali, Lalita Mazgn [Southern Illinois University Edwardsville]

Pyrethroids are a class of synthetically produced insecticides that are derived from the natural pyrethrins extracted from *Chrysanthemum* spp. The use of pyrethroids as common agricultural, public health, and household insecticides has been widely spread over the last several decades. The present study is aimed at examining and comparing the effects of two popular pyrethroids, deltamethrin and permethrin, on the tight junctions of the blood-brain barrier (BBB) of human brain microvascular endothelial cells (HBMEC) using an *in vitro* model. The primary function of the tight junctions is to prevent toxic substances from passing from the blood to the brain. Transendothelial electrical resistance (TEER), an important physiological marker used to measure the tightness of the BBB, was used to determine tight junction disruption when exposed to pyrethroids. It was found that TEER decreased in a dose- and time- dependent manner when the BBB was treated with deltamethrin and permethrin at all concentrations in the chosen range of 10^{-5} μM to 10^{-8} μM . The initial TEER measurement was taken before HBMEC were exposed to the pyrethroids, measuring an average of $202.5 \Omega \cdot \text{cm}^2$. After one hour of exposure, the TEER sharply declined for all concentrations for both chemicals. The deltamethrin concentrations 10^{-5} μM and 10^{-8} μM showed a change in TEER to $69 \Omega \cdot \text{cm}^2$ and $120 \Omega \cdot \text{cm}^2$, respectively. The samples treated with permethrin also showed decline in TEER with the 10^{-5} μM and 10^{-8} μM concentrations measuring at $75.5 \Omega \cdot \text{cm}^2$ and $145 \Omega \cdot \text{cm}^2$, respectively. TEER was measured for six hours, resulting in a steady decrease over time after the initial hour of exposure. This would indicate a disruption of the tight junctions over time. Further research will be performed using TEER and a permeability assay to compare the rates of efflux and influx of pyrethroids through the BBB, as well as using qPCR to observe any changes in ABC transporters.

3 3:00pm UG Fitness Disadvantage of the DDT Resistant 91-R Strain of *Drosophila melanogaster*

*¹Blaine A. Johnson, ¹Harley A. Youtzy, ¹Alexandra L. Johnson, ¹Ronak N. Patel, ¹M. Yusuf Ali, ¹Lalita Mazgaen, ²John M. Clark, ³Barry R. Pittendrigh, ¹Kyong S. Yoon [¹Southern Illinois University Edwardsville, ²University of Massachusetts Amherst, ³University of Illinois Urbana-Champaign] Physiological and fitness alterations in insects can occur as a result of exposure to xenobiotics. Adaptive fitness disadvantage have been commonly observed in many insecticide-resistant insect species. The 91-R strain of *Drosophila melanogaster* has been selected with dichlorodiphenyltrichloroethane (DDT) for more than a half century and determined to be highly resistant to DDT. Fitness disadvantage of the 91-R has also been characterized several times. However, linkages between metabolic alterations in terms of utilizing glucose, protein and lipid for cellular respiration and biochemical mechanisms associated with fitness disadvantage resulted from DDT exposure have not been well understood. Life history parameters (e.g., developmental time, fecundity and adult longevity) were measured in 91-R and two DDT susceptible strains (91-C and CS) under the standard laboratory rearing conditions to verify data from previous studies. The percent hatchability of 91-R strain was significantly lower than that of 91-C or CS ($p < 0.05$). Developmental time of 91-R was also significantly slower than that of CS ($p < 0.05$). It is expected that the fecundity of 91-R will be lower than that of 91-C or CS.

- 4 3:00pm UG Thermal Benefits of Different Weeding Methods of Green Roof Systems**
 *¹Caleb Mau, ¹S. Celik, ²K. Lockett, ¹S. Morgan, ¹W. Retzlaff [¹Southern Illinois University Edwardsville, ²Green Roof Blocks]
 Green roof systems offer a method of providing food, reducing building thermal costs, reducing storm water runoff, and other environmental benefits. However, to provide these benefits, rooftop maintenance must be performed. A 16,000 ft² green roof was planted in April 2009 with five *Sedum* species and installed on the SIUE Student Success Center in August 2009. In 2015, three replicate test plots were selected in different locations on the roof - an east, a west, and a center plot. Each plot consisted of three sections of sixteen Green Roof Blocks (GRBs), each based on their clipping/weeding methods; in one section all weeds were mechanically clipped, in the second all weeds were hand clipped, and in the third all weeds were left unclipped. Weeding/clipping dates were June and October 2015. To monitor the thermal performance of each weeding method, each of the four center blocks of each of the twelve plots were equipped with one thermal probe on the surface of the growth media and another attached to the roof membrane directly beneath the GRB. These thermal probes were connected to 4-channel Hoboware data loggers, which were set to record temperatures every hour at each probe. From August 14th – September 30th 2015, the varying maintenance methods produced a temperature variation between the surface of the growth media and the roof membrane of 2.37°F for the mechanically-clipped GRBs, -0.50°F for the hand-clipped GRBs, and 1.79°F for the non-maintained GRBs. In the early stages of this study, it appears that mechanical weeding decreases the roof thermal load more than hand-weeding or in the absence of weeding.
- 5 3:00pm Grad Long-Term Success of Sedums on a Midwestern Green Roof**
 *¹Joy Hodge, ¹Susan Morgan, ²Vic Jost, ³Kelly Lockett, ¹William Retzlaff [¹Southern Illinois University Edwardsville, ²Jost Greenhouses, ³Green Roof Blocks]
 In order to function environmentally, green roofs, as living infrastructure, require specialized plant species for each installation's climate and the extreme conditions of the roof's microclimate. Additionally, required species characteristics include aggressiveness since, after installation, many green roofs receive little to no maintenance. *Sedum* species have demonstrated better performance over other species on shallow, extensive green roofs. This study uses digital image analysis on a six year old Midwestern green roof to determine the percentage roof coverage area of the five original *Sedum* species: *S. album*, *S. kamtschaticum*, *S. rupestre*, *S. sexangulare*, and *S. spurium*. This study performed digital photo image analysis of 80 green roof plots taken at the end of the 2015 growing season. Overhead photos were taken with a Nikon D7000 camera and a Nikon 18-105mm lens. Images were analyzed with ESRI's ArcMap and ImageJ software. Preliminary analysis of 25% of the plot images, randomly selected, showed *S. sexangulare* outperformed the others while *S. album* and *S. kamtschaticum* performed better than *S. rupestre* or *S. spurium* which both had 0 - 1% roof coverage area. While *S. kamtschaticum* was only present in 1% of the plots, it covered 10 – 35% of the respective plots.
- 6 3:00pm Grad Bioaccumulation of Mercury and Selenium in Fish in the Lower Illinois River**
 *¹Kimberly R. Shoemaker, ²Caleb Wehling, ³Ben Lubinski, ¹Z.-Q. Lin [¹Southern Illinois University Edwardsville; ²Concordia University; ³National Great Rivers Research and Education Center, East Alton, IL]
 Mercury (Hg) is a well-known pollutant that is prevalent in the Illinois-Missouri region due to local multiple coal-fired power plants. Selenium (Se) is an essential micronutrient that is required for the proper function of Se-containing enzymes. Selenium has the ability to mitigate Hg toxic effects through the formation of stable Se-Hg compounds in cells. This field study explored the possibility of using the molar ratio of Se to Hg in fish tissues as an effective bioindicator of Hg environmental effects. Six local common species were collected from the Lower Illinois River near Grafton, Illinois, including Channel Catfish (*Ictalurus punctatus*), Silver Carp (*Hypophthalmichthys molitrix*), Common Carp (*Cyprinus carpio*), Smallmouth Buffalo (*Ictiobus bubalus*), Gizzard Shad (*Dorosoma cepedianum*), and White Bass (*Morone chrysops*). Each fish was dissected into brain, heart, kidney, liver, gill, skin, scale, and muscle tissue samples. The results show that concentrations of Hg were highest in muscle tissues of all fish species, with the exception of Gizzard Shad. The Se:Hg molar ratio in muscle tissues of Gizzard Shad was higher than of other species. Concentrations of Hg in muscle tissues were significantly ($p < 0.05$) lower in the filter feeding species than the non-filter feeder, and higher Se:Hg molar ratios were observed in the filter feeder. In Channel Catfish concentrations of Hg in muscle tissues increased

with increasing body size, but the Se:Hg molar ratio decreased with increasing fish length. Therefore, non-filter feeder species had a higher Hg toxicity risk than those filter feeders in the environment.

- 32 4:15pm Grad Differential RNAi Approaches to Enhance Knockdown Efficiency of Target Gene Transcripts in the Highly DDT-Resistant 91-R Strain of *Drosophila melanogaster***
 *¹Lalita Mazgaeeen, ²John M. Clark, ³Barry R. Pittendrigh, ¹Zhi-Qing Lin, ¹Kyong S. Yoon [¹Southern Illinois University Edwardsville, ²University of Massachusetts Amherst, ³University of Illinois Urbana-Champaign]
 Double-stranded RNA (dsRNA) has been widely used to knockdown transcription of the targeted gene of insects. Two techniques, feeding and injecting dsRNA, have been commonly used to treat insects for functional validation of genes because of simple and easy manipulations with satisfactory efficiencies of suppressing gene expression. However, these approaches often failed to produce anticipated down-regulation of the target genes in the fruit fly, *Drosophila melanogaster*. For down-regulation of tissue-specific transcription of the hard to knockdown Cyp4g1 that is associated with DDT resistance in the 91-R strain of *D. melanogaster*, female flies were treated with Chitosan-dsRNACyp4g1 nanoparticles, and knockdown bioassays were performed using the DDT coated vial (1µg/vial) exposure method. Female flies treated with Chitosan-dsRNACyp4g1 nanoparticles exhibited 1.5-fold decreased KT50 compared to the female flies treated with Chitosan-dsRNArp49 nanoparticles ($\chi^2 = 11.68$, df = 2, p < 0.05). Similarly, flies treated with selenium-PAMAM dendrimer-dsRNACyp4g1 nanoparticles showed 1.43-fold decreased KT50 when compared to flies treated with selenium-PAMAM dendrimer-dsRNArp49 ($\chi^2 = 13.81$, df = 2, p < 0.05). This suggests that nanoparticles used to treat flies enhanced cellular uptake of dsRNA and facilitated decrease the transcript level of the target gene. These results will be validated using quantitative real time PCR.
- 33 4:15pm Grad Molecular and Biochemical Characterization of the Wild-Type *Drosophila melanogaster* that Produces Enhanced Levels of ROS After Exposures to Sub-Lethal Amounts of Ivermectin**
 *¹M. Yusuf Ali, ¹Alexandra L. Johnson, ²John M. Clark, ³Barry R. Pittendrigh, ¹Kyong S. Yoon [¹Southern Illinois University Edwardsville, ²University of Massachusetts Amherst, ³University of Illinois Urbana-Champaign]
 Insect pests damage agricultural crops and also transmit various human and animal diseases. Resistance to insecticides is the main threat to sustainability of any arthropod pest control programs. The biochemical and molecular biological pathways, which lead to inheritable resistance in insects, are very poorly understood. Reactive oxygen species (ROS) levels are known to be elevated under the insecticide induced stress. ROS, such as superoxide anion radicals, are converted by superoxide dismutase to hydrogen peroxide, which then pass out of the mitochondria and endoplasmic reticulum. Hydrogen peroxide is, then, readily diffused into cell nucleus and converted into hydroxyl radical which is known to mutate DNA. If this event happens in germ cells, this mutation can be inherited and involved evolution of resistance. Using the glass vial contact method, a dose dependent mortality response (LC50 = 0.001%) was established following 72 hours of ivermectin exposure. A sub-lethal concentrations of ivermectin (e.g., 3×10^{-6} %) determined from the ivermectin mortality bioassays will be used to test if altered levels of ROS can be detected in the wild type fruit fly (Canton-S) gonads. It is expected that ROS induction by sub-lethal amounts of ivermectin will increase levels of malondialdehyde, a product of lipid peroxidation, and DNA adducts, such as M1-dGp, in the fly gonads. The transcription levels of detoxification genes will be also monitored over different generations using quantitative real time PCR.
- 34 4:15pm UG The Effect of Water Acidification on the Growth, Development and Immune Defense of Cuban Tree Frogs, *Osteopilus septentrionalis*, in the Presence of a Pathogen**
 *Mackenzie Peck, Travis Wilcoxon [Millikin University]
 Freshwater acidification, an issue that is largely linked to industrialization and human activity, poses a threat to natural environments. Amphibians are especially threatened by this issue, due to their permeable skin and sensitivity to environmental disturbances. We exposed Cuban tree frog (*Osteopilus septentrionalis*) tadpoles to neutral and acidified water, both with and without the common water bacteria and amphibian pathogen *Aeromonas hydrophila*. We monitored development, growth and immune defense among tadpoles from different treatments. We found that neither acidity nor the presence of a pathogen, nor a combination of the two, had a significant effect on growth or immune defense, as measured by snout-to-vent length and A.

hydrophila killing ability, respectively, when considering varying Gosner developmental stages. Our results support the null hypotheses that neither *A. hydrophila* killing ability nor snout-to-vent length are significantly affected by acidity or pathogen stressors, or a combination of acidity and pathogen stressors, in Cuban tree frogs. This experiment could hold implications for the future of native species as a result of increased invasive species survival in the presence of environmental stressors.

35 4:15pm UG

Study of Interaction between Neutral Coomassie Brilliant Blue Species and Bovine Serum Albumin

*Rebecca Ngo, Chin-Chuan Wei [Southern Illinois University Edwardsville]

Coomassie Brilliant Blue (CBB) is widely used to determine protein concentration in Bradford assay. Depend on pH, CBB can from cationic, neutral, and anionic species. In the assay, the solution is make to be acidic, in which CBB exists as primarily neutral species. The protein, bovine serum albumin (BSA), is used as a control to make standard curve so that the concentration of unknown sample can be determined. It is well documented that the protein assay is sensitive to proteins containing basic residues, such as Arg, and BSA is capable of binding several CBB molecules. Thus, it is hypothesized that the neutral CBB species is protonated (to become anionic form), which is essential for protein binding. However, the mechanism, including stoichiometry, is not clear. Here, we determined the binding affinity (K_a) and binding Stoichiometry (n) of CBB/BSA complex in the acidic condition ($\text{pH} = 1.59$) using UV-VIS spectroscopy. The titration of BSA to CBB resulted in a binding curve, which was then analyzed by using alternated Scatchard plot. Our data yielded at low concentration of BSA the K_a and n values were determined using alternated Scatchard's equation as determined to $4.98 \times 10^5 \text{ M}^{-1}$ and approximately 2, respectively. At high BSA concentration, the plot reveled a sharp slope with $K_a = 3.77 \times 10^4 \text{ M}^{-1}$ and $n = 5$. Currently, we are investigating possible protonation step the basic condition using isothermal titration calorimetry (ITC).

36 4:15pm Grad

Studying the Endocrine Disruption Activity of Environmentally Relevant ZnO Nanoparticles on *Xenopus laevis* Tadpoles

*Vineet Garlapally, David Jennings, Christopher Theodorakis [Southern Illinois University Edwardsville]

Nanotechnology is a relatively new and a promising field involving many vitally important spheres of human activities. One category of nanotechnology includes nanoparticles, which are particles of elements, compounds, or composites with at least one dimension in the range of 1-100 nm. Toxicity tests of nanoparticles is necessary because the small dimensions of nanoparticles might lead to lethal toxicity related issues for compounds that might be fairly inert as bulk materials. Previous studies have revealed that nano-ZnO (nZnO) lead to inhibition of metamorphosis in the African clawed frog, *Xenopus laevis*. Because of the central role of thyroid hormones in amphibian metamorphosis, the specific objective of this study is to investigate the role of zinc oxide nanoparticles on the thyroid hormone metabolism in *X. laevis* during metamorphic developmental stages. To achieve this, *X.laevis* were subjected to chronic exposures of nano-ZnO suspended in water at concentrations 0.125mg/L, 0.250mg/L, 0.50mg/L, 1mg/L and 2mg/L. The levels of corticotropic releasing factor and thyroxine hormones involved in thyroid homeostasis were measured in paraffin-embedded sections using immuno-histochemical techniques. The working hypothesis is that, nZnO-induced thyroid disruption would be evident in changes in the CRF levels in the brain and thyroid glands of *X.laevis* larvae.

HEALTH SCIENCES

7 3:00pm Grad

Characterization of Brux-Like Motor Patterns: Simultaneous Electromyography and Sonomicrometry

*¹Branden Bennett, ¹J. Devin Wall, ¹Kourtney Utz, ²Dan Welch [¹Southern Illinois University Edwardsville, ²Southern Illinois University School of Dental Medicine]

Human bruxism is a multifaceted disorder that involves involuntary gnashing and grinding of the teeth. Untreated, bruxism can lead to loss of enamel, broken fillings, headaches, and many other oral facial problems. Currently, the underlying etiologies of bruxism are not well understood. Current research suggests either malocclusion or neurological pathology, or a combination of both. Central pattern generators (CPGs) are circuits composed of interneurons that generate coordinated rhythmic outputs. Electromyogram (EMG)

recordings of a jaw closing muscle (anterior superficial masseter) and a jaw opening muscle (anterior digastric) were used to characterize the motor patterns produced by the masticatory CPG. We compared brux-like and masticatory motor patterns in the laboratory rat ($n=10$). Sonomicrometry, a novel technology that uses ultrasound to determine distance, was utilized in the anterior superficial masseter in order to compare the physical movement of the muscle to the EMGs. We found that the anterior digastric and the anterior superficial masseter muscle were in antiphase during mastication (circular mean = 0.865), and were in phase during brux-like movements (circular mean = 0.176). The length of the mean vector (r) indicates the directional concentration of data points around the mean vector angle. The coupling strength during brux-like movements was: $r = 0.778$, while the r during mastication was: $r = 0.893$. A physiological latency, the time from the onset of the EMG firing to the time of the onset of muscle contraction, was calculated and found to be larger during brux-like movements when compared to mastication ($p < 0.01$, Watson U2 test). This, along with the preliminary analysis of the sonomicrometry lead to the possibility that the anterior superficial masseter muscle may contribute a larger influence over the jaw movements during brux-like movements than it does during masticatory movements.

8 3:00pm UG

Effects of Cancerous Matrix on Normal Salivary Gland Cells

*¹Callie Mincy, ¹Shannon Payne, ²Seth Barnett, ²Asha Eapen [¹Southern Illinois University Edwardsville, ²Southern Illinois University School of Dental Medicine]

The extracellular matrix (ECM) of cancer cells plays an important role in malignant tumor growth. Cancer cells matrices are disorganized and can act as a scaffold necessary for tumor growth, progression and metastasis. In this study, we explore the use of ECM from human salivary gland cancer cells to induce and study morphological changes in normal human salivary gland cells. Normal human salivary gland cells (HSG) were seeded on the cancerous ECM of salivary gland cancer cells (HTB-41). The objective of the current research proposal is to understand the Smad2/3 signaling pathways that regulate the morphological changes in human salivary gland cancer. The long term goal is to explore and study the use of ECM as a tumor-induction model for salivary gland cancer progression.

9 3:00pm

A Resin Coating Protects Resin Modified Glass Ionomer (RMGI) from Moisture and Temperature Induced Damage

*Dan Welch, Michael Stallings, Kenneth Rawson, Dan Stoekel [Southern Illinois University School of Dental Medicine]

Resin modified glass ionomer cements (RMGI) are used as a tooth-colored restorative material. RMGIs polymerize in an overlapping series of at least two reactions. First, the resin polymerization is photo initiated by visible light and camphorquinone, or chemically by benzoyl peroxide with an amine accelerator. This is followed by a slower acid-base reaction in which the acid liberates metal ions from the calcium fluoro-aluminosilicate glass. As polysalt precipitates form, they cross-link the glass and polyacrylic acid chains. The matrix matures and reaches peak flexural strength at 24 hours after the initial polymerization. Protecting the restoration while the acid-base reaction goes to completion may be an effective method of decreasing damage to RMGI restorations. Some researchers have reported that RMGI is sensitive to temperature and moisture changes for the first 24 hours after photo polymerization. We hypothesized that placing a resin coat over the surface of an RMGI restoration would decrease sensitivity to moisture and temperature changes and increase shear strength. We measured the shear bond strength of Equia and control samples that had been thermo cycled 500 times between 5°C and 55°C and then maintained 37°C with 95% humidity. All samples were then sanded with 800 grit carbide sandpaper, and the Equia coat was fully removed from the experimental group to ensure the second recessed cone bonded only to RMGI. A second recessed-cone plate was backfilled so that the RMGI portions of the plates bonded to each other. Shear bond strength was then measured using a universal testing machine. The Equia group had a significantly greater shear strength than the control group ($P < 0.05$). Equia also appeared to affect the mode of failure by increasing the number of mixed failures ($P < 0.05$). Moreover, there is a trend toward decreased adhesive failure ($P = 0.053$). These data support the conclusion that a resin coat protects RMGI from moisture and temperature induced damage, and increases the shear strength.

- 10 3:00pm** **Mouse Immune Response Can Be Stimulated by Cubicin**
 *Dennis Kitz, Shannon Meckel, Jessica Haines, Jessica Carrier, Brian Ruiz, Ben Miller [Southern Illinois University Edwardsville]
 Cubicin (=Daptomycin) Cubist Pharmaceuticals Inc., Lexington, MA, is an FDA-approved drug in the cyclic-lipopeptide class of molecules. This cidal antibacterial antibiotic depolarizes the membrane of gram-positive bacteria inhibiting their synthesis of DNA, RNA and proteins causing cell death. Since earlier work in our laboratory has shown that many antibacterial antibiotics can boost some aspects of mouse immune response, some effects of cubicin on immune response have been examined. These included determining that neutrophil cidal activity is not enhanced for yeast targets, while macrophage cidal activity for yeasts and T cell DTH activity to the contact sensitizing chemical DNFB are both significantly enhanced in mice. However it remains to be seen if such stimulation of immune response is beneficial to patients receiving the drug. This work was funded in part by the Max Baer Heart Fund, Fraternal Order of Eagles in Illinois and B. Ruiz is an LS-AMP Research Scholar NSF/HRD 094024.
- 11 3:00pm UG** **Effect of Kava (Kavalactones) on Presynaptic and Postsynaptic Cholinergic Neurotransmission In *C. elegans***
 *Juliana Phillips, Bwarenaba Kautu [Greenville College]
 Kava, a root extract from the plant species *Piper methysticum*, is commonly ingested by South Pacific Islanders. Chronic consumption of kava has been tied to liver damage. The overuse of kava is becoming a public health concern on the island, and the known side effects have caused some countries like Australia to ban the use of it. The extract is known to cause sedative and anxiolytic effects on the human body, which suggests that it may interfere with neurotransmission. Several classes of compounds have been isolated from kava including kavalactones, which are believed to be primarily responsible for the biological effects of kava on the human body. Despite that, very little is understood in terms of the underlying cellular and molecular mechanism of action of kavalactones in the nervous system. Here, we used the model system, *C. elegans*, to unravel the molecular action of kavalactones with respect to cholinergic neurotransmission. Our behavioral and genetic results revealed that kavalactones modulate cholinergic transmission in the *C. elegans* nervous system. Moreover, using *C. elegans* function-altering mutations involving cholinergic transmission, we observed that kavalactones affect both presynaptic and postsynaptic pathways respectively. Additional neuroimaging experiments are underway to probe for potential changes in presynaptic and postsynaptic acetylcholine signaling.
- 28 4:15pm** **Mouse Immune Response Can Be Stimulated by Antibacterial Antibiotics**
 *Dennis Kitz, Brian Ruiz, Joshua Beasley, Samuel Barnes, Michael Hudson, Vance McCracken [Southern Illinois University Edwardsville]
 Drug-pathogen interactions are usually the focus for studies on antibacterial antibiotics, ignoring host pathogen interactions unless mandated by toxic or allergic host reactions. However our laboratory and others have found that antibiotics can directly and non-specifically influence host immune response. We have studied a number of drugs such as Ketek, Zyxon, Tigecycline and Dalbavancin for their effects on immune response on macrophage killing of yeast targets in vitro and on in vivo T cell DTH response to chemical antigen DNFB (Sigma). Such stimulation of these immune functions may benefit patients receiving these therapies in addition to to direct anti-pathogen activity. We are also initiating further studies of drug-host cell immune interactions looking at indicators such as changes in cytokine secretions indicative of enhanced inflammatory response. This work was supported in part by the Max Baer Heart Fund, Fraternal Order of Eagles in Illinois and B. Ruiz is an LS-AMP Research Scholar NSF/HRD 094024.
- 29 4:15pm Grad** **Osteopontin (OPN) Enhances Migration in Human Salivary Gland (SG) Cancer**
 *¹Kathryn Carter, ²Anita Joy [¹Southern Illinois University Edwardsville, ²Southern Illinois University School of Dental Medicine]
 Osteopontin, a multi-functional protein, is a key regulator of survival, proliferation, migration and invasion pathways in human cancers. The objective of our study was to determine if OPN can directly influence the enhanced cell migration seen in human SG cancers. Normal human SG cells (HSG), cancerous human SG cells (HTB41) and OPN-silenced, cancerous SG cells (siOPN/HTB41) were aseptically maintained at 37°C in a 5% CO₂ environment. HSG, HTB41 and siOPN/HTB41 cells were grown to confluence on uncoated cover-slips,

and HSG cells were also grown to confluence on cover-slips coated with recombinant human OPN (rhOPN). A 2-dimensional gap-closure assay and a 3-dimensional transwell migration assay were performed on all four groups. A uniform “scratch” was created with the tip of a sterile micropipette tip on Day 0, and cells were imaged every 24 hours. Normal HSG cells migrated and almost infiltrated the “scratch” by Day 4. Cancerous HTB41 cells migrated at a faster rate than HSG cells to obliterate the “scratch” in <48 hours. Normal HSG cells on rhOPN mimicked the eliminated the “scratch” by Day 2. OPN-silenced cancer HTB41 cells required 4 days to obliterate the “scratch”. Using rhOPN as the chemoattractant in transwell migration assays, normal HSG cells showed significantly higher migration rates as compared to naïve HSG cells and OPN-silenced cancer HTB41 cells ($p \leq 0.001$), and were comparable to migration exhibited by cancer HTB41 cells. Cancer cells are known to exhibit increased proliferation, migration, and the ability to invade into the surrounding tissue and metastasize. Consequently, cancer progression and metastasis is the most common reason for fatalities. We show that OPN plays a direct role in enhanced migration associated with human SG cancer cells. Thus, OPN could serve as a potential therapeutic target to hinder migration and potential metastasis in SG cancers.

30 4:15pm UG

Modulation of GABAergic Neurotransmission by Kavalactones in *C. elegans*

*Kellie Steele, Juli Phillips, Dominic Goggin, Bwarenaba Kautu [Greenville College]

Kava is a root extract of the plant *Piper methysticum*, commonly found in the South Pacific. When the root is ground, mixed with water, and consumed, it has been reported to have sedative and anxiolytic effects on the human body. There is now chronic consumption of kava by Pacific Islanders and its adverse affects have been reported. Because of this, there is a need to fully understand the mechanism of the effects of kava on the human body. The reported sedative and anxiolytic effects suggest that kava may be affecting certain neuronal pathways. Numerous kavalactones, the active ingredients in kava, have been identified but little is known about how these compounds affect inhibitory (GABA) signaling. In order to test this relationship, we used *C. elegans* as a model system to study the effect of kavalactones on the inhibitory (GABA) synaptic transmission. In our experiment we treated *C. elegans* with kavalactones and observed their responses. The worms displayed two phenotypes, epileptic-like convulsions and paralysis, indicating an imbalance in the inhibitory and excitatory neurotransmission. To specifically observe the relationship between kava and GABAergic (inhibitory) neurotransmission, we analyzed animals carrying mutations that distinctly affect presynaptic and postsynaptic GABAergic neurotransmission. Our results so far suggest that the kavalactones affect postsynaptic transmission of GABA. We are currently testing additional GABA-specific genes and observing cellular changes in postsynaptic receptor dynamics using confocal microscopy.

31 4:15pm Grad

The Effect of Parent Education Levels on Parenting Styles and Cultural Values

*Lainie Barron, Jared G. Deerhake, Haley E. von Holst, Ashley N. Marmouget, Eva Dreikurs Ferguson [Southern Illinois University Edwardsville]

The current study assesses if parenting style values are related to parental education levels. The Parental Values Inventories (PVi and PVa) developed by Ferguson measure parenting values from an Adlerian perspective. These measures are based on the work of Dreikurs (Dreikurs, Grunwald, & Peppers, 1998) and Lewin (Lewin, Lippitt, & White, 1939). Previous non-Adlerian research has demonstrated that there is a relationship between level of parent’s education and parenting style (Carr & Pike, 2012; Keshavarz & Baharudin, 2013). Whereas the PVi measures college students’ reports of how their parents raised them up to age 9, the PVa measures these same values held by the student currently. Additionally, a test by Triandis and Gelfand (1998) measures cultural values held by the student currently. Results show that the educational level of either the mother or father do not significantly relate to reports of how the parents raised the student. However, educational levels of parents were significantly related to college students’ current values. Students whose mother had a post-bachelor’s degree rated themselves as less autocratic than those whose mothers had lesser education, and students whose father had a high school education tended to rate themselves as more laissez faire than those whose fathers had more education. Additionally, the lower their fathers’ education level, the more horizontal individualistic the students’ cultural values were.

138 4:15pm Grad

Cell-Matrix Interaction: Activation of MAP kinase Signaling Pathway in Salivary Gland Cells

*Jacob Krisher, Callie Mincy, Shannon Paynee, Asha Eapen [Southern Illinois University Edwardsville]

The extracellular matrix is a highly organized structure of all tissues and organs, which defines tissue organization and cellular function, amongst many other tasks. Salivary gland cells secrete and adhere to the

extracellular matrix (ECM) for survival. However, during tumor progression and metastasis, salivary gland cancer cells secrete cancerous ECM, that promotes cells to survive. Cancer progression and survival is characterized by a complex reciprocity between these cells and the cancerous ECM. The goal of this study is to determine the role of cancerous ECM in the adhesion of normal salivary gland cells. For this purpose, we explored the use of the cancerous ECM of pleomorphic adenomas to culture normal salivary gland cells. Results from this study depicts the differentiation role of the cancerous ECM in transforming normal human salivary gland cells into a cancer specific lineage by activating the MAP kinase ERK1/2 signaling cascade. Overall, this study will help in designing an *in vitro* tool to study salivary gland cancer progression.

MICROBIOLOGY

- 73 3:00pm Grad Detection of Thermophilic Fungi In Corn-Based Food Products and Corn Fields and Their Potential Role in Mycotoxin Production**
 *Adeyemi Olanrewaju, Terri Tobias, Andrea Porras-Alfaro [Western Illinois University]
 Thermophilic fungi can grow at high temperatures between 45°C to 55°C and represent an important component of the microbial community in soils. The diversity and distribution of these fungi in corn agricultural fields and corn-derived food products and their potential role on mycotoxin production have not been studied. High incidence of lung infections has been recorded among corn farmers but the etiology of these infections has not been clearly determined. We hypothesized that high numbers of thermophilic/thermotolerant fungal spores can be isolated from corn fields and isolation rates varied seasonally influencing rates of lung infections/ allergic reactions on farmers. Fungi will be isolated from soil samples and corn-based products. Corn meal flour was sampled and tenfold serial dilution of the product was prepared and cultured on Emerson media and incubated at 50°C for two weeks. Fungal identification was carried out using Polymerase Chain Reaction (PCR) and DNA sequencing. From samples cultured, up to 50% yielded thermophilic fungi. *Aspergillus* was the most abundant genus based on morphological identification and microscopy: 4 different morphotypes from corn flour and 3 morphotypes from corn starch. These preliminary results indicate the presence of thermophiles in corn products which may have significant implications on human health.
- 74 3:00pm UG Isolation of Human Oral and Intestinal Bacteria and In Vitro Growth with Roundup™ Added to Nutrient Media**
 *Andrew Wall, Richard Finger [Lindenwood University-Belleville]
 Roundup™, a widely used herbicide, has an active ingredient of glyphosate which has been previously shown to have a mechanism of blocking the enzyme enolpyruvylshikimate-3-phosphate synthase (EPSPS). For gut microbiota with this enzyme, glyphosate disallows the production of aromatic amino acids and will affect survival. Some studies have hypothesized that glyphosate ingested by humans in foods may harm the symbiotic bacterial species in the gut. The aim of this study was to isolate and test various oral and intestinal bacteria for their in vitro growth in various percentages of glyphosate. Our results suggest that the bacterial species isolated from human oral cavity and intestines grown with 1% Roundup™ for several days yielded no statistically significant changes in growth in vitro, giving evidence that a diet at such concentration would have little effect on the gut microbiota that were isolated.
- 75 3:00pm UG Bacterial Diversity Associated with Novel Mucoromycotina Species**
 *Eliese Potocek, Terry Torres-Cruz, Terri Tobias, Andrea Porras-Alfaro [Western Illinois University]
 Fungi associate with different communities of bacteria, including endobacteria that grow inside fungal hyphae. Bacterial symbionts have been known to impact the growth of fungal organisms. A newly proposed genus belonging to the fungal subphylum Mucoromycotina has been identified in our laboratory. Electron microscopy pictures and next generation sequencing analysis show large number of bacteria associated with this fungus. The purpose of this study is to describe the diversity of bacterial species associated with this new fungus using cultured-based methods. Three isolates (TLT265, YP243, AZ0501) of the fungus were grown on different media types to isolate the bacteria (e.g. MEA, SDA, R2A, PYG, CDA) at different temperatures (25°C, 35°C, and 45°C). Plates were observed for noticeable bacterial growth and bacteria were transferred to new media to generate pure cultures. DNA was extracted and amplified using the 16S rRNA region. Preliminary results for the culture isolates showed isolation of *Bacillus* and *Stenotrophomonas*. The most abundant phyla

detected with next generation sequencing belong to Proteobacteria and Firmicutes, which include common taxa found in other close relatives of this new taxon.

76 3:00pm UG

Mosquito Mayhem: Are Illinois *Aedes* Mosquitoes Ready for *Chikungunya* Virus?

*Kennen Hutchison, Catherine Miller-Hunt, Jason Hunt [Western Illinois University]

Chikungunya virus (CHIKV) is a flavivirus that is transmitted by *Aedes aegypti* and *Aedes albopictus* mosquitoes. Although the virus has a low mortality rate in humans, it causes fever, severe muscle pain, and severe joint swelling. In 2005, an outbreak of CHIKV was identified on the French La Reunion Island in the Indian Ocean and infected more than 75% of the island population. This outbreak was later attributed to a new strain of CHIKV that exhibited a single amino acid change in the viral (spike) glycoprotein. The mutation, an alanine to valine change at amino acid 226 in the viral glycoprotein (A226V), allowed for a leap in vector usage from primarily *Ae. aegypti* to primarily *Ae. albopictus* and resulted in a high number of CHIKV cases on the Island. The fact that one amino acid mutation can expand vector competency throughout species in the *Aedes* genus is of interest to our lab. The aim of our project is to identify if other single amino acid mutations in the CHIKV glycoprotein could permit or increase CHIKV competency in *Aedes* species currently located in west-central Illinois. At this time, *Ae. aegypti* is not found in west-central Illinois, but other *Aedes* species, including *Ae. albopictus*, *Ae. japonicus* and *Ae. triserriatus* are. The results of our study will help to indicate if Illinois currently has a mosquito vector that is competent for CHIKV infection and we could therefore be at risk of facing the virus before the invasion of *Ae. aegypti* reaches our state. As a secondary objective, our research will look at the mechanisms of viral entry by CHIKV into mosquito cells and focus on the important pathways utilized in the process.

77 4:15pm UG

Commensal or Pathogen? *Escherichia coli* Diversity in a Rural Creek in Illinois

*Riley Schmid, Kaleigh Smith, Amy Lam, Rachana Shrestha, Kelly Jones, Drew Baltzell, Brittany Smith, Jason Smith, Shraddha Shrestha, Quentin Jordan, Mohammed Almalki, Faslul Karim, Kai Hung, Steven Daniel [Eastern Illinois University]

Escherichia coli is mostly a commensal bacterium, however, some strains are human pathogens. The goal of this study was to determine the diversity of *E. coli* strains isolated from Riley Creek in rural Coles County, Illinois. Six different water samples were collected and a Colitag™-MPN system was used to enumerate fecal coliforms. Samples averaged 10-40 cells/100 ml. EC broth and sorbitol MacConkey agar were used to select for non-O157 *E. coli*. Fifty-five isolates tested with API 20E and Enterotube II were identified as *E. coli* and exhibited a wide range of diversity. The API 20E test rendered 24 different biocodes with 16% as 5144572, while the Enterotube II generated 12 biocodes with 29% as 36560. Antibiotic susceptibility was determined using the Kirby-Bauer assay and 15 different antimicrobics. Isolates were generally susceptible to the antimicrobics tested; however, 24 and 20% of the isolates were resistant to ampicillin and cephalothin, respectively. Dryspot *E. coli* O157 and *E. coli* Seroscreen (026, 091, 0103, 0111, 0128, and 0145) latex agglutination kits (Oxoid™) were used for serotyping isolates. None of the isolates tested positive for the O157 serotype but five isolates were positive for one of the non-O157 serotypes. Overall, evidence suggests that the diverse *E. coli* isolates obtained in this study were mostly commensal; however, the presence of antibiotic resistance and the detection of one of the “Big Six” non-O157, shiga toxin-producing serotypes among isolates suggests that *E. coli* found in rural creeks may represent a potential threat to public health.

78 4:15pm UG

Construction of a Timeline for Morphogenesis and Sporulation in *Schizophyllum umbrinum*

*Ryan Momenteller, Emily Wade, Thomas Fowler [Southern Illinois University Edwardsville]

Schizophyllum umbrinum, a sister taxon to the model mushroom *Schizophyllum commune*, remains an exceedingly understudied species. *S. umbrinum* is self-fertile; mushroom formation and sporulation can occur without the complex mate recognition as seen in *S. commune*. In contrast, *S. commune* is an obligate outcrosser in which mushroom formation and sporulation is achieved through a successful mating interaction between two compatible individuals. To date there exists no evidence of a mating interaction in *S. umbrinum*. In order to better understand *S. umbrinum*'s lifecycle while aiming to overcome its fruiting inconsistencies in culture, optimized laboratory culture conditions were sought. We identified methods for prolific mushroom formation with consistent mushroom morphology. On one occasion two *S. umbrinum* fruiting bodies produced hundreds of spores, most of which were viable, indicating the lifecycle could be completed in laboratory culture. Fruiting and sporulation in *S. umbrinum* can take over a month on solid medium, much longer than *S. commune*, for which fruiting and sporulation can happen in ten days or less

under similar conditions. Interestingly, *S. umbrinum* grown on the surface of liquid media can fruit in just 2 days. However, the timing of sporulation has yet to be determined. With these improved culturing methods, we are developing a timeline for fruiting and sporulation in *S. umbrinum* under standardized conditions. Key morphological features that lead to mushroom formation and spore dispersion are being followed. A well-developed timeline comparable to that of the model *S. commune* will be beneficial for understanding how the very different reproductive strategies of the two species affect development of similar structures.

79 4:15pm UG

Enhanced Electrotransformation of *Leuconostoc citreum*

*Scott M. Holt, A. Aljubran, J. A. Lucas, T. Sartore [Western Illinois University]

Development of an efficient gene-transfer protocol for *Leuconostoc citreum* is important for understanding genetics of α -glucan synthesis and to enhance the biotechnology potential of these microorganisms. *L. citreum* has been resistant to electrotransformation since published protocols result in low transformation frequencies. Low transformation frequencies are probably due to the thick peptidoglycan cell wall. The goal of this study was to improve the electrotransformation frequency in *L. citreum* by using treatments that permeabilize the cell wall to allow for enhanced transfer of genetic material into the cell. Using a standard protocol, *L. citreum* was electrotransformed using varying concentrations of pGK12 and transformants were selected on MRS-chloramphenicol agar. Each electrotransformation was performed in triplicate. In general, transformation frequency improved as less plasmid DNA was used from 1.0 μ g to 0.1 μ g. To enhance permeability, *L. citreum* cells were treated with various concentrations of glycine, penicillin, or lysozyme. The treated *L. citreum* cells were then electrotransformed with pGK12 (0.25-0.1 μ g). Statistically significant increases in electrotransformation frequencies were obtained when *L. citreum* was treated with optimal concentrations of glycine, penicillin, or lysozyme when compared to the control (no treatments). These results were repeatable with two *L. citreum* strains. In summary, electrotransformation frequencies of *L. citreum* were improved by reducing plasmid DNA concentration and using treatments that permeabilize the bacterial cell wall. The enhanced electrotransformation protocol can be used to help understand the genetics of *Leuconostoc* and improve biotechnology applications.

PHYSICS, ASTRONOMY, & MATHEMATICS

12 3:00pm Grad

The Effects of Doped Nanoparticles on Nematic Liquid Crystal with Negative Dielectric Anisotropy

*Braxton Kilmer [Southern Illinois University Edwardsville]

Liquid Crystals (LC) are widely utilized in LC Display technologies. LC materials flow like any other liquid, however, their molecular structure is ordered like that of a crystal. When sandwiched between parallel conductive glass plates these amazing liquids act like optical switches. Applying low voltages across the samples can control the amount of light passing through them. All LC applications demand fast switching at low applied voltages. These parameters, in turn, critically depend on the LC material properties: electrical, optical, and thermal. One of the main aspects of LC research are the optimization of these material properties. The effects of size, shape and concentration of doped gold and silver nanoparticles (GNP, SNP) on properties of N-(4-Methoxybenzylidene)-4-butylaniline (MBBA) liquid crystal has been studied. The SNP has a 50nm size and spherical shape, and the GNP has a 10nm size and ellipsoidal shape. 1% and 2% concentrations (by weight) of each nanoparticle type have been dispersed in MBBA. The study shows that the doped nanoparticles dramatically affect the material properties of liquid crystal.

13 3:00pm

Lithium Diffusion in TiO₂ Nano Particles

*¹Dongxue Zhao, ²E.H. Majzoub [¹Greenville College, ²University of Missouri-St. Louis]

Lithium diffusion behavior plays an important role in the lithium intercalation or conversion processes in the active electrode materials. For lithium-ion batteries, the rate of capacity and electrochemical kinetics characteristic may be affected and controlled by lithium diffusion. Investigation of the lithium diffusion behavior and studying the lithium diffusion coefficient in active materials become more and more important in lithium ion battery research. More broadly, diffusion in a nano particle system is of paramount importance for any intercalation material, including Li-ion and metal hydride batteries. Galvanostatic intermittent titration technique (GITT) was used to investigate lithium diffusion in synthesized anatase TiO₂ nano particles of size 9 – 35nm. A new diffusion model based on the stretched exponential method is proposed and used to investigate the lithium diffusion behavior in the synthesized TiO₂ nano particles.

- 14 3:00pm UG An Experimental Study of Quantum Eraser**
 *Jordan Disch, Christopher Heckman [Greenville College]
 The goal of this quantum eraser is to “erase” a system’s path information. In this experiment, the information of a photon’s path is dependent on its polarization, or direction of oscillation of the electric field. If the path information has been erased, we will observe a sinusoidal behavior of coincidence counts by adjusting the path length of the light. In order to determine how effectively the information has been erased, we measure the system’s visibility. An ideal visibility is 1 (100%) with obtaining a value of 0.80 being our goal.
- 15 3:00pm UG A Linear and Non-linear Optical Characterization of Europium Doped Phosphate Glass**
 *Joseph Smith, Abdullatif Hamad [Southern Illinois University Edwardsville]
 From its humble conception in the late 1950’s to the treatment of disease and disfigurement in dermatology and ophthalmology today, it is hard to find a branch of technology that lasers have not influenced. And equally as important as the study of laser applications, is the studied of potential laser media. The purpose of this project is to determine the feasibility of using Europium doped phosphate glass (30% Eu_2O_3 , 3% Sm_2O_3 , and 2% CeO_2) as a laser medium capable of generating orange light ($\lambda=612$ nm). We studied the absorption and fluorescence at various temperatures. Also, the fluorescence relative intensity and lifetime of the orange spectra was measured for various excitation wavelengths. We found large absorption, and consequently large fluorescence, at 395 nm, 465 nm, and 532 nm. The largest absorption occurred at 395 nm. Exciting the sample with blue 465 nm or green 532 nm produced smaller absorption. The absorption at 532 nm (from ${}^7\text{F}_1$ to ${}^5\text{D}_1$) increased with temperature. As a result the fluorescence from the ${}^5\text{D}_0$ to ${}^7\text{F}_2$ increased as well. We found that the lifetime of the ${}^5\text{D}_0$ to ${}^7\text{F}_2$ transition is 2.2 ms. Finally, we studied the thermally induced change in the index of refraction using the thermal lensing and a pump-probe x-scan techniques. Thermal diffusivity and dn/dT for our sample will be reported and discussed.
- 16 3:00pm UG Measurement of the Two-Photon Absorption Coefficient and Nonlinear Index of Refraction in Si-Photodetector Using an Electrically Focused- Tunable Lens at 1.5 μm**
 *Justin Deterding, A. Hamad, H. Garcia [Southern Illinois University Edwardsville]
 We report the measurement of the Two-Photon Absorption (TPA) coefficient and non-linear refraction in a Si-Photodetector using the f -scan technique which is, a variation of the z-scan. f -scan employs the use of Electrically Focused Tunable Lens to vary the focal point of the beam relative to the sample the (Si-photodetector). TPA coefficient is determined from the induced current in the Si-photodetector (our sample). The nonlinear refraction (n_2) is deduced by collecting the reflected light from the Si-photodetector using Ge-photodetector. Both parameters can be determined experimentally in one scan. The experiment is performed using the output of a fiber based laser operating at 1.55 μm . The laser power at the entrance surface of the sample was 23 mW with pulse width of 50 fs. The measured values for the TPA coefficient and the nonlinear index of refraction (n_2) agree with the reported values in the literature.
- 17 3:00pm UG Ultraintense Laser-Cluster Interactions: Effects of the Cluster Shape**
 *¹Kasey Barrington, ¹Zachary Hartwick, ¹Joseph Trost, ¹Rishi Pandit, ²Nicolas Bigaouette, ²Lora Ramunno, ²Edward Ackad [¹Southern Illinois University Edwardsville; ²University of Ottawa, Canada]
 Highly dense spherical and ellipsoidal shaped rare-gas (Argon) clusters under extreme conditions are studied. These clusters are irradiated by an ultraintense extreme ultraviolet laser pulse to create these conditions. The clusters absorb a large amount of energy from the laser. In the absence of other matter, the energy in the clusters is isolated and cannot escape. This energy absorption causes electrons to be ejected from the Argon resulting in disintegration from the imbalanced coulombic forces. The disintegration follows a simple model that is well predicted by the clusters’ initial shape. The spherical cluster’s ions move in a direction that is radially outward from the center of the sphere, maintaining an overall spherical shape. Ellipsoidal shaped cluster’s ions move radially outwards from the center of the cluster, but, due to asymmetry of the initial shape, the cluster does not maintain its initial shape.

- 24 4:15pm UG The Study of Thermal Lensing, Photochemical Reaction, and Soret Effect in Castor Oil Using Collinear Pump-Probe Technique**
 *Philip Chrostoski, Joseph Smith, Abdullatif Hamad [Southern Illinois University Edwardsville]
 We used a collinear pump-probe technique to study the nonlinear change in the index of refraction and nonlinear absorption induced by the pump beam. The experiments were performed using an Argon laser operating at 447.9 nm as the pump beam and a He-Ne operating at 632.8 nm as the probe. The nonlinear refraction was detected by monitoring the on-axis transmitted power 1m after the sample as a function of time. The nonlinear absorption was measured by collecting the entire power of the beam transmitted through the sample. We found that the nonlinear refraction is due to thermal lensing (TL), photochemical reaction (PCR), and Soret effect (SE). Our data showed that SE is dominant at low pump powers while PCR is dominant at high pump powers. Furthermore, we found that the pump beam induced a change in its own absorption and the that of the probe beam as well. We observed a diminishing fluorescence as a function of time which is an indication of the PCR process. At low pump beam powers, the induced positive change in the refractive index due to SE and PCR is larger than the thermally induced change. We used a theoretical model to fit the data and extract the values for the various physical parameters.
- 25 4:15pm UG Experimental Production of Two Entangled Photons Using Spontaneous Parametric Down Conversion Type-II and Evaluation of a Quantum System**
 *Shuto Osawa [Greenville College]
 Quantum entanglement plays an important role in quantum information technology. We have produced entangled photon pairs by making use of Type-II Spontaneous Parametric Down Conversion. We examined a few characteristics of these entangled photon pairs using Entanglement Witness Operator, Quantum State Tomography, and CHSH inequality. We obtained 0.93 for fidelity from Quantum State Tomography. These entangled photon pairs may be used in quantum key distribution, quantum computing, and quantum teleportation among many other possibilities.
- 26 4:15pm UG Interferometric Autocorrelation of Ultrafast Light Pulses Using an Electrically Focus Tunable Lens**
 *Tyler Kelso, Hernando Garcia [Southern Illinois University Edwardsville]
 In the 1980s, the method of interferometric autocorrelation (IFA) was developed as an improvement on intensity autocorrelation (IA). This technique was able to provide more information about the shape and phase distortions of ultrafast optical pulses, in a collinear Michelson interferometer. Interferometric autocorrelation is based on a mechanical translation stage of micrometer resolution that provides the time-delay, this in turn increases the complexity of the experimental set-up. In this approach, we use an electrically tunable focus lens (EFTL) that considerably reduces the complexity of the set-up by replacing the mechanical translation stage with EFTL and using the changing focus as the delay. This, in turn gives us a .72 fs time resolution in a very compact system. This opens the door for a very compact, low cost ultrashort pulse characterization technique.
- 27 4:15pm UG Memristor**
 *Xiaotong Zheng [Greenville College]
 Normally known, there are three fundamental two-terminal circuit elements: the resistor, the capacitor, and the inductor. However, in 1971, Dr. Leon Chua, who is the circuit theorist, pointed out that theoretically, there should exist another basic element that link the magnetic flux, Φ , and the electric charge, q . Memristor, defined as linkage between the magnetic flux and the electric charge, has the same dimension as resistor, but its resistance is determined by how much electric charge has flowed in what direction through it in the past. Therefore, by measuring the resistance of a memristor, one can determine the amount of charge that has gone through, which achieves the function of memorizing the amount of electrical charging. This project is to discuss the properties of memristors by simulating the memristor signals with computer programing, as well as assembling a memristive device using operational amplifiers, resistors and capacitors.

SCIENCE, MATHEMATICS, & TECHNOLOGY EDUCATION

- 18 3:00pm Teachers Misconceptions about Climate Change Knowledge**
 *Elaine AbuSharbain, Karen Asbury [Southern Illinois University Edwardsville]
 Climate change is a pressing issue. It is important as a global community to be raising climate literate citizens who will be able to address the issue. This study was intended to assess the misconceptions that teachers hold regarding climate change, the potential of peer pressure at work, the curriculum they use and what they assess to be most effective, effective classroom strategies and utility of textbook, their assessment of students' interest in learning about climate change. Additional factors for assessment included the amount of class time dedicated to climate change topics and whether teachers outside of science disciplines address climate change.
- 19 3:00pm Grad Recruiting East St. Louis: Strategies for STEM Student Program Retention In an At-Risk Community**
 *Mallory Maves [Southern Illinois University Edwardsville]
 In order to attract and retain students, extracurricular programming must identify and meet not only students' interests and expectations, but also the standards of their parents. In our current project, named "Coding for Community," we examine the best means for bolstering student attendance, and examine the best resources for recruiting and retaining each student, many of whom are from an at-risk community, in East St. Louis, Illinois. Our team is drawn from various academic disciplines, including the Digital Humanities side of English and History, along with many STEM fields, found on the Southern Illinois University Edwardsville campus. In addition to these faculty and staff, other relationships were established in East St. Louis middle schools, and within the broader community. A student's satisfaction with programming should be a major factor in the student's retention in the program. All communications during recruitment and event programming should have the consideration of meeting the various cultural and ethnic characteristics of a majority African-American student group. The economic struggles and infrastructure problems of East St. Louis, Illinois presented several unforeseen obstacles at first, which required consideration of specific issues, and caused the program to adopt some alternative strategies. Free transportation, snacks, meals, and other incentives were arranged in this program to aid in the retention and satisfaction of students and their parents or guardians. Recruitment for this program was done by contacting schools and recruiting at them in the area, semi-frequent parent communication (letters, texting, and calling), and other forms of community outreach. Ultimately, this study examines which aspects of a student's recruitment experience are most important in influencing student retention, and focuses on the recruitment and retention of young African American students into the digital humanities, and technology education programs.
- 20 4:15pm UG Assessment of Climate Change Misconceptions along with Teaching Practices and Student Responses which Aid in Climate Change Education**
 *Brooke Kottkamp, Elaine AbuSharbain [Southern Illinois University Edwardsville]
 Climate change is a pressing issue often discussed as a problem the 'children of tomorrow' will face. It is important as a global community to be raising climate literate citizens who will become the prophesied 'leaders of tomorrow'. This study was intended to assess the misconceptions that both students and teachers hold regarding climate change while simultaneously determining ways in which to improve scientific understanding and inspire sustainable leadership. Two surveys were developed after consulting relevant literature: one for secondary and postsecondary teachers and another for students. Surveys began with identical misconceptions quizzes to identify barriers that students and teachers bring to class. The teachers' survey assessed classroom strategies and textbook utility, influences on teaching environment, and students' interest in learning about climate change. Additional factors for assessment included the amount of class time dedicated to climate change topics, teaching strategies utilized, and whether teachers outside of science disciplines address climate change. The college student survey sought to identify opinions about the necessity for climate change topic inclusion into their field of study as well as opportunities to develop leadership skills for climate change remediation. The surveys were sent electronically via list serves. Responses were collected anonymously and statistical analyses were conducted using SPSS software. Findings on misconceptions and perspectives with regards to climate change education, material availability, and self-awareness of field-specific leadership potential will be reported.

- 21 4:15pm UG** **The Effects of the Container, Aeration and Inoculation Optimization of *Chlamydomonas reinhardtii* Culturing for Use in Biodiesel Research in Introductory Biology Research Laboratories**
 *Kelly Cusack, Colton Shaw, Jake Miller, Kelly Barry [Southern Illinois University Edwardsville]
 A laboratory setting requires competency of the scientific method, proficiency in laboratory techniques, and critical thinking skills. The task of preparing students for the trials and errors of a laboratory setting can be a difficult and challenging one. However, when combining these skills in an interactive and engaging way students tend to be more receptive and enthusiastic to learn these skills. The three-stage process of culturing *Chlamydomonas reinhardtii*, biodiesel synthesis from algal lipids, and biodiesel characterization was subject to trials over one semester and made suitable for introductory Biological science laboratory students. This research laboratory experience begins with the culturing of *Chlamydomonas reinhardtii*. In order to optimize the culturing of algae, several variables were subject to trials and results were observed. These variables include the shape of the container, the amount of aeration throughout the container and the optimal volume of algae to inoculate the culture with in order to produce the amount of cells necessary for harvesting.
- 22 4:15pm Grad** **Coding for Community**
 *Mallory Maves [Southern Illinois University Edwardsville]
 This poster features the program “Coding for Community,” a project funded by a National Science Foundation grant. Administered by the Southern Illinois University at Edwardsville, the project is a collaboration between the Science Technology and Math Center, the Interdisciplinary Research and Scholarship Center, and the East St. Louis School District. Faculty in English and History who specialize in the digital humanities work alongside middle school teachers in East St. Louis to develop a three-year summer and after-school program for a group of middle school students. The research component of Coding for Community is assessing how a digital humanities, place-based approach inspires student interest in the computer sciences. Over the three-year program, which launched in the summer of 2015, students will build a comprehensive database and a content-rich digital map showcasing their research into the history and culture of the city. One of the project’s primary goals is to encourage students to think across both scientific and humanities disciplines. Students will use skills central to information technology and literacy to draw links between these topics, which will expand their critical thinking abilities and encourage them to see technology as a tool for exploring and visualizing broader questions. The project plans to train students in photography as they learn about East St. Louis architecture, video production as they conduct oral history interviews with East St. Louis residents, and develop skills in research and metadata as they develop their own research interests for the project. This presentation will highlight the projects’ progress and discuss how to develop successful collaborations between the fields of STEM and the digital humanities in an informal K-12 learning environment.
- 23 4:15pm Grad** **Developing Coding Tutorials for Educators and Middle School Students**
 *Sudhamadhuri Arvapally, Matt Johnson [Southern Illinois University Edwardsville]
 In today's world, web development plays a major role because web content can be viewed anywhere in the world using mobiles, tablets, laptops, etc. The core of web development is HTML and CSS for designing a web page. Our project, *Coding for Community*, aims to teach middle school students and teachers to understand the importance of web development and provide hands-on experience in developing webpages using server-based WordPress and an open source web-publishing platform called Omeka. In order for teachers to implement the curriculum, they must first learn the content and they must have teaching materials to use while teaching. The content includes difficult, abstract concepts in computer science such as coding in HTML and CSS and abstraction. Our program has developed tutorial documents to use to teach educators with no prior training, as well as accompanying tutorials to be used while teaching kids. This presentation will provide insight into the design principles and process of designing tutorials for teachers and students.

ZOOLOGY

106 3:00pm UG

Morphology of Canid and Felid Scapula Form

*Alexa Kinney, Luci Kohn [Southern Illinois University Edwardsville]

The mammalian scapula is integral to the movement and stabilization of the upper limb, and its form is influenced by the muscles that attach to it. Previous studies have shown that scapular form differs with varying forms of locomotion, and scapular regions differ in form between animals that climb and those that are terrestrial quadrupeds. Within the family Canidae, only the gray fox (*Urocyon cinereoargenteus*) climbs, and all other members of the family are terrestrial quadrupeds. Most taxa within the family Felidae are climbers. This study tests scapula form in four species of Canidae and one species of Felidae, assessing locomotor and phylogenetic differences. Scapulae of 6 swift fox (*Vulpes velox*), 2 arctic fox (*V. lagopus*), 34 red fox (*V. vulpes*), 26 gray fox (*U. cinereoargenteus*) and 51 bobcat (*Lynx rufus*) were included in this study. Three-dimensional coordinates of 15 landmarks were recorded with a Microscribe G2X digitizer. These landmarks were used to calculate 13 linear distances to describe the scapular blade, spinous process, neck and glenoid fossa. Data were adjusted for differences in overall size based on the geometric mean of each individual in order to compare non-size related shape differences between taxa. Analysis of variance and principal components analysis were used to test for significant differences between species, and these results were examined for differences in locomotion. Significant differences in scapula form were observed across taxa, with both functional and phylogenetic differences observed. Far from being a generalized bone, scapula form is the product of many different selective forces.

107 3:00pm UG

Food Limitation as a Hypothesis Explaining Stream Gradients in Morphology in a Freshwater Snail

*Alexander Smith, Paul Brunkow [Southern Illinois University Edwardsville]

Gradients in morphology is one of the most commonly observed patterns in gastropods and bivalves living in streams and rivers. Typically shells are relatively slender at upstream sites and relatively rotund or robust at downstream sites. Such patterns have played an important role in freshwater molluscan taxonomy, and predator defense and hydrodynamic efficiency have been invoked as explanatory mechanisms. The River Continuum Concept predicts that food limitation will be more severe at upstream sites, however, and other studies have tied snail shell shape to growth limitation. In the present study, we sampled the snail *Elimia potosienensis* from upstream and downstream sites of the Meramec River in east-central Missouri. We measured shell size and shape as well as fresh body mass to determine if snails from upstream sites were smaller for their shell size, an indication of food limitation. Body mass did not differ between sites ($P > 0.588$) after controlling for shell size; the relationship between shell size (measured as either centroid size or shell weight) and body size also did not differ between sites. Foot area did differ significantly between sites ($P < 0.0001$), even when including both shell size and body weight as covariates. Foot area was also significantly correlated with shell shape, with more slender snails having smaller feet; feet were smallest at the upstream site where shells were also the most slender. Overall, our results suggest that growth of soft tissue in these populations of *Elimia* relative to shell growth does not differ along the river gradient; our results also suggest that there may be differing functional relationships between the foot and shell size and morphology along the river gradient.

108 3:00pm Grad

Population Demography and Movement Patterns of the Illinois Chorus Frog, *Pseudacris illinoensis*, in Southwestern Illinois

*Alexis King, Lisa Hebenstreit, Richard Essner [Southern Illinois University Edwardsville]

Populations of the Illinois Chorus Frog, *Pseudacris illinoensis*, have been devastated by degradation of wetlands due to development from agriculture and industry. *Pseudacris illinoensis* is a fossorial frog that spends most of its life underground, only emerging in early spring to breed. The range for this species is limited, occurring in southwestern Illinois, southeastern Missouri, and northeastern Arkansas in sand prairie habitat. Populations of *P.illinoensis* are listed as threatened in Illinois and are a candidate species for protection under the federal Endangered Species Act. Conservation of this species is critical to preserving amphibian diversity in Illinois. An isolated population of *P. illinoensis* is present in Madison County, IL at the Sand Road Wetland Compensation Site adjacent to the campus of Southern Illinois University Edwardsville. Due to their fossorial lifestyle, little is known regarding their burrowing sites. In order to conserve this species, we must identify post-breeding habitat. The purpose of this study is to: 1) assess the status of this

population and to compare it with other known locations; and 2) identify critical habitat and travel routes. Several roads pass through remaining habitat, and vehicles are an important source of mortality in this population, particularly as frog cross from burrowing sites to breeding ponds and back. Identifying areas of high amphibian traffic may allow us to better protect these frogs and other native amphibians. Frogs will be captured by hand, weighed, sexed, measured for SVL, and photographed for individual identification via pattern mapping. A subset of frogs will be fitted with radio transmitters (BD-2X, Holohil) and tracked until they return to their burrowing sites. Tracking and population demography data will be incorporated into a GIS database to inform recovery efforts.

109 3:00pm UG

The Effect of Elevated and Variable Winter Temperatures on Metabolic Rate, Body Mass and Water Content of the Goldenrod Gall Fly, *Eurosta solidaginis*

*Alexis Ronan, Robert Ladner, Jason Williams [Southern Illinois University Edwardsville]

Overwintering insects must maintain a suppressed metabolism to preserve metabolic reserves needed for survival and spring development. Previous work indicates elevated temperature, such as what is projected to occur due to climate change, has a profound effect on an insect's metabolism. However, these studies used constant exposures and have ignored the potentially important contribution of diurnally temperature variation. To determine the effect of variable winter temperature on metabolism and parameters of survival, we are comparing oxygen consumption, body mass, and body water content from larvae of the goldenrod gall fly, *Eurosta solidaginis*, exposed to either constant average winter monthly temperatures or those subjected to diurnal cycles in temperature that fluctuate between monthly low and high temperature (i.e.: "average-constant" and "average-variable" treatments). In addition, to determine the effect of elevated winter temperatures on the above parameters we are subjecting larvae to constant temperature (elevated-constant group) and diurnally fluctuating regimes (elevated-variable group) that are predicted by a global warming model. After 45 days of exposure, larvae in the "elevated-constant group" had significantly higher mass loss (8.2 ± 1.8 % of original body mass) compared to the average constant, average variable and elevated variable groups which averaged a modest 3.9 ± 0.5 % mass loss. The high rate of mass loss for the elevated-constant group appears to be the result of both dry and water mass loss as water content was similar for all treatments, averaging 1.5 ± 0.1 mg water • mg dry mass⁻¹. As of February 14, no group has broken dormancy as all groups had similar metabolic rates when measured at 5°C averaging 22.1 ± 0.6 μl O₂•h•μg. If these trends are maintained, constant temperature regimes, especially at elevated temperature may be more detrimental to overwintering insects than variable conditions.

110 3:00pm UG

Comparative Pituitary Growth Hormone Immunostaining in *Anolis* Lizard Species (Sauria: Iguanidae) that Vary in Body Size

*Amanda Brink, David Jennings [Southern Illinois University Edwardsville]

Evolutionary changes in body size are common and changes in size have widespread consequences for anatomy, physiology, and ecology. Most analyses of the mechanisms that regulate body size focus on human medical conditions, species kept as domestic pets (dogs), or on organisms used for food (e.g., chickens, cattle, salmon). This study examines the evolution of mechanisms that regulate growth in three closely related species of *Anolis* lizards (*A. equestris*, *A. carolinensis*, and *A. sagrei*) that vary in body size and focuses on the production of pituitary growth hormone (GH). Previous work on these lizards has documented species differences in plasma levels of GH. Plasma GH is lowest in *A. sagrei*, the smallest species, but does not differ between *A. equestris*, the largest species, and *A. carolinensis*, an intermediate sized lizard. To determine if differences in plasma levels are the result of differences in GH production by the pituitary we used immunohistochemistry employing a primary antibody generated against chicken GH. This antibody has been successfully used to detect GH in the pituitary of other reptiles and preliminary results suggest that this antibody effectively recognized GH in the pituitary of *Anolis* species. To confirm the specificity of staining, preabsorption of the primary antibody with GH peptides will be used. Once staining specificity for GH has been confirmed, quantitative differences in pituitary GH cell number and area among species will be conducted using Image J.

111 3:00pm

Fire Ants Fly High for Love

*Ann Fritz, Gary Fritz, Ryan Pavolka, Tyler Clark, Sara Kelly [Eastern Illinois University]

The Red Imported Fire Ant exists as two social forms distinguishable by a single, di-allelic gene (Gp-9); single queen colonies (monogyne) are fixed for the B allele, whereas multiple queen colonies (polygyne) are almost

exclusively Bb heterozygotes. This study examined the Gp-9 genotypes and the presence/absence of sperm of males and females during mating flights at different altitudes. Ants had been previously collected in 2010 during two nuptial flights in Gainesville, Florida. By far, the majority of males were captured at the highest elevation range (75-135 m) coincident with a significantly higher frequency of inseminated females. Furthermore, males at this altitudinal range were significantly less likely to have sperm than those caught at the lower altitudinal range (3-60 m). Polygyne queens were found only at the lowest altitudinal range and all were inseminated. These data are consistent with previous studies suggesting copulation occurs primarily at high altitudes and that polygyne queens are poor dispersers.

112 3:00pm UG

Habituation and Dishabituation to a Heat Stimulus by Woodlice, *Armadillidium vulgare* (Isopoda: Armadillidiidae)

*Ashley N. Hackl, Marianne W. Robertson [Millikin University]

Armadillidium vulgare is a terrestrial isopod that defends itself by conglobation, or rolling into a ball. We elicited conglobation by placing woodlice on a platform heated to 40° C. We examined whether conglobation would decrease after exposure to heat over a series of trials. We exposed each control woodlice (n = 50) to the heat stimulus for two trials per woodlouse with a 38 minute interval between trials. We exposed each experimental woodlouse (n = 50) the heat stimulus over a series of 20 consecutive trials with a 2 minute interval between each trial. Our variable was presence or absence of repeated trials. Control woodlice showed no significant difference (NSD) in the frequency of conglobation between the first and the last trials. Conglobation significantly declined in successive trials of experimental woodlice. We tested dishabituation by presenting the heat stimulus after lengthening intervals to 4 - 12 minutes. Control woodlice responded every time they were exposed to heat. When the interval was lengthened to 12 minutes, 96% of the experimental woodlice recovered the conglobation response. Our data demonstrate that woodlice are able to habituate to a stimulus and then dishabituate, thus demonstrating non-associative learning in crustaceans. The ability to habituate to innocuous stimuli is adaptive in nature where stimulus filtering allows animals to respond to biologically relevant stimuli.

113 3:00pm UG

Skeletal Correlates of Stream Gradient Morphological Variation in Largescale Stonerollers (*Campostoma oligolepis*) (Cypriniformes: Cyprinidae)

*¹Benjamin Wedeking, ²Elijah Thiel, ¹Brian Stoff, ¹Paul Brunkow [¹Southern Illinois University Edwardsville, ²University of Illinois Urbana-Champaign]

Numerous studies have documented subtle intraspecific morphological variation in body depth and fin placement along stream gradients in lotic fish species. These studies have typically used external landmarks, such as fin insertions, eye position and operculum margins, to quantify fish shape in terms of the arrangement of external characters. No study, to our knowledge, has yet examined what if any skeletal variation underlies such external variation. In the present study, we took advantage of a previously documented morphological gradient in largescale stonerollers (*Campostoma oligolepis*) collected from 7 different sites along the Big River in east-central Missouri. Morphological variation was concentrated on antero-posterior shifts in the position of insertions of dorsal, anal and pelvic fins (quantified as RW2 in that study). We took a subsample of specimens from each site and cleared and stained them to view the intact skeleton. We counted and measured spinal vertebrae, and we measured length of the anterior pterygiophore of dorsal, anal and left pelvic fins, and the cranium. RW2 score was not correlated with cranium length or the length of either pterygiophore. RW2 score was significantly correlated with the number of vertebrae anterior to the dorsal fin and the number of vertebrae between the dorsal fin the pterygiophore of the anal fin. However, only the number of vertebrae between dorsal and anal fins differed among sites in the same way as RW2 scores. While not significantly different among sites using ANCOVA, total length of pre-dorsal vertebrae and total length of dorsal-anal vertebrae did follow the same pattern as RW2 scores across sites. Results from this study suggest that variation in external characters along a stream gradient may be underlain by functional skeletal differences.

114 3:00pm UG

Predator Induced Differences in Tail Morphology and Muscle Fiber Composition in Gray Treefrogs (*Anura: Hyla chrysoscelis* and *H. versicolor*)

*Breanna Olliges, David Jennings [Southern Illinois University Edwardsville]

Predator-induced plasticity is advantageous in environments that vary in predator occurrence. In environments with predators induced features enhance prey survival, while in non-predatory environments

anti-predator features decrease fitness. Gray treefrogs (*Hyla chrysoscelis* and *H. versicolor*) that develop in habitats containing predatory dragonfly larvae decrease their activity levels and develop relatively large, bright red tail fins. While the costs and benefits of these behavioral and phenotypic changes have been addressed, changes in muscle fiber composition in tail tissues has not been reported. The current work uses whole-mount immunohistochemistry and antibodies specific to either fast or slow twitch myosin to examine differences in tail muscle fiber types in tadpoles with each phenotype. Since tadpoles with the predator-induced phenotype move less, yet have larger tail fins, we predict that the predator-induced phenotype should also exhibit increases in the distribution and abundance of fast-twitch fiber types. In addition, the potential role of stress hormones (CORT) in the induction and development of altered tail morphology is addressed using ELISAs on whole-body extracts of each tadpole phenotype. During the early tadpole stages examined, no differences in CORT were detected. However, preliminary data suggest that there may be differences among the two tadpole types in CORT levels during metamorphic climax.

115 3:00pm UG

Habituation of the Goldfish *Carassius auratus* (Cypriniformes: Cyprinidae) to White Noise

*Cara Kuehl, Marianne Robertson, Travis Wilcoxon [Millikin University]

Freshwater goldfish, *Carassius auratus*, have weberian ossicles that enhance hearing, making them auditory specialists. Exposure to white noise leads to increased levels of stress in *C. auratus*. We examined whether goldfish have the ability to habituate to white noise, by testing whether activity levels would decrease to baseline levels after exposure to white noise over a series of trials. We housed each goldfish in an individual arena. We exposed each control fish (n = 18) to five minutes of white noise through an underwater speaker. We conducted two trials per fish with a 60 minute interval between trials. We exposed each experimental fish (n = 18) to five minutes of white noise over a series of 10 consecutive trials with a 1 minute interval between each trial. For each control and experimental fish, we recorded the number of pectoral and caudal fin movements and the total duration (minutes) of those movements. Control fish showed a significant difference in number of caudal fin movements, but no significant difference (NSD) in number of pectoral fin movements or duration of fin movements. There was also NSD in number of caudal fin movements or in the duration of caudal or pectoral fin movements in experimental fish. However, the number of pectoral fin movements in experimental fish showed a significant trend towards sensitization, followed by a significant trend towards de-sensitization. This indicates that fish became more sensitive to the white noise, as indicated by the increased activity, rather than less sensitive over repeated exposure.

116 3:00pm UG

Investigating the Use of 3D Technology to Create a Taxon that Does Not Exist: Generating Morphological Variation in the Pleuroceridae

*Christine Olson, Paul Brunkow [Southern Illinois University Edwardsville]

The Pleuroceridae is a family of freshwater snails distributed throughout the SE United States, which exhibits a high degree of morphological variation within and among species. *Pleurocera acuta* and *Elimia potosiensis* are syntopic in the lower reaches of the Meramec River in east-central Missouri, both reaching very high densities. Even though they appear similar, geometric morphometric analysis reveals each species to be quite distinct, with no overlap in shape across the whole size range. As part of a broader study examining hydrodynamic performance of pleurocerid shells, we sought to use 3D technology to create biologically realistic shells intermediate between *P. acuta* and *E. potosiensis*. 3D models of natural shells of each species were generated using photogrammetry. Previous work has shown that the greatest amount of variation in shape in both *P. acuta* and *E. potosiensis* is explained by changes in relative width: larger shells tend to be relatively slender compared to smaller shells. We created new shell models by incrementally altering the relative width of the 3D models using online software, and then subjected these new models to the same shape analysis as used for larger samples of natural shells from the Meramec River. Surprisingly, our modifications did not create new shapes in terms of Relative Warp 1 scores from a geometric morphometric analysis. We did alter Relative Warp 2 scores and shell length-to-width ratios, but these changes only spanned the variation that already existed between the two species. We discuss how seemingly obvious changes in one dimension may not be reflected in multivariate shape variables, and we will present alternative strategies for using 3D technology to modify existing natural variation in biologically realistic ways.

117 3:00pm UG

Cranial Morphology Distinguishing Two Closely Related Canidae Species

*Courtney Brewer, Luci Kohn [Southern Illinois University Edwardsville]

Canidae cranial features are influenced by many factors, including genetics, diet and behavior. Cranial form is the result of these functional and developmental influences. Swift fox (*Vulpes velox*), native to the Great Plains of North America, and arctic fox (*V. lagopus*), native to the arctic tundra, are considered to be genetically similar, though they currently live in very different habitats and experience different food resources. This study tests cranial differences in these two taxa, testing for differences between the taxa in the form of the cranial vault, cranial base, and face. The sample for this study includes crania from 20 swift fox (*V. velox*) and 20 arctic fox (*V. lagopus*). Three dimensional coordinates of 31 landmarks on the cranial vault, cranial base and face of each individual were recorded with a Microscribe G2X. These landmarks were used to define linear dimensions of the cranial vault, cranial base and face. Analysis of variance was used to test for sexual dimorphism within each species, as well as interspecific differences within each region. Morphological differences were also tested by discriminant function analysis. Genetic and functional differences have led to morphological distinctions in cranial form in these two taxa.

118 3:00pm UG

Sexual Dimorphism in Gray Wolf (*Canis lupus*) Mandible Form

*Daniel Miller, Sally Ayoob, Luci Kohn [Southern Illinois University Edwardsville]

Sexual size dimorphism, or differences between males and females, has been well documented across a wide variety of organisms. The finding of sexual dimorphism has been inconsistently observed in Canidae. Among the explanations of sexual dimorphism are sex differences in resource, and differences in size due to intraspecific competition for mates. The mandible is a single bone with three functional regions: the alveolar process, the body, and the ramus. These regions are influenced by development, diet, and muscle action. This study tests for sexual dimorphism in gray wolf (*Canis lupus*) mandibles, both in individual dimensions as well as mandibular functional regions. The sample for this study included mandibles of 29 gray wolves photographed from a standardized lateral view. ImageJ was used to record two-dimensional coordinates of 17 landmarks from each photograph. These coordinates were used to calculate 30 dimensions describing the form of the mandibular body, alveolus and ramus. Bite force was estimated using bony dimensions associated with the temporalis muscle, the masseter muscle, and dimensions of the tooth row. Analysis of variance was used to test for significant differences between males and females for each dimension as well as in each mandibular region. There were differences in the degree of sexual dimorphism across regions of the mandible. These results suggest that sexual dimorphism in the gray wolf may be more related to differences in resource use rather than overall differences in size.

119 3:00pm UG

Development, Growth, and Survival of a Web-Building Funnel Web Spider When Scavenging

*Daniel Sinclair, Tanner Holmes, Marianne Roberston [Millikin University]

The spider *Phidippus audax*, which is an active hunter, can survive throughout its life cycle as a scavenger. We examined whether a web-building funnel web spider, *Agelenopsis pennsylvanica*, could survive and develop throughout its life cycle as a scavenger. Three different groups of spiders were given three different diets and their development, growth, and survival were compared: a control group fed live prey (n = 64), an experimental group fed dead prey (n = 61), and another experimental group fed a mixture of live and dead prey (n = 62). We recorded and analyzed their instar length, size, and survivorship throughout the six instars. There was no significant difference in the instar length of the three groups. In instar four, spiders fed live prey were significantly larger than spiders fed dead prey. However, in the other instars, there was no significant difference in size in any of the groups. Spiders fed live prey and spiders fed mixed prey had significantly higher survivorship than those fed dead prey. *A. pennsylvanica* can survive on just dead prey. However, there are tradeoffs to survivorship and development. Spiders fed a mixture prey showed no costs so this diet could be utilized in nature.

120 3:00pm UG

Detecting Incremental Growth Markers in the Shells of Lotic Snails

*Drew Merideth, Paul Brunkow [Southern Illinois University Edwardsville]

Molluscan shells have often been used to reconstruct historical environmental conditions because of the sensitivity of shell secretion and construction to various physical and chemical parameters. Patterns of growth recorded in fossilized or historically collected specimens can reveal variation in temperature, pH, and calcium carbonate availability at sites from which the specimens were collected, typically integrating these conditions over long periods of time (weeks to months). Recent studies in marine snails have identified

patterns in shell deposition that may be on the time scale of single days. As part of a broader study examining how local conditions affect growth patterns of snails in rivers, we sought to identify incremental growth lines in pleurocerid snails of Missouri. We sectioned the body whorl of specimens of *Elimia potosiensis*, *Pleurocera acuta* and *Lithasia armigera*, and epoxied sections to glass slides. After grinding sections down to ca. 1 mm thick and polishing with 1.2 micrometer cerium oxide paste, sections were simultaneously etched and stained using a glutaraldehyde/Alcian blue/acetic acid solution and then viewed under axial illumination. We have detected discontinuities through primary lamellae of the cross-lamellar layer that indicate incremental changes in shell thickness, and in some specimens we have identified fine growth lines that indicate changes in shell length. We plan to calibrate these discontinuities with time scale of their deposition by marking live snails with calcein and then examining growth lines after a known period of growth. Developing a technique for the identification of growth increments in pleurocerid snails will help us to understand growth conditions at local sites for these species, which are slow growing and difficult to culture in captivity.

121 4:15pm UG

Inheritance of Pigmentation in *Physa* sp. (Gastropoda) from Camp Vandeventer Spring, Monroe County, Illinois

*Dustin Smith, Robert G. Weck [Southwestern Illinois College]

Little is known of the *Physa* snail populations from the caves and karst springs of Camp Vandeventer in Monroe County, Illinois. Hubricht (1941) identified *Physa halei* Lea from Ice Cave in Camp Vandeventer and noted the population had greatly reduced pigmentation. On 26 May 2014 we collected a single clutch of *Physa* embryos (n = 7) from a rock at the head of Camp Vandeventer Spring. The spring the resurgence point for waters flowing through Pautler Cave, one of Illinois' most biodiverse caves. The embryos were polymorphic, five were pigmented and two lacked pigmentation. The snails hatched from that clutch were raised and inbred to create true-breeding pigmented and depigmented strains. Controlled crosses were established between pigmented and depigmented snails. Two hundred ten F1 embryos were examined, 161 were viable (76.6% viability) and all were scored as pigmented based on the presence of melanin in the eyes of late stage embryos. Six F1 offspring were raised in isolation to maturity and allowed to self-fertilize, producing F2 offspring. A total of 34 separate F2 egg masses, containing 1030 eggs were examined. Eight hundred fifty three F2 embryos developed to late stage (82.82% viability) and were scored for the presence or absence of melanin in the eyes. A total of 630 F2 were pigmented and 323 were depigmented (i.e., albino). The segregation of F2 in a 3 pigmented:1 depigmented ratio supports the hypothesis that the depigmented phenotypes is result of a recessive allele at a single locus. Unlike the complete albinism as seen *Physa acuta* (Dillon and Wethington, 1992), the mantle of the depigmented snails was still sporadically patched with spots of melanin, suggesting an incomplete form of albinism. This study is part of a larger project to examine the phylogeography of cave-inhabiting physid snails in southwestern Illinois.

122 4:15pm UG

Using 3D Printed Models to Evaluate the Effect of Spines on Hydrodynamic Performance of Snail Shells

*Haley Kutosky, Paul Brunkow [Southern Illinois University Edwardsville]

In marine snails, shell armature such as the presence of spines or tubercles is not viewed as evolving in response to hydrodynamic demands, because water flow is too variable in terms of direction and velocity. Instead, shell armature is generally considered a response to predation pressure, especially by crushing crustaceans. When marine snail ancestors moved into freshwater streams and rivers, however, selective pressures may have changed in the absence of large-bodied crustaceans and the presence of unidirectional flow. In this study, we examine the potential role of spines in affecting hydrodynamic drag in *Lithasia armigera*, a pleurocerid snail native to the Ohio River drainage. We wanted to compare drag acting on shells with spines to drag acting on shells without spines; since no adult *L. armigera* are without spines, we needed to produce spineless shells, preferably without damaging existing shells. We scanned shells of adult *L. armigera* using a laser scanner, and then edited away spines on the resulting models using 3D software; we then printed spined and spineless duplicates of existing adult shells on a 3D printer. Drag acting on these models was evaluated in a recirculating flume with water flow at 50 cm/s, and drag coefficients were compared using a paired t-test. Spineless models experienced significantly less drag and possessed significantly lower drag coefficients ($P < 0.05$) than their spined analogs, suggesting that the presence of spines in these freshwater snails increases drag at any given shell size. We seek to expand this approach to examine the evolution of shell form throughout the Pleuroceridae in the SE United States.

123 4:15pm UG

Effect of Green Fluorescent Body Coloration on Shoaling Behavior of Zebrafish, *Danio rerio* (Cypriniformes: Cyprinidae)

*Jessica Brinegar, Marianne Robertson, Travis Wilcoxon [Millikin University]

Zebrafish, *Danio rerio*, form shoals consisting of loosely aggregated individuals swimming in different directions. Shoalmate preference can be influenced by body size, shape, coloration, and pattern. We examined the effect of body coloration on shoalmate preference in *D. rerio*. Having similar coloration may protect individuals from predators by the dilution effect. We divided an aquarium into 3 equal sections and put a wildtype in the center compartment. For control trials, we placed a wildtype shoal of 7 individuals in both side compartments. For experimental trials, we replaced one of the wildtype shoals with 7 green transgenic fish. We recorded the number of visits made to each side and the time spent on each side. Control fish showed no significant difference (NSD) in the average number of visits to the left versus right side and NSD in the average time spent with either shoal. Experimental fish exhibited NSD between the average number of visits to the transgenic versus the wildtype shoal, but they spent significantly more time shoaling with the wildtype. Wildtype test fish consistently visited each side to assess shoal composition but preferred phenotypically similar individuals, as predicted by the dilution effect. While *D. rerio* prefer similarly colored conspecifics, there are some fish species that preferentially shoal with individuals of different colors. This generates further questions about the influence of body coloration on shoalmate preference. Future research could examine the effect of the other transgenic colors (orange, yellow, blue, purple, and pink) on wildtype zebrafish shoal preference.

124 4:15pm UG

Innate Immune and Antioxidant Costs of Low Temperatures in Native *Hyla cinerea* and Invasive Tropical *Osteopilus septentrionalis*

*Kelsey Going, Travis Wilcoxon [Millikin University]

Temperature fluctuations affect amphibian immune systems and thermal tolerance likely plays a role in the geographic range over which different species can survive. We studied physiological costs associated with low temperatures in Green Tree Frogs (*Hyla cinerea*), which are native to the United States, and tropical, non-native Cuban Tree Frogs (*Osteopilus septentrionalis*) that have invaded Florida. Specifically, we examined variation in innate immunity and skin antioxidant capacity. To complete the study, 107 tree frog tadpoles were raised through metamorphosis and, as young frogs, divided into a control group maintained at room temperature of approximately 20 °C and an experimental group at approximately 10 °C. Individuals in the low temperature group were placed in the refrigerator for six to eight hours per day for 14 days to simulate early fall nocturnal ambient temperatures in northern regions of Gulf states. Cuban Tree Frogs had a significantly greater survival rate than Green Tree Frogs in the control group, but there was no significant difference between experimental groups. We also found that both species were negatively affected by low temperatures, with a decrease in bacterial killing ability and antioxidants on their skin, but the Cuban Tree Frogs were effected to a much greater extent. Our findings suggest that the spread of Cuban Tree Frogs into areas north of their current invasive range may be slowed by physiological costs of low temperatures, but we do not expect significantly greater mortality rates associated with cold alone than tree frogs already occupying such a range.

125 4:15pm Grad

Amphibian Diversity and Abundance in Old Artificial Ponds on the SIUE Campus

*¹Lisa Hebenstreit, ²Sean Terrill, ¹David Jennings [¹Southern Illinois University Edwardsville, ²University of Massachusetts Amherst]

Amphibian populations are often used as indicators of environmental quality, and declines in both diversity and abundance continue to be documented. Wetlands are an essential habitat for amphibian species, and community composition gives insights into habitat quality and has implications for wetland restoration. We surveyed two old artificial ponds located in close proximity (<150m) to each other on the SIUE campus from June through November 2015. The first pond had little forest cover or submerged debris, and received a lot of sunlight ("open" pond). The second had a high percent of forest cover, contained a large amount of submerged and fallen debris, and received significantly less sunlight ("covered" pond). Both ponds also differed in depth, water temperature and floating vegetation. At each pond, three drift fences (0.36 x 5m) with pitfall traps at each end and funnel traps midway along their length were installed. Six minnow traps were placed along pond margins at the same approximate depth. Traps were monitored daily, Tuesday through Friday, from June to August. Fall monitoring (Sept. – Nov.) was reduced to one day per week. The ponds were similar in overall diversity, however salamander larvae were only detected in the covered pond.

Seasonally, the two ponds differed in abundance, with much higher numbers of larval and juvenile frogs in the covered pond during the summer. Detectability also varied among ponds and among species and these differences likely influenced our abundance estimates. In summary, during our survey period, both ponds were actively used by a variety of amphibians, and breeding individuals of most species were evident. Despite differences pond features, similar species were present in both ponds. Future work should assess seasonal changes in diversity as early season breeders had likely finished reproducing prior to our initial survey dates.

126 4:15pm UG

Relationships between Shell and Soft Body Characters in Two Syntopic Snails

*Lucas Meyer, Paul Brunkow [Southern Illinois University Edwardsville]

Lotic snail species are well known for gradients in shell morphology along river systems, with upstream forms being relatively slender and downstream forms of the same species being relatively robust or rotund. *Pleurocera acuta* and *Elimia potosiensis* are two pleurocerid species that are syntopic in lower reaches of the Meramec River in east-central Missouri. Shape differences between them are explained primarily by changes in length-to-width ratio, and while *Pleurocera* is limited to downstream reaches, *Elimia* occurs further upstream at sites where it is more slender. To better characterize shape gradients in both species, we collected specimens of *Pleurocera* and *Elimia* where they are syntopic and additional *Elimia* specimens from two sites further upstream. Maximum foot area for each specimen was measured, and then snails were euthanized and removed from shells. We measured soft body weight, and we collected shell morphometric data from digital photographs. The relationship between body weight and shell size was stronger in *Elimia* than in *Pleurocera*, even when limiting analysis to syntopic *Elimia*. The relationship between shell size and Relative Warp 1 (RW1) was much stronger in *Elimia* than in *Pleurocera*, but not when limiting analysis to syntopic shells; *Elimia* and *Pleurocera* occupied very distinct shape morphospaces that even the more slender upstream forms of *Elimia* could not significantly expand. The relationship between shell size and RW2 was much stronger in *Elimia* than in *Pleurocera*, even when limiting analysis to syntopic shells. These results suggest that relationships between shell shape and functional aspects of the shell differ between the two species, perhaps in ways that limits upstream dispersal in one but not the other.

127 4:15pm UG

Comparing Laser Scanning to Photogrammetry for Capturing 3D Surface of Snail Shells

*Maya Habibi, Paul Brunkow [Southern Illinois University Edwardsville]

The recent rapid diversification of low cost 3D capture and printing technology accompanied by a profusion of 3D modeling and editing online freeware represents a valuable opportunity for studies of morphological variation and evolution. Researchers examining functional morphology can now, for example, create specimens that populate regions of morphospace that are not currently occupied by the variation present in existing species. In this study, we captured the surfaces of shells of *Lithasia armigera*, a pleurocerid snail native to the Ohio River drainage, using two different techniques. Shells were first scanned with the NextEngine laser scanner, which automatically rotates and scans specimens, capturing 3D surface data by detecting patterns of laser light on the surface. Specimens were then photographed from at least 40 different angles with a digital camera. Photographs were uploaded to 123D Catch, online freeware which uses shifts in perspective of shared pixels among photographs to recreate a closed 3D surface. Resulting 3D models were compared in pairwise fashion using Meshmixer, freeware which allows for rapid visualization and editing of 3D meshes. Laser scanning tended to misrepresent spines and the spire of the shell, and also showed reduced accuracy on major growth ridges; laser scanning produced a more accurate representation of the aperture. Photogrammetry produced more accurate spines and spires but tended to misrepresent fine surface detail. The biggest factor leading to these differences probably lies with the amount of post-processing necessary with laser-scanned models: laser scanning yields many more sampling points, but artifacts of small reflections needed to be removed to gain an accurate model. We will also discuss results from printing laser scanned versus photogrammetric models on a 3D printer.

128 4:15pm UG

Gradient in Shell Density in a Riverine Snail, *Elimia potosiensis*

*Miles Herr, Paul Brunkow [Southern Illinois University Edwardsville]

Upstream to downstream gradients in morphology are commonly observed in lotic snails and bivalves, with upstream forms being relatively slender and downstream forms of the same species being relatively robust. Such variation has historically informed the taxonomy of many of these species, and various hypotheses have been proposed to explain the generality of this pattern. Published analyses of shape variation along river

gradients have focused only on shell shape and have typically ignored other features of the shell or the soft body contained therein. To complement analysis of soft tissue weight and growth rate, the present study examined the covariation of shell shape, shell size and river position with shell density in *Elimia potosiensis* from the Meramec River in east-central Missouri. Snails were sampled from three sites along an upstream to downstream gradient and returned to the lab. After removal and weighing of soft tissue, shell density was measured by comparing dry weight versus weight when submerged in water; shell morphology was quantified using digital photographs. Shell density was not related to shell weight, body weight, or shell centroid size (all $P > 0.32$) but was significantly related to shell shape ($P < 0.0001$) with slender shells being less dense than more robust shells. This relationship held using multiple regression and including measures of shell and body size. Shell density differed significantly among sites ($P < 0.005$) using shell size and shell shape as covariates, with the downstream site possessing the most dense shells. The downstream site was also the only site where shell density was significantly related to shell shape, suggesting a greater flexibility in allocating resources to shell construction at this site.

129 4:15pm UG

A Comparison of Admission and Post-Rehabilitation Hematological Metrics for Six Species of Raptors at the Illinois Raptor Center

*¹Morgan Kincheloe, ¹Travis Wilcoxon, ²Jane Seitz, ²Jacques Nuzzo [¹Millikin University; ²Illinois Raptor Center, Decatur IL]

Wild birds are subject to naturally-occurring and human-caused incidents that impact their health. One group of wild birds that are often the focus of wildlife rehabilitation efforts are birds of prey, or raptors. We are interested in the circumstances that led to admittance of a raptor at the Illinois Raptor Center (IRC) and their overall health state upon admission to the center and prior to release. We examined hematological metrics including hematocrit, protein levels, calcium levels, and antioxidant capacity. We hypothesized that these hematological metrics will differ in samples taken from birds upon admission to the IRC compared to release. Further, we hypothesized that baseline values from birds at release would be indicative of normal, healthy wild raptors. We concluded that calcium and hematocrit are good indicators of a birds overall health. Total protein showed no significant differences between pre/post samples. Antioxidant capacity was significantly greater prior to release than at admission for all species. Exploring these vital metrics in raptors could help with wildlife veterinary treatments, and ability to monitor the progress from admittance to departure.

130 4:15pm UG

The Effect of Cholesterol and Tocopherol Supplementation on Rapid Cold Hardening and Low Temperature Tolerance

*Nicole Brueggemann, Rachel Smith, Jason Williams [Southern Illinois University Edwardsville]

Chilling injury is often lethal and occurs when cell membranes transition from a liquid crystalline to gel phase at low temperature. Certain insects undergo rapid cold hardening (RCH), which alters phospholipid fatty acid tails and allows them to resist cold-induced phase transition. For example, RCH will allow adult fruit flies raised at room temperature to survive a 2h exposure at -6°C if first subjected to 10°C for 30 min. Other integral membrane constituents (such as cholesterol and tocopherol) can also prevent membrane phase transitions, yet their effect on minimizing chilling injury or enhancing RCH are largely unknown. To examine this, we determined survival to low temperature, ability to RCH, and markers of low temperature tolerance (chill coma recovery time and post-cold walking performance) in *Drosophila melanogaster* fed either normal or supplemented food (cholesterol and/or tocopherol). Flies augmented with exogenous cholesterol and tocopherol survived a direct transfer to -6°C at a higher rate (71.2 ± 2.9 and 37.1 ± 1.6 %) than those fed a normal diet (2.3 ± 2.2 %). In addition, supplementing with cholesterol or tocopherol enhanced a fly's ability to undergo RCH as 94.7 ± 1.0 % and 82.9 ± 6.2 % those subjected to 10°C for 2 h prior to a 1 h exposure to -6°C survived compared to only 60 ± 3.6 % for those fed cholesterol-free food. Augmenting food with cholesterol and/or tocopherol also reduced chill coma recovery time from 19.2 ± 0.3 to 15.5 ± 0.4 min in RCH animals exposed to 0°C for 5 h. Lastly, cholesterol and/or tocopherol augmentation increased walking performance as flies successfully passed a vertical walking test at 0, 12, 48, and 96 h post low temperature exposure at higher rates than those fed a normal diet. In summary, cholesterol and tocopherol augmentation increased survival to low temperature and enhanced RCH in *D. melanogaster*.

131 4:15pm UG

The Effects of Tail Damage on Tadpole Development and Leaping and Swimming Abilities In Cuban Tree Frogs (*Osteopilus septentrionalis*) after Metamorphosis

*Nicole M. Koch, Travis E. Wilcoxon [Millikin University]

Tadpoles have many predators in the wild and they have difficulty escaping from predators, especially in earlier stages of development. Tadpoles do not have a skeleton or fins and, in general, less myotomes in the tip of their tail. When a predator attacks the tip of their tail, they are able to escape because it simply tears off. We examined the effects of tail damage in the early tadpole stages on the development of the tadpole and its leaping abilities after metamorphosis. The purpose of this was to test how physical injuries in the beginning of an organism's life may affect the organism's development and abilities in the remainder their life. We obtained 120 Cuban tree frogs, and to simulate predation, we cut off a piece of the top of the tadpoles' tails in one experimental group, cut off a piece of the bottom of the tadpoles' tails in the second experimental group, and did not make any cuts to tails of the control group. We discovered that Cuban tree frogs regenerate their tail; therefore, we cut tails of experimental tadpoles again and eventually combined the two experimental groups. After tadpoles completed metamorphosis, they were subjected to a swimming endurance test and subsequent measurement of their leaping abilities. We found no significant effect of tail damage on the leaping abilities of frogs after metamorphosis. We also found no significant difference in body size at metamorphosis among our groups. We conclude that the regeneration abilities of the Cuban tree frog tadpoles afford them the opportunity to survive minor predation events and recover with no apparent long-lasting ill effects. These abilities likely contribute to the Cuban tree frogs' success as an invasive species throughout the Florida peninsula.

132 4:15pm UG

Relationship Between Growth Hormone Receptors and the Body Size Differences in *Anolis* Lizards (Sauria: Iguanidae)

*Parminder Singh, David Jennings [Southern Illinois University Edwardsville]

Growth hormone (GH) originates in the pituitary of vertebrates and binds to its target receptors, which are localized to specific tissues. The interaction between GH and its receptor induces the production of a wide range of growth regulators including insulin-like growth factors (IGFs). Together GH and IGFs stimulate growth in a tissue-specific manner. The current work investigates how the endocrine regulation of growth has changed in closely related species of *Anolis* lizards that vary in body size. Previous work has shown that smaller species of *Anolis* (*A. sagrei*) have lower plasma levels of GH than do larger species. However, there was no significant difference in plasma GH between the intermediate sized *A. carolinensis* and the large *A. equestris*. One potential explanation for the lack of correlation between plasma GH and body size is that GH receptor number or affinity might differ among species. The primary goal of the current work is to use immunohistochemical techniques and an antibody to the GH receptor to examine GH receptor expression in liver samples of *Anolis* species that differ in body size. These initial studies will provide background information that can be used to develop more quantitative approaches to analyzing the role of species differences in GH receptor affinity and capacity in the evolutionary divergence in body size in *Anolis*.

133 4:15pm UG

Quantification of Lead in Central Illinois Birds of Prey

*¹Shelby Chesko, ¹Travis E. Wilcoxon, ²Jane Seitz, ²Jacques Nuzzo [¹Millikin University; ²Illinois Raptor Center, Decatur IL]

Some studies of raptors across the United States have revealed lead poisoning in birds of prey caused by human activities. Although several steps have been taken toward solving this issue, ingestion of lead from the food raptors consume is potentially a much greater conservation issue than previously indicated. Lead has negative neurological and hematological impacts on birds. We collected blood samples from raptors admitted to the Illinois Raptor Center in Decatur, Illinois for rehabilitation. From a blood sample, we determined lead content with an ESA LeadCare II lead analyzer. We tested if lead toxicity appears at a frequency in any species at a rate that differs from random. We also used spatial autocorrelation analyses to determine if birds that were positive for lead were associated with specific geographic locations and matched the results of the spatial autocorrelation analyses with public hunting data found through the Illinois Department of Natural Resources. To date, we have supported our hypothesis that we would most commonly detect lead in the blood of scavengers, such as Bald Eagles and Turkey Vultures. However, at this point in the study, we are also finding lead at toxic levels in Cooper's Hawks at a rate much greater than expected given their propensity to hunt live birds rather than scavenging dead prey. We have also found greater than expected prevalence of lead toxicity in Red-tailed Hawks. Overall, our work will help better

understand the sources of lead in multiple species of raptors, including these non-scavenger species.

134 4:15pm Grad Male Genitalia Morphology and the Role it Plays in Sperm Transfer in *Anastrepha auspensa* (Diptera: Tephritidae)

*Taylor Inboden, Ann Fritz [Eastern Illinois University]

Anastrepha suspensa is an agricultural pest species causing severe economic damage and is controlled by disrupting fertile copulations. During copulation, males transfer sperm as well as protein rich fluids through an aedeagus and distiphallus, which females store in three spermathecae and one ventral receptacle. Within the female reproductive tract, the ventral receptacle and the three spermathecae are strategically separated from each other. We hypothesized males' ability to direct sperm transfer within the female reproductive tract is through the structures found in the distiphallus. Previous studies of *Anastrepha* species have shown no sperm directing ability by males, and structures of the distiphallus have been observed as blocking the entrance to the ventral receptacle. Blocking the access to the ventral receptacle appears to be counterproductive from a male perspective because the ventral receptacle is the site of egg fertilization. To understand the morphology of the distiphallus and sperm storage, scanning electron microscopy (SEM) was used. The distiphallus appeared to have bifurcation, and appears to direct sperm to the four sites of sperm storage within the female. Our study suggests that a thorough and detailed understanding of the morphology of the male genitalia in relation to the morphology of the female tract, particularly how sperm is transferred to sites of sperm storage for ova fertilization, may illuminate the important role of co-evolution between the sexes.

135 4:15pm UG Karyotype of Topminnows in the *Fundulus notatus* Species Complex

*Tyler McGowan, David Duvernell [Southern Illinois University Edwardsville]

The *Fundulus notatus* species complex (*F. olivaceus*, *F. notatus*, and *F. euryzonus*) is a well-characterized group of freshwater killfishes that provide an excellent platform for the study of hybridization and introgression. This group of fish is ideal because they express a varying range of genetic divergence and display karyotypic variation both among and within the species. Current efforts are being made to better understand the impact that genetic divergence and chromosomal differences have on the transfer of genetic material when two distinguished populations from the *F. notatus* species complex come into contact with one another and potentially reproduce. This particular study provides the karyotype of three populations of fish within the *F. notatus* species complex that have never before been karyotyped. These karyotypes provide a better understanding of the chromosomal makeup of the fish from these particular populations and allow for a more complete documentation of the specific chromosomal differences among the species within the complex. This information helps contribute to further studies, which focus on how these chromosomal differences may impact hybridization within the complex.

136 4:15pm Grad Experimental Inhibition of Corticosterone in Gray Treefrog Tadpoles (Anura: *Hyla chrysoscelis* and *H. versicolor*)

*Victoria Goodwin, David Jennings [Southern Illinois University Edwardsville]

Amphibian metamorphosis is a model for the role of hormones in development. While much of this work has focused on thyroid hormone regulation of the transition from aquatic larva to terrestrial adult, other hormones have begun to receive more attention. In particular, corticosteroids (CORT) may play a prominent role in linking environmental signals to changes in metamorphic rate and timing. The objective of this study is to determine how experimental inhibition of CORT at premetamorphic and mature larval stages impacts development. Treefrog tadpoles collected from local sites were staged, measured (snout-vent length, tail length, tail depth), and then placed into one of eight experimental groups. Chemical treatments consisted of exposure to metyrapone (a commonly used inhibitor of CORT synthesis), mitotane (an anti-cancer drug used to destroy tissues producing corticosteroids), both drugs combined, or vehicle (ethanol). Four groups were only given chemical treatments, while a second set of four groups was also exposed to chemical cues from a tadpole predator (caged dragonfly larvae). At the end of the experiment, half of the tadpoles from each group were fixed and used for morphological measurements, the remaining tadpoles were flash frozen and then stored at -70°C until assayed for CORT using an ELISA. Chemical and predator treatments had little effect on morphological features or developmental rate. Hormone levels did differ among treatments, with both metyrapone and mitotane reducing CORT levels below the vehicle treated groups. The combined treatment did not further reduce hormone levels. The presence of predator cues generally resulted in higher

CORT levels that were observed in treatments that only contained chemical inhibitors. Although preliminary, our results suggest that mitotane is an effective blocker of CORT production, and may be able to alter CORT levels more effectively than the more commonly used metyrapone.

137 4:15pm UG

Swimming Kinematics in Gray Treefrog Tadpoles (*Anura: Hyla chrysoscelis* and *H. versicolor*) with Predator-Induced Tail Morphology

*Zack Ladson, David Jennings [Southern Illinois University Edwardsville]

Many species of frogs reproduce in sites that also contain predators, and amphibian eggs and larvae frequently suffer from high levels of predation. In some species, tadpoles exhibit phenotypic plasticity and can change their morphology and behavior in response to the presence of predators. Gray treefrog tadpoles develop more robust and highly pigmented tails in the presence of dragonfly nymphs. In addition to these morphological changes, tadpoles exposed to predation pressure also reduce the amount of time they spend swimming. The current work compares swimming performance of treefrog tadpoles with normal tails to the performance of tadpoles that have predator-induced changes in tail morphology. Treefrog tadpoles of each morph type were collected in the field, staged, and then measured for both body size and tail morphology. Each tadpole was then placed in an aquarium and filmed while swimming in order to determine if kinematic differences (e.g., swimming speed, acceleration) are found between the two tadpole types. While a number of studies have examined morphological and behavioral changes associated with predator-induced changes in the tail, the actual performance consequences of altered tail morphology are largely unknown.

ORAL PRESENTATION ABSTRACTS

9:00am – 12noon, Saturday, April 16, 2016, Morris University Center

*presenter, [school] with differences noted by superscript, UG = undergraduate, Grad = graduate student, others are faculty/regular

ANTHROPOLOGY & ARCHEOLOGY

11:30am
Hickory

Implications of Shoulder Pathology in Aged Grey Wolves

*¹Dennis Lawler, ²Julia Becker, ³Jennifer Reetz, ⁴Pamela Goodman, ⁵Richard Evans, ⁶David Rubin, ⁷Basil Tangredi, ¹Christopher Widga, ⁸Jill Sackman, ¹Terrence Martin, ⁹Luci Kohn, ¹⁰Gail Smith [¹Illinois State Museum; ²Tippecanoe Animal Hospital, Lafayette IN; ³University of Pennsylvania; ⁴Wolf Park, Battle Ground IN; ⁵Pacific Marine Mammal Center, Laguna Beach CA; ⁶Washington University School of Medicine; ⁷Green Mountain College; ⁸Blue Pearl Veterinary Partners, Southfield MI; ⁹Southern Illinois University Edwardsville; ¹⁰Antech Diagnostic Services, Downingtown PA]

Right and left scapula glenoid fossae and corresponding humeral articular surfaces were examined from seven aged sanctuary-maintained grey wolves (*C. l. lupus*). Observations were made *in situ* (at post-mortem examination), by radiography, and prior to and following laboratory clearing of soft tissues. Several specimens were evaluated using computed tomography. All specimens had pathological changes. Plain film radiography revealed only severe changes, whereas computed tomography yielded more detail and clarity. Direct examination of articular cartilage and joint capsules informed only about soft tissues. Dry bone revealed more information than did imaging studies. Zooarchaeologists work with complete and incomplete skeletons or individual bones. Thus, all interpretations are retrospective. Modern biologists and biomedical researchers often are in similar circumstances. Our data provide a basis for improved understanding of joint biology of animals, and for developing differential diagnoses for pathological features. Additionally, it is recognized that domestic dogs often live very long lives. The four oldest of this wolf group (15, 16, 17, 19 years) survived far longer than expected for the largest of domestic dogs. This may be an important species difference, which we recommend for further study. Finally, we hypothesize that late-life joint pathology phenotypes in sheltered non-domestic species imply a constitutional (genomic) basis that is expressed infrequently in the wild because of stochastic influences.

BOTANY

9:30am UG
Redbud

Collection, Transport, and Isolation of Orchid Mycorrhizal Fungi from Afar: Techniques Aimed at Effective Recovery of Viable Pelotons from Roots of Epiphytes, Terrestrials and Lithophytes in Remote Areas

*¹Amanda Wood, ¹Lawrence W. Zettler, ²Kazutomo Yokoya, ²Johnathan P. Kendon, ²Viswambharan Sarasan [¹Illinois College; ²Royal Botanic Gardens Kew, Surrey UK]

The destruction of orchid-rich habitats continues at an alarming pace in developing countries within tropical regions. Efforts to collect seed and mycorrhizal fungi of endangered species for conservation purposes is challenging, especially for researchers that must travel great distances, navigate formidable terrain, and return safely with fresh samples. These challenges are exacerbated by limited funds, political unrest, and unexpected hardships. In 2012, a joint effort was established between the Royal Botanic Gardens, Kew, and Illinois College to collect, identify, and safeguard mycorrhizal fungi of orchids native to the Central Highlands of Madagascar. Given the great distance between the UK and USA to that African country, coupled with rugged terrain to/from research sites from the capital (Antananarivo), maintaining fresh samples for long-distance transport back to the laboratory was a formidable challenge. We describe our techniques for retrieving fungi of epiphytes, terrestrials and lithophytes from afar. To maximize our chances for isolating mycorrhizal strains most effective at facilitating *in vitro* seed germination, roots of spontaneous seedlings were frequently targeted. Trips during both the dry season (April/May 2012, 2013) and rainy season (January 2015) were also made, the latter to account for differences in fungal activity that may have been favored by wetter conditions.

- 9:45am Redbud Grad Genetic Diversity of Northern and Southern Orchid Mycorrhizae Found in the Federally Threatened Eastern Prairie Fringed Orchid (*Platanthera leucophaea*)**
 *Hana Thixton [Southern Illinois University Edwardsville]
 The eastern prairie fringed orchid (*Platanthera leucophaea*) (Orchidaceae) was once a common and widespread species in wet prairies, sedge meadows, bogs, and fens throughout the upper Midwestern United States. The orchid has experienced great declines over time due to habitat loss, over-collection, and competition with non-native taxa and is currently listed as a federally threatened species. Previous conservation work suggests that *P. leucophaea* depends on associations with *Ceratorhiza* fungi. What is not known is if the specific strains of the fungi are widespread or if sites have their own sub strains that the orchid populations interact with in order to reproduce and survive. The purpose of this study is to examine the fungal associates with *P. leucophaea* throughout its range in Illinois, and see if transplanting new strains to current populations will augment seedling establishment. This new information could be critical for seedling reintroduction and conservation of the species.
- 10:30am Redbud Grad City Living: The Potential of Urban Milkweed Ecotypes for Monarch Conservation**
 *¹Jessamine Finch, ²Desirea Thole, ³Joel Abraham [¹Northwestern University, ²Minnesota State University Mankato, ³Yale University]
 The monarch butterfly population has declined dramatically in recent years due to habitat loss, agricultural chemical use, loss of larval host plants (milkweed; *Asclepias* spp.), and climate change. In response, monarch conservation efforts have gained momentum across the species range. Increasingly, efforts have been focused in more residential, even urban, areas. Small-scale pollinator and native plant gardens integrated into more developed areas allow for unique educational opportunities and provide stepping-stones of habitat bridging otherwise isolated reserves. However, the efficacy and best management practices of urban conservation and restoration efforts are largely unknown. To assess the viability of cities for monarch conservation and investigate the best practices for sourcing plant material for urban environments, two complementary research projects were undertaken. First, during the 2015 migration season, 9 common milkweed (*Asclepias syriaca*) populations along an urbanization gradient were monitored for monarch eggs and larvae. Significant differences in larval abundance were found among sites and landscape types. Suburban sites supported 1.4x & 1.9x more caterpillars and 1.5x & 1.7x more eggs than urban and rural sites, respectively ($p \leq 0.001$). Second, a reciprocal transplant study was used to test local adaptation of common milkweed originating from urban and rural landscapes. Populations significantly differed in seedling vegetative parameters and throughout the first growing season. Garden site, population of origin, and the interaction of garden and population all significantly impacted mature plant height ($p < 0.001$). Two of the four urban populations demonstrated increased performance at the urban garden ($p < 0.04$), suggesting local adaptation. Taken together, our results indicate that a) developed areas may provide some suitable monarch habitat, and b) select urban milkweed ecotypes may be particularly well suited for use in conservation plans.
- 10:45am Redbud WITHDRAWN**
- 11:00am Redbud UG Ghost Orchid (*Dendrophyllax lindenii*) Habitats in Florida and Cuba: Differences and Similarities**
 *¹Justin Mably, ²Ernesto Mújica Benítez, ¹Lawrence W. Zettler, ¹Shannon M. Skarha, ¹Laura L. Corey, ³Larry W. Richardson, ³Mark Danaher. [¹Illinois College; ²Soroa Orchid Botanical Garden, Cuba; ³Florida Panther National Wildlife Refuge]
 Few orchids native to North America have received as much widespread attention as the Ghost Orchid, *Dendrophyllax lindenii* (Lindl.) Benth ex Rolfe. The species' high profile, coupled with its alluring floral display and sweet-smelling fragrance, has rendered *D. lindenii* highly prized amongst hobbyists and private collectors. Throughout its natural range (south Florida, Cuba), the species is threatened by insect pests, loss of habitat (urbanization), periodic hurricanes, and poaching – the latter fueled by difficulties associated with its artificial propagation. Surprisingly little is known about the ecological requirements of *D. lindenii*, and until more information becomes available, this species could potentially succumb to extinction in natural areas this century. In 2013, we initiated a collaborative effort to study *D. lindenii* in natural areas in Florida and Cuba, with the common goal of promoting the species' conservation. Ghost Orchids within Guanahacabibes National Park,

Cuba, and the Florida Panther National Wildlife Refuge (FPNWR) were counted and surveyed, taking into account the associated flora, orientation on host trees, flowering, fruit set, and spontaneous seedling number. In July 2015, >100 Ghost Orchids were counted at 5 sites in the FPNWR; prior to the collaboration, only 16 ghost orchids were known to occur there. Root samples yielded mycorrhizal fungi assignable to *Ceratobasidium*, verified by ITS sequencing. This ongoing collaboration exemplifies how warming relations between the USA and Cuba can benefit orchid conservation.

CELLULAR, MOLECULAR, & DEVELOPMENTAL BIOLOGY

9:15am Grad Dogwood **Comparative Analysis of *Helicoverpa zea* Gene Expression and Growth on the Host Plant**

*Donald Bath, Richard Musser [Western Illinois University]

Annually millions of dollars are spent reducing crop damage from caterpillar herbivores such as *Helicoverpa zea*, commonly known as the 'corn earworm' or 'tomato fruitworm', a moth species whose larval stages feed on a variety of plants. By understanding the gene expression of plant and herbivore interactions a better understanding of co-evolution can be developed and well as the potential for novel methods in protecting agricultural crops. This research aims to understand how *H. zea* grows and compensates on a variety of plants with different defense tactics and different tissues such as leaves versus fruits. A series of growth assays were performed with *Helicoverpa zea* on several plants: control diet, leaves from soybeans (*Glycine max*), tobacco (*Nicotiana tabacum*), corn (*Zea mays*), and the leaves and fruit of tomatoes (*Solanum lycopersicum*). Results compared 3rd instar caterpillar's weights taken 72 hours after herbivory began on their respective plants tissues. Additional testing was performed with plants altered using defensive hormones jasmonate and salicylate. Gene expression was determined with real-time qPCR to represent compensatory digestive genes and counter defenses metabolism to types of plants and their tissues. The bioassays demonstrated caterpillars grew greatest on control diet and tomato fruit in relation to other tissues. In regards to leaf tissues caterpillars grew better on tomato leaves than any other leaves. Gene expression correlated well to these bioassays where caterpillars stimulated higher levels of digestive gene expression when feeding on leaves in comparison to fruits. Likewise detoxification genes were greater when feeding on leaves in comparison to fruits. Caterpillar always had higher levels of compensatory gene expression when feeding on plants with stimulated defenses. This study provides some the first measurements of gene expression across wide range of host plants.

9:30am UG Dogwood **Differentiation of Human Adipose Mesenchymal Stem Cells into Parathyroid Hormone Synthesizing Cells**

*¹Eliana Toren, ¹Josh Ginzel, ¹Feras Altwal, ¹Craig Cady, ²Mark Holterman, ³Miao Li, ³Mary McAsey [¹Bradley University; ²OSF Saint Francis, Peoria IL; ³SIU School of Medicine]

Hypoparathyroidism is characterized by insufficient levels of parathyroid hormone (PTH) in the blood, causing hypocalcemia or decreased levels of calcium. In functioning tissues, PTH is secreted by chief cells in the parathyroid when calcium levels decline, based on the function of calcium sensing receptor proteins (CaSR). Hypocalcemia can cause convulsions, arrhythmias, as well as numbness in the hands, feet, and mouth. No effective cure for dysfunction of the parathyroid currently exists, however, standard treatment includes daily oral calcium supplements which are difficult for patients to maintain for life and include complications such as hypercalcemia, or calcium levels above normal. Hypercalcemia can have serious effects including muscle and cardiac dysfunction. There are various types of stem cells that have the potential to differentiate into mature cell types in the body, giving rise to potential for replacement of damaged cells or tissues with newly differentiated, functioning ones. The use of adipose mesenchymal stem cells (hADSCs) has been recently emphasized because of their autologous nature and high differentiation potential. In this study, hADSCs were differentiated into PTH synthesizing cells using a novel differentiation protocol. All hADSCs were treated with fetal bovine serum (FBS) and experimental groups were treated with either activin A, parathyroid recombinant protein (PTHrP), or human parathyroid cell conditioned media. Cells treated with PTHrP or activin A formed clusters containing parathyroid-like cells after 26 days. Based on qRT-PCR and immunocytochemistry analysis, hADSCs treated with activin A and PTHrP both expressed PTH and CaSR mRNA message and protein. Parathyroid conditioned media treatment did not show expression of parathyroid specific characteristics. Future work will optimize the amount of cells that fully differentiate into parathyroid cells, as well as test this differentiation with other types of stem cells such as iPSCs.

- 9:45am Grad Dogwood** **Gene Expression Observed from the Interaction between Corn Earworm (*Helicoverpa zea*) Caterpillars and Corn (*Zea mays*) Tissues**
 *Kayleigh Diveley, Richard O. Musser [Western Illinois University]
 By understanding the genetic interaction of plant defense systems to insect pests such as caterpillars and in understanding how caterpillar digestive systems attempt to overcome these plant defenses, research may help to find novel methods in protecting our agricultural crops and limit the use of pesticides. This experiment aimed to observe the changes to gene expression caused by the interaction between Corn Earworm (*Helicoverpa zea*) caterpillars and Corn (*Zea mays*) tissue. To do so, changes to caterpillar growth and gene expression by feeding third instar caterpillars several treatments of corn tissues such as Corn Leaves, Corn Husk, Corn Silk, and Corn Fruit against an artificial diet were observed. A total of 10 to 15 distinct genes were observed for each experimental objective to represent the direct defenses of the corn as well as the digestive genes altered as a result of feeding on the tissues using real-time qualitative PCR. Our results revealed that plant defenses such as protease inhibitors appeared suppressed in the leaves due in part to the caterpillar salivary factors. In the bioassay we found the caterpillar grew the greatest on the Corn Fruit in relation to other corn tissues. Also, the caterpillar digestive genes correlated to this increased growth on the Corn Fruit in comparison to the other tissue by less expression for protease genes than if the caterpillar fed on leaves or other tissues.
- 10:30am UG Dogwood** **Enhancing Human Umbilical Cord Wharton's Jelly Mesenchymal Stem Cell Chemotaxis towards Ovarian Cancer as a Putative Cell-Based Therapy**
 *¹Kaysaw Tuy, ¹Andrea Baumgartel, ²Miao Li, ²Mary McAsey, ¹Craig Cady [¹Bradley University, ²SIU School of Medicine]
 Adult stem cells are the latest focus in regenerative medicine for their differentiation capacity and non-embryonic origins. In addition to their multipotent differentiation capacity, stem cells are known to migrate towards sites of injury and inflammation, including cancer. Human Wharton's Jelly umbilical cord stem cells (hWJSCs) are ideal for transplantation due to their low immunogenicity and non-tumorigenic properties. These properties and chemotactic characteristics of hWJSCs give rise to their potential use as a drug delivery vehicle for localized chemotherapy treatment. From previous chemotactic assays we have demonstrated that hWJSCs migrated towards various ovarian cancer mediated factors, including vascular endothelial growth factor 165 (VEGF-165), an angiogenic factor expressed in many cancers including ovarian cancer. Prior to migration testing, hWJSCs were exposed to VEGF-165 to assess chemotactic activity towards VEGF-165, wingless-type MMTV integration site family member 1 (WNT-1) and ovarian cancer cell conditioned media (OCCCM). The hWJSCs pre-exposed to VEGF had significantly increased migration toward OCCCM. These results demonstrate that chemotaxis of hWJSCs towards ovarian cancer can be enhanced, suggesting a potential application for a cell-based chemotherapy. The next phase of this study will investigate the retention of chemotactic phenotypes of transfected hWJSCs with chemotherapy related factors.
- 10:45am UG Dogwood** **Analysis of the Geranyl Geranyl Diphosphate Synthase Family in *Arabidopsis thaliana***
 *Luke Revelt, Veronica Heintz, Darron Luesse [Southern Illinois University Edwardsville]
 Chlorophyll is an important molecule for the absorption of light during photosynthesis. The enzyme geranyl geranyl pyrophosphate synthase (GGPS) is a critical enzyme in the isoprenoid pathway and responsible for the production of the molecule geranyl geranyl pyrophosphate (GGPP), a precursor to many isoprenoids such as carotenoids, hormones, and chlorophyll. There are 12 genes that make up the GGPS family in the model plant *Arabidopsis thaliana*. By analyzing individual mutations in the GGPS family genes in *Arabidopsis*, we hope to better understand the function of each gene in this family. Mutants homozygous for t-DNA insertions in GGPS1, GGPS3, GGPS5, and GGPS7 have been confirmed, and lines containing mutations in GGPS8 and GGPS10 are still awaiting validation. To help understand the function of each GGPS gene, we are measuring the chlorophyll content in each mutant. To learn more about the regulation of each GGPS gene with respect to location, we analyzed the promoter elements of each GGPS gene and compared them to the known localizations of each gene product to see if certain promoter elements accompanied certain localizations. Finally, we are attempting rescue of the previously described *gpps11* mutant using another chloroplast-localized family member, GGPS3. The construct for rescue has been produced and we are awaiting transformation results.
- 11:00am UG** **The Effects of Nicotine on the Development of Monoaminergic Neurons in *Danio rerio***

Dogwood

*Nikolaos T. Polizos, Andrew A. Hill [Knox College]

Nicotine has been shown to have profound effects on the nervous systems in a variety of animal models. Previous research has found that nicotine exposure during development leads to a reduction in the number of serotonergic neurons in rodents. We are using *Danio rerio* to examine if embryonic nicotine exposure has a similar effect for monoaminergic neurons in general. For this study, we will be using the ETvmat2:GFP transgenic line of *Danio rerio*. This line labels the monoaminergic neurons using a GFP which is bound to vesicular monoamine transporter 2 (vmat2) a protein common to most monoaminergic neurons. To count the number of monoaminergic neurons, we are using immunofluorescence to amplify the signal inherent in the ETvmat2:GFP line. We are using a primary anti-GFP antibody, followed by a secondary antibody conjugated to a fluorophore which fluoresces at a similar wavelength to GFP. Confocal microscopy and a whole-mount technique will allow individual monoaminergic cell bodies to be resolved. From here we will be able to compare cell counts between groups of fish that have been exposed to different doses of nicotine and achieve quantitative results.

11:15am UG
Dogwood

Have We Seen Enough? Quantifying the Extent of Behavior Displayed by Serine Proteases in a Molecular Dynamic Simulation

*Thomas Teague, Edward Ackad, Mohammad Yousef [Southern Illinois University Edwardsville]

Experiments provide the final verdict throughout all of science. Those involving biomolecules are notoriously time-consuming, expensive, and often do not provide a clear picture of the underlying mechanisms. Molecular dynamics (MD) simulations of these processes avoid the aforementioned difficulties, but they are restricted to relatively short time scales due to computational limitations. Accordingly, the possibility exists that the model has not completely captured the relevant behavior of the molecule in question. Assessing the extent to which this has occurred is, arguably, as important as the construction of the models themselves. A recently developed method for this utilizes Good-Turing statistical analysis to give a quantified measure of convergence for biomolecular simulations. We applied Good-Turing statistics to the MD trajectories of a model system of three strains of the nonstructural protease 3/4A of the Hepatitis C virus and compared the results to their experimentally-determined activity assays to determine the accuracy of the simulation. We found the method to be correct and efficient in assessing the proteases in question, which grants us many capabilities including the ability to predict, in silico, the catalytic activity of serine proteases.

CHEMISTRY

11:30am UG
Dogwood

Qualitative Rate Study of Variations on the Ugi-Smiles Reaction

*Abbie Fox, Sarah Luesse [Southern Illinois University Edwardsville]

Multicomponent coupling reactions (MCRs) are efficient methods for creating biologically relevant compounds. The Ugi-Smiles reaction is a well-established four-component coupling of a phenol, amine, aldehyde, and isocyanide to form a highly-functionalized amide. In the presence of 2-furaldehyde and allylamine, a dual Ugi-Smiles Diels-Alder (US-IMDA) process occurs, forming an epoxyisoindoline. Recent competitive studies using ¹H NMR time focus on the difference in reaction rate for components that undergo only standard Ugi-Smiles product formation and components that provide tandem US-IMDA products.

ENGINEERING & TECHNOLOGY

11:00am
Maple

WITHDRAWN

11:15am Grad
Maple

Biomechanical Assessment of a Mobile Axis of Rotation Cervical Disc

*¹Kenneth R. Blank, ²Stephanie Werner, ³Leonard I. Voronov, ⁴Saeed Khayatzaeh, ⁴Robert M. Havey, ⁴Gerard Carandang, ³Avinash G. Patwardhan [¹University of Illinois Chicago; ²Dominican University; ³Loyola University Medical Center; ⁴Hines VA Biomechanics Laboratory, Hines IL]

Anterior cervical discectomy and fusion has been associated with adjacent segment degeneration. Cervical total disc arthroplasty (TDA) has been proposed as an alternative. The purpose of this study was to assess the effect of an innovative design of TDA on cervical motion after 1- and 2-level arthroplasty. Nine

cadaveric C3-T1 spines (38.3±5.8 yrs) were tested. The testing apparatus allowed continuous cycling in flexion-extension (FE), lateral bending (LB), and axial rotation (AR) to ±1.5 Nm. Compressive preload (150N) was used in flexion-extension. Vertebral motion was measured using optoelectronic measurement. Forces and moments were measured using a 6-axis load cell. TDA implantation was performed consistent with company guidelines (Triadyme-C, Dymicron, Orem, UT, USA). Intact, C5-C6 TDA (n=9), C6-C7 TDA (n=7). ANOVA was used for statistical analyses, p<0.05 shows significance. 1-level TDA, results from C5-C6, ROM (deg) changed from: FE: 12.8±2.5 to 10.5±2.1 (p=0.03); LB: 8.5±2.8 to 3.7±1.0 (p<0.01); AR: 10.4±1.1 to 6.2±1.9 (p<0.01). Change in segmental stiffness (Nm/deg): Flexion: 0.09±0.03 to 0.21±0.09 (p=0.004); Extension: 0.08±0.03 to 0.18±0.07 (p=0.003). Change in neutral zone (deg): FE 1.8±0.7 to 1.8±0.8 (p=0.966). 2-level TDA, results from C6-C7, ROM (deg) changed from: FE: 10.0±3.4 to 11.4±3.0 (p=0.07); LB: 7.5±2.8 to 5.1±2.3 (p=0.07); AR: 7.7±1.7 to 5.3±0.9 (p=0.02). Change in segmental stiffness (Nm/deg): Flexion: 0.13±0.06 to 0.15±0.08 (p=0.424); Extension: 0.12±0.05 to 0.11±0.04 (p=0.736). Change in neutral zone (deg): FE 1.5±1.0 to 2.1±0.9 (p=0.304). This innovative design of disc prostheses restored ROM in FE to intact levels. In LB the TDA maintained 68% ROM at C6-C7 and 43% at C5-C6. In AR 60% ROM was maintained at C5-C6 and 69% at C6-C7. The data suggest that this TDA provides similar cervical spine kinematics as compared to the preoperative condition.

11:30am
Maple

WITHDRAWN

ENVIRONMENTAL SCIENCE

9:00am
Maple

Grad **Evaluating Native Plant Survival on a Mid-Western Green Roof**

*¹Alllyssa Decker, ²G. Koehler, ³K. Lockett, ¹S. Morgan, ¹W. Retzlaff [¹Southern Illinois University Edwardsville, ²Pizzo Native Plant Nursery, ³Green Roof Blocks]

Green roofs have ecological benefits that address numerous modern environmental issues. Many studies have evaluated Sedums on green roofs; on the other hand, there is much interest in native plant performance. In our study, Green Roof Blocks were planted with 3 experimental treatments: native only; native species plus Sedums; and with Sedums only. The native species only treatment consisted of *Eragrostis spectabilis*, *Coreopsis lanceolata*, *Penstemon pallidus*, *Penstemon hirsutus*, *Koeleria macrantha*, *Rudbeckia hirta*, *Aster laevis* and *Carex muhlenbergii*. These areas were planted with one plug per native species for a total of eight plugs per Green Roof Block. Natives were interspersed between existing Sedum plantings in the native species plus Sedum planting treatment. There was again one plug per six species but only six native plugs per block. The species in these planting areas were *Bouteloua gracilis*, *Buchloe dactyloides*, *Asclepius verticillata*, *Bouteloua curtipendula*, *Geum triflorum* and *Sporobolus cryptandrus*. All native plants were planted in the two treatments on 5/29/2013 and 6/5/2013. All plants in the study plots were irrigated weekly as needed in 2013 and 2014. In November, 2013, June, 2014, June, 2015 and November, 2015, plant survival was measured. In the plots with natives only, survival ranged from 0 to 72 percent. To date, *Coreopsis lanceolata* and *Penstemon pallidus* had the greatest percent survival. In the plots with natives plus Sedums, survival ranged from 0 to 65 percent. Survival of the four native grasses was greater than 99 percent in the first growing season. Survival of *Buchloe dactyloides* was still greater than 65 percent in November 2015. In addition, the forb *Coreopsis lanceolata* was rapidly spreading outside of the initial planting areas, indicating that this native species not only survives on the roof, but is able to reproduce successfully.

9:15am
Maple

Effect of Anthropogenic Contamination on Genetic Diversity in Mediterranean Mussels from the Strait of Istanbul

*Chris Theodorakis [Southern Illinois University Edwardsville]

The objective of this study was to determine the effects of urban contamination on genetic diversity and gene flow of Mediterranean mussels (*Mytilus galloprovincialis*) from the Strait of Istanbul, Turkey. Mussels were collected from two reference sites and five other sites with varying degrees of contamination within a 50 km stretch of shoreline in or near Istanbul. Sections of mitochondrial D-loop were PCR-amplified from mitochondrial DNA and sequenced. Genetic diversity of the D-loop was represented by both nucleotide substitutions and complex insertion/deletion patterns. This locus revealed that the genetic diversity of the contaminated sites was less than that of the reference sites and was significantly correlated with the level of contamination. There were also two major clades, one of which was more prevalent on the Asian side of the strait, which was the least

contaminated site (“clade 1”). The other major clade (“clade 2”) was more prevalent on the European side of the strait, which was more contaminated with pollution. There was evidence of gene flow from the Asian site to downstream sampling sites on the European side of the strait, but there was evidence that gene flow in some sites was hampered by elevated environmental contamination. In addition, there was evidence that larval recruits belonging to clade 1 genotypes may have been selected against in the contaminated sites. These findings are significant because it 1) provides further evidence that anthropogenic disturbance can increase genetic diversity of impacted populations, 2) suggest a unique evolutionary history for one of the major clades, 3) demonstrates that fine-grained genetic structuring may occur over short distances in marine species with pelagic larvae, and 4) it is one of the few studies that demonstrates possible anthropogenic impacts on genetic diversity in a marine species with a pelagic dispersal stage.

9:30am Maple Grad Examining Metropolitan Communities to Assess Disparities in Air Pollution and Asthma Using Spatial and Statistical Analyses

*Hannah Fyfe [Southern Illinois University Edwardsville]

Criteria pollutants controlled under the Clean Air Act including Particulate Matter (PM), Nitrogen Oxides (NO_x), and Sulfur Dioxide (SO₂) have the capacity to threaten the integrity of the public health within a community. The study of Environmental Justice (EJ) communities focuses on the uneven burden of environmental contamination in low-income, high-minority areas, especially those within urban districts. The monitoring of epidemiological trends, specifically respiratory conditions such as asthma, can be used to assess the effects that non-attainment of air pollutants has on a population. The study sites being assessed (St. Louis, Missouri and Kansas City, Kansas) provide an opportunity for the examination of geographically unique areas to determine if EJ communities have higher rates of asthma due to exposure to criteria air pollutants. Both sites are located on the boundary between two states, making it possible to examine if different states implement environmental policies to variant degrees of public health preservation. The study utilizes air emissions data for major industrial point sources, socioeconomic census data, and Emergency Department utilization records. By using spatial and statistical analyses, it will be determined if Emergency Department utilization for asthma-related treatment is affected by socioeconomic factors such as minority status and income level. The presence of major sources of air pollution will be assessed in comparison to the demographics of the metropolitan populations. This research also incorporates comparisons between the two respective states to measure the ability that each State Implementation Policy (SIP) has to manage the health effects of air pollution for at risk communities. The integration of environmental policies with a public health issue provides a means of addressing social inequalities within EJ communities with respect to the uneven distribution of sources of air pollution in minority high risk areas.

9:45am Maple Grad Microbial Transformation and Volatilization of Elemental Selenium Nanoparticles

*Jun Wang, LeighAnn Jones, Z.-Q. Lin [Southern Illinois University Edwardsville]

With rapid development of nanotechnology, selenium (Se) nanoparticles (SeNPs) have been widely used in many different fields, such as medical, agricultural, and nutritional industries. Due to their unique physical and chemical properties, SeNPs as emerging contaminant could pose potential adverse impacts on the environment. Little is known about the chemical behaviors of SeNPs in a soil-plant system, and particularly the biological processes that control the transport and fate of SeNPs in the environment have not been well elucidated. To demonstrate that SeNPs can be bio-transformed in soil-plant systems, a series of laboratory experiments have been conducted using Se-hyperaccumulator plant *Stanleya pinnata* and the plant associated soil bacterium *Pseudomonas fuscovaginae*. The results showed that soil microbial Se volatilization was the dominant process for Se volatilization in the soil-plant system that was treated with 3 mg/kg SeNPs, and further the amount of Se volatilized from roots (88.64±10.62 µg/pot) was significantly higher than from shoots (0.21±0.86 µg/pot). The rate of Se volatilization from SeNPs by *P. fuscovaginae* is Se-concentration dependent. With the Se treatments of 1, 5, and 10 mg/L in bacterial growth substrate, rates of Se volatilization during a 24-hour sampling period was 0.14±0.11 µg/flask, 1.06±0.19 µg/flask, and 1.44±0.11 µg/flask, respectively. The amount of Se volatilized from SeNPs by the bacterium was lower than from sodium selenate, but higher than the volatilization from bulk elemental Se. This study indicated that SeNPs are bioavailable and can be bio-transformed to volatile Se compounds. Soil rhizosphere bacteria play an important role in Se volatilization from SeNPs.

- 10:30am UG Weeding Maintenance of Green Roof Systems**
Maple *¹Kayla Tatum, ¹Susan Morgan, ²Vic Jost, ³Kelly Lockett, ¹Bill Retzlaff [¹Southern Illinois University Edwardsville, ²Jost Greenhouses, ³Green Roof Blocks]
 Green roof systems offer a method of providing food, reducing building thermal costs, reducing storm water runoff, and other environmental benefits. However, to provide these benefits, rooftop maintenance must be performed. A 16,000 ft² green roof was planted in April 2009 with five Sedum species and installed on the SIUE Student Success Center in August 2009. In 2015, three replicate test plots were selected in different locations on the roof - an east, a west, and a center plot. Each plot consisted of three sections of sixteen Green Roof Blocks (GRBs), each based on their clipping/weeding methods; in one section all weeds were mechanically clipped, in the second all weeds were hand clipped, and in the third all weeds were left unclipped. Weeding/clipping dates were June and October 2016. Sedum roof coverage was measured once at the beginning of the study in July and again in November at the end of the growing season. Sedum roof coverage was greater than 68% across all three weeding methods in July. In November, mechanically trimmed plot coverage (28.6%) was significantly lower than the other two methods (unweeded 39.8%; hand weeded 41.1%). In the early stages of this study it appears that mechanical weeding methods may have a negative effect on Sedum roof coverage.
- 10:45am Grad Effects of Chemical Speciation on Selenium Accumulation in Fungal Mycelia**
Maple *¹Ranjitha Uppala, ²Hojat Ghahremani-majd, ¹Z.-Q. Lin [¹Southern Illinois University Edwardsville; ²University of Bu-Ali Sina, Hamedan Iran]
 Selenium (Se) containing glutathione peroxidase and thioredoxin reductase enzymes play important roles in detoxification and antioxidation in human body. Selenium deficiency may cause serious health complications in humans. Thus, the development and uses of Se-biofortified food products recently becomes one of the agricultural research topics. Edible mushrooms are rich in proteins and essential amino acids, and some are capable of accumulating micronutrient elements like Se. This laboratory study was conducted to determine the feasibility of producing Se-enriched mushroom mycelia through tissue cultivation and effects of different chemical forms, including element Se nanoparticles, on Se accumulation in mycelium tissues of different mushroom species. The results showed that significant amounts of Se were accumulated in mycelium tissues, and Se bioaccumulation varied significantly ($p < 0.05$) among the mushroom species, including Reishi (*Ganoderma lucidum*), Shiitake (*Lentinula edodes*), Hericum (*Hericum erinaceus*), Pearl Oyster (*Pleurotus ostreatus*) and Blue Oyster (*Pleurotus columbinus*). The highest Se concentration (315 mg/kg) was observed in Blue Oyster mycelia. Concentrations of Se accumulated in mycelium tissues of Reishi and Blue Oyster increased with increasing the level of Se treatment in growth media, from 1, 2.5, 5 to 10 mg/L and in the form of selenate (Na₂SeO₄) or elemental Se nanoparticles (SeNPs). The mycelium growth was significantly inhibited by Se in selenate at the treatment level of 20 mg/L, while the 1 mg/L treatment significantly enhanced the mycelium biomass production compared to the control.

HEALTH SCIENCES

- 10:45am Antimicrobial-Resistant *Klebsiella*: 11-yr Survey of Pinnipeds**
Oak *¹Dennis Lawler, ²Basil Tangredi, ¹Richard Evans [¹Pacific Marine Mammal Center, Laguna Beach CA; ²Green Mountain College]
 The Pacific Marine Mammal Center, Laguna Beach CA, conducted an 11-year study (2004-2015) of bacterial isolates from lesions of pinnipeds that were presented to the rescue center, including patterns of antibiotic resistance. Among the isolates, we noted an overall increasing trend toward multidrug resistance (MDR), defined as non-susceptibility to at least one antimicrobial agent in ≥ 3 of 7 antimicrobial classes. *Klebsiellae* accounted for 112 of 847 gram-negative isolates (13%), including *K. pneumoniae* (n=101; the type species), *K. oxytoca* (n=9), and *K. rhinoscleromatis* (n=2). *Klebsiella* resistance to second-generation fluoroquinolone antibiotics trended significantly upward, reaching 37% of isolates by 2014-2015. *Klebsiellae* represent sources of human infection by recreational contact with contaminated water, by food-borne illness from contaminated seafood, or by waste effluent. Waste effluent may represent a continuing health threat, since it is not designed to remove bacterial nuclear or plasmid DNA. Effluent is the most likely source for the infections that we observed. Multidrug resistant (MDR) *Klebsiella* spp. have become a major challenge in human and veterinary medicine. Multidrug resistant *Klebsiella* spp. is now a global problem in human medicine. In veterinary medicine, it has been identified as part of the commensal gut microbiota but can be an opportunistic invader of the mammary gland, the reproductive

tract, and the urinary tract. MDR *Klebsiella* is considered to be an emerging One Health issue. Managing this important health threat requires understanding how the ecology and prevalence in wildlife can interact with the clinical diseases in individuals and populations.

MICROBIOLOGY

- 11:00am Grad Oak** **Seasonal Variation of Dark Septate Fungi in an Arid Grassland and their Potential Role on Plant Growth**
 *¹Cedric Ndinga Muniania, ¹Katrina Sandona, ²Jayne Belnap, ³Cheryl R. Kuske, ¹Andrea Porras-Alfaro [¹Western Illinois University; ²US Geological Survey, Moab UT; ³Los Alamos National Laboratory, Los Alamos NM]
 The high temperatures and long extended drought periods in arid ecosystems promote the colonization of diverse microenvironments by dominant communities of dark septate fungi (DSF). Due to their abundance, DSF are likely to contribute to soil nutrient enrichment and stabilization, and plant survival in these stressful conditions, but their role and diversity are still not well described. We collected soil and isolated fungi from different microenvironments in an arid grassland near Moab, UT. The biocrust fungi were isolated from lichen, moss and cyanobacteria dominated crusts, and rhizosphere soils were collected from two plants, *Bromus tectorum* and *Hilaria jamesii*. Fungi were isolated using a serial dilution technique and identified using ITS rRNA sequencing. Seasonal variation of DSF was evaluated using culture-based approaches and compare with fungal community profiles from Illumina sequencing. Our imaging pigment analysis reveals that DSF are more abundant in BSC compared to rhizosphere showing differences in colonization rates by season with an increase during the summer months. Trends on culture data were confirmed with the analysis of Illumina data, which showed an increase in abundance of dark septate fungi (e.g. *Alternaria* and *Phoma*) in rhizosphere and below biocrust during the summer months. From the 813 fungi isolated, Pleosporales was the dominant order in both biocrust and rhizosphere. The most dominant DSF genera included *Alternaria*, *Preussia*, *Cladosporium*, *Phoma* and unknown Pleosporales. Seed germination experiments using dominant taxa were conducted in corn and soybean to determine their potential roles on plant growth. *Cladosporium* and *Alternaria* in particular, showed growth promoting ability stimulating root production and stem elongation. This variation in abundance and colonization of DSF could reflect an adaptation to the environmental conditions in the summer as well as potential plant demand when heat and drought conditions are high. The growth promoting ability of DSF could be an important factor to help plants to cop with heat and drought conditions.
- 11:15am Grad Oak** **Characterization of Molecular Mechanisms of Silver Nanoparticle Toxicity in *Escherichia coli* (*E. coli*)**
 *Lisa Adden, Chris Theodorakis, Vance McCracken [Southern Illinois University Edwardsville]
 Silver nanoparticles (Ag-Nps) are widely used in industry and medicine, but potential effects of environmental exposures are poorly characterized. This study investigated mechanisms of Ag-Np toxicity in *Escherichia coli*, with a focus on effects of reactive oxygen species (ROS) production. Because agglomeration causes Ag-Nps to behave like bulk materials, we confirmed nanostate chemistry by Malvern Zetasizer prior to analyzing antimicrobial effects. These studies demonstrated that Ag-Nps agglomerations were sensitive to salt concentration and temperature; therefore low salt (0.05% NaCl) LB solution and low temperature (32° C) were used for subsequent experiments. Ag-Nps had a significant effect on *E. coli* growth kinetics, delaying entry into log phase growth. Bacterial sensitivity was analyzed via disk diffusion assays with varying masses of Ag-Nps per disk (0-25 µg/disk). Significant inhibition of growth was observed at 0.78 µg Ag-Nps/disk. Minimum inhibitory concentration (MIC) and minimum bactericidal concentrations (MBC) tests performed in LB media supplemented with varying concentrations of Ag-Nps (1-100 µg/mL) demonstrated the MIC for Ag-Nps was 50 µg/mL; MBC was 150 µg/mL. Intracellular ROS levels were measured with H2DCFDA staining: a significant increase of intracellular ROS was detected at 1.562 µg Ag-Nps/mL. Protein carbonyl formation was measured using a colorimetric assay and lipid peroxidation by the TBARS assay to assess effects on macromolecules. Ag-Nps significantly increased protein carbonyl formation and lipid peroxidation at 3.125 µg/mL. Thus, it appears that silver nanoparticles inhibit microbial growth and induce ROS and oxidative stress at µg/mL concentrations. Such knowledge can contribute to the ecological risk assessment of these emerging contaminants.

- 11:30am Grad Oak Novel Early Lineage in the *Mucoromycotina***
 *¹Terry Torres Cruz, ¹Maryam Almatruk, ¹Terri Tobias, ²Cheryl R. Kuske, ¹Andrea Porras-Alfaro
 [¹Western Illinois University; ²Los Alamos National Laboratory, Los Alamos NM]
 Soils contain large fungal diversity making them highly valuable for the discovery of new species. This study seeks to characterize a novel fungal species in the *Mucoromycotina*. Isolates were obtained from the Duke Forest Free Air Carbon Enrichment Site by soil dilutions on PYG+ media at 25°C. Morphological characteristics were described and a phylogenetic analysis was conducted using multiple genetic regions and a draft genome. Bacterial symbionts were also analyzed using 454-sequencing to describe the bacterial community associated to this fungus. This novel taxon is abundant in lower soil horizons and responds to long term N fertilization. The closest BLAST results for the isolates belong to uncultured soil fungal sequences obtained from metagenomic analyses and an isolate from endophytic fungi in mosses. Characterization of the fungus on different growth media reveals changes in colony morphology, associated to the growth of specific groups of bacteria. Light and electron microscopy showed coenocytic hyphae, yeast like structures, and potential chlamydospores. Using electron microscopy, the bacterial communities were also observed on the fungus surface. Analysis of SSU and phylogenomic analysis using a partial genome showed that these isolates represent a new clade closely related to *Endogone* as an early lineage in the Mucoromycotina.

SCIENCE, MATHEMATICS, & TECHNOLOGY EDUCATION

- 9:15am Grad Oak Analysis of a Pilot Phase CURE Implementation in an Introductory Biology Course for Science Majors**
 *K. Charles Knoth Jr., Kelly Barry [Southern Illinois University Edwardsville]
 Course-based undergraduate research experiences (CUREs) provide research benefits to an entire class of students. Research experiences have been shown to, at minimum, enhance research skills, critical thinking, and productivity. Research experiences also lead to increased retention in science. Unique from a handful of undergraduate's gaining authentic research experience under the guidance of a principal investigator, CUREs are able to enrich significantly more students by including entire courses of students. There are several obstacles coupled with introducing CUREs, such as the logistics of dealing with large class sizes and designing research experiences. Our objective has been to overcome frequent obstacles and determine the benefits of CUREs where they reach the largest audience - in the introductory biology course laboratory for biology majors at Southern Illinois University Edwardsville. Here, we utilize the process of converting microalgae into biodiesel as the CURE environment. Data collected from the initial Spring 2016 pilot phase will be presented.
- 9:30am Grad Oak Teaching Undergraduate Statistics: What is a p-Value Truly Worth?**
 *Anna Valeva [Western Illinois University]
 In this paper we share our experience in teaching undergraduate level statistics courses and in particular the widely adopted tool for statistical inference – hypothesis testing. The p-value is used as a crucial concept in the decision making process of hypothesis testing, but its meaning and importance are widely misinterpreted. This leads to a host of misconceptions in practice when users of statistics across sciences conduct studies based on quantitative data analysis. It also has led to a widely implemented standard for accepting research studies for publication – a p-value of less than five percent. We summarize the well documented drawbacks of making decisions solely based on p-values, and while it is tempting to present students with a straightforward decision making rule readily available in the numerical output of all software packages, we suggest rewriting the hypothesis testing section of undergraduate texts, so that the meaning of p-values is put in context and decisions are made considering an array of logical arguments encompassing the entirety of the scientific information behind the research question and data collection process.
- 9:45am UG Oak Developing a More Engaging and Safer Demonstration Apparatus for Combustible Dust Explosions**
 *Brenna McIlvoy, Susan D. Wiediger [Southern Illinois University Edwardsville]
 Combustible dust is an often overlooked hazard that occurs in many industrial settings and is a subject of current Chemical Safety Board calls for regulation. Teaching students about dust explosions addresses fundamental science concepts such as kinetics while also preparing them for possible future careers. In this research project, a modified metal coffee can apparatus was originally built for testing. A range of dusts were tested with particular focus on coffee creamer, which does not have the same allergen problems as the lycopodium powder typically used in demonstrations. A second transparent apparatus was developed, similar to the transparent Hartmann

tube used as the industry standard. However, this version could be built by a K-12 teacher largely using off-the-shelf components. Development of both apparatuses will be discussed; the reproducibility of results and the safety will be compared.

10:30am
Oak

Discovering A.P.E. and the Selection of a Health Profession

*Johnny Lloyd [Aurora University]

A.P.E. stands for A = Aptitude (what a person does best); P=Passion (what a person loves to do); and E=Entertainment (having fun). Within a two hour biology credit course called Health Professions Seminar, students (Health Science majors) go on the journey of discovering their A.P.E. The course introduces the student to the basic health care environment and examines the roles and responsibilities of various occupations. The factors such as personality, leadership, and values which may influence career decisions are explored. Selective films like "Patch Adams," "Something the Lord Made," and "Gifted Hands, the Ben Carson Story" are viewed and reflection papers are written. One on one talks (at least 30 minutes) with professor are conducted and outside health care professionals are invited to speak. In addition, students present power point presentations about assigned health care professions explaining the career (responsibilities); educational preparation; and the future of the profession. Finally, a career paper is written which includes an interview (in person, phone, or internet) with a health care provider in the student's chosen field and a series of questions involving significant experiences; the assessment of one's academic potential to succeed; and the integration of personality, leadership, and values on a career decision.

ZOOLOGY

9:00am
Hickory

Grad Comparative Functional Osteological Morphology of the Forelimb in Mustelidae

*Aubree Dahler, Luci Kohn [Southern Illinois University Edwardsville]

The Mustelidae family resides in a wide range of habitats and encompasses a range of locomotor categories: half-bound, semi-aquatic, semi-fossorial, and generalized. There has been limited research on the morphology of the mustelid appendages that focus on functional differences for which the structure has to sustain different loading mechanisms. Previous studies showed adaptation of a more robust and short humerus, prominent medial epicondyle, and an elongated olecranon process in fossorial species for a greater out-force when digging. Specimens with a specific locomotor category are more distinguishable than generalists. This study tests differences in upper limb skeletal dimensions in 6 species of Mustelidae, representing 4 different locomotor categories to test skeletal differences associated with locomotion. The sample for this study includes *Mustela frenata* (long-tailed weasel), *M. nivalis* (least weasel), *M. erminea* (short-tailed weasel), *Neovison vison* (mink), *Taxidea taxus* (American badger), and *Lontra canadensis* (river otter). Standardized photographs were taken for each individual, and 14 humerus and 12 ulna 2D landmarks were digitized using ImageJ. Data was adjusted for differences in size and 6 functional indices were calculated. Both principal components analysis and analysis of variance were used to test for species and locomotor differences. Results show significant differences in humerus and ulna proximal, distal, length, and width dimensions, with the river otter and American badger showing the most significant differences to the other species. The least weasel is most similar to both the short and long-tailed weasels. This separation could be the result of the otter and badgers having different locomotor category from the others, while the similarity among the weasels is attributed to their half-bound locomotion.

9:15am
Hickory

Spatial Ecology of Northern Copperheads (*Agkistrodon contortrix*) in St. Clair and Monroe Counties, Illinois

*¹Benjamin Jellen, ²Robert G. Weck, ³Matthew Hill, [¹McKendree University; ²Southwestern Illinois College; ³US Army Corps of Engineers, St. Louis MO]

The objectives of this project were to analyze movement and hibernation site selection for two populations of Northern Copperheads (*Agkistrodon contortrix*) in St. Clair and Monroe Counties, Illinois. Radio-equipped adult *A. contortrix* were re-located twice weekly from July - November and radio-equipped neonates were re-located twice weekly for approximately three weeks following parturition in order to gain insight on periods of greatest activity in relation to age, reproductive condition, and time of year. No difference was observed in either home range size or mean daily distance moved between post-partum and non post-partum females; however, adults moved longer daily distances and occupied a larger home range than neonates. Snakes were least active in November. All radio-equipped individuals elected to overwinter individually in rodent burrows in a relatively

closed canopy.

- 9:30am Grad** **The Effect of Hunter-Derived Offal Piles on Local Scavengers**
Hickory *Christopher Huff, Richard L. Essner, Jr. [Southern Illinois University Edwardsville]
 Each fall hunters kill hundreds of thousands of White-tailed Deer (*Odocoileus virginianus*) in Missouri and Illinois. Field dressing these deer provides a large influx of nutrient rich offal into the ecosystem. To date, little research has examined the effects of this resource on wildlife. We used trail cameras positioned over offal piles to examine species richness and diversity in a range of habitats during the 2011-2013 hunting seasons in Missouri and Illinois. There were a total of 17 different sampling sites, resulting in over 4,000 photographs. Images were analyzed and organized into timed feeding events. Sites were categorized into one of three habitat types: field, edge, or forest. We documented 10 different scavenger species feeding on the offal. There was no significant difference in scavenger diversity ($F=2.95$; $d.f.=2,14$; $p=0.085$), richness ($F=2.25$; $d.f.=2,14$; $p=0.14$), nor preferred habitat preference ($F=0.51$; $d.f.=2,14$; $p=0.61$) among habitat types. We also found no significant difference in the community structure of scavengers among the three habitat types ($R=-0.049$; $p=0.64$). However, there was a difference in the preferred mean feeding times of avian vs. mammalian scavengers ($U=1,215.5$; $Z=11.24$; $p=0$). The presence of offal piles does not appear to repel deer, as they were frequently observed in close proximity. The similarity of the scavenger guild among habitat types can be attributed to the mosaic of fragmented habitat that characterizes the Midwest, as well as the generalized behavior of the species encountered in the study.
- 9:45am** **AMPK Activity Increases in Response to Acute Cold Stress in the Zebra Mussel**
Hickory *Jennifer Jost [Bradley University]
 Ectothermic species are affected by environmental fluctuations, and studies are needed on thermal tolerances since changes in ambient temperature affect metabolic demands. Zebra mussels are highly invasive, yet little is known about their physiology under biologically relevant conditions, especially with regard to cellular parameters. This study utilized AMP-activated protein kinase (AMPK), a key regulator of cellular energy levels, to examine the effects of cold water temperatures on zebra mussel (*Dreissena polymorpha*) physiology. AMPK activity reflects changes in energy supply and demand, which are typically associated with high temperature stress. However, a previous study showed that cold acclimation resulted in a temporary elevation in AMPK activity in zebra mussels. In order to investigate this response further, zebra mussels were collected, exposed to a rapid and progressive temperature decrease to 10°C, and held at 10°C for 24 hours. AMPK activity did not increase above baseline levels during the progressive temperature decrease. However, by 24hrs, there was a significant elevation in AMPK activity. One possible explanation is that the processes associated with acclimation to cooler waters may be energetically taxing. In other species, the process of thermal acclimation involves changes in biochemical reaction rates and gene expression. Therefore, it is reasonable to assume that this process would temporarily increase metabolic demands. Zebra mussels are capable of thermal acclimation, and as ambient water temperature varies, the sublethal and lethal temperature ranges also vary. In addition, a two-week lab acclimation to winter conditions is sufficient to alter the thermal tolerances of summer collected mussels, suggesting that thermal acclimation can occur quickly and that water temperature is the main driver of this process.
- 10:30am UG** **Effect of Habitat Fragmentation on Mantled Howler Monkey (*Allouatta palliata*) Behavior and Diet, in the Occidental Central Plateau of Costa Rica**
Hickory *Maximillian A. Dorsey [Knox College]
 Forest fragmentation is an increasingly common occurrence that affects the animals that live within the fragment. I categorized and observed the frequency of nine different behaviors and the diet in a troop of howler monkeys living in live fences on a 4.2 ha farm in San Ramón, Costa Rica. Through comparison with previous studies both in small forest fragments and large continuous forests, small forest fragments appear to promote less social interaction within the troop and greater levels of inter-tree movement in lieu of intra-tree movement. I also found that howler monkeys in the smaller fragments tend to have a greater dietary diversity than troops in continuous forests
- 10:45am Grad** **Comparative Morphology of the Mandible within Canidae**
Hickory *Sally Ayoob, Luci Kohn [Southern Illinois University Edwardsville]
 Mandible form is the product of developmental, functional and evolutionary forces. The mandible works as a lever that transmits the forces generated by masseter, temporal, and pterygoid muscles, to the dentition which

serve to capture, cut and shear food. The association between mandible, feeding ecology, and behavior is explained through morphology and the relationship between mandible form and function. In this study, we are testing the relationship between bite force strength and feeding ecology. Standardized lateral photographs of 55 red fox (*Vulpes vulpes*), 47 gray fox (*Urocyon cinereoargenteus*), 66 coyote (*Canis latrans*), and 47 gray wolf (*Canis lupus*) were taken and photographs were digitized using ImageJ. A total of 17 landmarks were selected to differentiate between functional and developmental regions and data were adjusted for differences in size. To estimate bite force, mechanical advantage was measured using mandibular dimensions of temporalis and masseter muscles relative to the condyle and both canine and carnassial teeth. Analysis of variance (ANOVA) was conducted to examine significance in these mandibular dimensions. Results showed a significance difference in the mechanical advantage across taxa. These results suggest an overall shape difference in the mandible due to variation in both alveolar and ramus regions. Differences in these regions are often attributed to muscle interactions and feeding ecology.

11:00am Grad Comparative Mandibular Morphology in Cervidae

Hickory

*Sarah Giacomini, Luci Kohn [Southern Illinois University Edwardsville]

The mandible is a complex morphological structure that is made up of a variety of different parts and processes that play a key role in an animal's development. By studying morphology of the mammalian mandible, further ontogenetic and phylogenetic variation can be observed. Previous research alludes to the functional relationship between feeding type and jaw morphology in a number of different omnivorous and carnivorous species. Current research thus far is broad and focuses on a wide number of species from multiple different families. In order to further and more easily understand the relationship for all feeding-type categories, more research needs to be done on herbivorous species. This study examines the relationship between mandibular morphology and diet within the family Cervidae. This is a comparative study of mandibular morphology between 4 species within the family Cervidae which include *Odocoileus virginianus* (White tail deer), *O. hemionus* (Mule Deer), *Rangifer tarandus* (Caribou) and *Cervus elaphus* (Elk). The sample included 11 *R. tarandus*, 45 *O. virginianus*, 17 *O. hemionus* and 14 *C. elaphus*. Two-dimensional coordinates of 21 landmarks were recorded from the medial and lateral side of each mandible. These coordinates were used to calculate 31 linear distances defining the body and ramus. Data were adjusted for size differences using the geometric mean. Analysis of variance was used to test dimensional differences in each region across taxa. Results show significant shape differences in mandible form and bite force across taxa. These significant differences could be due to the various diets maintained by these species, and how these diets affect the size of muscles located in the different regions of the mandible.

11:15am

Hickory

Antibodies against Avian Pox and *Mycoplasma gallisepticum* in Birds of Prey in Central Illinois

*¹Travis Wilcoxon, ²Elizabeth R. Wrobel, ³Jacques Nuzzo, ³Jane Seitz [¹Millikin University; ²University of Georgia; ³Illinois Raptor Center, Decatur IL]

We assessed prevalence of antibodies against the bacterium, *Mycoplasma gallisepticum*, and virus, *Avipoxvirus*, in seven species of birds of prey admitted to the Illinois Raptor Center from 1 January 2014 to 1 September 2015. We used visual identification of pathology to diagnose current infections and enzyme-linked immunosorbent assays (ELISA) for avian IgY antibodies against each pathogen to determine infection history of the birds. Species that commonly prey upon birds had a greater prevalence of antibodies against each pathogen. Our finding of infrequent physical signs of disease, but frequent antibody presence suggests that while exposure to each of these pathogens is not a rare occurrence, and these birds of prey are capable of mounting an effective adaptive immune response and preventing development of pathology in most cases. Overall, this study reveals important pathogen prevalence and disease dynamics in birds of prey.

ACKNOWLEDGEMENTS

We are pleased and proud to have been able to support the mission of the Illinois State Academy of Science by organizing this 108th annual meeting on the SIUe campus. To all of those who contributed to the scientific presentations, we thank you for your efforts and wish you continued success in your pursuits. To visitors who came from across the state and region, we are grateful for the time and effort you expended to join us and hope that your visit was enriching and worthwhile, and that you will come back to visit SIUe in the future.

We thank SIUe Interim Chancellor Dr. Steve Hansen, Graduate School Dean Dr. Jerry Weinberg and Associate Dean Dr. Susan Morgan, and College of Arts and Sciences Dean Dr. Greg Budzban for supporting the effort from its inception. Deans Weinberg and Morgan and the Graduate School, through a Graduate School Conferences & Workshop Award, provided extraordinary financial support for many of the activities of the meeting, including provision of tickets to Capt. Lovell's presentation for student members of ISAS.

Our thanks to the SIUe Department of Biological Sciences (Dr. Dave Duvernell, chair), and the following student organizations, the Biology Club, the Chemistry Club, and the Pre-Medical Association, for sponsoring the ISAS annual meeting on our campus, and the members of these groups for their contributions of time and effort toward the success of the meeting. The cooperation of colleagues in the Department of Chemistry (Dr. Leah O'Brien, chair) and Environmental Sciences Program (Dr. ZQ Lin, director) to permit the Science West building to house the Friday poster session is gratefully recognized.

Arrangements for campus services were made by Cindy Cobetto (Office of Educational Outreach/Conferences) and Grant Andree (College of Arts and Sciences, Arts& Issues); Grant Andree arranged for Capt. Lovell's presentation. We are immensely appreciative of their behind the scenes preparation and coordination of the annual meeting events over many months.

We are grateful for the financial support and cooperation of the William C. Shaw Lecture series (Dr. Jeffrey Sabby, committee chair) and the Department of Physics (Dr. Abdullatif Hamad, chair), the SIUe Arts & Issues series, the SIUe Graduate School, and the Madison County Regional Office of Education to have Captain James Lovell join us to present "Apollo 13: A Successful Failure."

We thank ISAS President Dr. Gary Bulla and the ISAS Executive officers and Council members for their efforts to promote this meeting, and the Division chairs for additionally reviewing abstracts and officiating their respective scientific programs during the annual meeting. The *Proceedings of the National Academy of Sciences* (PNAS) was a Promotional Partner of this year's ISAS annual meeting.

We extend our very deepest appreciation to Tere North, ISAS Webmaster and Robyn Myers, ISAS Executive Secretary, for their invaluable efforts to keep the ISAS organized all year long, but especially for the great amount of their time, effort, and wisdom of experience provided toward this year's meeting. It is impossible for us to list their many contributions or thank both of them enough for their tremendous contributions. Thank you both!

With warmest regards,

Dr. Tom Fowler and Dr. Bill Retzlaff

Vice-Presidents for the 2016 Annual Meeting



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