

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

**Supplement to Volume 110**



**109<sup>th</sup> Annual Meeting  
March 31 – April 1, 2017**

**Harper College  
Palatine, Illinois**

**Illinois State Academy of Science**

**Founded 1907**

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

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# 109<sup>th</sup> ISAS Annual Meeting

March 31 – April 1, 2017

Harper College

Host: Roger Rouse

## MEETING SCHEDULE

### Friday, March 31st

- 12noon – 2:00pm ISAS Council Meeting (Building X, Room 250, lunch provided)
- 1:00pm – 5:30pm Registration (Avanté Main Entrance)
- 1:00pm – 3:00pm Poster setup (Building Z, 1st, 2nd, & 3rd floors)
- 3:00pm – 4:15pm Poster Session A (Building Z, 1st, 2nd, & 3rd floors)
- 4:15pm – 5:30pm Poster Session B (Building Z, 1st, 2nd, & 3rd floors)
- 6:00pm – 7:30pm Dinner Banquet (Wojcik Conference Center Dining Room)
- 7:30pm – 9:00pm Keynote Address – Benjamin Kant (Wojcik Conference Center, Rm W120)

### Saturday, April 1st

- 8:00am – 9:00am Continental Breakfast (Building D, East End)
- 8:00am – 11:45am Registration (Building D, East End)
- 9:00am – 10:00am Oral Presentations Begin (Building D)
- 10:00am – 10:30am Coffee Break
- 10:30am – 11:45am Oral Presentations Continue (Building D)
- 12noon – 12:30pm Divisions Meetings and Judging Results (Building D)
- 12:30pm – 2:00pm Luncheon & Awards Presentations (Building D, East End)
- 3:00pm – 4:00pm Metropolitan Farms Tour (Off site - Must be booked in advance)

## CAMPUS MAP – BUILDING & PARKING INFORMATION



**Avanté - Main Entrance**  
Friday Registration

**Building X**  
ISAS Council Meeting

**Building Z**  
Poster Presentations

**Building D**  
Continental Breakfast  
Saturday Registration & Oral Presentations  
Awards Luncheon & Annual Meeting

**Wojcik Conference Center**  
Dinner Banquet & Keynote Address



Welcome to our Smoke-Free Campus

**Parking**  
Attendees are encouraged to park in lot 3 and enter through Avanté - Main Entrance.

## POSTER PRESENTATION SCHEDULE – FRIDAY, MARCH 31, 2017

### All Poster Presentations in Building Z, 1ST, 2ND, & 3RD FLOORS

Session A 3:00-4:15pm – Odd Numbers				Session B 4:15-5:30pm – Even Numbers			
#	Division	#	Division	#	Division	#	Division
1	Agriculture	51	Chemistry	2	Agriculture	50	Chemistry
3	Botany	53	Chemistry	4	Botany	52	Chemistry
5	Botany	55	Computer Science	6	Botany	54	Chemistry
7	Botany	57	Earth Science	8	Botany	56	Computer Science
9	Botany	59	Environmental Science	10	Cell Biology	58	Environmental Science
11	Cell Biology	61	Environmental Science	12	Cell Biology	60	Environmental Science
13	Cell Biology	63	Microbiology	14	Cell Biology	62	Environmental Science
15	Cell Biology	65	Microbiology	16	Cell Biology	64	Microbiology
17	Cell Biology	67	Microbiology	18	Cell Biology	66	Microbiology
19	Cell Biology	69	Microbiology	20	Cell Biology	68	Microbiology
21	Cell Biology	71	Microbiology	22	Cell Biology	70	Microbiology
23	Cell Biology	73	Physics & Astronomy	24	Cell Biology	72	Microbiology
25	Cell Biology	75	Zoology	26	Cell Biology	74	Physics & Astronomy
27	Cell Biology	77	Zoology	28	Cell Biology	76	Zoology
29	Cell Biology	79	Zoology	30	Cell Biology	78	Zoology
31	Cell Biology	81	Zoology	32	Cell Biology	80	Zoology
33	Cell Biology	83	Zoology	34	Cell Biology	82	Zoology
35	Cell Biology	85	Zoology	36	Cell Biology	84	Zoology
37	Chemistry	87	Zoology	38	Chemistry	86	Zoology
39	Chemistry	89	Zoology	40	Chemistry	88	Zoology
41	Chemistry	91	Zoology	42	Chemistry	90	Zoology
43	Chemistry	93	Zoology	44	Chemistry	92	Zoology
45	Chemistry	95	Zoology	46	Chemistry	94	Zoology
47	Chemistry	97	Zoology	48	Chemistry	96	Zoology
49	Chemistry						

## ORAL PRESENTATION ROOM SCHEDULE – SATURDAY, APRIL 1, 2017

### All Oral Presentations in Building D, Rooms 172, 174, 178, 272, & 274

	Room 172	Room 174	Room 178	Room 272	Room 274
<b>9:00am</b>		Cellular Biology			Zoology
<b>9:15am</b>		Cellular Biology		Environmental Sci	Zoology
<b>9:30am</b>	Botany	Cellular Biology	Physics & Astronomy	Environmental Sci	Zoology
<b>9:45am</b>	Botany	Cellular Biology	Computer Science	Environmental Sci	Zoology
<b>10:00am</b>	<b>Coffee Break</b>				
<b>10:15am</b>					
<b>10:30am</b>	Botany	Health Sciences	STEM Education	Environmental Sci	Zoology
<b>10:45am</b>	Botany	Health Sciences	STEM Education	Environmental Sci	Zoology
<b>11:00am</b>	Botany	Health Sciences	STEM Education	Environmental Sci	Zoology
<b>11:15am</b>	Botany	Microbiology		Environmental Sci	Zoology
<b>11:30am</b>		Microbiology			Zoology

#### Division Abbreviations

Cellular Biology	Cellular, Molecular, & Developmental Biology
Physics & Astronomy	Physics, Astronomy, & Mathematics

#### Participant Abbreviations

Grad	Graduate Student
UG	Undergraduate Student
None	Regular/Faculty Member

#### School and Organization Abbreviations

Bradley	Bradley University
EIU	Eastern Illinois University
Governors	Governors State University
Greenville	Greenville College
Harper	Harper College
IC	Illinois College
Knox	Knox College
Millikin	Millikin University

Rockford	Rockford University
Roosevelt	Roosevelt University
SIUe	Southern Illinois University Edwardsville
St. Xavier	St. Xavier University
UIC	University of Illinois Chicago
UIS	University of Illinois Springfield
WIU	Western Illinois University

## POSTER PRESENTATIONS – FRIDAY, MARCH 31, 2017 – BUILDING Z

Time	#	Presenter	Title of Presentation (Posters)
<b>Agriculture</b>			
3:00PM	1	Keely Egelhoff (UG, WIU)	Can Innovative Marketing Strategies Impact Projected Market Share Sales of Impending 2000R John Deere Series Compact Tractors in 2017?
4:15PM	2	Nichole Miller (UG, WIU)	Effects of Seed Embryo Orientation on Moisture Uptake and <i>Zea mays</i> Germination and Emergence
<b>Botany</b>			
3:00PM	3	Miles Gossett (UG, SIUe)	Forty Years of Change in the Woody Vegetation of Bohm Woods, Southwestern Illinois
4:15PM	4	Christopher Featherstone (UG, SIUe)	Analysis of Topographic Variation in the Species Composition of a Restored Prairie in Southwestern Illinois
3:00PM	5	Eric Ntiamoah (Grad, SIUe)	Restoration of Grasslands Invaded by <i>Sericea Lespedeza</i> ( <i>Lespedeza cuneata</i> ): Seed Bank Biology
4:15PM	6	Jordyn Grawe (UG, SIUe)	The Quantification of the Intracellular Storage Lipids of <i>Chlorella vulgaris</i> Stained with Oil Red O for Biofuel Production
3:00PM	7	Yao Luxia (UG, University of Illinois)	Assessing Patterns of Arthropod Abundance in Illinois Grasslands
4:15PM	8	Neal Jankowski (Grad, Governors)	<i>Monarda fistulosa</i> Nectar: A Limiting Resource in Northeastern Illinois and Northwestern Indiana Tallgrass Prairie Restorations
3:00PM	9	Annalise Ankney (UG, SIUe)	Changes in the Density of Exotic and Native Woody Understory Species in the SIUE Nature Preserve 2008-2016
<b>Cellular, Molecular, &amp; Developmental Biology</b>			
4:15PM	10	Maryneth Biyok (UG, EIU)	Using Real Time PCR for the Definitive Identification of <i>Culex</i> Species
3:00PM	11	Ryan Alderman (UG, EIU)	<i>Aedes</i> Mosquitoes in Coles County
4:15PM	12	Lindsay Spitz (UG, EIU)	<i>Anopheles</i> Mosquitoes in Coles County
3:00PM	13	Megan Cooper (UG, EIU)	Occurrence of <i>Culex</i> Mosquito Species in Coles County Illinois
4:15PM	14	Devin Wall (Grad, SIUe)	The Effects of L-Dopa on Brux-Like Motor Patterns and Mastication: EMG Phase Analysis in Rats
3:00PM	15	Jack Blank (UG, Bradley)	Optimization of Polycaprolactone and Collagen-Based Nanofiber Scaffolds for the Proliferation of Autologous Stem Cells
4:15PM	16	Rea Taci (UG, WIU)	The Expression of Fatty Acid Desaturase Genes in <i>toc132toc120</i> Heterozygote Mutant of <i>Arabidopsis thaliana</i> that has been Exposed to Ozone
3:00PM	17	Meshack Afithile (WIU)	The FAD5 Gene is Downregulated in <i>toc132toc120</i> Heterozygote Mutant of <i>Arabidopsis thaliana</i>
4:15PM	18	Meshack Afithile (WIU)	The TOC159 mutant of <i>Arabidopsis thaliana</i> Accumulates Reduced Levels of Monogalactosyldiacylglycerol and Polyunsaturated Fatty Acids
3:00PM	19	Emily Banigan (UG, WIU)	Fatty Acid Composition in <i>toc132toc120</i> Heterozygote Mutant of <i>Arabidopsis thaliana</i> that has been Exposed to Ozone
4:15PM	20	Deanna Musaitif (Grad, Bradley)	Investigating the Cellular and Molecular Response of the Zebra Mussel, <i>Dreissena polymorpha</i> , to Chronic Cold Exposure and its Implications on Thermal Tolerance
3:00PM	21	Lata Udari (Grad, EIU)	Mutational Analysis of Estrogen Receptor Beta (ER- $\beta$ ) Gene in Individual with Premature Ovarian Failure

Time	#	Presenter	Title of Presentation (Posters)
4:15PM	22	Jacob Krisher (Grad, SIUe)	Cell-Matrix Interaction: Activation of MAP Kinase Signaling Pathway in Salivary Gland Cells
3:00PM	23	Shankar Gurung (Grad, EIU)	Expression of the Brine Shrimp Protein <i>Afr</i> LEA6 in <i>E. coli</i> and Purification Using Intein Mediated On-Column Cleavage
4:15PM	24	Belainesh Nigeda (UG, SIUe)	Identification of a Putative Autonomous Element for the <i>car</i> Transposon of <i>Schizophyllum commune</i>
3:00PM	25	Emily Wade (UG, SIUe)	Evaluation of the Role of Light in Fruiting Body Formation in the Fungus <i>Schizophyllum umbrinum</i> as compared to its sister species, <i>Schizophyllum commune</i>
4:15PM	26	Emily Banigan (UG, WIU)	The Expression of Genes in the Jasmonic Acid Pathway in <i>toc132toc120</i> Heterozygote Mutant of <i>Arabidopsis thaliana</i>
3:00PM	27	Ivan Ayala (Grad, SIUe)	The NuA4 Histone Acetyltransferase Complex Affects Epigenetic Regulation of Regeneration in <i>Schmidtea mediterranea</i>
4:15PM	28	Oluwabukola Ajasa (Grad, WIU)	Gene Expression of Corn Earworm in Response to Infection by <i>Serratia marcescens</i> and <i>Pseudomonas aeruginosa</i>
3:00PM	29	Joshua Ginzel (UG, Bradley)	The Influence of 3D Spheroid Formation on Neural Differentiation Potential of Mesenchymal Stem Cells
4:15PM	30	Mashaël Alaradi (Grad, EIU)	Evaluate the Transcriptome Response of White-Rot Fungi to Lignocellulosic Biomass
3:00PM	31	Aishah Asiri (Grad, EIU)	Effects of Asiatic Acid on Neurite Outgrowth in Neuro-2a Cells
4:15PM	32	Sophia Wirth (Grad, SIUe)	Sexual Development Affects Volatile Production of <i>Schizophyllum commune</i>
3:00PM	33	Jessica Haines (UG, SIUe)	Evaluation of the Function of Genes Associated with Long-Term Memory in <i>Schmidtea mediterranea</i> Using RNAi Knockdown Techniques
4:15PM	34	Lucero Villarreal (Grad, SIUe)	Characterization of Planarian homologs of Human Xeroderma Pigmentosum Genes and their Function in Repairing UV Damage
3:00PM	35	Sean Mechem (UG, SIUe)	Evaluation of Neurotransmitters Related to Long-Term Memory in <i>Schmidtea mediterranea</i> Using RNAi Knockdown Techniques and a Familiarization Training Program
4:15PM	36	Daniel Karcher (Grad, SIUe)	Deletion of Two <i>dicer</i> -like Genes and Characterization of Null Mutants in <i>S. commune</i>
<b>Chemistry</b>			
3:00PM	37	Paisley Harper (UG, SIUe)	Relationship between Antibiotics Found in Wastewater and Receiving Streams
4:15PM	38	Julia Hill (UG, WIU)	Determination of Nitrate in Soil Due to CAFO Use in Rural Illinois
3:00PM	39	Alexander Pixler, UG (Rockford)	An <i>Ab Initio</i> Study of Physisorption of Carbon Dioxide on Metal-Organic Frameworks
4:15PM	40	Erik Sarnello (Grad, WIU)	Synthesis and Characterization of Solid-State Materials
3:00PM	41	Ahmad Mahmood (Grad, WIU)	Selective Reduction of 2-Iododimethyl Terphthalate to Synthesize Differently Substituted O-Iodoxybenzoic Acid (IBX)
4:15PM	42	Rachel Crews (Grad, WIU)	Analysis of Total Antioxidant Activity in Brewed Teas
3:00PM	43	Esan Taiwo (Grad, WIU)	Towards the Synthesis of a Hyperavalent Iodine Reagent on a [2.2]-Cyclophane Framework
4:15PM	44	Osamah Al-Mohammed Baqer (Grad, WIU)	C-H Bond Chalcogenation and Oxidation of Indole



Time	#	Presenter	Title of Presentation (Posters)
3:00PM	45	Taylor Windbiel (UG, WIU)	Caffeine Analysis of Cold Brew Tea
4:15PM	46	Michael Lohman (UG, SIUe)	Mapping Antibiotics in Southwest Illinois from Wastewater Treatment Plants
3:00PM	47	Killian Tracey (UG, WIU)	Development of a High Temperature Solid State Synthesis Educational Lab
4:15PM	48	Nicole Walker (UG, WIU)	Synthesis of Group 6 Carbonyls for CO <sub>2</sub> Remediation
3:00PM	49	Mattea Scanlan (UG, WIU)	Development of Solid State Undergraduate Laboratory
4:15PM	50	Quinn Kruel (UG, WIU)	Comparison of Hot Brew and Cold Brew Tea
3:00PM	51	Sarah Donnelly (UG, WIU)	Solid State Synthesis of Copper Sulfide Using a NaCl-KCl Flux
4:15PM	52	Bethany Esterlen (UG, WIU)	A GC-FID Method for the Forensic Discrimination of Lipstick Residues
3:00PM	53	Ravi Kiran Lella (Grad, WIU)	Discovery of Internal Standard for the Determination of Limonene in Sweet Orange ( <i>Citrus sinensis</i> ) Oil by Gas Chromatography
4:15PM	54	Wei Chean Chuah (Grad, WIU)	Ionization of Polar Compounds by Nitrogen Direct Analysis in Real Time
<b>Computer Science</b>			
3:00PM	55	Nasim Mobasheri (Grad, UIC)	On Optimal Approximability Results for Computing the Strong Metric Dimension
4:15PM	56	Farzane Yahyanejad (Grad, UIC)	Effect of Gromov-Hyperbolicity Parameter on Cuts and Expansions in Graphs and Some Algorithmic Implications
<b>Earth Science</b>			
3:00PM	57	Steven Oldham (UG, EIU)	Modeling Sediment Transport in a Stream Channel in Response to Increased Impervious Land Surfaces
<b>Environmental Science</b>			
4:15PM	58	Alexandra Johnson (UG, SIUe)	Functional Validation of P450 Genes in the Human Body Louse Using the <i>Drosophila melanogaster</i> GAL4/UAS-RNAi System
3:00PM	59	Heba Megahy (UG, SIUe)	Functional Validation of ATP-Binding Cassette Transporter (ABCT) Genes in the Human Body Louse Using the <i>Drosophila melanogaster</i> (Dm) GAL4/UAS-RNAi System
4:15PM	60	Edmund Bruning (UG, SIUe)	Effect of High Sugar and DDT Induced Stress in Longevity of Wild Type <i>Drosophila melanogaster</i>
3:00PM	61	Frantz Joseph (Grad, SIUe)	Cellular Adsorption and Speciation of Selenium by <i>Pseudomonas fuscovaginae</i> from Nanoscale Elemental Selenium Particles
4:15PM	62	Shelby Chesko (UG, Millikin)	Quantification of Lead in Central Illinois Birds of Prey and their Avian Prey Base
<b>Microbiology</b>			
3:00PM	63	Gian Villagomez (UG, IC)	Association between Endobacteria in Orchid Mycorrhizal Fungi and Promotion of Orchid Seed Germination
4:15PM	64	Abiola Oladapo (Grad, WIU)	Yellow Fever Virus Infectivity of the Innate Immune System Using Axl Receptor
3:00PM	65	Brooke Greiner (UG, EIU)	Metabolic Characterization of <i>Saccharomyces cerevisiae</i> strain ATCC 96581
4:15PM	66	Mohammed Almalki (Grad, EIU)	Detection of Antibiotic Resistance Loci in Wastewater Samples

Time	#	Presenter	Title of Presentation (Posters)
3:00PM	67	Justin Chang (UG, EIU)	Determining Nutritional Needs of an Acidophilic Archaeal Organism
4:15PM	68	Samson Olaitan Omole (Grad, WIU)	Role of Axl Protein in the Infection of Innate Immune Cells by Dengue Virus
3:00PM	69	Lance Price (UG, SIUe)	Housekeeper or Homewrecker? Characterizing Bacteriophages and Investigating their Effects on Amoeba-Burkholderia Symbiosis
4:15PM	70	Niloufar Khojandi (Grad, SIUe)	The More the Merrier? Secondary Bacterial Infections in the <i>Dictyostelium-Burkholderia</i> Symbiosis System
3:00PM	71	Jacob Miller (Grad, SIUe)	You Can Count on <i>Dictyostelium</i> : Using Flow Cytometry to Measure Parameters of <i>Burkholderia</i> Infection
4:15PM	72	Morgan Shanahan (UG, SIUe)	Fluorescent Staining of Nuclei in the Basidiospores and Hyphae of <i>Schizophyllum umbrinum</i>
<b>Physics, Astronomy, &amp; Mathematics</b>			
3:00PM	73	Richard Lambert (UG, WIU)	Assessing the Detectability of Planet Nine with ALMA and the VLA
4:15PM	74	Wei Siang Tan (Grad, WIU)	H <sub>2</sub> CS Absorption in the High Mass Star Forming Region G34.26+0.15
<b>Zoology</b>			
3:00PM	75	Melissa Uhl (UG, Bradley)	Patterns of Gene Expression of <i>wingless</i> and <i>defective proventriculus</i> in Three Genera of Stalk-Eyed flies (Diopsidae) Exhibiting Varying Levels of Sexual Dimorphism
4:15PM	76	Nadia Lovko (Grad, Bradley)	The Effects of Elevated Serotonin on Antipredation Behavior in Sexually Dimorphic Stalk-Eyed Flies ( <i>Teleopsis dalmanni</i> )
3:00PM	77	Kevin Helenthal (Grad, SIUe)	The Effects of Artificial Breeding Pools on the Reproductive Success of Illinois Chorus Frogs ( <i>Pseudacris illinoensis</i> )
4:15PM	78	Alexis King (Grad, SIUe)	Movement Patterns of the Illinois Chorus Frog, <i>Pseudacris illinoensis</i> , in Southwestern Illinois
3:00PM	79	Samantha Sorrick (Grad, SIUe)	Home Range and Microhabitat Preference of the Eastern Box Turtle, <i>Terrapene carolina</i>
4:15PM	80	Corrinne O'brien (Grad, SIUe)	Population Demography of the Eastern Narrowmouth Toad <i>Gastrophryne carolinensis</i> in Southwestern Illinois
3:00PM	81	Daniela Hernandez (St. Xavier, UG)	Monk Parakeet Nests Provide a Moderate Microclimate that could Reduce Thermoregulatory Costs During the Summer
4:15PM	82	Rachel Sullivan (Grad, SIUe)	Handedness is Not Linked to Asynchronous Locomotion in a Basal Anuran
3:00PM	83	Jacob Kaiser (Grad, SIUe)	Estimating Mesopredator Density and Evaluating Trophic Relationships in Southwestern Illinois
4:15PM	84	Matthew Hunsaker (UG, SIUe)	Comparison of Avian Communities of Mature and Regrowth Oak-Hickory Forest in Southwestern Illinois
3:00PM	85	Katie Eckhoff & Madison Baer (UG, Bradley)	Short Term Effects of Heat and Hypoxia on Zebra Mussels
4:15PM	86	Daniel Miller (UG, SIUe)	Mandible Biomechanics in Canids and Felids
3:00PM	87	Robert Ladner (UG, SIUe)	The Effect of Elevated and Variable Winter Temperatures on Survival and Pace of Development in the Goldenrod Gall Fly, <i>Eurosta solidaginis</i>
4:15PM	88	Candace Karnish (Grad, SIUe)	Repeated Freezing Negatively Impacts Hemocyte Count in the Goldenrod Gall Fly, <i>Eurosta solidaginis</i>
3:00PM	89	Eriberta Vasquez (Grad, Roosevelt)	Comparative Analysis of Intestinal Parasites on Three Midwestern Bird Species

Time	#	Presenter	Title of Presentation (Posters)
4:15PM	90	Kassandra Karssen (Grad, SIUe)	Resource Utilization in a Headstarted Population of Ornate Box Turtle, <i>Terrapene ornata ornata</i> , in Northern Illinois
3:00PM	91	Rachel Thomas (UG, St. Xavier)	Examining Vigilance and Sentinel Behavior of Monk Parakeets and Possible Connections to Vigilance of Other Urban Adapted Birds in the Chicagoland Area
4:15PM	92	Dillan Laaker (Grad, SIUe)	Avian Use of Floodplain Forest Communities Along the Upper Mississippi River
3:00PM	93	Miles Herr (UG, SIUe)	Relationship Between Shell Characters and Crush Resistance in the Pleurocerid Snail <i>Elimia potosiensis</i>
4:15PM	94	Haley Kutosky (UG, SIUe)	Effects of Shell Ornamentation on Hydrodynamic Drag and Lift in the Freshwater Snail <i>Lithasia armigera</i>
3:00PM	95	Christine Olson (UG, SIUe)	Analysis of Shell Shape in Freshwater Snails of the Family Pleuroceridae
4:15PM	96	Amanda Markovich & Tessa England (UG, SIUe)	Pre-Zygotic Reproductive Isolation among Topminnows in an Artificial Stream System
3:00PM	97	Sierra Semel (Grad, WIU)	Reducing Stereotypic Pacing in Polar Bears ( <i>Ursus maritimus</i> ) and Brown Bears ( <i>U. arctos</i> ) by Erecting Visual Barriers Between Neighboring Individuals

## ORAL PRESENTATIONS – SATURDAY, APRIL 1, 2017 – BUILDING D

Time	Room	Presenter	Title of Presentation
<b>Botany</b>			
9:30AM	172	Peter Minchin (SIUe)	Non-Metric Multidimensional Scaling of Vegetation Data: Insights and Innovations
9:45AM	172	Noah Dell (Grad, SIUe)	Assessing the Robustness of Numerical Clustering Methods for Use in Vegetation Classification
10:30AM	172	Kurt Schulz (SIUe)	As Good as the Competition? Photosynthesis of Amur Honeysuckle ( <i>Lonicera maackii</i> ), Spicebush ( <i>Lindera benzoin</i> ), and Pawpaw ( <i>Asimina triloba</i> ) in Heavy Shade
10:45AM	172	Jon Clark (SIUe)	Self-Facilitation of the Riparian Invader Japanese Hops ( <i>Humulus japonicus</i> : Cannabaceae)
11:00AM	172	Adam Herdman (UG, IC)	An Update on Ghost Orchid ( <i>Dendrophylax lindenii</i> ) Populations in Florida and Cuba, with Special Reference to Seedling Recruitment
11:15AM	172	Hana Thixton (Grad, SIUe)	Identification of Site-Specific Mycorrhizal Fungi Associates of the Federally Threatened Eastern Prairie Fringed Orchid ( <i>Platanthera leucophaea</i> ) in Illinois
<b>Cellular, Molecular, &amp; Developmental Biology</b>			
9:00AM	174	Jonathan Tiessen (UG, Bradley)	Enhanced Proliferation of Human Adipose-Derived Mesenchymal Stem Cells on Polycaprolactone Nanofiber Cell Scaffolds Electrospun with Type 1 Collagen Fibers
9:15AM	174	Katherine Kessler (UG, Bradley)	Pre-Exposure of Human Wharton's Jelly Mesenchymal Stem Cell to Factors Increases Chemotaxis Towards Ovarian Cancer
9:30AM	174	Kaysaw Tuy (Grad, Bradley)	Assessing the Lethality of Genetically Engineered Wharton's Jelly Umbilical Cord Mesenchymal Stem Cells as a Cell-Based Therapy for Ovarian Cancer
9:45AM	174	Ammar Al-furaiji (Grad, WIU)	Differential Gene Expression of <i>Helicoverpa zea</i> (Tomato Fruitworm) in Response to Feeding on Different Types of Tomato ( <i>Solanum lycopersicum</i> ) Plant Tissues
<b>Computer Science</b>			
9:45AM	178	Tanima Chatterjee (Grad, UIC)	On the Computational Complexities of Three Privacy Measures for Large Networks Under Active Attack
<b>Environmental Science</b>			
9:15AM	272	Ranjitha Uppala (Grad, SIUe)	Bioaccumulation and Chemical Transformation of Selenium in Edible Fungal Mycelia
9:30AM	272	Chris Theodorakis (SIUe)	Nanomaterials Environmental Impact
9:45AM	272	Yousuf Ali (Grad, SIUe)	Female Fruit Flies Treated with Sub-Lethal Amounts of Ivermectin Produced Increased Levels of Reactive Oxygen Species and Malondialdehyde in their Ovaries
10:30AM	272	Lalita Mazgaen (Grad, SIUe)	Utilization of Nanoparticles to Enhance Knockdown Efficiency of Target Gene Transcripts in the Highly DDT-Resistant <i>9I-R</i> strain of <i>Drosophila melanogaster</i>
10:45AM	272	Caleb Mau (UG, SIUe)	Thermal Performance of Green Roofs Under Different Maintenance Methods
11:00AM	272	Kayla Tatum (UG, SIUe)	Weeding Maintenance of Green Roof Systems
11:15AM	272	Jamie Lange (Grad, UIS)	Spatial Association between Brown-headed Cowbirds ( <i>Molothrus ater</i> ) and Bison ( <i>Bison bison</i> ) over Time at Nachusa Grasslands, Illinois
<b>Health Sciences</b>			
10:30AM	174	Callie Mincy (UG, SIUe)	Salivary Gland Cancer Cells Uniquely Re-Express Cell Adhesion Molecules
10:45AM	174	Juliana Phillips (UG, Greenville)	Effect of Kava (Kavalactones) on Presynaptic and Postsynaptic Cholinergic Neurotransmission in <i>C. elegans</i>

Time	Room	Presenter	Title of Presentation
11:00AM	174	Emily Rosen (UG, Knox)	The Effects of a Traffic-Light Label Intervention on College Students' Dietary Choices in All-You-Can-Eat Cafeteria
<b>Microbiology</b>			
11:15AM	174	Adeyemi Olanrewaju (Grad, WIU)	Detection of Thermophilic Fungi in Corn-Based Food Products and Determination of their Optimal Growth Temperature
11:30AM	174	Kevin Danikowski (Grad, Harper)	Phosphatase Activity in <i>Staphylococcus aureus</i> Biofilm versus Suspension
<b>Physics, Astronomy, &amp; Mathematics</b>			
9:30AM	178	Angelica Strack (UG, WIU)	Variability of a Hydroxyl Maser in a Pre-Planetary Nebula
<b>STEM Education</b>			
10:30AM	178	Megan Corbett (Grad, WIU)	Mobile, Touch Screen Technology as an Aid in Mathematics Education
10:45AM	178	Robert Seiser (Roosevelt)	The RU-NECSS Graduate Biology Cohort: A Partnership to Enhance Teacher Training and Build Multi-Level STEM Education Pathways
11:00AM	178	Kenneth Knoth (Grad, SIUe)	Biological Course-Based Undergraduate Research Experiences: An Examination of an Introductory Level Implementation
<b>Zoology</b>			
9:00AM	274	Richard Essner (SIUe)	Pelvic Function in Anuran Jumping: Interspecific Differences in the Kinematics and Motor Control of the Iliosacral Articulation During Take-Off and Landing
9:15AM	274	Shelby Melzer (UG, UIS)	Diet of Wintering Short-eared Owls ( <i>Asio flammeus</i> ) in the Grand Prairie Region of Illinois
9:30AM	274	Molly Levy (Grad, UIS)	Movement Ecology of Franklin's Ground Squirrels ( <i>Poliocitellus franklinii</i> ) in a Fragmented Landscape
9:45AM	274	Timothy Mayer (Grad, UIS)	Agent-Based Modeling of Movement of Franklin's Ground Squirrels ( <i>Poliocitellus franklinii</i> ) in a Fragmented Landscape
10:30AM	274	Jeffery Cronin (Grad, UIS)	Mesopredator Habitat Use in a Fragmented Midwestern Landscape
10:45AM	274	Mackenzie Peck (UG, Millikin)	Effects of Water Acidification and Pathogen Exposure on Immune Defense in Invasive Cuban Tree Frog ( <i>Osteopilus septentrionalis</i> ) and Native American Bullfrog ( <i>Rana catesbeiana</i> ) Tadpoles
11:00AM	274	Elizabeth Errickson (Grad, UIS)	Winter Roost Selection of Short-eared Owls ( <i>Asio flammeus</i> ) in an Agriculture-Dominated Landscape
11:15AM	274	Aaron Alexander (Grad, SIUe)	Evaluating the Success of Prairie Restorations in Southwest Illinois in Providing Suitable Habitat for Prairie Birds
11:30AM	274	Rachael Weber (UG, Millikin)	Effects of Elevated Corticosterone on Innate and Adaptive Immunity in Northern Leopard Frog Tadpoles



## KEYNOTE ADDRESS – BENJAMIN KANT

FRIDAY, MARCH 31ST AT 7:30PM, WOJCIK CONFERENCE CENTER, RM W120



## Keynote Address **BENJAMIN KANT**

Founder/CEO

Friday, March 31 at 7:30pm  
Wojcik Conference Center  
Room W120

Benjamin Kant is Founder and CEO of Metropolitan Farms, a 10,000 square foot facility built on a former parking lot on the west side of Chicago. Its mission is to grow fresh food in the city where it is eaten to support a healthier, more secure, and environmentally-sustainable food system. Metropolitan Farms uses commercial-scale aquaponic technology in a controlled-environment greenhouse to grow fresh produce and fish the year round. The fish create the nutrients for the produce in a natural and sustainable cycle. Metropolitan Farms sells fresh produce and fish through multiple channels to local markets and seeks to advance design and operations of commercial aquaponics.

Metropolitan Farms demonstrates how biological technologies can bring the natural world closer to the urban one. With a deep affinity for aquatic creatures and plants, Ben is a dreamer and doer who relishes building Metropolitan Farms and turning his vision into reality. Benjamin has a background in finance and management and degrees from the University of Illinois at Chicago, the University of St. Andrews, and Brandeis University. He is also LEED AP certified.

**Metropolitan Farms sells Saturday tours of their greenhouse and will offer one on April 1, the closing day of the conference. Tour starts at 3 pm and is available by advance reservation through the Metropolitan Farms website or at a reduced rate through Groupon or Goldstar. Tour is limited to 30 participants; a second tour may be opened if there is enough interest.**

[metro-farms.com](http://metro-farms.com)

## POSTER PRESENTATION ABSTRACTS

3:00-4:15pm or 4:15-5:30pm, Friday, March 31, 2017, in Building Z

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

### AGRICULTURE

- 1    3:00pm UG    **Can Innovative Marketing Strategies Impact Projected Market Share Sales of Impending 2000R John Deere Series Compact Tractors in 2017?**  
 \*Keely Egelhoff, Jason Franken [Western Illinois University]  
 Market planning strategies play a major role in releasing new products into monopolistic markets. The small to mid-sized tractor industry is a prime example, where many companies sell very similar but somewhat differentiated products. In this study, using very specific targets, John Deere was able to increase its projected sales for the 2000R series compact tractor. By combining customer feedback, salesmen training, and even community involvement, John Deere dealerships should see an upward trend in sales for the 2000R compact tractors in 2017. While the market is always changing due to past sales numbers and competitors' offerings, these strategies help dealers assess demand for the new luxury 2000R series.
  
- 2    4:15pm UG    **Effects of Seed Embryo Orientation on Moisture Uptake and *Zea mays* Germination and Emergence**  
 \*Nichole Miller, Mark Bernards [Western Illinois University]  
 Uniform corn (*Zea mays*) emergence is critical for maximizing crop yield potential and may be influenced by embryo orientation and access to moisture in the soil. Studies were conducted to measure: 1) time to emergence as affected by embryo orientation in the soil, and 2) time to germination as affected by embryo contact with environmental moisture. In the embryo orientation experiment, corn seed was planted with four embryo orientations (embryo down, embryo up, kernel tip down, kernel tip up) into a saturated potting mix in trays and was then grown in a greenhouse. Emergence was measured daily by counting the number of plants where the coleoptile had reached the soil surface. There were two experiments measuring embryo orientation and access to moisture. In the first experiment, seed was placed on moist paper towels in the four orientation positions described above. In the second experiment, seed was placed embryo side down or embryo side up in bottle caps floating on water in sealed petri dishes. Germination was measured daily by counting the number of plants where the radicle had pushed through the seed coat.

### BOTANY

- 3    3:00pm UG    **Forty Years of Change in the Woody Vegetation of Bohm Woods, Southwestern Illinois**  
 \*Miles Gossett, Peter R. Minchin [Southern Illinois University Edwardsville]  
 Oak-hickory forests are adapted to burn periodically. Fires prevent the saplings of the oaks (*Quercus* spp.) and hickories (*Carya* spp.) from being shaded out by shade-tolerant species, such as sugar maple (*Acer saccharum*). Bohm Woods Nature Preserve, adjacent to the Southern Illinois University Edwardsville campus, is the last remaining area of unlogged forest in Madison County, Illinois. In 1977, the tree and shrub layers of the mesic upland forest sections in Bohm woods were sampled as part of the Illinois Natural Areas Inventory. We resampled in 2016 to investigate whether the abundance of woody species has changed over forty years. Two hypotheses tested were that *Acer saccharum* has increased in the canopy layer, and that the invasive Bush honeysuckle (*Lonicera maackii*) has increased in the understory. To survey the tree layer, twenty 250 m<sup>2</sup> circular plots were established 25 m apart along the mid-slope of the forest. A map from the 1977 survey was used to determine the approximate location of the region sampled, but it was not possible to locate the exact sampling points. In each plot, species and DBH of each tree (defined as DBH ≥ 10 cm) was recorded. The dominance of each tree species (m<sup>2</sup>/ha) was then calculated. The shrub layer was sampled in 20 m<sup>2</sup> circular plots concentric with the tree plots. Shrubs were defined as woody plants over 1 m tall and < 10 cm DBH. The number of stems of each species was tallied in each shrub plot. The mean densities (stems/ha) of shrub species in 2016 and 1977 were compared using generalized linear modeling with a log link function and negative binomial errors. The tree data from 1977 was not recorded by plot, so only an average

dominance was available for each species. This average was compared to the sample of 20 plots in the 2016 data using a one sample t-test performed on log-transformed dominance. In the tree layer, the three most dominant trees in 1977, Red oak (*Quercus rubra*), White ash (*Fraxinus americana*), and American basswood (*Tilia americana*), decreased in dominance ( $P < 0.05$ ), due mainly to tree falls associated with storms. No change was detected in the dominance of *Acer saccharum* from 1977 to 2016 ( $P = 0.075$ ), so the first hypothesis was not supported, however, it's possible that sample size was too small to detect a change. In the shrub layer, there was an increase in the density of *Lonicera maackii* (supporting the second hypothesis) and Spice bush (*Lindera benzoin*), while the sapling density of trees, such as Red oak (*Quercus rubra*), declined ( $P < 0.05$ ). The increase of the invasive shrub *Lonicera maackii* along with the decrease in *Quercus*, *Fraxinus*, and *Tilia* in the canopy layer and their lack of sapling recruitment, demonstrate the need for active management of Bohm Woods, including the use of prescribed fire and physical/chemical control of invasives.

#### 4 4:15pm UG

##### **Analysis of Topographic Variation in the Species Composition of a Restored Prairie in Southwestern Illinois**

\*Christopher Featherstone, Peter R. Minchin [Southern Illinois University Edwardsville]

Tall-grass prairies in Illinois have lost more than 99.99% of their original area, mainly to agriculture. Prairie restorations are being undertaken to increase the area of habitat for plant and animal species that depend on this ecosystem. Since the establishment of SIUE campus about 5 ha of former agricultural land adjacent to Whiteside Drive on the western margin of campus was planted to prairie grasses and forbs. Since 2010, the prairie has been included in the SIUE nature preserve. This research is part of an ongoing effort to obtain baseline biodiversity data for the preserve. An initial survey suggested that species composition of the prairie varies with topography. We hypothesized that composition changes along the gradient from ridges to swales. In summer 2016, three parallel 50-m transects were established about 20m apart from a ridge down to the bottom of a swale. A 1 m<sup>2</sup> quadrat was placed every 5 m along each transect. Each species with foliage overlapping the quadrat was identified and assigned to a cover class using a modified Braun-Blanquet scale. NMDS ordination using the Bray-Curtis index was used to visualize the differences in species composition among the quadrats. Analysis of similarities (ANOSIM) was used to test whether the plant communities in three zones (ridge, mid-slope, swale) were statistically different and Indicator Species Analysis was used to find species that typified each zone. The ordination showed a continuous range of community variation from ridge to swale. Apparent community differences among the zones were confirmed by ANOSIM ( $R=0.45$ ,  $P<0.0001$ ). ISA found that the grass *Schizachyrium scoparium* was an indicator of the ridge zone, the invasive subshrub *Lespedeza cuneata* was an indicator of the mid-slope, and the swale was characterized by the grass *Andropogon gerardii*, and the forbs *Helianthus tuberosus* and *Solidago altissima*. The gradient in community composition may result from differences in moisture availability between the ridge (drier) and the swale (wetter). Alternatively differences in soil properties (e.g. nutrient availability) between the ridge and swale may explain the pattern. These factors could be investigated in future research. Though *Lespedeza cuneata* was more abundant on the mid-slope, it was present throughout the prairie and control of its abundance should be a priority in future management. Overall, the diversity of the sampled region of the prairie was low, with only 16 species being recorded. While sampling throughout the prairie would likely find more species, our impression is that diversity is low due to dominance by the grasses *Andropogon gerardii* and *Schizachyrium scoparium*. In recent years the entire prairie has been burned in early spring or late fall. Diversity may be better maintained or increased by burning subsets of the area on different schedules or by burning in August to remove biomass of the dominant grasses before carbohydrates are stored in their root systems.

#### 5 3:00pm Grad

##### **Restoration of Grasslands Invaded by *Sericea lespedeza* (*Lespedeza cuneata*): Seed Bank Biology**

\*<sup>1</sup>Eric Ntiamoah, <sup>2</sup>Kurt Schulz [<sup>1</sup>Millikin University, <sup>2</sup>Southern Illinois University Edwardsville]

*Sericea lespedeza* (*Lespedeza cuneata*) is a noxious invader capable of suppressing native species in grasslands and prairies in the United States. Once established, *lespedeza* is very difficult to remove due to its long-persistent seed bank. To successfully control *lespedeza* we have to find effective ways to suppress or kill seeds in the soil, but this has received little research attention. In our work, we are characterizing the soil seed bank at 3 different invaded sites. This summer, in the second part of this research, we will assess the success of a pre-emergent herbicide (Preen®) in preventing the germination of *lespedeza* seed bank after *lespedeza* removal. We will also evaluate the growth of an aggressive native grass (*Sorghastrum nutans*) as a



replacement species. Here we present data for the seed bank study. Soil samples were collected on the Southern Illinois University Edwardsville campus from three lespedeza invaded sites. Eight 1m x 1m plots were randomly located at each site, and soil cores were collected from the center of each plot. The samples were cold stratified at 4°C for 8 weeks to break the physiological dormancy of the seeds. The samples were spread on sterile potting medium in plastic trays and kept in the SIUE greenhouse. Emerging lespedeza seedlings were recorded weekly. Current results show that that *Lespedeza cuneata* germinates rapidly (< 7 d) and develops a large soil seed bank. All 24 seed bank samples show germinants. Final data will be available for presentation.

- 6 4:15pm UG The Quantification of the Intracellular Storage Lipids of *Chlorella vulgaris* Stained with Oil Red O for Biofuel Production**  
 \*Jordyn Grawe, Kelly Cusack, Katie Farlow, Chrissy Simmons, Kelly Barry [Southern Illinois University Edwardsville]  
 The implementation of a CURE (course-based undergraduate research) in introductory biology allows SIUE biology students the opportunity to develop their own research projects in a course lab setting. The SIUE Biology focuses on algae biodiesel production. This laboratory sequence begins with three foundational labs consisting of algae culturing, acid transesterification of algal lipids, and characterization of biofuel. Students are then encouraged to investigate factors which may influence algal growth and/or accumulation of lipids in order to increase the yield of biodiesel. While algae growth can be quantified spectrophotometrically there has been no procedure for quantifying intracellular lipid accumulation. A reliable and simple quantification of intracellular algal storage lipids would expand the research opportunities for student investigations. We report a quantification method that involves staining with Oil Red O, a noncarcinogenic stain commonly used for staining adipose tissue, followed by cell lysis and visible spectrophotometry. This method provides a rapid and efficient quantification of algal storage lipids.
- 7 3:00pm UG Accessing Patterns of Arthropod Abundance in Illinois Grasslands**  
 \*<sup>1</sup>Yao Luxia, <sup>1</sup>Jacqueline Orozco, <sup>1</sup>Catherine Jimenez, <sup>2</sup>Eric Janssen, <sup>2</sup>Brenda Molano-Flores [<sup>1</sup>University of Illinois, <sup>2</sup>Illinois Natural History Survey]  
 Anthropogenic changes have resulted in the decline of Illinois grassland from 60% to less than 0.01% of the original grassland. These changes have led to the decline of many grassland species and habitat degradation. In this study we assess the patterns of arthropod abundance in high vs. low quality Illinois grasslands. We used plant and arthropod data collected by the Illinois statewide program known as the Critical Trends Assessment Program from 1997-2016. In this program, grasslands are sampled for plants and arthropods on a five year rotation (i.e., a cycle). To assess patterns of arthropod abundance we counted arthropods in high quality grasslands (30 > plant species) and in low quality grasslands (< 15 plant species) for all cycles (i.e., four). High quality sites had higher arthropod abundance in all cycles, however, significant differences were not found in all cycles. In addition, positive correlations were found between the abundance of arthropods and the native plant species richness, the total plant species richness and the total plant cover on the grasslands. The results from this study suggest that grasslands with greater plant species diversity can support a larger number of arthropods and these high quality grasslands should be the focus of conservation and management efforts.
- 8 4:15pm Grad *Monarda fistulosa* Nectar: A Limiting Resource in Northeastern Illinois and Northwestern Indiana Tallgrass Prairie Restorations**  
 \*Neal Jankowski, Mary Carrington [Governors State University]  
 Honeybees (*Apis mellifera*) are essential for production of a substantial portion of the world's food supply, but they are a non-native species in North American tallgrass prairies and could compete with native bees that provide key ecosystem services in natural ecosystems. With less than 1% of the original area of tallgrass prairies remaining, ensuring the continuation of native bee communities is paramount and necessitates characterization of relationships between honeybees and native bees. To investigate possible competitive interactions between honeybees and native bees, during June through August of 2015 and 2016, we worked in six northeastern Illinois and northwestern Indiana prairie restorations—three sites with introduced honeybee hives, and three sites without hives. To determine if nectar from a representative plant species was a limiting resource, we quantified nectar in bee balm (*Monarda fistulosa*) that we netted to exclude pollinators of different sizes. We then conducted a repeated measure MANOVA to compare bee balm nectar

volumes among flowers excluding different groups of pollinators. Treatments excluding honeybees and bumblebees and treatments that excluded only bumblebees had nectar volumes in between treatments with no netting (with lowest mean nectar volume) and treatments netted to exclude all pollinators (with highest mean nectar volume). Although the main hypothesis of the overarching study that honeybees are competing with native bees cannot be supported by these results, we can say that nectar from bee balm is a limiting resource for which different bee species may be competing.

9 3:00pm UG

### **Changes in the Density of Exotic and Native Woody Understory Species in the SIUE Nature Preserve 2008-2016**

\*Annalise Ankney, Peter R. Minchin [Southern Illinois University Edwardsville]

The exotic shrub, *Lonicera maackii* (Bush honeysuckle), has invaded deciduous forests in the midwestern United States. Because this species leafs out earlier in spring than native shrubs and spring ephemerals and retains its leaves longer in fall, it is thought to negatively impact native species through competition for resources. Some studies also suggest that Bush honeysuckle can suppress natives allelopathically. In 2010, 154 ha of land on the western edge of SIUE campus was protected as a nature preserve (SIUENP). The preserve includes Sweet William Woods (SWW), which contains the largest area of mature oak-hickory forest on campus. In 2016, we resampled 750-m<sup>2</sup> vegetation plots established in SWW in 2008 in order to test the hypothesis that Bush honeysuckle density has increased and woody native understory species have decreased. Using results from an aerial photo study, we randomly selected five plots in each of three different forest age classes (43 y, 68 y, and > 100 y). Stem counts of Bush honeysuckle and two natives, the shrub *Lindera benzoin* (Spice bush) and the small tree *Asimina triloba* (Paw paw) were obtained from a 30 x 1 m belt transect in each plot, for plants at least 1 m in height (hereafter called shrubs). Stem counts for shorter individuals of these species (seedlings) were made in ten 0.25 m<sup>2</sup> quadrats spaced at 3 m intervals along the transect. The belt and quadrats were positioned as closely as possible to their 2008 locations. For each species, the count data for both shrubs and seedlings were analyzed using generalized linear models with negative binomial errors and log link, with forest age and time as predictors. Time was treated as a repeated factor using generalized estimating equations that effectively fit the expected correlation among repeated counts for a plot as a covariate. This analysis was chosen over repeated measures ANOVA, since it correctly specifies the error distribution of counts. The results showed a significant increase in mean *Lonicera maackii* density in forest over 100 years of age for both shrubs (P=0.0354) and seedlings (P<0.0001). Mean shrub density increased from 1530 to 3800 stems/ha and seedling density increased from 22400 to 52800 stems/ha. There were no significant changes in *Lonicera maackii* densities in forests aged 43 or 68 years. Aside from an increase in mean *Asimina triloba* shrub density in 68-year-old forest, no other changes in density of *Asimina triloba* or *Lindera benzoin* shrubs or seedlings were detected. Thus our hypothesis was partially supported: *Lonicera maackii* density has more than doubled in the most mature forest areas but no concurrent decrease in the native species were found. Management of the SIUENP should prioritize removal of *Lonicera maackii* from the mature forest sections before densities increase to the levels recorded in the regrowth forest.

## **CELLULAR, MOLECULAR, & DEVELOPMENTAL BIOLOGY**

10 4:15pm UG

### **Using Real Time PCR for the Definitive Identification of *Culex* Species**

\*Maryneth Biyok, Megan Cooper, Antony Oluoch, Thomas Canam [Eastern Illinois University]

*Culex* mosquitoes are important vectors of human and animal diseases. In Illinois and many other states, *Culex restuans* and *Culex pipiens* are the most widely distributed and most prevalent species. While control of these vectors depends on their trapping and accurate identification, mosquitoes from the two species are often difficult to distinguish morphologically. For this reason, we used a real time PCR protocol based on primers and probes specific to both species to accurately distinguish mosquitoes that would otherwise have been difficult to speciate on the basis of morphologic characteristics.

- 11 3:00pm UG *Aedes* Mosquitoes in Coles County**  
 \*Ryan Alderman, Hannah Baysingar, Lindsey Spitz, David Emrick, Antony Oluoch, Thomas Canam [Eastern Illinois University]  
*Aedes* mosquitoes are vectors of a wide number of human viral diseases including Dengue fever, Yellow fever, West Nile virus, eastern encephalitis virus, and Zika Virus. Interest in this genus has peaked recently due to concerns about the spread of Zika virus. Between May and October of 2016, we carried out a survey for these mosquitoes in selected locations in Coles County, Illinois. We used a combination of light and gravid traps in both residential and wooded locations. A wide range of species of *Aedes* mosquitoes were identified: *Aedes vexans* (824), *Aedes albopictus* (437), *Aedes trivittatus* (49), *Aedes triseriatus* (56), *Aedes stiticus* (1), *Aedes japonicus* (93), *Aedes grossbecki* (6), *Aedes sanadensis* (3), *Aedes atropalpus* (8), *Aedes aegypti* (4) and 13 unidentifiable species. Out of all the species collected, *Aedes vexans* and *Aedes albopictus* had the highest occurrence. Most mosquitoes were trapped in the months of July, August, and September. It is notable that *Aedes albopictus* (a potential vector of Zika virus) had a higher prevalence than *Aedes aegypti* (the established vector of Zika virus).
- 12 4:15pm UG *Anopheles* Mosquitoes in Coles County**  
 \*Lindsay Spitz, Tom Canam, Antony Oluoch [Eastern Illinois University]  
 Though *Anopheles* mosquitoes are best known for transmission of malaria, members of this genus can also transmit other diseases such as filarial worms and a host of arboviral diseases. *Anopheles* species encountered in Illinois include *Anopheles crucians*, *A. punctipennis*, *A. walkeri* and *A. quadrimaculatus*. Between May and October 2016, we carried out a survey for these mosquitoes in selected locations in Coles County, Illinois. We used a combination of light and gravid traps to collect and identify these insects in both residential and wooded locations. A total of 226 *Anopheles* mosquitoes were identified. Of these 70 percent were *A. punctipennis*, 20 percent *A. quadrimaculatus*, and 6 percent were *A. walkeri*. These results confirm observations in other counties of Illinois on the occurrence of *Anopheles* species. Compared to the occurrence of *Aedes* (1506) and *Culex* (1606) species respectively, these results also confirm that these species play a relatively minor role in disease transmission in Coles county.
- 13 3:00pm UG Occurrence of *Culex* Mosquito Species in Coles County Illinois**  
 \*Megan Cooper, Antony Oluoch, Thomas Canam [Eastern Illinois University]  
*Culex* species are blood feeding mosquitoes that belong to the subfamily *Culicinae*. This genus contains insect species that are responsible for the transmission of diseases of medical and veterinary importance such as West Nile Virus and St Louis Encephalitis Virus. Several species of this genus have been reported to occur in Illinois. In order to ensure adequate control measures, there is a need to continually update the database for the seasonal and spatial occurrence of these and other mosquito species. Between May and October 2016, we carried out a survey for *Culex* mosquitoes at six locations in Coles County using both light and gravid traps. A total of 1,473 *Culex* mosquito species were trapped and sorted by species. This report details the species specific distribution, and temporal occurrence of these insects in Coles County.
- 14 4:15pm Grad The Effects of L-Dopa on Brux-Like Motor Patterns and Mastication: EMG Phase Analysis in Rats**  
 \*<sup>1</sup>Devin Wall, <sup>1</sup>Branden D. Bennett, <sup>2</sup>Dan B. Welch [<sup>1</sup>Southern Illinois University Edwardsville, <sup>2</sup>SIU School of Dental Medicine]  
 In humans, bruxism is defined as the grinding and/or clenching of the teeth, and can cause dentally related pathology. Episodes of human bruxism can be phasic (rhythmical bursts), tonic (clenching burst), or mixed. In humans, L-dopa can attenuate phasic/mixed bruxism during sleep. We are attempting to characterize this L-dopa phenomena using rats as an animal model. Rats display a brux-like motor pattern with similar phasic characteristics. Rats received an IP injection of L-dopa (10mg/kg)/Benserazide (15mg/kg) or saline vehicle. EMG electrodes were surgically implanted into the anterior superficial masseter, anterior digastric, and posterior superficial masseter muscles. A headcap was secured to the skull with screws. Wires were run sub-dermally from the muscles to the head cap. A preamplifier (X10) was attached to the headcap, and sent to a secondary amplifier (x100). This amplified signal was sent to an A/D converter, and digitally recorded with a personal computer. We observed the brux-like behavior for one hour. After the initial hour of observation, the rats were given food and masticatory behavior was also recorded. We compared the phase relationships between the selected muscles using a Watson-Williams F-test, and found the phase values to be similar (NS). Number of episodes per hour, average duration of an episode, average time displaying brux-

like behavior per hour, average cycle period, burst duration, and cycles per second were compared groups using a Welch's t-test. These characteristics were also similar for both groups (NS). However the number of brux-like episodes per hour between controls ( $\mu=47.8$ ,  $SD=18.7$ ) was greater than the group that received the L-dopa treatment ( $\mu=16$ ,  $SD=12.53$ ); ( $t(6.989)=3.159$ ,  $p=.016$ ). This result demonstrates how L-dopa possesses an attenuating effect on brux-like motor patterns in rats.

15 3:00pm UG

#### **Optimization of Polycaprolactone and Collagen-Based Nanofiber Scaffolds for the Proliferation of Autologous Stem Cells**

\*<sup>1</sup>Jack Blank, <sup>1</sup>Jaclyn Conway, <sup>1</sup>Jon Tiessen, <sup>1</sup>Craig Cady, <sup>1</sup>Kalyani Nair, <sup>2</sup>Ashim Gupta, <sup>2</sup>Michael W. Neumeister, <sup>2</sup>Michael Ruebhausen [<sup>1</sup>Bradley University, <sup>2</sup>SIU School of Medicine]

Integration of autologous stem cells into scaffolds for tissue regeneration has become an increasingly relevant topic in clinical settings. Efforts have been made to find suitable scaffolds for clinical use that aid in the proliferation and eventual differentiation of these adult autologous stem cells. Electrospinning of the biocompatible polymer polycaprolactone and collagen, a structural protein found in connective tissues, has allowed for the fabrication of a hybrid extracellular matrix that can implement autologous stem cells. Fabrication and prediction of the mechanical characteristics associated with differing degrees of the polymer and protein concentration in these scaffolds can allow for successful and repeatable stem cell proliferation and eventual differentiation. SEM, AFM, tensile testing, and degradation testing were all done in order to characterize the varying properties of the scaffolds as collagen concentrations were increased in different scaffolds. These mechanical properties were then utilized to construct a novel finite element model to predict the macroscale mechanical properties of future PCL-collagen nanofiber matrices. Proliferation and integration of the stem cells into the fibers was confirmed through fluorescence microscopy and done in order to relate this growth to the mechanical properties of different nanofiber scaffolds. These scaffolds and their characterization show promise for making highly repeatable and optimized nanofiber scaffolds for use in regenerative medicine.

16 4:15pm UG

#### **The Expression of Fatty Acid Desaturase Genes in *toc132toc120* Heterozygote Mutant of *Arabidopsis thaliana* that has been Exposed to Ozone**

\*Rea Taci, Jessica Jirik, Emily Banigan, Alexis Factor, Brianna Chandler, Meshack Afithile [Western Illinois University]

When plants are exposed to increased levels of ozone, their mesophyll cells accumulate reactive oxygen species (ROS), mainly hydrogen peroxide ( $H_2O_2$ ) and superoxide ( $O_2^-$ ). The accumulation of elevated ROS can result in the breakdown of membrane lipids and cell death. Consequently, plants have evolved a mechanism that uses enzymes and polyunsaturated fatty acids (PUFAs) to remove ROS. Since our preliminary lipid data indicate that levels of 16-carbon fatty acids are altered in wild type *Arabidopsis* plants that were exposed to ~350 ppb ozone for 3 hours, we measured the expression of ozone-responsive genes under the same conditions. In both wild type and *toc132toc120* mutant plants that were exposed to ozone for 3 hours, the ozone-responsive genes that encode cytoplasmic ascorbate peroxidase (cAPX1), stromal APX, catalase 1, glutathione transferase (GST6) and phenylalanine ammonia lyase (PAL1) were upregulated. Our preliminary lipid data showed decreased levels of 16:3, a fatty acid that is found exclusively in the chloroplast lipid, MGDG. We hypothesize that 3h of exposure to ~350 ppb ozone might repress the expression of MGD1 synthase gene and result in decreased synthesis of MGDG. Alternatively, this could have resulted in downregulation of FAD5, FAD6 or FAD7 genes, which encode fatty acid desaturases. Data that include expression of fatty acid desaturase genes will be presented.

17 3:00pm

#### **The FAD5 Gene is Downregulated in *toc132toc120* Heterozygote Mutant of *Arabidopsis thaliana***

\*Meshack Afithile [Western Illinois University]

A mutant of *Arabidopsis thaliana* that is null and heterozygous for TOC132 and TOC120 genes respectively accumulates increased levels of 16:0 and decreased 16:3, suggesting altered homeostasis in fatty acid synthesis. In the *toc132toc120* mutant plants, the FAD5 gene was repressed and this correlated with decreased levels of 16:3. The MGD1 gene was expressed at control levels and the mutant accumulated levels of MGDG that were similar to the wild type. In the mutant however, MGDG had decreased 16:3 levels, suggesting that the activity of FAD5 desaturase was compromised. Overall, these data show that a mutation in the TOC132 gene results in decreased 16:3 levels, indicating the need for an intact Toc132/Toc120

receptor, presumably to facilitate the import of the FAD5 preprotein into chloroplasts.

18 4:15pm

### **The TOC159 mutant of *Arabidopsis thaliana* Accumulates Reduced Levels of Monogalactosyldiacylglycerol and Polyunsaturated Fatty Acids**

\*Meshack Afithile [Western Illinois University]

We evaluated whether the TOC159 mutant of *Arabidopsis* called *plastid protein import2-2 (ppi2-2)* accumulates normal levels of fatty acids, and transcripts of galactolipid synthesis enzymes. The MGD1 gene was downregulated and the *ppi2-2* mutant accumulates decreased levels of monogalactosyldiacylglycerol (MGDG) and 16:3, which suggests that the prokaryotic pathway was impaired in the mutant. The HY5 gene, which encodes long hypocotyl 5 transcription factor, was upregulated in the mutant. The DGD1 gene, an HY5 target was marginally increased and the mutant accumulates digalactosyldiacylglycerol (DGDG) at the control level. The mutant had increased expression of 3-ketoacyl-ACP synthase II gene, which encodes a plastid enzyme that elongates 16:0 to 18:0. A gene that encodes stearyl-ACP desaturase (SAD) was expressed at the control level and 18:1 was increased, which suggest that SAD may be strongly regulated at the posttranscriptional level. The molar ratio of MGDG to bilayer forming plastid lipids was decreased in the cold-acclimated wild type but not in the *ppi2-2* mutant. This indicates that the mutant was unresponsive to cold-stress, and is consistent with increased levels of 18:0, and decreased 16:3 and 18:3 in the *ppi2-2* mutant. Overall, these data indicate that a defective Toc159 receptor impaired the synthesis of MGDG, and affected desaturation of 16 and 18-carbon fatty acids.

19 3:00pm UG

### **Fatty Acid Composition in *toc132toc120* Heterozygote Mutant of *Arabidopsis thaliana* that has been Exposed to Ozone**

\*Emily Banigan, Jessica Jirik, Alexandra Siavelis, Taci Rea, Meshack Afithile [Western Illinois University]

When *Arabidopsis* plants are exposed to increased levels of ozone, their mesophyll cells accumulate increased levels of hydrogen peroxide ( $H_2O_2$ ) and superoxide ( $O_2^-$ ), which are known as reactive oxygen species (ROS). The accumulation of ROS can result in the breakdown of membrane lipids and cell death. Plants have evolved a mechanism that uses enzymes and polyunsaturated fatty acids (PUFAs) to remove ROS. *Arabidopsis* plants were exposed to ozone for 3 hours and left in an ozone free environment for 21 hours. It has been documented that prolonged exposure of plants to ozone results in the breakdown of PUFAs, which result in the accumulation of malondialdehyde (MDA). In our study, levels of MDA were increased above the control levels at 21 hours following 3-hour exposure to ozone. Increased levels of MDA were not mirrored by decreased levels of linolenic acid (18:3), which suggest that chloroplast lipids were tightly regulated under ozone-induced stress. Within 3 hours of exposure to ozone, homeostasis of 16-carbon fatty acids was altered. The levels of 16:0 were increased while levels of 16:2 and 16:3 were decreased. Since levels of 18:3 were not decreased, it is unlikely that the synthesis of a major chloroplast lipid, MGDG was impaired. We therefore hypothesize that 3h of exposure to ozone downregulated the expression of FAD5, FAD6 or FAD7 genes.

20 4:15pm Grad

### **Investigating the Cellular and Molecular Response of the Zebra Mussel, *Dreissena polymorpha*, to Chronic Cold Exposure and its Implications on Thermal Tolerance**

\*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 the invasive zebra mussel *Dreissena polymorpha*, little is known about their thermal physiology on a cellular level. Furthermore, most 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. To investigate this response, mussels were exposed to a step-wise, two week acclimation to either 10°C or 26°C and held for an additional four weeks. Results show that chronic cold temperature exposure did not affect mussel total antioxidant capacity or hemolymph osmolarity, suggesting that exposure to 10°C alone did not elicit oxidative stress or cause mussels to lose their osmoregulatory capabilities. No significant differences were detected across treatments for change in dry shell mass or shell length. However, change in dry tissue mass varied significantly with mussels at 10°C losing tissue mass while those at 26°C gained tissue. Additionally, western blotting will be used to determine (a) the duration of exposure necessary to elicit an increase in AMPK activity, (b) the duration of increased AMPK activity levels, and (c) to measure additional cellular and molecular parameters to determine if cellular damage is occurring.

**21 3:00pm Grad Mutational Analysis of Estrogen Receptor Beta (ER-β) Gene in Individual with Premature Ovarian Failure**

\*Lata Udari [Eastern Illinois University]

Premature Ovarian Failure (POF) is defined as cessation of ovarian function under the age of 40 and it is characterized by secondary amenorrhoea, hypoestrogenism and elevated gonadotrophins serum levels leading to infertility. In early menopause POF affects 1% of woman. Causes of POF are extremely heterogenous. POF causes either by loss of egg is accelerated or the follicles themselves become less responsive to hormonal stimulation. It is characterized by low levels of gonadal hormones (estrogens and inhibins) and high levels of gonadotropins (Luteinizing Hormone and Follicle Stimulating Hormone) beyond infertility hormonal defects may cause severe cardiovascular consequences and leads to the early onset of osteoporosis. ER beta gene is mapped on chromosome number 14q23.2. ERβ is essential for normal ovulation efficiency. The main objective of this study was to screen the mutations in estrogen receptor beta gene by using the techniques DNA isolation, Polymerase Chain Reaction and Restriction Fragment Length Polymorphism. In this pilot study, the results did not reveal the presence of the variant in selected individuals; however, a large sample size is required for the confirmation of the role of ERβ individuals with Premature Ovarian Failure.

**22 4:15pm Grad Cell-Matrix Interaction: Activation of MAP Kinase Signaling Pathway in Salivary Gland Cells**

\*<sup>1</sup>Jacob Krisher, <sup>2</sup>Lurdes Queimado, <sup>1</sup>Callie Mincy, <sup>1</sup>Shannon Payne, <sup>3</sup>Asha Eapen [<sup>1</sup>Southern Illinois University Edwardsville, <sup>2</sup>University of Oklahoma Health Sciences Center, <sup>3</sup>University of Illinois at Chicago]

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. Furthermore the cancerous matrix is known to have the ability to control expression of certain proteins, including fos related antigen-1(Fra-1) and dentin matrix protein 1 (DMP1). The goal of this study is to determine the role of cancerous ECM in the adhesion of normal salivary gland cells, as well as its effect on protein expression of Fra-1 and DMP1. For this purpose, we explored the use of the cancerous ECM of pleomorphic adenoma cells to culture normal salivary gland cells. Results from this study depict 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; a pathway well-known to be hyperactivated in various cancers. Overall, this study will help in designing an *in vitro* tool to study salivary gland cancer progression.

**23 3:00pm Grad Expression of the Brine Shrimp Protein AfrLEA6 in *E. coli* and Purification Using Intein Mediated On-Column Cleavage**

\*<sup>1</sup>Shankar Gurung, <sup>2</sup>Michael A. Menze [<sup>1</sup>Eastern Illinois University, <sup>2</sup>University of Louisville]

Anhydrobiotic organisms accumulate hydrophilic proteins before the onset of dehydration, including Late Embryogenesis Abundant (LEA) proteins. In the brine shrimp (*Artemia franciscana*), multiple LEA proteins are expressed concurrently and in different subcellular localizations. Of the known LEA proteins present in anhydrobiotic animals, the protein AfrLEA6 belongs to the group of seed maturation proteins (SMP), and despite being abundant in plant seeds, this group has been found in only one animal (*A. franciscana*). Even though the expression of LEA proteins is closely related with desiccation tolerance, the precise function and

purpose of AfrLEA6 in *A. franciscana* is unknown. To better understand the role of LEA proteins in animal cells, large quantities of the protein are needed for in vitro studies, but unfortunately LEA proteins are expressed only in low amounts in *A. franciscana*. Therefore, an *E. coli* expression system was chosen to generate large quantities of AfrLEA6. Using the pTXB1 vector in BL21 (*E. coli*) cells yielded approximately 20mg of 95% pure AfrLEA6 protein per liter of the culture. This vector uses the IMPACT (Intein mediated purification with an affinity chitin-binding tag) kit purification system. This approach allows for a single affinity chromatography step and avoids the use of purification tags that remain on the protein of interest, or involve cumbersome cleavage steps using proteases to yield untagged proteins for biochemical characterization. However, the last c-terminal amino acids penultimate to the beginning of the intein protein played a crucial role in the cleavage efficiency using this purification strategy. The native AfrLEA6 contained an aspartic acid (Asp) at the c-terminus which yielded almost no cleavage when treated with 50mM dithiothreitol. However, when Asp was mutated to glutamic acid or alanine, an enormous increase in the amount of the cleaved protein was observed. Future research on structural and functional analysis of this protein can augment our knowledge about the mechanism by which group 6 LEA proteins function to improve long-term desiccation tolerance in animal cells and may offers novel avenues for biotechnological applications.

24 4:15pm UG

#### **Identification of a Putative Autonomous Element for the *car* Transposon of *Schizophyllum commune***

\*Belainesh Nigeda, Thomas J Fowler [Southern Illinois University Edwardsville]

Cut-and-paste DNA transposons are widespread among eukaryotes including fungi. This class of transposons is characterized by terminal inverted repeat sequences (TIRS) that contribute to their ability to be moved to new genome locations by the action of a transposase. Autonomous transposons encode the transposase required for excision and insertion, while nonautonomous transposons rely on transposase expressed from autonomous elements. A putative DNA transposable element was identified in *Schizophyllum commune* as the likely cause of an abnormal hyphal growth phenotype called "thin" that arose as a sector within a normal colony. The *thn1* gene in the mutant sector had an insertion of a putative transposon, which has been nicknamed the *car* transposon. Its DNA sequence has terminal inverted repeats but does not code any signature protein domains or motifs of a transposase, suggesting a nonautonomous transposon. The insertion into *thn1* also appeared to create a target duplication site at its borders, providing further evidence that the *car* sequence is a transposon that spontaneously inserted. The published sequence of the *S. commune* genome was searched with the original *car* DNA sequence and a larger sequence with the *car* TIRS was identified. This DNA encodes a DDE motif, suggesting it may be an autonomous *car* transposon. The current study explores how prevalent the *car* DNA is among strains of the species and whether it can be detected in a sister species, *S. umbrinum*. Genomic Southern blots with DNA from several distinct *S. commune* strains and *S. umbrinum* were hybridized with a probe of ~ 1200 bp derived from the putative autonomous *car* DNA. Genomic Southern blot analysis of EcoRI-digested DNA revealed a small number hybridizing DNA bands in H4-8, H1-99 and H1-107 that are closely related to the *car* probe DNA. This result corresponded well with expectations from the H4-8 genome sequence. Probing the sister species, *S. umbrinum*, with the *car* DNA detected some weak hybridization, but no strong bands.

25 3:00pm UG

#### **Evaluation of the Role of Light in Fruiting Body Formation in the Fungus *Schizophyllum umbrinum* as compared to its sister species, *Schizophyllum commune***

\*Emily Wade, Thomas J Fowler [Southern Illinois University Edwardsville]

*Schizophyllum umbrinum* has life history differences compared to its well-known sister species *Schizophyllum commune*. *S. commune* requires a genetically compatible mate to produce fruiting bodies and subsequently, viable offspring. *S. umbrinum*, on the other hand, utilizes a homothallic mating mechanism. *S. commune* requires input of blue light and signal transduction through the white collar (WC) complex for the initiation of fruiting body formation. It is unknown if this requirement holds true for *S. umbrinum* fruiting body formation. The mechanism of fruiting body initiation and formation in *S. umbrinum* remains unclear. In an attempt to better understand the process, mushroom growth and development of *S. umbrinum* was observed in three growth conditions. These growth conditions included cultures grown in white light (control group), blue light, and complete darkness with the exception of observation for short periods under a red photographic safe-light. I hypothesized that without the input of blue light, *S. umbrinum* would not be able to create a fertile fruiting body. Thus, cultures grown in complete darkness will not form fruiting bodies and

cultures that are grown in the presence of the blue light wavelengths (both the blue and white light treatment groups) will be able to form fertile fruiting structures. A six-week trial was conducted with a light exposure time of 2 hours per 24 hours on five consecutive days out of every seven days. Following the six weeks of light treatment, cultures from the white light (control) group exhibited a lower than expected incidence of fruiting. Light exposure time for a second trial was increased to 24 hour exposure (constant light treatment). Mycelial radial growth rate of *S. umbrinum* on potato flake agar was measured during the second trial. Preliminary observations from the second trial suggest that cultures grown in the blue light condition exhibit denser aerial hyphal growth, as compared to the cultures from the other two conditions. This observation was consistent with the first trial. This suggests that the other wavelengths present in white light may provide an inhibitory effect toward aerial hyphal growth. The evidence to date indicates *S. umbrinum* is sensitive to blue light and suggests the hypothesis that blue light is needed in *S. umbrinum* for mushroom development could have validity. There were no differences observed for fruiting and sporulation patterns between cultures from both the blue and white light treatment groups. Nearly all cultures of *S. umbrinum* that were grown in the dark did not show any signs of fruiting body initiation, however, because some fruiting bodies or fruiting body-like structures formed on some dark grown cultures, the results suggest that blue light is not an absolute requirement for fruiting body initiation, but may enhance its probability, speed, and pattern. This research project was funded by the Undergraduate Research and Creative Activities (URCA) program.

26 4:15pm UG

**The Expression of Genes in the Jasmonic Acid Pathway in *toc132toc120* Heterozygote Mutant of *Arabidopsis thaliana***

\*Emily Banigan, Jessica Jirik, Alexandra Siavelis, Taci Rea, Brianna Chandler, Alexis Factor [Western Illinois University]

When plants are wounded, the fatty acid linolenic acid (18:3) is modified to produce the plant hormone, jasmonic acid (JA), which accumulates to high levels in wounded tissues. The JA pathway is initiated in the chloroplasts and completed in the peroxisomes. JA is then exported to the cytoplasm where it is conjugated to isoleucine to form JA-Ile. The latter binds to its receptor, which leads to induction of signals that turn on an array of plant defense genes. Enzymes that function in the JA pathway are encoded by nuclear genes. Proteins that are synthesized in the cytoplasm are recognized by receptors in membranes of the chloroplasts and peroxisomes. Receptors on the outer membrane of the chloroplast include at Toc159. Mutation in the Toc120/132 receptor yields plants with a pale phenotype. We evaluated the ability of Toc120/132 mutant to accumulate mRNA that encodes enzymes that function in the JA pathway as well as transcript levels of JA responsive genes. In both the wounded wild type and Toc132/120 mutant plants, the expression of LOX2, AOS, OPR3, and JAR1 genes were upregulated. These data suggest that the Toc132/120 complex might not be critical to the import of enzymes that initiate the JA pathway in chloroplasts. Alternatively, a single copy of the Toc120 gene might be sufficient for the import of these proteins. A more reasonable hypothesis is that the Toc159 receptor might mediate the import of proteins in the JA pathway.

27 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 regulates multiple vital nuclear functions, including cell cycle progression, DNA repair and transcription. It is involved in epigenetic regulation of gene expression, adding acetyl groups to lysine residues on histone H4 to affect expression of genes in the nearby chromatin. Planarians like *Schmidtea mediterranea* have the amazing ability to regenerate any part of their body using a pool of pluripotent stem cells they maintain throughout their lifetimes, which makes them an excellent model system in which to study the molecular mechanisms underlying stem cell pluripotency and differentiation. Because NuA4 complex genes are highly conserved, much of what we learn about the function of this complex in planarians can be applied to understanding its role in the stem cells of other organisms, including humans. We have identified planarian homologs of 15 proteins in the human NuA4 complex (Ruvbl2, Morf4l2, Mra, Epc1, Tip60, Trrap, Gas41, Ruvbl1, Brd8, Yl-1, Baf53a, Dmap, Ing3, Meaf6-1 and Meaf6-2) and silenced 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 observe two groups of RNAi worms, a regenerating group and a



homeostasis group. The first group will be cut following the knockdown to observe how well they restore their lost tissue. The homeostasis group will be fixed and stained to mark mitotic cells to determine if the stem cells are dividing normally. We will also use whole-mount in situ hybridization to determine where each of the NuA4 complex genes is expressed in planarians. 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.

**28 4:15pm Grad Gene Expression of Corn Earworm in Response to Infection by *Serratia marcescens* and *Pseudomonas aeruginosa***

\*Oluwabukola Ajasa, Richard Musser, Sue Hum-Musser, Jeffery Liles, Keshab Mainali, Randahl Nickerson [Western Illinois University]

The corn earworm, *Helicoverpa zea*, is a common crop pest that causes huge economic losses in agriculture. Due to an increased selection pressure for insecticidal resistance, more and more insect pests are becoming resistant to insecticides making them progressively harder to control. An alternate form of pest control has been utilized; the development and application of different types of microbial pathogens for the control of pests. Work on the development of new insect control methods require that we understand the mechanisms involved in pathogen infection and resistance. This insect is susceptible to infection by several different types of pathogens. In this study we examined the effect of common pathogenic bacterial strains on the growth, survival and gene expression of corn earworm larvae. We examined how *Helicoverpa zea*, reacts when exposed to pathogenic strains of *Pseudomonas aeruginosa*, and *Serratia marcescens* by measuring the transcriptomic gene expression. *Helicoverpa zea* caterpillars were allowed to feed on diets that were treated *S. marcescens*, *P. aeruginosa* or a control diet. The caterpillars' growth and mortality rates were measured. We observed a decrease in weight, difference in time to pupation, and higher mortality in caterpillars in the bacterial treatments compared to the caterpillars that fed on control diet. Caterpillar microarrays and real-time quantitative polymerase chain reaction analysis of caterpillar tissue revealed that caterpillars had a significant increase in the expression of genes involved in metabolism, digestion, and the immune response. The analysis of the specific gene regulation that occurs in the caterpillars in response to these pathogens gave insight into the defense mechanisms used by *H. zea* during bacterial infection and how biologists can exploit weakness in caterpillar defense to find a solution in biological control.

**29 3:00pm UG The Influence of 3D Spheroid Formation on Neural Differentiation Potential of Mesenchymal Stem Cells**

\*Joshua Ginzel, Claire Woods, Craig Cady [Bradley University]

Stem cells demonstrate potential for replacement of damaged cells or tissues through differentiation into multiple mature cell types. Due to their autologous nature and multipotency, mesenchymal stem cells (MSCs) have been applied to non-mesenchymal fates with limited differentiation efficiency. Previous studies suggest 3D culture systems emulate the *in vivo* stem cell niche improving expansion ability and differentiation potential. Improved differentiation efficiency of MSCs into neural cells will improve the therapeutic potential for neurodegenerative diseases such as Parkinson's disease (PD) and Alzheimer's disease (AD). In this study, bone marrow derived mesenchymal stem cells were formed into 3D spheroids using a hanging drop culture system. Monolayer and spheroid experimental groups were treated with brain-derived neurotrophic factor (BDNF), retinoic acid (RA), dibutyl cyclic adenosine monophosphate (DBcAMP), fibroblast growth factor 2 (FGF-2), and sonic hedgehog (Shh). Two days after treatment, spheroids were transferred to adherent monolayer culture. Experimental groups were continually exposed to neurodifferentiation factors until neuronal-like morphology was observed. We hypothesize that treated spheroid MSCs will express neuronal and glial surface proteins and mRNA versus monolayer cultured MSCs based on immunocytochemistry and qRT-PCR analysis. Preliminary data suggests neuronal and glial expression is increased in spheroid treated cells. Future work will optimize the protocol efficiency as well as apply 3D spheroid culture to other mesenchymal stem cell sources.

**30 4:15pm Grad Evaluate the Transcriptome Response of White-Rot Fungi to Lignocellulosic Biomass**

\*Mashaal Alaradi [Eastern Illinois University]

There are several processes to extract lignin from cellulose fiber to produce biofuel. Pulping, organosolv, thermochemical and thermomechanical treatments are expensive and may have a negative impact on the environment. In contrast, removal of lignin using white-rot fungi is a natural, environmentally-friendly

solution. For example, the white-rot fungus *Phanerochaete chrysosporium* is a biological pretreatment agent that has the capability to break down lignin using a suite of primarily hydrolytic and oxidative enzymes, allowing the manufacture of ethanol from the resulting cellulose. Previous research has demonstrated the effectiveness of using white-rot fungi for pretreatment of biomass; however, the biochemical mechanisms involved in biomass deconstruction are poorly understood. Dedicated crops like *Miscanthus* and hardwoods were used in the present experiment to evaluate the transcriptome (i.e. expression) response of white-rot fungi to lignocellulosic biomass. By studying the transcriptome of *P. chrysosporium* after developing on these biomass types, we expect to reveal novel genes and enzymes that play important roles in lignocellulose deconstruction. After 5 weeks of growth by the fungus on either *Miscanthus* or maple wood chips, total RNA was extracted using a robust RNA extraction protocol and sequenced using Illumina RNA-Seq technology. The RNA-Seq analysis resulted in over 400 million transcript sequences across nine samples. The data will be subsequently processed using *RobiNA*, which specializes in sorting and annotating transcriptome sequences. The data from the transcriptome experiments will improve our fundamental understanding of how white-rot fungi are capable of deconstructing biomass from a molecular and biochemical perspective.

### 31 3:00pm Grad Effects of Asiatic Acid on Neurite Outgrowth in Neuro-2a Cells

\*Aishah Asiri, Leah Welker, David Grimm, Britto P. Nathan [Eastern Illinois University]

Recently, medicinal plants from ancient Ayurvedic medicine have provided clues to the discovery of novel therapeutics for various diseases. In Ayurvedic medicine, a common Indian plant, *Centella asiatica* is highly regarded as a “rasayana” or nerve tonic. The *Centella* extract is used to ward off age-related dementia and to increase memory and intelligence. The mechanism by which *Centella* improves memory and learning and reduces the risk of dementia is unclear. We recently tested the effects of asiatic acid, the main active component of *Centella*, on neuronal growth. We hypothesized that asiatic acid will promote neuronal growth and neurite network formation. To test this hypothesis, we examined the effects of asiatic acid on neuronal growth in murine neuroblastoma cells, Neuro2a. Neuro2a cells were cultured for 24 hours in DMEM medium containing 10 mM glucose and 10% FBS in six-well plates at a concentration of 200,000 cells/well. The cells were further cultured for 72 hours in DMEM containing 10 mM glucose and with either 1 mM asiatic acid in ethanol or ethanol alone (vehicle). Cells were photographed, and neurite outgrowth quantified using NeuronJ software. The results revealed that asiatic acid treatment significantly increased the percentage of cells bearing neurites as compared to neurons grown in medium alone. In addition, asiatic acid treatment significantly increased neurite extension and combined length of neurites. The effect of asiatic acid on cell proliferation was examined using standard trypan blue staining. The data revealed that doubling time was significantly slower in cells cultured in presence of asiatic acid as compared to cells grown in vehicle (ethanol) alone ( $p < 0.05$ ). To investigate the impact of asiatic acid on bioenergetics in Neuro2a cells we analyzed the electron transport chain of the mitochondria via respirometry. The respiration rates of Neuro2a cells cultured in medium containing asiatic acid was significantly ( $p < 0.05$ ) higher than cells grown in medium containing vehicle alone. Together these results suggest that asiatic acid is neurotrophic. This effect may explain the beneficial role of *Centella asiatica* extract on learning and memory and preventing neurological disorders.

### 32 4:15pm Grad Sexual Development Affects Volatile Production of *Schizophyllum commune*

\*<sup>1</sup>Sophia Wirth, <sup>2</sup>Lisa-Marija Ahrens, <sup>2</sup>Elke-Martina Jung, <sup>2</sup>Katrin Krause, <sup>3</sup>Maritta Kunert, <sup>3</sup>Wilhelm Boland, <sup>1</sup>Thomas Fowler, <sup>2</sup>Erika Kothe [Southern Illinois University Edwardsville, <sup>2</sup>Friedrich Schiller University, <sup>3</sup>Max Planck Institute for Chemical Ecology]

Signal transduction pathways by heterotrimeric guanine-nucleotide binding protein (G-protein) signaling is critical for understanding pheromone response in the basidiomycete *Schizophyllum commune*. Regulators of G-protein signaling (RGS) are involved in the modulation of heterotrimeric G-protein signaling cascades and control mycelia growth, hydrophobicity and sexual development. G-proteins might be also an important control point for differential expression of fungal secondary metabolites. Induced expression of both the RGS *thn1* and the G-protein  $\alpha$ -subunit gene *scgp-a* within 6 to 48 h after mating partners' contact was demonstrated by quantitative real-time PCR. Using bimolecular fluorescent complementation assays, we were able to demonstrate protein-protein interaction between the Thn1 and ScGP-A *in vivo* during mating. In accordance with the temporal expression patterns found for G-protein signal transduction components protein-protein interaction was detectable 48 h after mating. Thus, appearance of detectable fluorescence in hyphae should result from the specific complex formation by interacting proteins and not from unspecific background fluorescence. Fusion proteins are mainly targeted to the plasma membrane of clamp cells and

septae, indicating a role of G-protein signaling in clamp cell fusion. In *S. commune* a spontaneous occurring mutation of *thn1* is caused by transposon insertions. These mutants show a partial defect in mating, abnormal clamp formation and an absence of fruiting body development. The aerial mycelia formation is reduced and mutants show an easily wettable phenotype, which indicate that Thn1 regulates surface hydrophobicity. Deletion of *thn1* has a similar effect on vegetative growth, but the  $\Delta thn1$  strain was found to mate unilateral, suggesting the regulation of pheromone signaling by *thn1*. This is reflected in the volatilome. The chemical composition of volatiles was investigated using solid phase microextraction coupled with GC-MS. The wild-type was found to produce mainly esters, whereas transposon mutants and *thn1* deletion strain emit a mixture of different sesquiterpenes, including  $\beta$ -bisabolol as the main component. These findings provide evidence that Thn1-mediated signaling control negatively affects cellular response associated with pheromone signaling and secondary metabolism in *S. commune*.

33 3:00pm UG

### **Evaluation of the Function of Genes Associated with Long-Term Memory in *Schmidtea mediterranea* Using RNAi Knockdown Techniques**

\*Jessica Haines, Amy Hubert [Southern Illinois University Edwardsville]

The planarian flatworm *Schmidtea mediterranea* is a popular molecular-genetic model system that has a structurally simple, yet well-organized centralized brain that exhibits many similarities to that of higher animals. They are capable of abstracting and storing memories of environmental familiarity over time through the central nervous system (CNS). Planarians display distinct responsive behaviors to external stimuli; their sensory organs send signals to the brain to process, which directs appropriate behavioral responses. Planarians can be habituated to an unfamiliar stimulus through repeated exposure. The objective of this experiment is to determine whether specific genes that have been found to be involved in memory in other organisms contribute to long-term memory in planarians. We identified planarian homologs of five genes known to cause long term associative memory (LTAM) effects in *C. elegans*. In this experiment, planarians will be habituated to an unfamiliar stimulus, rough plates, and then will undergo RNAi to knockdown the selected genes. Memory will be assayed based on the amount of time it takes for the planarians to swim across the rough surface of a petri dish to reach food placed on the other side. Worms with memories of the rough surface will reach the food more quickly than those that were not habituated to that surface, and knockdown of a gene required for memory should eliminate this difference between the groups. Antibody staining will be used to determine if any changes occurred in the anatomy of the CNS in experimental planarians after treatment. We hope that these studies will contribute to a better understanding of the molecular basis of memory and genetic factors that affect it.

34 4:15pm Grad

### **Characterization of Planarian Homologs of Human Xeroderma Pigmentosum Genes and their Function in Repairing UV Damage**

\*Lucero Villarreal, Amy Hubert [Southern Illinois University Edwardsville]

Patients with Xeroderma Pigmentosum (XP), a rare hereditary disease, have an increased risk of contracting skin cancer and an extreme sensitivity to UV light. The disease is caused by mutations in genes involved in DNA nucleotide excision repair (NER). NER is a highly multipurpose and complex DNA damage removal pathway that counteracts the damaging effects of a multitude of DNA lesions caused by exogenous mutagens. The planarian flatworm *Schmidtea mediterranea* is an ideal *in vivo* model to perform regeneration studies related to cancer because of their unlimited restorative and physiological renewal capacities. Their regeneration ability relies on a pool of neoblasts, undifferentiated stem cells that the worms maintain in high abundance throughout their lifetimes. In order for neoblasts to work properly, they need to keep their DNA free of mutations, and NER may play an important role in this process. To better understand how defects in NER lead to Xeroderma Pigmentosum, we are working on characterizing this pathway in *Schmidtea mediterranea*. Doing the study in planarians will allow us to find out whether those reparative pathways are important for neoblast maintenance and regeneration and elucidate the role of DNA repair in general stem cell function. We performed BLAST searches to identify the planarian homologs of human genes implicated in XP (XPA, ERCC1, ERCC3/XPB, XPC, ERCC2/XPD, ERCC6, DDB2, ERCC4/XPF, ERCC5/XPG, POLH and RAD2/FEN1) and found matches for all except DDB2. The e-values in the BLAST searches ranged from  $1 \times 10^{-13}$ , indicating that these genes are highly conserved. We are currently in the process of cloning those genes to induce their knockdown by RNA interference in planarians, in the presence and absence of UV damage, to see if there is an increased sensitivity to UV light when the gene product is absent. We will also test the worms' regenerative ability and measure changes in stem cell number to see how they are affected by the

knockdown. Understanding how DNA repair pathways such as NER function in planarian stem cells will help us better understand how they maintain the stem cell population and use it to regenerate without aging or cancer.

35 3:00pm UG

**Evaluation of Neurotransmitters Related to Long-Term Memory in *Schmidtea mediterranea* Using RNAi Knockdown Techniques and a Familiarization Training Program**

\*Sean Mechem, Amy Hubert [Southern Illinois University Edwardsville]

The planarian flatworm *Schmidtea mediterranea* is a popular system for research into the molecular mechanisms of memory and neuronal function because it represents the most primitive example of centralization and cephalization of the nervous system and has the ability to regenerate its entire body and brain. These planarians are capable of storing information relating to environmental stimuli in their central nervous system, which even persists through regeneration of the head. Familiarization of planarians to certain environmental stimuli can be achieved through repeated exposure to a stimulus. We aim to determine if neurotransmitters that are critical for memory in other organisms are required for learning and memory in *Schmidtea mediterranea*. Planarians will be familiarized with rough-surfaced or smooth-surfaced petri dishes and then undergo RNAi to achieve knockdown of genes related to neurotransmitter production or uptake. Then the amount of time it takes the worms to reach a drop of calf liver on the other side of a rough-surfaced plate will be recorded and used to determine if each neurotransmitter is critical to memory. Worms that retain memories of prior exposure to the rough surface will take less time to explore the plate and will reach the food faster than the worms familiarized with the smooth surface. The knockdown of genes that are critical for memory should eliminate this difference. The results of this experiment can allow for more focused research on neurotransmitters and their role in memory in planarians. Dysfunctions of the cholinergic system and alterations of the glutamatergic and serotonergic system are also thought to contribute to learning and memory deficits in patients with Alzheimer's disease, so more research into these systems is needed. The training program used can also be repeated with different genes to determine their impact on memory.

36 4:15pm Grad

**Deletion of Two *dicer*-like Genes and Characterization of Null Mutants in *S. commune***

\*Daniel Karcher, Jill La Rue, Thomas J Fowler [Southern Illinois University Edwardsville]

RNA interference is a conserved mechanism of gene silencing in nearly all eukaryotes. RNAi uses small, 20-30 nucleotide RNA molecules to target and degrade or otherwise silence RNA molecules with complementary sequences. This mechanism has been found to function in regulation of gene expression, chromatin remodeling, and genome defense against viruses and transposons. Dicer proteins are responsible for the production of small RNAs from dsRNA precursors, and are essential components of RNAi pathways. Two putative Dicer-encoding genes (Protein IDs 2007168 and 2494406) have been identified in the genome of the model Basidiomycete fungus *Schizophyllum commune*. The predicted proteins contain Ribonuclease III, Helicase C, and Dicer dimerization domains, all of which are conserved in Dicer proteins. De Jong et al (2006) provided evidence that mechanisms for hairpin-triggered RNA silencing are present in *S. commune*. However, the underlying mechanism of this response has not been studied. It is expected that at least one of the two predicted *dicer* genes is involved in this form of RNA silencing, but it is unknown whether they are redundant or perform separate functions. Each of the two predicted *dicer* genes was deleted by homologous recombination with a plasmid construct containing DNA regions from both upstream and downstream of the target gene, flanking a phleomycin resistance cassette. Southern blot analysis revealed successful deletions of the genes, along with the presence of multiple apparent ectopic insertions of the plasmid construct in knockout transformants for one of the genes (2007168). These transformants were crossed with the strain 12-43, and progeny resistant to zeocin were analyzed by Southern blot to select those that contained the plasmid insertion only at the locus of the predicted *dicer* gene. Since both genes were successfully deleted, loss of either *dicer*-like gene is not lethal to *S. commune*. No apparent differences in appearance or growth were noticed in monokaryons of either *dicer*-like knockout strain compared to the wild type. Additional crosses are needed to produce dikaryons that are homoallelic for either deletion, and to generate a mutant lacking both predicted *dicer* genes. Future experiments will attempt to induce RNA silencing in single and double mutants by introduction of a hairpin RNA-encoding gene to determine which, if either, *dicer*-like gene contributes to the silencing mechanism.

## CHEMISTRY

37 3:00pm UG

### **Relationship between Antibiotics Found in Wastewater and Receiving Streams**

\*Paisley Harper, Michael Lohman, Clayton Donald, Hannah Lupton, Danielle Goetter, Kevin Tucker [Southern Illinois University Edwardsville]

The presence of pharmaceuticals and personal care products in the environment has been reported in the literature to occur through numerous pathways including through wastewater. In order to detect the presence of pharmaceuticals in wastewater and freshwater runoff samples, the extraction of specific antibiotics by solid-phase extraction (SPE) was examined using liquid chromatography mass spectrometry (LC-MS). Samples were obtained from wastewater effluent and their receiving streams in southwest Illinois. The wastewater was processed using filtration followed by SPE using a Visiprep Large Volume Sampler with a vacuum manifold to prepare wastewater and freshwater samples. LC-MS analysis was performed on an Agilent 6460 to qualitatively determine if there was a relationship between the presence of each antibiotic in the wastewater and the receiving stream.

38 4:15pm UG

### **Determination of Nitrate in Soil Due to CAFO Use in Rural Illinois**

\*Julia Hill [Western Illinois University]

The meat industry, with the increasing population and advent of new technologies, is ever changing and growing. Historically, animals were allowed to roam free on open pastures and graze as they pleased. Due to the advancement of technology, the focus has shifted from quality of products to quantity of products. Lately, meat producers have turned to large confined animal feeding operations (CAFOs) rather than free ranges. Most CAFOs are structured similarly and have livestock buildings where the animals are housed. CAFOs are typically very crowded as there is a high number of animals per unit of surface area giving the animals very little room to roam freely. The livestock buildings are equipped with ventilation that remove much of the gaseous waste products but the solid waste is often collected under the building. Many CAFOs pump the waste from under the building into a holding pond which separates the solid and liquid waste and many of the environmentally toxic contaminants are decomposed or transformed via UV light or bacteria to less toxic chemicals. In low concentrations many of these contaminants are not harmful to the environment, but in the concentrations produced at large CAFOs they become dangerous. These facilities can have many negative effects on the surrounding environment from ground water contamination to surface/stream water contamination. My research will be focused on determining the concentration of nitrates in soil samples collected from a stream bank located approximately one quarter mile from a CAFO. The soil will be sampled at two locations one upstream and one downstream. The purpose of sampling the soil will allow for the determination of the nitrate concentration on a larger time scale. The research will be able to determine if the CAFO has contributed to an increased level of soil nitrates. The soil is the best way to determine if there is a leak as the sample does not move and allows for the waste material to build up unlike the stream which is constantly moving and transporting contaminants. To determine the nitrate level in the soil, we will use the method of Mulvaney to determine the concentration of nitrate. This method turns the soil sample into a slurry using DI water to dissolve all the nitrate salts as all nitrate compounds are soluble. Once the sample is dissolved it is then filtered and the resulting solution will be analyzed using a Cole-Parmer nitrogen combination ion-selective electrode. The electrode is used to measure the amount of nitrate in solution and determine whether these CAFOs are having an adverse effect on the environment.

39 3:00pm UG

### **An *Ab Initio* Study of Physisorption of Carbon Dioxide on Metal-Organic Frameworks**

\* Alexander Pixler, William Doria, [Rockford University]

CO<sub>2</sub> binding to previously untested metal-organic frameworks (MOFs) was investigated. To do so, the binding energy of CO<sub>2</sub> to the organic linker was calculated using density functional theory. We used our methods to predict the binding energies of previously investigated compounds (IRMOF-3 and MOF-5) and compared these to their reported binding energies, then used the best-performing basis sets to predict the CO<sub>2</sub> binding energy of a new organic linker. Various parameters such as the number of rings, ring size, and substituent groups in the organic linker affect the binding of CO<sub>2</sub> to the linker. We designed a new organic linker, pyrazine-2-5 dicarboxylic acid, differing from IRMOF-3 by the presence of two nitrogens in the ring. The basis sets tested were 6-31G, 6-311G, 6-311G\*, and 6-311+G\*. Surprisingly, 6-311+G\* was found to yield poor results for CO<sub>2</sub> adsorption on MOF-5. Instead, the best-performing basis set was the smaller 6-311G. Our

study finds that pyrazine-2-5 dicarboxylic acid is predicted to yield significantly stronger CO<sub>2</sub> adsorption (~36 kJ/mol) than that exhibited by IRMOF-3 or MOF-5 (19 kJ and 17 kJ/mol, respectively). It is hoped that the present research will enable the design of more effective MOFs for CO<sub>2</sub> binding.

40 4:15pm Grad

### **Synthesis and Characterization of Solid-State Materials**

\*Erik Sarnello [Western Illinois University]

This research aims to investigate the many unique structures and properties associated with crystalline solid-state materials via optical microscopy, scanning electron microscopy, and X-ray crystallography. Recently, transition-metal tin-chalcogenide compounds have drawn a great deal of interest due to their unique electronic and structural properties. The thermoelectric and semi-conducting properties of these materials have the potential to greatly improve the efficiency of modern electronics as well as many industrial applications. A compound of interest, CoSn<sub>2</sub>Te<sub>4</sub>, was first synthesized and crystallized via the ceramic solid-state synthesis method. To begin, each element, in powdered form, was combined in a stoichiometric ratio in carbon-coated quartz tubes. Each tube was then vacuum sealed under a pressure of roughly 40-60 microns of Hg. Sample tubes were then loaded into a temperature controlled furnace which reaches a maximum holding temperature of 800°C. Once the temperature program completes, each sample tube is then opened and sorted for crystalline materials via optical microscopy.

41 3:00pm Grad

### **Selective Reduction of 2-Iododimethyl Terphthalate to Synthesize Differently Substituted O-Iodoxybenzoic Acid (IBX)**

\*Ahmad Mahmood, Saja Al-Majmaie, Thottumkara K. Vinod [Western Illinois University]

*o*-Iodoxybenzoic acid (IBX), 1, a highly versatile hypervalent iodine (V) reagent has been heralded as a mild and efficient oxidant for a variety of synthetic transformations ranging from oxidation of alcohols to the corresponding carbonyl derivatives to the oxidation of activated C-H bonds. The reagent, however, is known to suffer from practical drawbacks including limited solubility in common organic solvents and its potential explosive nature when synthesized using the initially reported KBrO<sub>3</sub> protocol. Our research for the last several years was aimed the synthesis of IBX derivatives that are user and eco-friendly with many of them possessing solubility in most eco-friendly solvent of all, water. One of the water-soluble IBX derivative recently reported is the carboxy appended IBX derivative, 2, readily prepared from commercially available diacid, 3. Currently we are investigating the selective reduction of the diester of 3 to prepare both 4 and 5 and have had considerable success in accessing both derivatives. Synthetic routes for structurally modified IBX derivatives 6 and 7 from 4 and 5 will be discussed on this poster.

42 4:15pm Grad

### **Analysis of Total Antioxidant Activity in Brewed Teas**

\*Rachel Crews, Brian Bellott [Western Illinois University]

Antioxidants are widely accepted for their ability to reduce free radicals in the human body. This is important because free radicals damage cell membranes which can lead to deadly diseases. Antioxidants are found in food such as fruits, vegetables, and drinks such as tea. Tea has long been touted for its health benefits. One of those health benefits is the presence of many antioxidants which makes it useful for lowering the risk of and preventing diseases. Our research interests are in comparing the concentration of antioxidants in cold brew tea versus hot brew tea. The total antioxidant concentration will be determined using the diphenyl-2-picryl-hydrazyl (DPPH) photometric assay. DPPH is a stable free radical that produces a violet solution when combined with ethanol. When an antioxidant molecule is present, the molecule reduces DPPH leaving an uncolored ethanol solution. The analysis of this experiment will be done using a colorimetric assay with the Ultraviolet-Visible Spectroscopy (UV-Vis) instrument. The absorption of tea will be measured using the same wavelength for both hot brew and cold brew thus making them comparable.

43 3:00pm Grad

### **Towards the Synthesis of a Hypervalent Iodine Reagent on a [2.2]-Cyclophane Framework**

\*Esan Taiwo, Thottumkara K. Vinod [Western Illinois University]

*o*-Iodoxybenzoic acid (IBX), 1, a highly versatile hypervalent iodine (V) reagent has been heralded as a mild and efficient oxidant for a variety of synthetic transformations ranging from oxidation of alcohols to the corresponding carbonyl derivatives to the oxidation of activated C-H bonds. The reagent, however, is known to suffer from practical drawbacks including limited solubility in common organic solvents and its potential explosive nature when synthesized using the initially reported KBrO<sub>3</sub> protocol. Our research for the last several years was aimed the synthesis of IBX derivatives that are user and eco-friendly with many of them

possessing solubility in most eco-friendly solvent of all, water. A few of the water-soluble IBX derivatives are carboxy-appended IBX derivatives 2-4. We have recently also reported the synthesis of 5-a-pentafluorosulfanyl group appended IBX derivative. Synthesis of the first hypervalent iodine reagent on a [2.2]-cyclophane framework is currently under progress in our laboratory. We believe that the transannular hypervalent linkage in 6 will modify both the solubility of the reagent as well as its reactivity. The new hypervalent reagent will be accessed via its [3.3]-dithiacyclophane precursor 7. This poster will present our progress towards the synthesis of 6.

**44 4:15pm Grad C-H Bond Chalcogenation and Oxidation of Indole**

**\*Osamah Al-Mohammed Baqer, Jin Jin [Western Illinois University]**

Indole is one of the most abundant heterocycles in nature. Its structure is found in many bioactive natural products and drug molecules. The examples of indole-containing bioactive molecules are tryptophan (one of the essential amino acids and a constituent of most proteins), indole-3-acetic acid (plant growth hormone) and serotonin (neurotransmitter). Many drug molecules also contain indole in their structures such as Imitrex, Maxalt and Ralpac for the treatment of the disease Migraine. During the past few decades, the field of C-H bond functionalization in organic chemistry has flourished. The approach is very attractive to organic chemists because C-H activation and functionalization is "greener" than conventional methods. In our research, we explored the C-H bond chalcogenation reactions of indole. We are interested in introducing chalcogen atoms to the heterocycles because chalcogens take very important roles in the biological world. All animals need significant amounts of sulfur. All animals and some plants need trace amounts of selenium and humans consume on average between 6 and 200 micrograms of selenium per day. Mushrooms and brazil nuts are especially noted for their high selenium content. Selenium and tellurium can both protect against heavy metal poisoning. Two chalcogenation products of indole were successfully prepared and characterized by NMR spectroscopy. We also found an interesting oxidation reaction of indole to give oxindole by using  $\text{TeCl}_4$  and  $\text{I}_2$ . We hope the combination of these two reagents can also be applied to catalyze other oxidation reactions.

**45 3:00pm UG Caffeine Analysis of Cold Brew Tea**

**\*Taylor Windbiel, Brian Bellott [Western Illinois University]**

One of current trends in coffee shops is the sale of cold brewed tea. This tea is not meant to be brewed in the same way as typical hot brew tea, but instead this tea is brewed over the course of 12-24 hours often times using 4-10 times the amount of tea compared to hot brewed methods. Proponents of the method boast of the smoother flavor of the tea when compared to the same tea brewed using traditional hot brew methods. Along with other students in the research group we are going to explore the caffeine content of cold brewed tea. It is our hypothesis, even with the extended brewing time and extra tea leaves, that the caffeine content will be lower in cold brewed tea than in hot brewed tea. We are going to analyze the caffeine content in the brewed teas using gas chromatography (GC). This poster will present the solid phase extraction method employed for the extraction of caffeine from brewed tea and the GC method used to quantify the amount of caffeine in the brewed teas. To determine the concentration of caffeine in the tea sample we will construct a limit of detection curve, a limit of quantitation curve and a standard calibration curve.

**46 4:15pm UG Mapping Antibiotics in Southwest Illinois from Wastewater Treatment Plants**

**\*Michael Lohman, Paisley Harper, Clayton Donald, Hannah Lupton, Danielle Goetter, Kevin Tucker [Southern Illinois University Edwardsville]**

Antibiotics are present in wastewater, surface water and ground water in America and many other countries around the world. Method development is required in order to enhance the extraction of antibiotics from wastewater. The presence of antibiotics in the greater St. Louis region will be examined to determine the removal efficiency of the antibiotics by the wastewater treatment plants (WWTPs) and to see if regions differ in what pharmaceuticals are present. Wastewater from seven different wastewater treatment plants was analyzed for the presence of antibiotics in primary and effluent sources. The samples were filtered, processed using solid-phase extraction, and analyzed using liquid chromatography mass spectrometry. From this data, geographical information was generated about the levels of antibiotics prevalent in the region. This information will lead to the development of more efficient WWTP methods for the removal of antibiotics.

- 47 3:00pm UG Development of a High Temperature Solid State Synthesis Educational Lab**  
 \*Killian Tracey, Brian J. Bellott [Western Illinois University]  
 This project is aimed at the high temperature solid state synthesis of  $M_xQ_y$  (where M is a transition metal and Q is either S, Se, or Te). Our goal is to develop an efficient synthesis of several different  $M_xQ_y$  combinations which can be conducted by undergraduate students during the course of two 3 hour teaching laboratories. Solid state chemistry is an important rising field of chemistry responsible for important advancements in technology, medicine, and more. However, the increased need for solid state chemists is rising faster than the resources for undergraduate work in solid state chemistry, thus is the reason for the development of this lab. Compounds are loaded into quartz loading vessels coated with graphene at specific ratios, sealed under vacuum with a methane-oxygen torch, and loaded into a computer-controlled furnace for one week. The results are examined and the process adjusted in order to evolve an educational lab with a high success rate.
- 48 4:15pm UG Synthesis of Group 6 Carbonyls for CO<sub>2</sub> Remediation**  
 \*Nicole Walker, Brian J. Bellott [Western Illinois University]  
 There has been a rising concern with the dramatic increase in the atmospheric CO<sub>2</sub> levels due to its role in the acceleration of Global Warming. The process of CO<sub>2</sub> reduction can convert some of this excess CO<sub>2</sub> into CO, which is useful in a wide variety of reactions; for example, the chemical manufacturing industry uses CO and hydrogen gas to synthesize methane and water. This methane is a feedstock that can be used to make plastics, fuels, and ammonia-based fertilizers. Significant research efforts have focused on using groups 7, 8, and 9 transition metals as catalysts to reduce CO<sub>2</sub>, and while these have shown a good deal of promise, the elements that have been the most effective as centers for these catalysts have been the heavier ones. This makes these catalysts poor solutions on a real-world scale due to being cost prohibitive on an industrial scale. An alternative avenue that has been studied relatively little so far is the use of group 6 metal carbonyl complexes as catalysts for the reduction of CO<sub>2</sub>. Reports have already shown that  $M(CO)_6$  (M = Cr, Mo, or W) compounds can reduce CO<sub>2</sub> with CO as the major product. There have been a small number of promising studies using group 6 metal carbonyl complexes with attached phosphine ligands, but overall there has been fairly little study of the possibility of using group 6 metal carbonyl complexes containing phosphine ligands as the catalysts for the reduction of CO<sub>2</sub> to CO. This work will present the syntheses of multiple group 6 metal complexes having different phosphine ligands attached.
- 49 3:00pm UG Development of Solid State Undergraduate Laboratory**  
 \*Mattea Scanlan, Brian Bellott [Western Illinois University]  
 Development of a solid state educational lab would allow students access to laboratories which produce many useful technologies. The major drawback associated with conducting solid state research is expertise and equipment. Many faculty themselves have not conducted any solid state research, so they do not know how to design or conduct the teaching laboratory. As for equipment, many solid state reactions require specialized furnaces, reaction vessels, high vacuum lines, microscopes, scanning electron microscopes with energy dispersive X-ray spectroscopy detection, and either a powder diffractometer or a single crystal diffractometer. To properly introduce a new laboratory would require well over \$300,000 in funds. The goal of this project is to reduce the cost of the laboratory to less than \$500 in startup and then less than \$50 in yearly operating costs for a lab of 30-50 students. This poster will discuss the process of synthesizing FeSe crystals and the best conditions for this synthesis. It will also explain why FeSe would serve as one good target for this educational laboratory project.
- 50 4:15pm UG Comparison of Hot Brew and Cold Brew Tea**  
 \*Quinn Krueel, Brian Bellott [Western Illinois University]  
 One of the biggest current trends in tea consumption is to cold brew tea instead of doing a traditional hot brew. For hot brewed tea, the tea is typically steeped in warm to boiling water for 3-7 minutes. In comparison to the well-established hot brew methods, cold brewing tea methods are still being developed. This is because many of the pleasant chemicals extracted from the tea leaves during a hot brew cannot be easily extracted with cold water. To combat this extraction problem the amount of tea leaves used is often increased and the steep time is also drastically altered. This produces a different flavor of tea, but it is not clear how the caffeine content is altered. This study will develop a standard method for the analysis of the caffeine content of differently brewed teas. The method that we will be using begins with a solid phase extraction technique to obtain an isolated caffeine sample from the brewed tea. This isolated



sample is then put through the gas chromatography process to get the intensity and reaction time of caffeine in the isolated sample. We will also be constructing a calibration curve using samples of known caffeine concentration. This calibration curve will aid us in determining the concentrations of the samples of caffeine extracted from each brewed tea. Currently we are only examining black tea leaves.

51 3:00pm UG

### **Solid State Synthesis of Copper Sulfide Using a NaCl-KCl Flux**

\*Sarah Donnelly, Brian Bellott [Western Illinois University]

A new project in our research group is the development of an educational teaching lab centered on solid state synthesis. Many modern materials are synthesized by solid state techniques. It is our aim to develop a teaching lab which will cover many aspects of solid state synthesis which can be completed during two three hour lab sections. This allows for the first week to focus on preparing the reactions, while the second week will be focused on characterization of the synthesized materials. Also the two week time frame allows for the reaction to be completed over 1 weeks' time. One of the reaction conditions we wish for the students to explore is the influence a flux can have on the reaction. This poster will discuss the optimal reaction stoichiometry, reaction temperature program, and amount of NaCl-KCl flux used to produce the highest quality single crystals. Samples will be characterized by optimal microscopy, FTIR, and X-ray single crystal structures.

52 4:15pm UG

### **A GC-FID Method for the Forensic Discrimination of Lipstick Residues**

\*Bethany Esterlen [Western Illinois University]

Previous work in our research group has been focused on the development of a lipstick extraction procedure and selecting an analytical method best suited for the forensic discrimination of forty various lipstick samples. This poster will discuss the optimal extraction method in comparison to other known chromatography methods. Previously, three different analytical methods were compared to determine which method is the optimal analytical method for the forensic discrimination of lipstick residues. The three methods previously compared were thin layer chromatography (TLC), high performance liquid chromatography (HPLC), and gas chromatography (GC). This poster will demonstrate why GC was selected, in comparison to TLC and HPLC. We will also show analysis of our statistical data to show the ability of GC-FID to discriminate lipstick shades which are indistinguishable to the naked eye.

53 3:00pm Grad

### **Discovery of Internal Standard for the Determination of Limonene in Sweet Orange (*Citrus sinensis*) Oil by Gas Chromatography**

\*Ravi Kiran Lella, Wei Chean Chuah [Western Illinois University]

Limonene content is used to classify oil of citrus rinds into different grades. The determination of limonene from industrial process streams require a method to be fast, sensitive, precise, accurate, and specific. Gas chromatographic methods for the determination of limonene are abundant throughout the literature. Both external and internal standard are used in the determination. A method with internal standard calibration is preferred due to its better precision and accuracy. The components of sweet orange (*Citrus sinensis*) oil include a wide variety of hydrocarbons, aldehydes, alcohols, esters, ketones, and some miscellaneous compounds. Anisole was previously used as the internal standard. However, our experimental results showed that it coeluted with impurities in sweet orange oil. Therefore, other alternative compounds including chlorobenzene, p-xylene, bromobenzene and acetophenone, which have never been detected in sweet orange oil, have been studied as potential internal standards in the current report. Our results showed that while bromobenzene coeluted with impurities in sweet orange oil, p-xylene and chlorobenzene eluted before all the components in sweet orange oil and acetophenone eluted after limonene without overlapping with impurities in sweet orange oil. Chlorobenzene and p-xylene were better choices than acetophenone because the developed methods were able to achieve required separation within two minutes. Validation of the method with both chlorobenzene and p-xylene showed that the methods were linear, precise, accurate, specific and stable. A forced-degradation experiment showed that sweet orange oil was degraded by heat and the limonene content could be readily determined by the validated method.

54 4:15pm Grad

### **Ionization of Polar Compounds by Nitrogen Direct Analysis in Real Time**

\*<sup>1</sup>Wei Chean Chuah, <sup>2</sup>Zhenqian Zhu, <sup>3</sup>Edward Remsen, <sup>2</sup>John E. Bartmess, <sup>1</sup>Liguo Song [<sup>1</sup>Western Illinois University, <sup>2</sup>University of Tennessee, <sup>3</sup>Bradley University]

N<sub>2</sub> has been used as standby gas in DART ion source. It is not popular used for DART analysis because the

detailed ionization mechanisms of  $N_2$  DART still remain unclear. In the present work, the detailed ionization mechanism of  $N_2$  DART for the analysis of polar compounds were investigated for the first time. The results showed that common solvents such as acetonitrile, methanol and ethanol could not be ionized by  $N_2$  DART efficiently. To achieve the best sensitivity, solvent was allowed to be evaporated before ionization of analytes by  $N_2$  DART. Therefore, the dominant ionization mechanism of  $N_2$  DART is likely the direct Penning ionization and followed by self-protonation of the analytes which result the generation of protonated ions. For the analysis of polar compounds from various representative functional groups,  $N_2$  DART demonstrated good sensitivity. Besides,  $N_2$  DART showed excellent generation of ammonium adducts at low orifice 1 voltage, which is 15 eV or lower, without aid from dopants. The ammonium ions are easily generated from ammonia in ambient air because of the less competition with other atmospheric gas species.

## COMPUTER SCIENCE

### 55 3:00pm Grad **On Optimal Approximability Results for Computing the Strong Metric Dimension**

\*<sup>1</sup>Nasim Mobasher, Bhaskar Dasgupta [University of Illinois Chicago]

The strong metric dimension of a graph was first introduced by Sebő and Tannier (Mathematics of Operations Research, 29(2), 383-393, 2004) as an alternative to the (weak) metric dimension of graphs previously introduced independently by Slater (Proc. 6th Southeastern Conference on Combinatorics, Graph Theory, and Computing, 549-559, 1975) and by Harary and Melter (Ars Combinatoria, 2, 191-195, 1976), and has since been investigated in several research papers. However, the exact worst-case computational complexity of computing the strong metric dimension has remained open beyond being NP-complete. In this communication, we show that the problem of computing the strong metric dimension of a graph of  $n$  nodes admits a polynomial-time 2-approximation, admits a  $O^*(2^{0.287n})$ -time exact computation algorithm, admits a  $O(1.2738^k + nk)$ -time exact computation algorithm if the strong metric dimension is at most  $k$ , does not admit a polynomial time  $(2 - \epsilon)$ -approximation algorithm assuming the unique games conjecture is true, does not admit a polynomial time  $(10 \sqrt{5} - 21 - \epsilon)$ -approximation algorithm assuming  $P \neq NP$ , does not admit a  $O^*(2^{o(n)})$ -time exact computation algorithm assuming the exponential time hypothesis is true, and does not admit a  $O^*(n^{o(k)})$ -time exact computation algorithm if the strong metric dimension is at most  $k$  assuming the exponential time hypothesis is true.

### 56 4:15pm Grad **Effect of Gromov-Hyperbolicity Parameter on Cuts and Expansions in Graphs and Some Algorithmic Implications**

\*<sup>1</sup>Farzane Yahyanejad, <sup>1</sup>Bhaskar Dasgupta, <sup>1</sup>Nasim Mobasher, <sup>2</sup>Marek Karpinski [<sup>1</sup>University of Illinois Chicago, <sup>2</sup>University of Bonn]

$\delta$ -hyperbolic graphs, originally conceived by Gromov in 1987, occur often in many network applications; for fixed  $\delta$ , such graphs are simply called hyperbolic graphs and include non-trivial interesting classes of “non-expander” graphs. The main motivation of this paper is to investigate the effect of the hyperbolicity measure  $\delta$  on expansion and cut-size bounds on graphs (here  $\delta$  need not be a constant), and the asymptotic ranges of  $\delta$  for which these results may provide improved approximation algorithms for related combinatorial problems. To this effect, we provide constructive bounds on node expansions for  $\delta$ -hyperbolic graphs as a function of  $\delta$ , and show that many witnesses (subsets of nodes) for such expansions can be computed efficiently even if the witnesses are required to be nested or sufficiently distinct from each other. To the best of our knowledge, these are the first such constructive bounds proven. We also show how to find a large family of  $s$ - $t$  cuts with relatively small number of cut-edges when  $s$  and  $t$  are sufficiently far apart. We then provide algorithmic consequences of these bounds and their related proof techniques for two problems for  $\delta$ -hyperbolic graphs.

## EARTH SCIENCE

57 3:00pm UG

### **Modeling Sediment Transport in a Stream Channel in Response to Increased Impervious Land Surfaces**

\*Steven Oldham, Diane M. Burns, James D. Riley [Eastern Illinois University]

Modifications to land cover have a great impact on the overall morphology of local river systems. One leading manner in which land cover is altered is through urbanization. This form of modification usually includes the placement of impermeable surfaces in areas that were naturally permeable. Such impermeable surfaces include pavement and concrete, both of which are prevalent in the construction processes associated with urban development. These new impermeable surfaces greatly influence the channel morphology of streams near and within urbanized areas. This, in part, is due to the water being concentrated into sewers and culverts and then pumped into local streams. This leads to the deepening of channels in relation to the width, a reduction in the bedload sediments transported into and within the area, a great increase in the instability of the stream banks, and a large drop in the number of barforms. To model these dramatic morphological changes, a stream table is used to form a watershed, ceramic tiles are used to mimic the urbanized impermeable surfaces, and finally a cloth is used to act as the natural ground cover through which water is naturally absorbed into the system. By studying this, one can begin to understand the importance of monitoring and studying the impacts of human development on channel morphology.

## ENVIRONMENTAL SCIENCE

58 4:15pm UG

### **Functional Validation of P450 Genes in the Human Body Louse Using the *Drosophila melanogaster* GAL4/UAS-RNAi System**

\*<sup>1</sup>Alexandra Johnson, <sup>1</sup>Gabrielle R. Smith, <sup>1</sup>Yousuf Ali, <sup>2</sup>John M. Clark, <sup>3</sup>Barry R. Pittendrigh, <sup>1</sup>Kyong S. Yoon [<sup>1</sup>Southern Illinois University Edwardsville, <sup>2</sup>University of Massachusetts, <sup>3</sup>Michigan State University]

Previously, *Cyp6CJ1*, *Cyp9AG1* and *Cyp9AG2* genes in the insecticide-susceptible human body louse were identified as P450 genes putatively associated with ivermectin tolerance and resistance. In this research, orthologous genes in *Drosophila melanogaster* (*Cyp6g2*, *Cyp9h1* and *Cyp9f2*, respectively) were selected for functional validations. Using the GAL4/UAS-RNAi technique, these *Drosophila* genes were down-regulated in F1 female flies by heat shocking them at 37 °C for 1 hr. The F1 females (heat shocked or non-heat shocked) were exposed to 1% ivermectin using the glass vial contact method to conduct a behavioral bioassay. All groups of heat shocked flies supposedly expressing dsRNAs for down-regulating *Cyp6g2*, *Cyp9h1* and *Cyp9f2* were significantly sensitive to ivermectin treatments when compared to non-heat shocked flies ( $\chi^2 = 49.04$ ,  $df = 2$ ,  $p < 0.05$ ;  $\chi^2 = 59.61$ ,  $df = 2$ ,  $p < 0.05$ ;  $\chi^2 = 57.64$ ,  $df = 2$ ,  $p < 0.05$ , respectively).

59 3:00pm UG

### **Functional Validation of ATP-Binding Cassette Transporter (ABCT) Genes in the Human Body Louse Using the *Drosophila melanogaster* (Dm) GAL4/UAS-RNAi System**

\*<sup>1</sup>Heba Megahy, <sup>1</sup>Pedro Razo, <sup>1</sup>Yousuf Ali, <sup>2</sup>John M. Clark, <sup>3</sup>Barry R. Pittendrigh, <sup>1</sup>Kyong S. Yoon [<sup>1</sup>Southern Illinois University Edwardsville, <sup>2</sup>University of Massachusetts, <sup>3</sup>Michigan State University]

Researchers previously reported that 4 ABCT genes (*ABCB6*, *ABCC4*, *ABCG7* and *ABCG10*) in the human body louse were associated with ivermectin tolerance and resistance. For functional validation, 3 Dm ABCT genes (CG1824, CG6214, and CG3227) orthologous to the body louse *ABCB6*, *ABCC4* and *ABCG7/10* genes, respectively, were selected and down-regulated using the GAL4/UAS-RNAi technique. The glass vial contact method was employed to perform behavioral bioassays in the presence of 1% ivermectin. Using the bioassay data, ivermectin sensitivities between heat shocked and non-heat shocked F1 flies were compared. Heat shocked flies supposedly expressing dsRNAs for down-regulating CG6214 and CG3217 showed significantly increased ivermectin sensitivity compared to non-head shocked flies ( $\chi^2 = 57.64$ ,  $df = 2$ ,  $p < 0.05$ ;  $\chi^2 = 7.14$ ,  $df = 2$ ,  $p < 0.05$ , respectively). However, there was no significant difference between heat shocked flies supposedly expression dsRNAs for down-regulating CG1824 and non-heat shocked flies ( $\chi^2 = 1.83$ ,  $df = 2$ ,  $p > 0.05$ ).

60 4:15pm UG

**Effect of High Sugar and DDT Induced Stress in Longevity of Wild Type *Drosophila melanogaster***

\*<sup>1</sup>Edmund Bruning, <sup>1</sup>Ronak Patel, <sup>1</sup>Yousuf Ali, <sup>2</sup>Barry R. Pittendrigh, <sup>3</sup>John M. Clark, <sup>1</sup>Kyong S. Yoo  
[<sup>1</sup>Southern Illinois University Edwardsville, <sup>2</sup>Michigan State University, <sup>3</sup>University of Massachusetts]

With increased use of insecticides in agricultural crops, non-target organisms including humans are more frequently exposed to low levels of insecticides through dietary and other sources. However, little is known about the effect of sub-lethal amount of insecticide exposure along with high calorie intake. To address this issue, a model organism, *Drosophila melanogaster* (CS-strain), was initially used to determine sub-lethal concentrations of DDT. Then, longevity of flies exposed to regular diet only, high sugar diet only, or high sugar diet plus sub-lethal amounts of DDT was recorded. Significantly decreased longevity of flies exposed to high sugar diet only was found when compared to flies maintained with regular diet (log rank survival analysis,  $p < 0.05$ ). Additionally, significantly decreased longevity of flies exposed to sub-lethal amounts of DDT plus high sugar was determined compared to control flies exposed to high sugar diet only (log rank survival analysis,  $p < 0.05$ ).

61 3:00pm Grad

**Cellular Adsorption and Speciation of Selenium by *Pseudomonas fuscovaginae* from Nanoscale Elemental Selenium Particles**

\*Frantz B. Joseph, Stefan Jones, Eric Voss, Kevin Rowland, and Z.-Q. Lin [Southern Illinois University Edwardsville]

Nanoparticles with a diameter of 0-100 nm display unique physical and chemical properties. Although elemental selenium (Se) is generally not water soluble and thus, not bioavailable, our previous studies showed that nanoscale elemental Se particles (SeNPs) can be absorbed and volatilized by soil bacterial *Pseudomonas fuscovaginae* that was isolated from a Se hyperaccumulator plant *Stanleya pinnata*, which is significantly higher than bulk/non-nanoscale elemental Se. However, it is not clear if elemental SeNPs have been bio-transformed by *P. fuscovaginae* and how much Se from SeNPs have been accumulated internally in bacterial cells compared to the amount of Se adsorbed or deposited on cell surfaces. To answer these specific research questions, this laboratory study applied chemically synthesized elemental SeNPs to the bacterial cultural solution, and used the synchrotron-based X-ray Absorption Near-edge Spectroscopy (XANES) to determine potential Se chemical form changes derived from the bacterial strain. Atomic Force Microscopy (AFM) was used to observe SeNPs adsorbed on bacterial cell surfaces under natural (i.e. no sample fixation and dehydration) and ambient conditions, while Scanning Electron Microscopy (SEM) coupled with Energy-dispersive X-ray spectroscopy (EDX) was used to characterize Se adsorbed on the surface of the bacterium. This study also determined the effectiveness of different washing procedures to remove the adsorbed Se from cell surfaces. The research findings from this study would provide insight into better understanding the biogeochemistry of Se in polluted soil and water environments.

62 4:15pm UG

**Quantification of Lead in Central Illinois Birds of Prey and their Avian Prey Base**

\*<sup>1</sup>Shelby Chesko, <sup>1</sup>Travis Wilcoxon, <sup>2</sup>Jane Seitz, <sup>2</sup>Jacques Nuzzo [<sup>1</sup>Millikin University, <sup>2</sup>Illinois Raptor Center]

Studies of raptors across the United States have revealed lead poisoning linked to human activities. Lead has negative neurological and hematological impacts on birds. 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. We collected blood samples from raptors admitted to the Illinois Raptor Center in Decatur, Illinois for rehabilitation from March 2014 to February 2017 and determined lead content with an ESA LeadCare II lead analyzer. We tested if lead toxicity appears with a frequency among species that differs from random. We also used spatial autocorrelation analyses to determine if birds that were positive for lead were associated with specific hunting regions and matched the results of the spatial autocorrelation analyses with public hunting data found through the Illinois Department of Natural Resources. After finding that non-scavenging species, such as Cooper's Hawks, frequently showed high levels of lead, we also tested blood samples from common prey species in the area for lead. Lead toxicity does appear among species at a rate that differs from random, with scavengers representing the highest proportion of high lead individuals. We also found that there was no significant association between Hunting Region 3 and 4, despite substantial differences in hunting activity. Further, we found evidence that lead is prevalent in the living prey base of many of these species, particularly in urban pigeons. Overall, our work provides better understanding of the

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

## MICROBIOLOGY

- 63 3:00pm UG Association between Endobacteria in Orchid Mycorrhizal Fungi and Promotion of Orchid Seed Germination**  
 \*Gian Villagomez, Lawrence W. Zettler, Laura Corey [Illinois College]  
 The presence of endobacteria in the mycorrhizal fungi of crop plants has been shown to promote growth and nutrient utilization. However, the role endobacteria play with regards to the function of orchid mycorrhizae is not well understood, particularly with respect to the ability of the fungal strains to support germination. Orchids depend upon mycorrhizal fungi for germination, and efforts to conserve and reintroduce endangered orchids can be enhanced by optimizing symbiotic germination. Mycorrhizal fungi isolated from the roots of mature orchid show a range of germination-promoting activity. To determine a correlation between the presence of endobacteria and the ability to promote germination, we are carrying out a survey of known super-germinators as well as closely related strains that do not promote germination. Based on 16S ribosomal sequences, we find that the super-germinator strains have endobacteria, while the poor germinators lack endobacteria.
- 64 4:15pm Grad Yellow Fever Virus Infectivity of the Innate Immune System Using Axl Receptor**  
 \*Abiola Oladapom, Catherine Miller-Hunt [Western Illinois University]  
 Arboviruses are known to utilize members of the tyrosine kinases receptors especially of the TAM family for their mechanism of viral entry and subsequent cell infection. Some Arboviruses are known to interact with the N-terminal immunoglobulin-like portion of the Axl-receptor resulting in tyrosine phosphorylation of the Axl receptor which then enhances viral infection. This research project is aimed at understanding the infectivity and cell tropism mechanism of Yellow fever virus (YFV) through Axl receptor and Macrophage 1 and Macrophage 2 (M1 and M2)-Axl dependent entry. I will first conduct virus cultivation to propagate the virus and demonstrate western blotting for viral protein expression, Enzyme Linked Immunosorbent Assay (ELISA) for virus purification and YFV titre determination. Antibody inhibition assays will be conducted to determine if Axl-specific antibodies can block YFV binding and entry into human cells. I will also isolate monocytes from voluntary blood donors and differentiate them into M1 and M2-subset macrophages to investigate M1 and M2- Axl dependent entry. A significant data result for the interaction between YFV and M1 and M2 -Axl receptor will provide information about how YFV uses macrophages for infection and how Axl-specific antibodies can be used to block YFV binding.
- 65 3:00pm UG Metabolic Characterization of *Saccharomyces cerevisiae* strain ATCC 96581**  
 \*<sup>1</sup>Brooke Greiner, <sup>2</sup>Dalton William, <sup>1</sup>Kai Hung [<sup>1</sup>Eastern Illinois University, <sup>2</sup>Illinois State University]  
 Cellulosic ethanol fermentation is an important area of research for sustainable energy development. The processes required to chemically break down cellulosic material typically creates an acidic hydrolysate (pH ranging from 4 to 6) containing acetate (mM range). Organisms capable of fermenting carbohydrates in this type of hydrolysate into ethanol are valuable assets for renewable energy. Strain ATCC 96581 was isolated in 1992 with a reported capacity to grow at low pH and consume xylose, a common component of cellulosic hydrolysate. Under duplicate trials, optical density and hemocytometer measurement of growth using Yeast Peptone Dextrose, Yeast Peptone Xylose, Yeast Minimal Medium Dextrose, and Yeast Minimal Medium Xylose at neutral pH did not demonstrate metabolic activity on xylose. High-performance Liquid Chromatography analyses confirmed the growth data, as well, with no statistically significant ( $p > 0.05$ ) consumption of xylose between the start and the end of growth experiments. Further analysis carried out at different pH and growth conditions will be carried out to confirm the strain's metabolic capacity.
- 66 4:15pm Grad Detection of Antibiotic Resistance Loci in Wastewater Samples**  
 \*Mohammed Almalki, Sunil Pandey, Kai Hung [Eastern Illinois University]  
 The spread of antibiotic resistance poses a severe and pressing threat to public health. In municipal wastewater treatment plants, microbial flora from city residents mingle during treatment, thus enabling lateral gene transfer events such as transformation and transduction where antibiotic resistance loci can be

exchanged within and between microbial species. In this student, wastewater samples from municipal plant were collected at different stages of treatment and the total DNA were extracted to be used in PCR-based detection of beta-lactamase (*bla*) resistance loci. Preliminary data suggested that wastewater samples contain high level of impurity that suppresses PCR reactions. Current work aims to resolve the PCR inhibition problem and to obtain data on the presence of *bla* loci in wastewater samples.

67 3:00pm UG

### **Determining Nutritional Needs of an Acidophilic Archaeal Organism**

\*Justin Chang, Caitlin Acree, Kai Hung [Eastern Illinois University]

*Ferroplasma acidarmanus* (fer1) is an archaeon that grows in a highly acidic environment (pH 0 to pH 3), with an optimal growth environment at pH of 1. Currently, this organism is cultured in a complex medium containing yeast extract and ferrous sulfate as the major source of energy. Since yeast extract contains many different components of undefined mixtures of amino acids, trace metal elements, and other growth-promoting material, the growth medium creates many variables and makes it difficult to fully understand what the physiology of this organism. In this report, different formulations of the growth medium where the yeast extract component is replaced were tested to find the defined medium composition suitable for fer1. Our data showed that fer1 cannot grow at 0.01% yeast extract or below. Further, the medium designed for *Helicobacter pylori* also failed to support fer1 growth. Currently we are investigating the effects of addition of purine bases to the media. Serial transfer of growth medium will be carried out to eliminate carry over effects and multiple trials will be conducted to obtain statistically significant outcomes.

68 4:15pm Grad

### **Role of Axl Protein in the Infection of Innate Immune Cells by Dengue Virus**

\*Samson Olaitan Omole, Catherine Miller-Hunt [Western Illinois University]

Dengue virus (DENV), is among the Flaviviridae family and genus *Flavivirus*, it is transmitted by *Aedes aegypti* and *Aedes Albopictus* mosquitoes. The virus has been reported to be one of the major causes of illness and mortality in the tropical and subtropical regions. Despite the efforts to know and determine the molecules that are responsible for the interaction between DENV and host cells, yet no receptor has been identified. Studies have shown that DENV and Zika virus (ZIKV) are closely related, resulting in substantial antigenic overlap and AXL protein is involved in endocytosis of ZIKV. This study is designed to determine if AXL protein is required for DENV entry and pathogenesis. The DENV titer will be determined via plaque assay. The immunoprecipitation of the virus with recombinant human AXL protein to determine if they bind to each other. Monocytes will be extracted from human blood and differentiate into Macrophages I and II in the presences of cytokines after 6 days of incubation. The Macrophages I and II will be used to determine the subsets necessary for infection. If DENV binds to the AXL protein, this will help us to understand more about Dengue virus entry and its pathogenesis. Identifying the mechanism(s) behind DENV cellular receptor usage may open the door to one or more ways that DENV infection can be manipulated therapeutically.

69 3:00pm UG

### **Housekeeper or Homewrecker? Characterizing Bacteriophages and Investigating their Effects on Amoeba-Burkholderia Symbiosis**

\*Lance Price, Susanne DiSalvo [Southern Illinois University Edwardsville]

Bacteriophages are virus that specifically infect bacterial cells. They are typically very selective, only infecting a narrow range of bacterial species or strains. Bacteriophages are promising as potential alternatives to antibiotics. They also have been shown to affect the interactions between symbiotic bacteria and their hosts. Such alterations can be negative or positive, either causing symbiont population to decrease, or resulting in the transfer of some new function contained within the viral genome. This is of particular interest to our lab because our research focuses on understanding bacterial-eukaryotic interactions and the influence of conditional alterations on their dynamics using a simple eukaryote-bacteria symbiotic model. Specifically, we study the interaction between *Dictyostelium discoideum*, a common amoeba found in the soil, and symbiotic isolates of *Burkholderia* bacteria. Two *Burkholderia* clades are used in our research that have been shown to influence amoebas and over time change their interactions with bacteria. We isolated distinct *Burkholderia* strains that differ in their interactions with their hosts. We isolated bacteriophages specific to these *Burkholderia* strains and have successfully isolated a phage that infects the B859 strain of *Burkholderia*. We are conducting more research to characterize this bacteriophage and determine its spread of infection and are in the process of isolating bacteriophages specific to other *Burkholderia* strains. Future research will explore the symbiotic relationship between *Dictyostelium discoideum* and *Burkholderia* to determine if there are any positive or negative influences on their symbiotic interaction during exposure to *Burkholderia*-

specific bacteriophages.

- 70 4:15pm Grad The More the Merrier? Secondary Bacterial Infections in the *Dictyostelium-Burkholderia* Symbiosis System**  
 \*Niloufar Khojandi, Susanne DiSalvo [Southern Illinois University Edwardsville]  
 Symbiotic interactions are pervasive and have played a pivotal role in the evolution of eukaryotes. The outcomes of symbiosis are diverse and may be influenced by host and symbiont genotypes as well as the surrounding ecosystem. The symbiosis between *Burkholderia* bacteria and the soil amoeba *Dictyostelium discoideum* can serve as a tractable model to unravel basic questions concerning symbiotic relationships. *Burkholderia* symbionts infect amoeba cells and impart conditional costs and benefits to their amoeba hosts. Interestingly, *Burkholderia* infection appears to increase amoeba susceptibility to secondary bacterial infections. Our goal is to understand how other bacteria effect amoeba fitness and how co-infection relates to secondary bacterial identity and *Burkholderia* identity. In order to answer these questions, we have analyzed the *Burkholderia-Dictyostelium* symbiosis system in co-culture with a variety of additional bacterial species. We labeled *Burkholderia* with red fluorescent protein and secondary bacteria species with green fluorescent protein to observe co-infections through confocal imaging. Concurrently, we measured host fitness by counting amoeba spore productivity after co-culture. Our preliminary observations suggest that the degree of secondary bacterial induction is dependent both on *Burkholderia* and secondary bacteria identity. For instance, *Burkholderia* 70 elicits more secondary bacterial infections than other *Burkholderia* isolates. Furthermore, fitness measurements suggest that *Burkholderia* infections may have different consequences on host fitness under different co-culture conditions.
- 71 3:00pm Grad You Can Count on *Dictyostelium*: Using Flow Cytometry to Measure Parameters of *Burkholderia* Infection**  
 \*Jacob Miller [Southern Illinois University Edwardsville]  
 In symbiosis, (the living together of unlike organisms) the line between mutualism and parasitism can be thin. The eukaryotic-bacteria interaction between *Dictyostelium amoeba* and *Burkholderia* bacteria can be used as a simple model system to study symbiosis. This system may be extrapolated to understand interactions between more complex organisms. *Burkholderia* symbionts were initially identified in wild *Dictyostelium* isolates. In the lab, we can disrupt infections through antibiotic treatment and induce new infections by exposing *Dictyostelium* to *Burkholderia*. Interestingly, infection of *Dictyostelium* may be beneficial or detrimental depending on context and infection outcomes are influenced by *Burkholderia* genotype. Thus, *Burkholderia* symbionts are phylogenetically and phenotypically distinct. Microscopy studies demonstrated that *Burkholderia* symbionts intracellularly infect hosts. Typically, we investigate the dynamics and consequences of *Burkholderia* infections by measuring *Dictyostelium* fitness via hemocytometer counts and visualizing infection processes through fluorescent microscopy. Although powerful, these methods are not high-throughput and thereby limit data collection. The goal of my project is to develop flow cytometry methods to analyze spore counts and infection parameters using a collection of phylogenetically distinct fluorescently labeled *Burkholderia* isolates. This method will allow us to rapidly count host and symbiont cells and thereby gather a plethora of information about *Burkholderia* infection dynamics. Once assays are developed and confirmed, I will investigate several components of the infection cycle, such as: the spread of infection in host populations, host and symbiont growth rates, host cell death rates, how infection dosage influences fitness, and how altered growth conditions shift the parameters of infection. Here I discuss and present my initial results using flow cytometry to measure host fitness and the degree of *Burkholderia* infections in host populations.
- 72 4:15pm UG Fluorescent Staining of Nuclei in the Basidiospores and Hyphae of *Schizophyllum umbrinum***  
 \*Morgan Shanahan, Ryan Momenteller, Thomas Fowler [Southern Illinois University Edwardsville]  
*Schizophyllum umbrinum* is a fungal species that displays a homothallic life cycle in which an individual that can form fertile mushrooms without the need for a mate. Unlike the more commonly studied heterothallic *Schizophyllum commune*, much remains unknown about reproduction in *Schizophyllum umbrinum*. An area that has not been sorted out sufficiently is in the details of presumed mating and sexual reproduction of this species because of its homothallic nature. To better understand how *S. umbrinum* reproduces, we set out to stain nuclei with DAPI within the basidiospores of this species and count the number of nuclei that are within them. The typical pattern of nuclei in the spores were compared to the sister species *S. commune*. Spores

in *S. umbrinum* usually have two nuclei inside a single spore, which is the same pattern of nuclei in the spores of *S. commune*. This result suggests that meiotic and mitotic divisions in *S. umbrinum* may be patterned similar to those seen in *S. commune*. In addition, we have set out to stain the hyphae of *S. umbrinum* to determine their nuclear status. One previous study reported an approximately equal mixture of cells with one or two nuclei, and rarely greater than two nuclei. We intend to do this using calcofluor-white to stain the chitin in the hyphal cell wall to delineate cell boundaries and DAPI to stain the nuclei inside to achieve nuclear counts.

## PHYSICS, ASTRONOMY, & MATHEMATICS

73 3:00pm UG

### Assessing the Detectability of Planet Nine with ALMA and the VLA

\*Richard Lambert, E. D. Araya [Western Illinois University]

The possibility of a ninth planet in our Solar System has been one of the most intriguing results of the last few years in astronomy. Trujillo & Sheppard (2014) reported that a new planet could exist in the outer Solar System based on the peculiar orbits of trans-Neptunian objects. Millholland & Laughlin (2016) predicted that Planet Nine may have a mass between 6 and 12 Earth masses, and a semi-major axis of ~654 AU. The goal of this project is to estimate the observing time required by ALMA and the VLA to detect this putative planet. Assuming a mass range of 6 – 12 Earth masses, a semi major axis range of 300 – 800 AU, a 0.0 albedo, and that the surface temperature of the planet is in equilibrium with Solar radiation, we can estimate the surface temperature of the planet and use the Rayleigh-Jeans Law to find the flux density of the planet at different observing bands available with ALMA and the VLA. Using the sensitivity calculators available on the ALMA and VLA websites, we estimated the time required to detect the planet at frequencies ranging from 45 – 950 GHz in a single pointing. We then estimated the total time required to detect the planet assuming a blind search in the area suggested by Millholland & Laughlin of  $2\text{h} \leq \text{RA} \leq 3\text{h } 20\text{m}$  and  $-20^\circ \leq \text{Dec} \leq 20^\circ$ . In this work, we present the results of our calculations and discuss how realistic is to detect Planet Nine based on interferometric observations.

74 4:15pm Grad

### H<sub>2</sub>CS Absorption in the High Mass Star Forming Region G34.26+0.15

\*Wei Siang Tan, Eesterban. D. Araya [Western Illinois University]

High-mass stars have masses greater than 8 solar masses and are the main source of heavy elements such as iron in the interstellar medium. This type of stars form in giant molecular clouds. Studying the molecular environment in star-forming regions is crucial to understand the physical structure and conditions that lead to the formation of high-mass stars. Thioformaldehyde (H<sub>2</sub>CS) is among the molecules found in star forming regions. We present observations of H<sub>2</sub>CS toward the high mass star-forming region G34.26+0.15. We detected an H<sub>2</sub>CS absorption line at the rest frequency of 6278.65 MHz. We used the radiative transfer code RADEX to investigate the physical conditions of the molecular cloud responsible for this absorption line. We explored different models based on a range of temperatures, densities, abundances and physical sizes, and conclude that the absorption is most likely tracing the molecular envelope of the ionized region in G34.26+0.15.

## ZOOLOGY

75 3:00pm UG

### Patterns of Gene Expression of *wingless* and *defective proventriculus* in Three Genera of Stalk-Eyed Flies (Diopsidae) Exhibiting Varying Levels of Sexual Dimorphism

\*Melissa Uhl, Jaime L. Grace [Bradley University]

Sexual dimorphism is prominent within the animal kingdom, with many examples of armaments and ornaments used to fight for or attract members of the opposite sex. This type of sexual dimorphism is commonly seen in males of the species wielding exaggerated traits that are selected for by females. This sexual selection drives the evolution of increasing sexual dimorphism within a species. The family Diopsidae contains many species of stalk-eyed fly, which hold a range of sexual dimorphism patterns in regards to length of eyestalks. Some species are monomorphic by which females and males appear identical, and other species are extremely dimorphic with males possessing eyestalks greater than the length of their body. The evolutionary origin of these patterns of monomorphism and dimorphism are disputed among the scientific



community. Two genes, *wingless* and *defective proventriculus*, are thought to be involved in head development in these flies. This study seeks to discover if the expression of these genes correlate with eyestalk length in three species of stalk-eyed flies with varying levels of dimorphism. Quantitative polymerase chain reaction methods will be used to determine gene expression levels within the head tissue of male and female adult *Spyracephala beccari*, *Teleopsis dalmanni*, and *Diasemopsis meigenii*. A correlation of gene expression levels and eyestalk length would suggest a mechanism for the evolution of dimorphism in stalk eyed flies and involvement of these genes in eyestalk development.

**76 4:15pm Grad The Effects of Elevated Serotonin on Antipredation Behavior in Sexually Dimorphic Stalk-Eyed Flies (*Teleopsis dalmanni*)**

\*Nadia Lovko, Jaime L. Grace [Bradley University]

The outcomes of aggressive interactions have demonstrable fitness consequences. For example, aggression levels affect survival rates during encounters with predators and determine access to resources and mating opportunities through intraspecific competition. Despite the fitness implications of aggression, much is still unknown about the underlying mechanisms. The biogenic amine serotonin has been implicated in modulating aggression and has been shown to influence intrasexual competitions. This project uses the stalk-eyed fly (*Teleopsis dalmanni*) to quantify the effects of elevated serotonin on insect aggression when facing a generalist predator. The effects of elevated serotonin levels on antipredation behavior and individual survival will be evaluated using forced proximity experiments with jumping spiders (*Phiddipus johnsoni*).

Furthermore, quantitative PCR will be used to measure gene expression of the different serotonin subreceptors found in the insect brain to learn more about the relative roles of specific receptors in modulating aggressive behavior. The objectives of this project are to (1) systematically measure the baseline aggression levels in male and female stalk-eyed flies in a predator-prey interaction, (2) measure the aggression levels in male and female stalk-eyed flies in a predator-prey interaction when serotonin levels are elevated, (3) measure the expression of serotonin and serotonin receptors in the flies following interactions to ensure serotonin levels are being altered by the treatment and to see which receptors are being affected, (4) examine the relationship between elevated serotonin levels and survival in both males and females, (5) examine how elevated serotonin influences behavioral transition frequencies in males and females, and (6) examine how the effects of elevated serotonin differ between males and females.

**77 3:00pm Grad The Effects of Artificial Breeding Pools on the Reproductive Success of Illinois Chorus Frogs (*Pseudacris illinoensis*)**

\*Kevin Helenthal, Richard Essner [Southern Illinois University Edwardsville]

Illinois Chorus Frogs (*Pseudacris illinoensis*) are found in Southeast Missouri, Central and Southern Illinois, and Northeastern Arkansas. This species has been declining across its range due to habitat loss from agricultural and urban development, resulting in its threatened status in Illinois. While the Illinois Department of Natural Resources (IDNR) has spent the past couple decades purchasing and restoring the sand prairie habitat that this fossorial frog needs for burrowing during the non-breeding season, efforts to restore the ephemeral pools these frogs use for breeding, have met with limited success. At the IDNR mitigation site on Sand Rd. in Madison County, IL, where a population of ~400 Illinois Chorus Frogs resides, a poorly restored wetland has been invaded by bullfrogs and fish. The presence of these predators, has limited reproductive success on the site and forced frogs to migrate to more suitable breeding habitat across a high-traffic road, leading to increased mortality. In an effort to improve survival and reproduction of this threatened species, we plan to establish an array of artificial ephemeral pools on the mitigation site (n=40) to increase available breeding habitat. In addition, we will attempt to reduce levels of predation by applying predator barriers to half of the pools (n=20). We will monitor pools on a daily basis through surveys of adults and tadpoles, to assess the effectiveness of the pools. In addition, we will monitor the use of the pools by other amphibian species, including Western Chorus Frogs, *Pseudacris triseriata*, and Spring Peepers, *Pseudacris crucifer*, which may also benefit from the presence of the pools, thereby improving species richness on the mitigation site.

**78 4:15pm Grad Movement Patterns of the Illinois Chorus Frog, *Pseudacris illinoensis*, in Southwestern Illinois**

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

Populations of the Illinois Chorus Frog, *Pseudacris illinoensis*, have been devastated by degradation of wetlands due to development of agriculture as well as industry. *P. illinoensis* is a fossorial frog that spends

most of its life underground, only emerging to breed in early spring. 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 in decline in the rest of their range. 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. Due to their fossorial lifestyle not much is known about where their burrowing sites are, to conserve this species we must be able to identify its post breeding habitat. The purpose of this study is to identify burrowing sites as well as areas of high chorus frog traffic. One common cause of death for these frogs is getting hit by cars as they are traveling from their burrows to the ponds, identifying areas of high amphibian traffic may allow us to better protect these frogs and other native amphibians. Frogs were captured by hand and weighed, sexed, and measured for SVL. At this time they were also fitted with a radio transmitter and then tracked until they returned to their burrowing sites or the transmitter was removed. During the first year of this study we identified burrowing sites on the mitigation site but also on private property, including agricultural fields. A predation event was also recorded when a common garter snake ate a frog with a transmitter on. This year I will have twenty transmitters, I will be using ten of them to track movement to the ponds and ten to track movements back to their burrowing sites. The tracking data will be put into a GIS program to map burrowing sites and hopefully identify travel corridors.

79 3:00pm Grad

### **Home Range and Microhabitat Preference of the Eastern Box Turtle, *Terrapene carolina***

\*Samantha Sorrick, Richard Essner [Southern Illinois University Edwardsville]

The Eastern Box Turtle, *Terrapene carolina*, is a species that has seen declines exceeding 30% in the last several decades, despite the fact that many people consider it to be common. It is listed on IUCN as "vulnerable", just one step away from being considered endangered. There are many factors contributing to the Eastern Box Turtle's decline, but perhaps the most important among them is habitat destruction. In order to create management plans to conserve this species, populations must be monitored and assessments of their habitat needs and usages should be studied. The objectives of this study are to determine: 1) average home range of turtles by sex and age class; 2) habitat and microhabitat preferences; and 3) daily and seasonal activity patterns, for a population of Eastern Box Turtles on the SIUE campus. I hypothesize that 1) the preferred habitat of the tracked turtles will be woodland areas, and 2) preferred microhabitats are utilized in relation to temperature fluctuations. Based on data from previous studies, I expect to see a home range of about 2 - 7 hectares, 4.9 - 17.3 acres. Home range and habitat preferences will be determined by use of radio telemetry. Turtles will be caught opportunistically across campus, fitted with a radio transmitter, and tracked weekly with a radio receiver. Individuals will also be notched with a lettering system in order to determine identity. GPS locations, habitat assessments, and individual measurements will be taken at the time of tracking. The results of this study should provide useful information for management plans of local Eastern Box Turtles by telling how much area this population utilizes and what its microhabitat usages and needs are.

80 4:15pm Grad

### **Population Demography of the Eastern Narrowmouth Toad *Gastrophryne carolinensis* in Southwestern Illinois**

\*Corrinne O'brien, Rick Essner [Southern Illinois University Edwardsville]

The current status and distribution of the state-threatened Eastern Narrowmouth Toad, *Gastrophryne carolinensis*, is poorly known in the state of Illinois. Historically populations have been observed from six southern counties within the Mississippi floodplain, however recent studies have observed *G. carolinensis* in only two counties, Monroe and Randolph (Phillips et al. 1999). Populations are commonly located throughout the southeastern and midwestern United States, but are rare in Illinois which is at the edge of their natural range. Illinois populations not only suffer from isolation, but also face habitat loss due to urbanization. Populations of *G. carolinensis* will be monitored through a mark-recapture study utilizing passive integrative transponder (PIT) tags. Captured individuals will be implanted with 7.0mm Loligo Systems PIT tags in the dorsal lymphatic sac. Study sites are located within the bluff corridor of Monroe County, Illinois managed by the Illinois Department of Resources and monitored through the Clifftop Alliance organization. Sites include Fults Hill Prairie Nature Preserve, Kidd Lake Marsh State Natural Area, DeMint Memorial Hill Prairie, and Renault Herpetological Area. Other privately owned areas of interest within the Illinois Nature Preserve system include Salt Lick Point Land and Water Reserve, White Rock Nature Preserve, Angela's Prairie Nature Preserve, and Brickey-Goenterman Nature Preserve. I will visit sites multiple times

during the breeding season in order to estimate population size using the Jolly-Seber method for open populations, as well as demographic features of the population including survival, age class, and sex ratio.

81 3:00pm UG

### **Monk Parakeet Nests Provide a Moderate Microclimate that could Reduce Thermoregulatory Costs During the Summer**

\*Daniela Hernandez, Christopher Appelt [St. Xavier University]

Monk parakeets (*Myiopsitta monachus*) are native to South America, but they have successfully colonized areas around the world. This may be due in part to the fact they are the only species in the family Psittacidae that constructs colonial stick nests they use year-round for roosting. Since these birds evolved in tropical and temperate climates, the nests may play a part in moderating thermoregulation costs. Monk parakeets have been successfully nesting in the Chicago area since 1970 and are subjected to both hot summers and cold winters. For this study, we tested the potential for nest chambers to provide a moderate microclimate during the summer, which can result in hot days and relatively cool evenings. We placed Thermocron iButtons, which are temperature data loggers, into two nests (including one with nestlings) in two different deciduous trees in Bridgeview, Illinois. We placed a control data logger approximately 20 cm away from each nest to compare temperature fluctuations both inside and outside the nests for four weeks (29 June to 27 July, 2016). Within nest temperatures were cooler on average by 5.2°C compared to the outside during peak daytime high temperatures and warmer by 2.5°C compared to low overnight outside temperatures. This is the first temperature data collected from wild monk parakeet nests and the first ever collected during the summer. Our data demonstrate monk parakeet nests may reduce thermoregulatory costs in summer. Future work will examine nest temperatures during the winter.

82 4:15pm Grad

### **Handedness is Not Linked to Asynchronous Locomotion in a Basal Anuran**

\*Rachel Sullivan, Richard Essner [Southern Illinois University Edwardsville]

Frogs exhibit a range of locomotor behaviors which can be broadly grouped based upon limb movement patterns. Asynchronous behaviors are those that involve alternating limb movements and include crawling, climbing, burrowing, and asynchronous (trot) swimming. Synchronous behaviors are those that involve simultaneous limb movements and include jumping, lunge feeding, and synchronous (frog-kick) swimming. The degree of handedness (preferential limb use) in motor responses is thought to reflect functional lateralization of the brain, an indicator of neural complexity. Handedness has been examined across a range of anuran taxa and has been hypothesized to be related to a species' preferred locomotor mode, with greater handedness predicted in species that make more extensive use of asynchronous locomotion. In contrast, it has been hypothesized that anuran handedness varies phylogenetically, with ambidexterity being the ancestral condition and handedness being derived. To date, research in this area has focused primarily on derived taxa and relatively little is known about basal taxa. The basal-most anuran family Leiopelmatidae is the sister group to all other frogs (Lalagobatrachia), and represents an excellent test of these competing hypotheses. Moreover, leiopelmatids rely exclusively on asynchronous swimming and likely exceed all other anuran taxa in their reliance on alternating limb movements during locomotion. We tested these competing hypotheses by examining handedness in two behaviors, righting response and trot-swimming, in the leiopelmatid Rocky Mountain Tailed Frog, *Ascaphus montanus*. Tailed Frogs showed no evidence of handedness despite the prevalence of asynchronous locomotion in their behavioral repertoire. The absence of handedness in a highly asynchronous basal anuran taxon, suggests that this phenomenon was not characteristic of the earliest frogs, but rather appeared later in the evolutionary history of the group.

83 3:00pm Grad

### **Estimating Mesopredator Density and Evaluating Trophic Relationships in Southwestern Illinois**

\*Jacob Kaiser, Peter Minchin [Southern Illinois University Edwardsville]

Trophic interactions are an important factor influencing species composition in many ecosystems with higher trophic levels often exerting pressure on lower levels and regulating their population sizes. In areas with few or no top predators, mesopredators may be released from predation pressure, resulting in higher mesopredator predation on lower trophic levels. This is known as the mesopredator release hypothesis (MRH). This study examines the correlation between abundance of mesopredators and the abundance of other components of their communities at three sites in southwestern Illinois and test the MRH. Several sites will be surveyed across a land-use gradient using a random encounter model (REM) to estimate densities of species from camera trap data. Density and diversity of small mammals and birds will be estimated to

determine effects of mesopredators on their prey. Coyote (*Canis latrans*) density will also be estimated to determine effects of a top level predator on mesopredator densities. Initial camera trap surveys were conducted during fall 2016 (October 1st -November 31st) at three sites: Sweet William Woods (SWW) on the campus of Southern Illinois University Edwardsville, the John M. Olin Nature Preserve (JO) in Godfrey, IL, and a private property (PP) located north of Edwardsville, IL. SWW had the highest estimated density of raccoons, *Procyon lotor*, (13.9 individuals/km<sup>2</sup>) and the lowest density of coyotes (0.18 individuals/km<sup>2</sup>) whereas JO and PP both had similar raccoon densities (4.9 and 5.1 individuals/km<sup>2</sup> respectively). The high raccoon density at SWW may be due to the low density of *C. latrans* or the availability of food in trash bins around the campus. Virginia opossum (*Didelphis virginiana*) density was similar between JO and SWW (5.1 and 5.3 individuals/km<sup>2</sup>) and higher at PP (9.8 individuals/ km<sup>2</sup>). JO had the highest reciprocal Simpson's diversity index of mesopredators (2.27), with PP (2.11) and SWW (1.37) being lower. Two deer mice (*Peromyscus maniculatus*) were trapped on PP and JO. Bird diversity was highest in JO (12.58) with PP (10.63) and SW (9.66) being lower. Additional survey periods will be conducted in spring and summer 2017. The results of this study could be used to inform land managers whether or not their areas are experiencing the effects of the MRH and how to proceed in order to rectify it.

84 4:15pm UG

### **Comparison of Avian Communities of Mature and Regrowth Oak-Hickory Forest in Southwestern Illinois**

\*Matthew Hunsaker, Peter Minchin [Southern Illinois University Edwardsville]

Prior to European settlement, Illinois was a mosaic of oak-hickory forest and tall-grass prairie. During the 1800s many European settlers moved west, converting the prairies to agricultural land, while nearly all the forests were cut for fuel and building materials. Southern Illinois University Edwardsville (SIUE) was developed on agricultural land and this has since allowed for large areas of forest to regrow since the 1960s. This study was conducted in order to compare the difference in avian communities between mature regrowth forest and younger regrowth. The bird data analyzed was from a previous study in 2008, using density estimates from fixed-distance point-count surveys conducted on a network of 130 plots throughout SIUE campus forest areas and adjacent Bohm Woods Nature Preserve. The plots were originally set up in 2006 for vegetation monitoring and a habitat study of the southern flying squirrel. Using estimates of forest age in each plot derived by another project using historic aerial photos, this study compared regrowth forest aged 45 years or less (young regrowth) to forest aged at least 60 years (mature regrowth). An ordination using non-metric multidimensional scaling (NMDS) was used to plot the difference in bird community composition among plots. This gives a coordinate diagram in which the distances between plots indicate how different the avian communities are. Analysis of similarities (ANOSIM) was used to test whether the two forest groups have the same bird community. Both the ANOSIM test and the ordination used the Bray-Curtis dissimilarity index. Indicator species analysis (ISA) was then used to determine which species typified each group. The two forest groups overlapped broadly in the ordination but their centroids appeared offset. ANOSIM showed that the young and mature regrowth forests had different avian communities ( $R = 0.068$ ,  $P = 0.0001$ ). ISA found seven significant indicator species ( $P < 0.1$ ) for each of the two groups. Younger regrowth indicators were common "backyard birds", the American Goldfinch, Bluejay, Eastern Towhee, Gray Catbird, Northern Cardinal, Northern Parula, and Philadelphia Vireo. The mature forest indicators were species more likely to require the interior habitat of mature forest. They were the Acadian Flycatcher, Chestnut-sided Warbler, Hairy Woodpecker, Red-eyed Vireo, Ruby-throated Hummingbird, Swainson's Thrush, and Wood Thrush. These results contribute to our understanding of the relationship between oak-hickory forest age and avian community makeup. Specifically, management of forest on SIUE campus should take into account that regrowth at least 60 years of age is required to provide habitat suitable for mature forest species.

85 3:00pm UG

### **Short Term Effects of Heat and Hypoxia on Zebra Mussels**

\*Katie Eckhoff, Madison Baer [Bradley Illinois]

Sessile aquatic invertebrates are particularly vulnerable to physiological changes caused by fluctuations in their environment. Zebra mussels are invasive, and little is known about their cellular physiology. Increased water temperatures and aquatic hypoxia are the most common environmental changes, and often happen simultaneously. However, few studies have investigated the effects of these multiple co-stressors on organisms, and even fewer have investigated these effects on zebra mussels. This short-term study aims to look at the variables, heat and hypoxia, under realistic biological conditions both separately and as co-

stressors over the course of 24 hours. Mussels were collected from Banner Marsh in central Illinois and slowly acclimated from river water temperature to one of four experimental treatments: control (20°C/normoxia), heat (30°C, normoxia), hypoxic conditions (20°C, DO=5mg/L) and heat/hypoxia (30°C/DO=5mg/L). AMPK activity and HSP70 levels were used to identify the cellular response to these stressors. It is predicted that cellular markers will corroborate these physiological stressors and indicate decreased organismal performance. This study found there to be a synergistic response when zebra mussels were exposed to a combination of those stressors.

86 4:15pm UG

### **Mandible Biomechanics in Canids and Felids**

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

Interspecific differences between species within the Order Carnivora results from developmental differences due to genetic and environmental influences. These differentiation factors affect the size and shape of carnivore mandibles, and can be observed in three mandibular functional and developmental regions: the alveolar process, the body, and the ramus. These regions are influenced by development, diet, and muscle action. This study examines mandible form and bite force differences in gray wolves (*Canis lupus*), bobcats (*Lynx rufus*) and Canadian lynx (*Lynx canadensis*). The sample for this study included mandibles of 29 gray wolves (*C. lupus*), 48 Canadian lynx (*L. canadensis*), and 46 bobcats (*L. rufus*). All mandibles were photographed from a standardized lateral view and two-dimensional coordinates of 16 landmarks were recorded from each photograph using ImageJ. Dimensions describing the form of the alveolar process, mandibular body, and ramus were calculated, and data was adjusted for size differences. Regional form differences between species were estimated were tested, and bite force was estimated. There was significant difference in bite force across species, and the mechanical advantage of the temporalis and masseter were significantly lower in gray wolves than in the lynx species. Evolutionary forces which lead to differences between canids and felids have resulted in significant differences throughout the mandible form, and accompanying significant differences in bite force.

87 3:00pm UG

### **The Effect of Elevated and Variable Winter Temperatures on Survival and Pace of Development in the Goldenrod Gall Fly, *Eurosta solidaginis***

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

Previous work suggests that elevated winter temperature positively impacts metabolic fuel usage, reduces survival, and speeds the onset and pace of post-winter development in dormant insects. However, these studies used constant exposure temperature and have ignored the potentially important contribution of diurnal variation. To determine the effect of variable winter temperature on parameters associated with survival and development, we compared pupation date, eclosion date, and survival in 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 subjected larvae to constant temperature (elevated-constant group) and diurnally fluctuating regimes (elevated-variable group) that are predicted by a climate change model. Levels of pupation and eclosion for larvae subjected to elevated-constant, elevated-variable, and average-variable groups were significantly higher (averaging 64% and 28% respectively) than for larvae in the average-constant group which only averaged 21% and 5%. Adults that displayed coordinated movement five days after eclosion were only found in the elevated and average-variable temperature groups (16% and 12% respectively), while no viable adults emerged in either constant-temperature treatments. Elevated winter temperature greatly increased the rate of larval development as the average date for pupation and eclosion were April 2 and May 13 for the elevated variable-temperature treatment while mean pupation and eclosion dates for the average-variable treatment was April 13 and June 3. In sum, elevated winter temperature greatly enhanced the rate of larval development, but larvae experiencing constant temperature regimes had significantly reduced survival.

88 4:15pm Grad

### **Repeated Freezing Negatively Impacts Hemocyte Count in the Goldenrod Gall Fly, *Eurosta solidaginis***

\*Candace Karnish, Jason Williams, Vance McCracken [Southern Illinois University Edwardsville]

Most studies examining effects of extreme temperature on insect immunity have focused on negative impacts of high-temperature exposure. Although largely unexplored, a recent study suggests that repeated

exposure to freezing temperature may enhance insects' ability to survive microbial challenge. To determine if repeated low-temperature exposure impacts innate immunity of the goldenrod gall fly, *Eurosta solidaginis*, we counted hemocyte number in winter-acclimated larvae 24 h or 96 h after they were subjected to either zero (control), five, or ten diurnal exposures to  $-18^{\circ}\text{C}$ . To assess if time spent frozen, rather than freezing and thawing, influenced immunity, we also counted hemocytes in larvae exposed to a single, six-day constant freeze. Hemocyte count for  $1\ \mu\text{l}$  of diluted hemolymph was significantly reduced 24 h after larvae were exposed to either five ( $98 \pm 14$ ) or ten ( $113 \pm 14$ ) freezing events compared to controls, which averaged  $171 \pm 25$  cells ( $P < 0.05$ ). Negative effects of repeated freezing persisted for 96 h, as both experimental groups averaged only  $102 \pm 15$  hemocytes. In contrast to repeated low-temperature exposures, larvae exposed to a single six-day freeze had similar hemocyte counts at 24 and 96 h after thaw as controls (averaging  $154 \pm 25$ ). In sum, repeated freezing negatively impacts hemocyte number in the goldenrod gall fly; however, the effect of low temperature on other measures of immunity, such as phenoloxidase or antimicrobial peptides, are yet to be determined.

#### 89 3:00pm Grad **Comparative Analysis of Intestinal Parasites on Three Midwestern Bird Species**

\*Eriberta Vasquez, Shelby Peteler [Roosevelt University]

Intestinal parasites are parasitic worms that are ubiquitous globally, infecting both humans and wildlife. Parasites require 1-3 hosts to complete their life cycle, typically an intermediate, and a definitive host. An intermediate host is an organism that a parasite utilizes for its first juvenile phase of development. A definitive host is an organism that the parasite utilizes for their adult stage of development and reproduction. This study focuses on parasites in definitive passerine hosts. Comparative analysis was performed on the presence of intestinal parasites in three passerine species: American Robin (*Turdus migratorius*), Gray Catbird (*Dumetella carolinensis*) and Brown Thrasher (*Toxostoma rufum*). Many helminth surveys that exist today are pre-dated, and require revising based on updated systematics. Four taxa of intestinal helminths were surveyed: *Acanthocephala*, *Cestoda*, *Nematoda*, and *Trematoda*.

Acanthocephalans are "thorny-headed" helminths, in phyla *Acanthocephala*. Cestodes (tapeworms) and Trematodes (flukes), are flatworms in phyla *Platyhelminthes*. Nematodes are roundworms in phyla *Nematoda*. The passerine species were collected post-mortem from window-collisions throughout the Chicagoland area and deposited at The Field Museum. Necropsies were performed for screening of parasites in each hosts' gastrointestinal tract using a dissecting scope. Morphological and molecular samples of the four taxa of parasites were vouchered for identification from each passerine definitive host. American Robin had the greatest diversity and intensity of parasites infection, followed by Gray Catbird, and Brown Thrasher. American Robin had presence of all four taxa. Gray Catbird had only Acanthocephalans, Cestodes, and Nematodes present. Brown Thrasher had only Acanthocephalans, and Trematodes present. American Robin had the highest average parasite intensity of 13.66 per bird. Gray Catbird parasite intensity was 1.76 parasites per bird. Brown Thrasher had an average intensity of 0.5 parasites per bird. Migration patterns, habitat, and diet may contribute to parasite diversity and intensity. Our study provides the first, initial understanding about the diversity of parasites in Midwestern birds.

#### 90 4:15pm Grad **Resource Utilization in a Headstarted Population of Ornate Box Turtle, *Terrapene ornata ornata*, in Northern Illinois**

\*Kassandra Karssen, Peter R. Minchin [Southern Illinois University Edwardsville]

In 2008 the United States Fish and Wildlife Service (USFWS) started a long-term study focusing on the Ornate Box Turtle (OBT), *Terrapene ornata ornata*, at two locations in Northern Illinois: Lost Mound Sand Prairie (LMSP) and Thompson Sand Prairie (TSP). The following year the OBT was listed as an Illinois Threatened Species because of low population numbers as well as their small and isolated habitats that are scattered throughout the state. Shortly after OBTs' were listed in Illinois it was decided by USFWS to attempt to headstart the populations at TSP and LMSP. Headstart programs are viewed as a valuable tool in trying to increase population sizes of many species of animals. It is believed that by collecting and rearing animals in captivity and then releasing them when they are larger their chances of surviving to reproduction are increased. The objectives of my research are to locate and collect data on both the remnant and wild population and the headstart turtles at LMSP and TSP to see what they are utilizing within their environment as well as what their daily, weekly, and monthly movement patterns are. I hypothesize that headstarted individuals will seek out and utilize the same resources as the wild turtles, such as permanent and temporary water sources, burrows and thick vegetation for shelter, and various food sources ranging from prickly pear

cactus to insects. During my study I will be collecting data on daily movement, cataloging resources in areas of high traffic, as well as keeping an accurate timeline of when important events such as nesting take place. Additionally I will be collecting data on all OBTs I come across during my study time, including carapace length, plastron length, weight, number of growth rings, and sex. By collecting these data I will be able to determine movement patterns, resource utilization, home ranges, make comparisons between headstart individuals and wild individuals, and also growth rates for turtles of known ages. The results of this research will provide valuable information to guide headstart efforts for other threatened species in the United States and throughout the world, as well as inform USFWS as to how they can better manage for OBTs.

91 3:00pm UG

### **Examining Vigilance and Sentinel Behavior of Monk Parakeets and Possible Connections to Vigilance of Other Urban Adapted Birds in the Chicagoland Area**

\*<sup>1</sup>Rachel Thomas, <sup>2</sup>Travis E. Wilcoxon, <sup>1</sup>Christopher W. Appelt [<sup>1</sup>St. Xavier University, <sup>2</sup>Millikin University]

Vigilance can increase survival by increasing the probability of detecting potential threats. A sentinel system, in which one or more individuals are consistently alert, allows other individuals of a group to participate in non-vigilant behaviors. Monk parakeets (*Myiopsitta monachus*) are gregarious, have successfully colonized areas throughout the world, and have been in the Chicago area for more than 40 years. Part of their success could be due to a sentinel system, which has been attributed to this species but has never been demonstrated. Furthermore, if monk parakeets are more vigilant than other resident species, those species might exhibit reduced vigilance in their presence. Therefore, we had three hypotheses about avian vigilance in the Chicago area: 1) monk parakeets use a sentinel system; 2) individual monk parakeet vigilance and that of sympatric bird species are related to flock size dynamics; 3) monk parakeets exhibit greater vigilance than other urban adapted bird species. To test the first hypothesis, we collected focal vigilance data on three individuals in monk parakeets flocks based on physical position: highest, second highest, and lowest. To test the second and third hypotheses, we collected corporate vigilance data for single and mixed species flocks. Preliminary analyses have not supported the use of a sentinel system or greater vigilance by monk parakeets than other avian species in the Chicago area; however, vigilance does seem to relate to changes in flock size. These data provide new information about how monk parakeets might interact with the ecosystems they colonize.

92 4:15pm Grad

### **Avian Use of Floodplain Forest Communities Along the Upper Mississippi River**

\*Dillan Laaker, Peter R. Minchin [Southern Illinois University Edwardsville]

The floodplain forests along the Upper Mississippi River are known to provide valuable habitat for many species of migrating songbirds, which breed in the northern USA or Canada and over-winter in Central or South America. Forest communities vary in the floodplains of the confluence region where the Illinois and Missouri Rivers join the Mississippi, providing a variety of habitats for migrating bird species. Effective management of these lands by state and federal agencies requires that managers understand patterns of species use of different forest communities. This research will explore how bird species diversity, abundance, and community composition varies among the floodplain forest communities along the Upper Mississippi River. Using a protocol developed through a partnership with the U.S. Army Corps of Engineers, Audubon Center at Riverlands, and the Cornell Lab of Ornithology, we will conduct 10 minute avian point count surveys from May 15 – June 30 at 150 sampling points located throughout the forested areas of the Upper Mississippi River floodplain. The point count data from the spring 2017 surveys will be added to point count data taken over the past three spring survey seasons. Using the U.S. Army Corps of Engineers Forest Management Geodatabase (FMG), each point surveyed in the spring avian bird counts will be assigned a forest community type. By merging 4 years of avian point count data with the FMG, relationships between forest communities and corresponding bird diversity will be explored using generalized linear modelling and multivariate analysis, assisting future forest management for migrating bird species along the Upper Mississippi River.

93 3:00pm UG

### **Relationship Between Shell Characters and Crush Resistance in the Pleurocerid Snail *Elimia potosiensis***

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

Snail shells function in part as defensive structures that protect the animal living inside. Research has shown that freshwater snails can alter shell form in response to predator cues in an adaptive way; i.e., toward

shapes that make them less vulnerable to predators. Little work has been performed, however, on how shell density affects susceptibility to crushing predators, independently of shell shape or size. We sampled *Elimia potosiensis* throughout the Meramec River in east-central Missouri; *Elimia* has been shown to alter shell shape in response to crayfish cues, but *Elimia* is also subject to crushing predation by turtles. Snails were euthanized and removed from shells, and we photographed shells and measured shell density by comparing dry and submerged weights. Shells were then crushed on a high capacity electronic balance using a lever arm suspending a bucket that was filled with water at a constant rate. Larger shells were significantly more crush resistant than smaller shells, and more rotund shells were significantly more crush resistant than slender shells, after correcting for shell size. Shell density was significantly positively related to crush resistance after correcting for size, but became non-significant when accounting for shell shape. Thus, shape was a better determinant of crush resistance than density. We have previously observed a significant relationship between shell shape and density in this species, and this research points to the possibility of a physiological limitation in response to predator cues: does making the shell more rotund require increasing shell density? Or are both shape and density being independently modified to reduce predation risk?

94 4:15pm UG

#### **Effects of Shell Ornamentation on Hydrodynamic Drag and Lift in the Freshwater Snail *Lithasia armigera***

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

Ornamentation in marine snail shells is typically viewed as an adaptation to avoid damage from crushing predators and not as adaptation in response to flowing water. Directional water velocity in lotic environments is much more predictable and stable than in marine environments, however, and thus spines in freshwater snails may serve a hydrodynamic role. We used a recirculating flume with a novel force transducer design to measure hydrodynamic drag and lift on replicated shells of the armored rock snail, *Lithasia armigera*. Specifically, we were interested in how the large spines on *L. armigera* affected drag and lift as water flowed over shells of these lotic snails. To facilitate comparing natural shells with “spineless” shells, we used 3D reconstructed and printed duplicates of natural shells and compared the hydrodynamics of these shells with copies from which spines had been removed. Water flow was set at 50 cm/sec, an intermediate flow rate for this species. Results indicate that spines significantly increase drag and also increase drag coefficient, suggesting that spines increase drag regardless of shell size. However, results also suggest that, while spines increased overall lift, spines reduced overall lift coefficient. Correcting for vertically projected surface area, spines would have an overall effect of reducing lift, which may be a more costly force to overcome compared to drag. Our data are the first to be collected on freshwater snails, and should be compared to the efficacy of spines in reducing predation by turtles as part of a larger analysis of the role of spines in *Lithasia*.

95 3:00pm UG

#### **Analysis of Shell Shape in Freshwater Snails of the Family Pleuroceridae**

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

We used digital photographs to designate shell landmarks on 455 specimens of pleurocerid snails from 13 species collected from several different locations throughout Indiana, Ohio, Missouri and Illinois. Recent collections were combined with shells collected in the late 1800's and early 1990's on loan from the Illinois Natural History Survey. We used geometric morphometrics to quantify shell shape and used shell centroid size as a covariate in comparing collections. In all samples, shell shape was significantly correlated with shell size, with larger shells being relatively slender. Species differed from each other with respect to the strength of this relationship, with the very robust *Lithasia salebrosa* showing the weakest relationship between size and shape. Species were generally well separated in shape-size space, with *Elimia* and *Lithasia* species being more similar to each other with respect to shape and *Pleurocera* species being more slender. Ornamented species (*Lithasia* and *Io*) were also larger, but not due to ornamentation, and thus occupied a distinct region of shape-size space. The slender *E. semicarinata* occupied the same space as *P. acuta* and *P. canaliculata*. We hope to add more species to this analysis, and we hope to determine functional relationships between shell size and shell ornamentation within the Pleuroceridae.

96 4:15pm UG

#### **Pre-Zygotic Reproductive Isolation among Topminnows in an Artificial Stream System**

\*Amanda Markovich, Tessa England, David Duvernell [Southern Illinois University Edwardsville]

Selective mating is a common pre-zygotic reproductive isolation mechanism. Topminnows in the genus *Fundulus* make a good model for studies of reproductive isolation. We quantified the degree to which



selective mating occurs between *F. olivaceus* and *F. notatus* by placing both species in artificial stream mesocosms. The null hypothesis (random mating) was that the paternity of offspring would occur in proportion to the frequency of males of the respective species. The alternative hypothesis was that the offspring would exhibit excess conspecific paternity. Stream mesocosms included interconnected round pools with a gravel substrate. Populations consisted of 6 males and females of each species. Suspended yarn mops served as artificial substrates for egg deposition, and eggs were collected weekly during the peak of the breeding season. Eggs were genotyped via a polymerase chain reaction - restriction fragment length polymorphism (PCR-RFLP) assay for diagnostic variants at one nuclear and one mitochondrial gene locus. A chi-square analysis was conducted to test for deviations from random mating expectations. Overall, statistically significant conspecific mate preference was detected among females of both species sampled from multiple independent drainages.

**97 3:00pm Grad Reducing Stereotypic Pacing in Polar Bears (*Ursus maritimus*) and Brown Bears (*U. arctos*) by Erecting Visual Barriers Between Neighboring Individuals**

\*<sup>1</sup>Sierra Semel, <sup>1</sup>Susan T. Meiers, Lance J. Miller [<sup>1</sup>Western Illinois University, <sup>2</sup>Chicago Zoological Society]

Animal welfare has always been an integral component of managing zoological facilities, but is now directly relevant in meeting the standards of national accreditation for zoos and aquaria. Incorporating animal welfare evaluation into daily animal management serves a critical role not only in helping to keep zoological animal populations healthy, but also provides the public with a positive perception of the conservation and educational roles provided by zoological facilities. One behavior in zoo animals that can be indicative of a welfare concern is the stereotypic behavior of pacing, a highly repetitive and invariant behavior that lacks an obvious goal. Polar bears (*Ursus maritimus*) and brown bears (*U. arctos*), as well as a majority of other large carnivores, are well known to exhibit classic stereotypies even under professional care. Although stereotypic behavior does not necessarily imply poor welfare, it often has been linked to the presence of stress or frustration for the animal. Indeed, some animals living in a zoological setting may be motivated to perform a behavior, but are unable to do so for various reasons, thus resulting in frustration, and these situations tend to result in displacement or re-directed activities. If the problem continues or is repeated, stereotypies such as pacing may develop. It is suggested that if singly housed individuals can see conspecifics, but are not allowed direct interaction, they may become frustrated because natural social behavior cannot be exhibited. Over time, such situations could result in the expression of stereotypic pacing. For this study, it is hypothesized that erecting visual barriers between bear exhibits at the Brookfield Zoo could decrease the pacing behavior currently exhibited by the bears. Indeed, the stereotypic pacing behavior demonstrated by the bears could be a result of individuals being able to see each other through the large Plexiglas windows incorporated in the walls of adjoining exhibits. Because the bears are able to see each other, but are not able to physically interact, they may become frustrated and displace frustration in the form of pacing. Continuous sampling will be used to record the duration of pacing and species-specific behaviors during a six-week study period. Statistically significant differences in duration between baseline and treatment periods of pacing and species-specific behaviors will be evaluated to identify whether species-specific behaviors replace pacing behavior, and if so, which behaviors in particular. We predict that if the presence of the barriers can decrease the frustration of seeing conspecifics or congeners without the ability to interact, the duration of pacing bouts in the exhibit will significantly decrease while the duration of species-specific behaviors will increase.

## ORAL PRESENTATION ABSTRACTS

9:00am – 12noon, Saturday, April 1, 2017, Building D

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

### BOTANY

9:30am  
Rm 172

#### **Non-Metric Multidimensional Scaling of Vegetation Data: Insights and Innovations**

\*Peter Minchin [Southern Illinois University Edwardsville]

Non-metric Multidimensional Scaling (NMDS) is an ordination method first developed in the early 1960s for the analysis of psychological data. It was first applied to vegetation data in the 1970s and comparative evaluations in the 1980s showed it to be a robust and effective technique for this purpose. With increases in computing power and the availability of software, NMDS has become one of the most commonly-used ordination methods by vegetation scientists. Nevertheless, there some widespread misunderstandings about the method and a few recent papers have even suggested that it produces misleading results and should not be used. I first present insights into NMDS that I have gained 40 years of experience in programming and using the method to analyze community data. In the process, I correct misconceptions about NMDS, clarify some technical aspects that are important for its effective use, and describe innovations that make the technique even more useful. Finally, I defend NMDS from recent criticisms, which I show to be based poor choices of analysis options and the use of data generating models that engineer data designed to trip up NMDS but which bear little resemblance to the kinds of data usually collected in vegetation studies.

9:45am  
Rm 172

#### **Grad Assessing the Robustness of Numerical Clustering Methods for Use in Vegetation Classification**

\*Noah Dell, Peter R. Minchin [Southern Illinois University Edwardsville]

Numerical clustering encompasses a group of exploratory multivariate statistical methods devoted to finding groups in data based on either responses of individual variables or dissimilarity measures calculated from the variables. Despite their popularity, there have been few controlled comparisons of methods using data of known clustering structure and which compare more than a few methods. This study utilizes simulated plant community data to assess what data properties affect the performance of numerical clustering methods commonly used in vegetation classification, including properties that can be controlled during data collection and measured before statistical analysis. This was done by creating simulation experiments varying properties of species assemblages themselves –  $\beta$ -diversity,  $\alpha$ -diversity, the distribution of peak species abundances on simulated gradients, and the level and type of noise in the data – or the clustering structure of sites in environmental space – number of samples per group, equality of number of samples or group variance among groups, within group variance in species space, and the number of groups. Cluster recovery was measured using the Adjusted Rand Index (ARI) – a chance-corrected measure of the proportion of elements classified similarly in two clustering results. ARI is an approximation of the proportion of sites correctly classified, so scores near 1.0 indicate accurate cluster recovery, while scores near 0.0 indicate poor cluster recovery. Methods are robust if they have a mean ARI score near 1.0 despite variation in data properties. Methods tested include flexible beta clustering, TWINSpan, average, complete, and single linkage, K-means, Partitioning Around Medoids, ISOPAM, OPTPART, OPTSIL, Noise Clustering, model-based EM clustering, weighted modularity clustering, Information Analysis, and supervised Random Forest classification. K-means and single linkage, should be avoided because they demonstrate sensitivity to slight alterations in data properties and low accuracy overall (mean ARI often  $< 0.7$ ). Flexible beta clustering and TWINSpan, often achieve high levels of cluster recovery, but not in all cases. While performing well where  $\beta$ -diversity is high (ARI  $\approx 0.95$ ), performance declines where  $\beta$ -diversity is low (mean ARI 0.975), except when misclassification error is high, because it uses species abundances and not dissimilarities. Our results suggest creating formal classification systems, perhaps using unsupervised clustering, and then managing new species assemblage data using Random Forest models is a more statistically robust practice than using unsupervised clustering alone.

10:30am  
Rm 172

#### **As Good as the Competition? Photosynthesis of Amur Honeysuckle (*Lonicera maackii*), Spicebush (*Lindera benzoin*), and Pawpaw (*Asimina triloba*) in Heavy Shade**

\*Kurt Schulz, Anh Nguyen [Southern Illinois University Edwardsville]

Amur honeysuckle (*Lonicera maackii*) is a predictable, very damaging shrubby invader of forests throughout the

lower Midwest. Two features of this species have been highlighted as explanations for its success: 1) Honeysuckle produces large quantities of bird-dispersed seed. 2) Leaf display during early spring and late fall allows carbon gain when the tree canopy is leafless. Seed production and photosynthetic opportunities intersect in an interesting way: honeysuckles under closed forest canopies tend to produce far fewer seeds than those in the sun. This differential should be modest if the spring and fall light windows were as central to carbon gain as is purported. We examined photosynthetic light acclimation patterns in honeysuckle under an *Acer* canopy to location- and size-matched individuals of native *Lindera benzoin* and *Asimina triloba*. On a leaf area basis, all three species showed equivalent light response curves, chlorophyll density, and chlorophyll a:b ratio. Honeysuckle leaves tend to be about twice as heavy per unit area. Thus, mass-based measures for honeysuckle photosynthetic rates and chlorophyll content are 50% of those of native species. Mass-based measures frame photosynthetic gains in terms of payback for investment into leaves. Protracted spring and fall photosynthetic periods in closed forests are probably necessary for supporting higher respiratory and construction costs of vegetative tissue, as opposed to benefiting growth and reproduction.

10:45am  
Rm 172

### **Self-Facilitation of the Riparian Invader Japanese Hops (*Humulus japonicus*: Cannabaceae)**

\*Jon Clark, Kurt Schulz [Southern Illinois University Edwardsville]

Japanese hops (*Humulus japonicus*) is an introduced exotic plant with a native range stretching across most of Eastern Asia. Originally intended for use as an ornamental vine or in a medicinal tonic, *H. japonicus*, is rapidly becoming a common component of riparian communities through most of the east coast and into the Midwestern river valleys of North America. Japanese hop has been observed to germinate earlier than most native competitors allowing it to easily establish and overtop its neighbors. A field experiment was performed to test for the potential for self-facilitation in Japanese hops with regard to its germination and growth. Soil samples were taken from three locations on the SIUE campus. At each site, samples from an area with hop present, and samples from an adjacent area without hop were collected. The soil was then processed to remove large debris and silica sand was added to a total volume of 20% in order to improve porosity. Each of the samples were analyzed for pH, organic content, and texture to ensure the soils were comparable. *H. japonicus* and *Festuca rubra* (red fescue - control) seeds were potted in each respective treatment and the pots were set up in a random block design. The study site was covered with 70% shade cloth to simulate the edge habitats where *H. japonicus* is readily found. Germination was monitored daily and the experiment was terminated after 5 consecutive days of no new hop germination. There were significant effects on rate of germination of *H. japonicus* between treatments ( $p < 0.001$ ), as well as percent germination ( $p < 0.001$ ).

11:00am UG  
Rm 172

### **An Update on Ghost Orchid (*Dendrophylax lindenii*) Populations in Florida and Cuba, with Special Reference to Seedling Recruitment**

\*<sup>1</sup>Adam Herdman, <sup>1</sup>Jack Waggoner, <sup>2</sup>Ernesto Mujica Benitez, <sup>1</sup>Lawrence Zettler, <sup>3</sup>Mark Danaher [1Illinois College, 2Soroa Orchid Botanical Garden, Cuba, 3Florida Panther National Wildlife Refuge] The Ghost Orchid, *Dendrophylax lindenii*, is a rare, leafless epiphyte native to S Florida and Cuba. Despite being separated by ca. 800 km, orchid populations in the two regions differ in several fundamental aspects. In 2013, we began a collaborative, long-term project aimed at assessing population viability in both regions, and understanding the biotic and abiotic factors that facilitate seedling recruitment. In July 2015 - the first year of our survey - 100 Ghost Orchids were counted at the Florida Panther National Wildlife Refuge (FPNWR), when only 16 were known there previously. In Cuba, 241 orchids were counted, almost one-third (30.3%) of which were seedlings - nearly double the percentage documented in the FPNWR (16.4%). In 2016, an additional 127 orchids were documented at the FPNWR, 71 of which were seedlings. A striking (59.6%) increase in flowering was noted in Florida that year compared to the year before, yet fruit set remained consistently low in both areas (<5% of available flowers). In Florida, *D. lindenii* was affixed to just two host tree species - *Fraxinus caroliniana* and *Annona glabra*, whereas in Cuba 18 tree species served this purpose: *Maba crassinervis* (16.2%), *Erythroxylum aerolatum* (15.4%), *Comoclada dentata* (14.9%), *Mastichodendron foetidissimum* (10.4%), *Tabebuia angustata* (10.0%). Young seedlings were often documented in clusters on corrugated bark surfaces at both sites probably attributed to the presence of suitable mycorrhizal fungi (*Ceratobasidium* spp.) on these substrates serving as "hot spots" for seed germination. This suggests that seedling recruitment may be more limited by insufficient pollination.

**11:15am Grad Ghost Orchid (*Dendrophylax lindenii*) Habitats in Florida and Cuba: Differences and Similarities**  
**Rm 172**

\*Hana Thixton, Elizabeth Esselman [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 *Ceratobasidium* (formerly *Ceratorhiza*) fungi. *Ceratobasidium* has been properly identified within a population in Iowa, but unsuccessful with other populations. 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 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.

## **CELLULAR, MOLECULAR, & DEVELOPMENTAL BIOLOGY**

**9:00am UG Enhanced Proliferation of Human Adipose-Derived Mesenchymal Stem Cells on Polycaprolactone**  
**Rm 174 Nanofiber Cell Scaffolds Electrospun with Type 1 Collagen Fibers**

\*<sup>1</sup>Jonathan Tiessen, <sup>1</sup>Jaclyn Conway, <sup>1</sup>Jack Blank, <sup>1</sup>Craig Cady, <sup>2</sup>Ashim Gupta, <sup>2</sup>Michael Ruebhausen, <sup>2</sup>Michael W. Neumeister, <sup>1</sup>Kalyani Nair [<sup>1</sup>Bradley University, <sup>2</sup>Southern Illinois University School of Medicine]

Recent efforts to show clinical relevance of autologous stem cell-based therapies with special interest in human adipose mesenchymal stem cells (hADSC's) demonstrated a need for biocompatible cell scaffolding as substrates for tissue regeneration. Polycaprolactone is a popular and unique biomaterial that has high biocompatibility and is clinically relevant. The present work focuses on integrating type 1 collagen fibers at three increasing concentrations into an electrospun polycaprolactone nanofiber matrix to enhance biocompatibility as well as cell adhesion and proliferation. Type 1 collagen effectively integrated into the nanofiber scaffold structure, verified by scanning electron microscopy. We show that hADSC growth was significantly enhanced on collagen-PCL mats compared to mats composed of PCL alone. hADSC's were shown by fluorescence microscopy to integrate into multiple layers of the PCL-collagen and PCL mats. These data show promise for the future of integrated polymer-collagen nanofiber cell scaffolds in tissue regeneration.

**9:15am UG Pre-Exposure of Human Wharton's Jelly Mesenchymal Stem Cell to Factors Increases Chemotaxis**  
**Rm 174 Towards Ovarian Cancer**

\*<sup>1</sup>Katherine Kessler, <sup>1</sup>Kaysaw Tuy, <sup>2</sup>Jennifer Li, <sup>1</sup>Craig Cady [<sup>1</sup>Bradley University, <sup>2</sup>Southern Illinois University School of Medicine]

Ovarian cancer (OC) is the most fatal reproductive cancer in women. OC often goes undiagnosed until it has advanced resulting in chemotherapy with poor patient outcome. Recently, adult stem cells have become a subject of interest as a way to localized chemotherapy treatment. Along with their ability to differentiate into multiple cell types, adult stem cells have the ability to migrate towards cancer. Human Wharton's jelly umbilical cord mesenchymal stem cells (hWJMSC's) have the potential to function as a cell-based therapy due to their non-tumorigenic and low immunogenic properties. We have shown through previous chemotaxis assays that hWJMSC migrate to OC mediated by numerous cancer produced factors, one being vascular endothelial growth factor 165 (VEGF-165). We have shown that hWJMSC migration to OC can be enhanced by pre-exposure to VEGF-165. In this study, enhanced migration was induced with physiological levels of factors produced by OC cells including interleukin-6 (IL-6), interleukin-8 (IL-8), tumor necrosis factor-alpha (TNF- $\alpha$ ), and interferon gamma (IFN- $\gamma$ ). Exposure of hWJMSCs to these factors for 24 hours was shown to significantly increase chemotaxis towards OC conditioned media. We genetically engineered hWJMSCs to express cytosine deaminase (CD) an essential element of a potential cell based therapy. Treatment would begin with hWJMSCs expressing CD and would migrate to and concentrate at OC tumor sites. Concentrated hWJMSCs would release CD converting a non-toxic agent 5-fluorocytosine into an antineoplastic agent 5-fluorouracil at the tumor arresting tumor growth. Overall, this research would lead to a more localized and effective chemotherapy treatment in comparison to the current

systemic chemotherapy that can produce a significant number of negative side effects with poor patient outcomes.

**9:30am Rm 174      Grad      Assessing the Lethality of Genetically Engineered Wharton's Jelly Umbilical Cord Mesenchymal Stem Cells as a Cell-Based Therapy for Ovarian Cancer**

\*<sup>1</sup>Kaysaw Tuy, <sup>1</sup>Katie Kessler, <sup>2</sup>Jennifer Li, <sup>1</sup>Craig Cady [<sup>1</sup>Bradley University, <sup>2</sup>Southern Illinois University School of Medicine]

Advanced ovarian cancer has the lowest 5 year survival rate of any gynecological cancer. In this study, human Wharton's Jelly umbilical cord mesenchymal stem cells were genetically engineered to express cytosine deaminase (hWJMSC\_CD) to convert the non-toxic prodrug, 5-fluorocytosine (5-FC), into the chemotherapy agent, 5-fluorouracil, as a potential treatment for ovarian cancer. We hypothesize that hWJMSC\_CD cells will significantly reduce proliferation of HEY ovarian cancer cells in co-culture following treatment with 5-FC. To determine changes in proliferation (lethality) of HEY cells, an MTT assay will be performed to assess cell proliferation following co-culture experiments. Preliminary results from qrtPCR and immunocytochemistry showed the presence of cytosine deaminase and its mRNA. Isolated hWJMSC\_CD cells grown with 5FC had significantly reduced proliferation, while the transfer of this supernatant onto HEY cells caused lethality, thus indicating successful synthesis and functionality of the enzyme in the hWJMSC\_CD cells. The ultimate goal is to provide an alternative, localized, cell-based treatment for ovarian cancer to reduce the number of side-effects and eliminating primary and secondary tumors that can lead to poor patient outcomes.

**9:45am Rm 174      Grad      Differential Gene Expression of *Helicoverpa zea* (Tomato Fruitworm) in Response to Feeding on Different Types of Tomato (*Solanum lycopersicum*) Plant Tissues**

\*Ammar Al-furaiji, Donald Bath, Sue Hum-Musser, Richard O. Musse [Western Illinois University]

The tomato fruitworm (*Helicoverpa zea*) is generalist herbivorous insect. These insects are known to feed on several kinds of plants. Here, we focus on the tomato, *Solanum lycopersicum*, plant tissues. By feeding on plants, *H. zea* stimulates a wide range of plant stress and defense responses as well as digestive and growth genes. Consequently, over time plants can evolve defenses to caterpillar feeding. As a response to these defenses, the herbivore evolves counter-defenses. These responses have been said to be a part of the respective "evolutionary arms race" to each other and other factors. Most of the previous studies have focused on the leaves of the tomato plant. Here I am investigating the responses of *H. zea* after feeding on tomato leaves and tomato fruits compared to caterpillars feeding on an artificial diet. Caterpillars were reared on an artificial diet. At the 4th or 5th instar, 20 caterpillars were left to rear on the artificial diet, 20 caterpillars were added to tomato leaves and 20 caterpillars were added to the individual fruit. Caterpillars were weighed before and after herbivory to examine the effect of feeding on different diet regimes on weight gain. Average caterpillars weight gains were significantly higher for the artificial diet, closely followed by caterpillars that fed on the tomato fruits ( $P < 0.05$ ). Caterpillars that fed on tomato leaves were dramatically smaller. Caterpillars were flash frozen in liquid nitrogen after 72 hours of feeding and stored at  $-80^{\circ}\text{C}$ . Total RNA was extracted using the TRIzol method. Microarray hybridization then was conducted following the manufacture's protocol. The microarray hybridization technique was used to compare the caterpillars' gene expression based on their different diets. Then, the microarrays were scanned with an Axon Microarray scanner. The scanned data were normalized across the chip and compared between the three treatments. Interestingly, more than 8,000 genes were stimulated. Of the 8,000 genes altered, 4,008 genes were significantly stimulated when the data were analyzed statistically using ANOVA test (one-way ANOVA, 3 degree of freedom,  $P < 0.05$ , Benjamini-Hochberg correction). The transcriptomic expression for compensatory gene expression for caterpillars that fed on leaves in comparison to fruits was particularly dramatic for digestive genes such as proteases and lipases. Additionally, the expression of stress-related genes and detoxification genes such as cytochrome 450 genes were altered. This is likely due to tomato leaves having higher levels of plant defenses and generally lower nutrition available than fruits. All in all, the initial results show thousands of genes differently expressed between the treatments. Gene expression analysis gives us a better understanding of caterpillar counter-defenses in relationship to its host.

## COMPUTER SCIENCE

9:45am  
Rm 178

### Grad **On the Computational Complexities of Three Privacy Measures for Large Networks Under Active Attack**

\*<sup>1</sup>Tanima Chatterjee, <sup>1</sup>Nasim Mobasheri, <sup>1</sup>Bhaskar Dasgupta, <sup>1</sup>Venkatkumar Srinivasan, <sup>2</sup>Ismael G. Yero [<sup>1</sup>University of Illinois Chicago, <sup>2</sup>Universidad de Cádiz]

With the arrival of modern Internet era, large public networks of various types have come to existence to benefit the society as a whole and several research areas such as sociology, economics and geography in particular. However, the societal and research benefits of these networks have also given rise to potentially significant privacy issues in the sense that malicious entities may violate the privacy of the users of such a network by analyzing the network and deliberately using such privacy violations for deleterious purposes. Such considerations have given rise to a new active research area that deals with the quantification of privacy of users in large networks and the corresponding investigation of computational complexity issues of computing such quantified privacy measures. In this paper, we formalize three such privacy measures for large networks and provide non-trivial theoretical computational complexity results for computing these measures. Our results show the first two measures can be computed efficiently, whereas the third measure is provably hard to compute within a logarithmic approximation factor. Furthermore, we also provide computational complexity results for the case when the privacy requirement of the network is severely restricted, including an efficient logarithmic approximation.

## ENVIRONMENTAL SCIENCE

9:15am  
Rm 272

### **Bioaccumulation and Chemical Transformation of Selenium in Edible Fungal Mycelia**

\*<sup>1</sup>Ranjitha Uppala, <sup>1</sup>Zhi-Qing Lin, <sup>2</sup>Hojat Majd, <sup>1</sup>Christopher W. Theodorakis, <sup>1</sup>Tom Fowler [<sup>1</sup>Southern Illinois University Edwardsville, <sup>2</sup>University of Bu-Ali Sina, Iran]

Selenium (Se) is an essential element for humans and animals. The development and uses of Se-biofortified food products has become one of the important agricultural research topics in recent years. Edible mushrooms are naturally rich in proteins, essential amino acids, and micronutrients. Because of their medicinal values, some mushroom species have been widely produced in different parts of the world. One may hypothesized that Se-biofortified mushroom products become an important dietary source of Se intake. The aim of this laboratory study was to determine the feasibility of producing Se-enriched mushroom mycelia through tissue culture, and effects of different Se chemical forms (including nanoscale element Se particles or SeNPs) on Se accumulation in mycelium tissues of selected mushroom species. The results showed that significant amounts of Se were accumulated in mycelium tissues, and the fungal Se bioaccumulation varied significantly ( $p < 0.05$ ) among Reishi (*Ganoderma lucidum*), Shiitake (*Lentinula edodes*), Lion's mane (*Hericium erinaceus*), Oyster Pearl (*Pleurotus ostreatus*) and Oyster Blue (*Pleurotus columbinus*). The highest Se concentration of  $315 \pm 19.4$  mg/kg was observed in Oyster Blue in the growth substrate treated with  $\text{Na}_2\text{SeO}_4$ , while the Se concentration of  $155.99 \pm 30.47$  mg/kg was measured in the SeNPs treatment of 10 mg/L. Concentrations of Se in mycelium tissues of Reishi and Oyster Blue increased with increasing the substrate Se treatment from 1 to 10 mg/L in the form of  $\text{Na}_2\text{SeO}_4$  or SeNPs. This study further demonstrated that SeNPs could be biotransformed and volatilized by fungal mycelia, but the volatilization rate from  $\text{Na}_2\text{SeO}_4$  was greater than the rate from SeNPs.

9:30am  
Rm 272

### **Nanomaterials Environmental Impact**

\*Chris Theodorakis, Vineet Garlapally [Southern Illinois University Edwardsville]

The production of nanomaterials is on the rise, and metal oxides nanomaterials especially the being employed for a wide range of applications. However, nanomaterials have the potential to negatively impact the environment, because they may affect the health of aquatic organisms. For example, previous research has shown that exposure to high concentrations of ZnO particles can lead to retardation of growth and metamorphosis in the African clawed frog, *Xenopus laevis*. It is well-known that thyroid hormones are critical to amphibian metamorphosis. Therefore, the main objective of this study is to determine how the exposure to ZnO nanoparticles affect growth, development, and thyroid histopathology of *X. laevis*. Tadpoles were exposed starting in ovo to 0.125, 0.25, 0.5, 1.0 and 2mg/L (nominal concentration) ZnO nanoparticles for up to 35 days. Survival, growth (final body mass), and developmental (Neukoop-Faber [NF] stage) were recorded. In addition,

histopathological analysis was carried out to determine effects on the thyroid gland; endpoints included thyroid follicle wall thickness, hyperplasia score, and total follicle area. After 35 days of exposure, survival, growth and NF stage were all reduced compared to control at concentrations of 0.5 mg/L and above. Thyroid follicular hyperplasia was increased at all concentrations, indicating disruption of the hypothalamic/pituitary/thyroid signaling axis. In addition, follicle wall thickness and total follicle area were reduced at concentrations of 0.5 mg/L and above, indicating retardation of thyroid development. These findings are significant because, not only is this the first reports of effects on nanoparticles on thyroid hormone disruption, but this is also the first report of the effects of nanoparticles on endocrine disruption in general.

9:45am  
Rm 272

**Grad Female Fruit Flies Treated with Sub-Lethal Amounts of Ivermectin Produced Increased Levels of Reactive Oxygen Species and Malondialdehyde in their Ovaries**

\*<sup>1</sup>Yousuf Ali, <sup>2</sup>John M. Clark, <sup>3</sup>Barry R. Pittendrigh, <sup>1</sup>Kyong S. Yoon [<sup>1</sup>Southern Illinois University Edwardsville, <sup>2</sup>University of Massachusetts, <sup>3</sup>Michigan State University]

Present study addresses that insecticide induced reactive oxygen species (ROS) may cause hypermutations in germ line cells. If this happens, the mutations can be inherited and involved in evolution of resistance. Using the glass vial contact method, a dose dependent mortality response ( $LC_{50} = 0.001\%$ ) was established following 72 hours of ivermectin exposure. Based on this data, sub-lethal concentrations ( $1 \times 10^{-6}\%$  -  $1 \times 10^{-1}\%$ ) of ivermectin under the specific laboratory bioassay conditions were set for the ivermectin treatments. After exposures to sub-lethal concentrations of ivermectin, levels of hydroxyl radicals in fly ovaries were determined using a fluorescent probe (Hydroxyphenyl fluorescein). The levels of hydroxyl radicals in ovaries of ivermectin treated flies were significantly higher compared to the level of hydroxyl radicals in ovaries of untreated control flies ( $p < 0.05$ ). A dose and time dependent increase of hydroxyl radicals was determined by the regression analysis using Ancova ( $p < 0.05$ ). The levels of malondialdehyde (MDA), a lipid peroxidation product induced by increased hydroxyl radical, were measured by thiobarbituric assay. A time dependent accumulation of MDA was determined by the regression analysis using Ancova ( $p < 0.05$ ).

10:30am  
Rm 272

**Grad Utilization of Nanoparticles to Enhance Knockdown Efficiency of Target Gene Transcripts in the Highly DDT-Resistant 91-R strain of *Drosophila melanogaster***

\*<sup>1</sup>Lalita Mazgaen, <sup>2</sup>John M. Clark, <sup>3</sup>Barry R. Pittendrigh, <sup>1</sup>Zhi-Qing Lin, <sup>1</sup>Kyong S. Yoon [<sup>1</sup>Southern Illinois University Edwardsville, <sup>2</sup>University of Massachusetts, <sup>3</sup>Michigan State University] [Southern Illinois University Edwardsville]

Double-stranded RNA (dsRNA) has been widely used to down-regulate transcription of the targeted genes in many organisms including insects. Two techniques, feeding and injecting dsRNA, have been commonly employed to treat insects for functional validation of genes because of the 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 *Drosophila melanogaster*. To investigate the effect of nanoparticle-dsRNA complexes, female flies were treated with polymeric nanoparticles [e.g., chitosan, polyamidoamine dendrimers (PDN), and PDN-selenium (SN)]-dsRNA complexes and knockdown bioassays were performed using the DDT coated vials (1mg/vial). The highly DDT-resistant 91-R female flies fed with chitosan-SN-*Mrp1* dsRNA, PDN-SN-*Mrp1* dsRNA and chitosan-*Mrp1* dsRNA showed significantly increased knockdown sensitivity (KS) compared to those flies fed with nanoparticles-*Rp49*dsRNA (54.0, 45.39 and 43.21%, respectively). Also, adult females treated with PDN-*Cyp4g1* dsRNA, PDN-SN-*Cyp4g1* dsRNA and chitosan-SN-*Cyp4g1* showed significantly increased KS compared to those flies treated with respective nanoparticles-*RP49* dsRNA complexes (49.88, 40.27 and 27.24%, respectively).

10:45am  
Rm 272

**UG Weeding Maintenance of Green Roof Systems**

\*<sup>1</sup>Kayla Tatum, <sup>1</sup>S. Morgan, <sup>2</sup>V. Jost, <sup>3</sup>K. Luckett, <sup>1</sup>B. Retzlaff [<sup>1</sup>Southern Illinois University Edwardsville, <sup>2</sup>Jost Greenhouses, <sup>3</sup>Green 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 1,486 m<sup>2</sup> 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 removed by hand, and in the third all weeds were left in place. Weeding/clipping dates were June through October in 2015, and April through October in 2016. *Sedum* roof coverage was measured once at the beginning of the growing season and again at the end of the growing season in 2015 and 2016. *Sedum* roof coverage was greater than 68% across all three weeding methods in July 2015. In November 2015, mechanically trimmed plot *sedum* roof coverage (28.6%) was significantly lower than the other two methods (unweeded 39.8%; hand weeded 41.1%). *Sedum* roof coverage was greater than 40% across all three weeding plots in May 2016. In November 2016, hand weeded plot *sedum* roof coverage (6.5%) was significantly higher than the other two methods (unweeded 1.9%; mechanically trimmed 3.4%). It appears that mechanical weeding methods may have a negative effect on *Sedum* roof coverage. However, the continuous decline of *Sedum* percent roof coverage across the 2015-2016 seasons suggests that other green roof maintenance may be required.

11:00am UG  
Rm 272

### **Thermal Performance of Green Roofs Under Different Maintenance Methods**

\*<sup>1</sup>Caleb Mau, <sup>1</sup>S. Celik, <sup>1</sup>K. Tatum, <sup>2</sup>K. Luckett, <sup>3</sup>V. Jost, <sup>1</sup>S. Morgan, <sup>1</sup>W. Retzlaff [<sup>1</sup>Southern Illinois University Edwardsville, <sup>2</sup>Green Roof Blocks, <sup>3</sup>Jost Greenhouses]

Green roof systems offer a method of providing food, reducing building thermal cooling costs, reducing storm water runoff, and other environmental benefits. However, to provide these benefits, it is becoming more evident that some type of rooftop horticultural maintenance must be performed. A 1,486 m<sup>2</sup> modular, extensive 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 GRBs, each based on their clipping/weeding methods; in one section all weeds/plants were mechanically trimmed, in the second all weeds were hand-pulled, and in the third all weeds were left in place. Weeding/trimming dates were in June, August, and October 2015 and again in 2016. To monitor the thermal performance of each weeding treatment, each of the four center GRBs 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. For this thermal analysis, the ten days with the highest average temperature differential between roof surface and roof membrane were chosen (June 13th, 18th-20th, and 24th-29th, 2016). During peak heat load (2pm – 5pm), hand-weeded plots demonstrated the lowest membrane temperature on eight out of the ten selected days. During the same period, mechanically-weeded plots exhibited the highest temperature differential between roof surface and roof membrane on eight out of the ten days. In the early stages of this analysis, it appears that hand weeding reduces the roof membrane temperature and therefore may reduce the heat load on the roof. In addition, mechanically-weeded plots had the highest temperature differential between the roof surface and roof membrane. Based on this analysis, it is clear that the condition (mechanically weeded, hand weeded, or no weeding) of the green roof affects rooftop thermal performance.

11:15am Grad  
Rm 274

### **Spatial Association between Brown-headed Cowbirds (*Molothrus ater*) and Bison (*Bison bison*) over Time at Nachusa Grasslands, Illinois**

\*Jamie Lange, Tih-Fen Ting [University of Illinois Springfield]

The brown-headed cowbird (*Molothrus ater*) is the most common obligate brood parasite in North America. It is well known that cowbirds share a feeding relationship with large grazing animals, but few studies have examined the spatial and temporal interactions between these brood parasites and native grazers, bison (*Bison bison*). We tagged 20 female cowbirds with VHF radio transmitters in May and tracked them until August in 2016. Location and activity data of the radio-tagged cowbirds were obtained both manually and via the set-up of three Automated Recording Units (ARUs) within the bison units. Early results based on the manual hand-tracking data suggest that female cowbirds demonstrated a close spatial affinity to bison in May. However, such a close spatial association between female cowbirds and bison started to fade in June, with cowbirds spending time outside the bison units. By mid-July, all of the tagged cowbirds were relocated entirely in the feedlots, some up to four miles away, outside the Nachusa Grasslands Preserve. Further analyses are required to 1) fine-tune the extent of spatial interaction between bison and female brown-headed cowbirds over time based on the ARU data, and 2) examine how changes in the spatial distribution of bison influence the feeding and breeding strategies of cowbirds in a bison-gazed landscape.



## HEALTH SCIENCES

10:30am UG  
Rm 174

### **Salivary Gland Cancer Cells Uniquely Re-Express Cell Adhesion Molecules**

\*<sup>1</sup>Callie Mincy, <sup>2</sup>Kathryn Carter, <sup>2</sup>Donald Reed, <sup>2</sup>Adrianna Marcuzzi, <sup>2</sup>Anita Joy [<sup>1</sup>Southern Illinois University Edwardsville, <sup>2</sup>Southern Illinois University School of Dental Medicine]

The extracellular matrix (ECM) is a complex meshwork of highly cross-linked proteins that are secreted by cells, providing support and anchorage for the very cells that secrete it. Cells attach to the ECM via transmembrane proteins such as integrins. The cell-matrix interactions are not limited to mere attachment, but in fact, cell-ECM interactions serve as conduits for various signaling pathways that can regulate proliferation, survival, migration, and differentiation. In normal cells, the cadherins are transmembrane, intercellular adhesion molecules. In cancer metastasis, cells lose these intercellular connections, resulting in increased ability to migrate away from the primary tumor. Prior studies in our lab have shown that although salivary gland (SG) cancer cells break away from the primary tumor and exhibit higher migratory capacity, they do not migrate individually, but rather as distinct cohorts. We hypothesize, that although SG cancer cells lose their cadherin interactions from the primary tumor, the migrating cancer cohort overexpresses cadherin to enhance 'stickiness' as they metastasize. We also speculate that this altered expression of cell adhesion molecules may be mediated through the cancer ECM/matrisome. Normal human SG cells (HSG) and human SG cancer cells (HTB-41) were maintained in a 5% CO<sub>2</sub> atmosphere at 37°C. The ECM from cancer HTB-41 cells were selectively preserved and normal HSG cells were seeded on the ECM of HTB-41 (HSG# cells). Immunofluorescence was used to evaluate the localization of e-cadherin, n-cadherin, and  $\beta$ -catenin in HSG# cells as compared to negative control normal HSG cells and positive control cancer HTB-41 cells. Total proteins were isolated and western blotting was performed with anti e-cadherin, anti n-cadherin, and anti  $\beta$ -catenin antibodies. Experiments were repeated in triplicate and statistical analyses performed. As hypothesized, e-cadherin, n-cadherin, and  $\beta$ -catenin exhibited varying levels of redistributions in cancer SG cells as well as in normal SG cells exposed to the cancer ECM. There was a complete loss of intercellular e-cadherin expression, increased n-cadherin, and decreased  $\beta$ -catenin under the influence of the cancer ECM. The cancer ECM significantly altered the cytoarchitecture of normal SG cells to a more migratory morphology, and this seems to be a transient state before cancer cells begin to re-express significantly increased e-cadherin and  $\beta$ -catenin. This re-expression of adhesion molecules seems to facilitate cancer cell cohorts to exhibit homogeneity and cohesiveness in order to migrate and invade into surrounding tissues during SG cancer progression and metastasis.

10:45am UG  
Rm 174

### **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.

11:00am UG  
Rm 174

### **The Effects of a Traffic-Light Label Intervention on College Students' Dietary Choices in All-You-Can-Eat Cafeteria**

\*Emily Rosen, Judith Thorn [Knox College]

To determine the proportions of nutrient rich, nutrient neutral, and nutrient poor foods eaten by college students in an all-you-can-eat cafeteria, and to assess students' knowledge regarding the nutritional value of the

foods before and during a traffic-light labeling intervention. 94 surveys to determine perceptions of the nutritional value of foods were collected from students at a college campus. In the cafeteria, a 1-week intervention was implemented in which foods were labeled with colored dots (red: nutrient poor, yellow: nutrient neutral, green: nutrient rich). 47 students took pictures of their food at lunch and dinner for 1 week before and 1 week during the intervention. The surface area of each item of food was calculated using ImageJ software and categorized as nutrient rich, nutrient neutral, or nutrient poor. 2-way ANOVA testing will be used to measure changes in proportions of red, yellow and green foods consumed. Among the 47 participants, we found that prior to the intervention 44.62% of foods eaten at lunch and dinner were nutrient rich, 5.38% were nutrient neutral, and 49.91% were nutrient poor. In surveys collected before the intervention, students correctly identified nutrient poor foods 51.33% of the time and nutrient rich food 75.12% of the time. Further analysis will be conducted to determine changes in dietary behaviors before and during the intervention. The results from the survey and food intake observations demonstrate limited knowledge regarding nutrition and poor food choices among college students.

## MICROBIOLOGY

- 11:15am Grad Rm 174** **Detection of Thermophilic Fungi in Corn-Based Food Products and Determination of their Optimal Growth Temperature**  
 \*Adeyemi Olanrewaju, 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-derived food products and their potential role in mycotoxin production have not been studied. Based on previous studies, we hypothesized that thermophile spores might be present in corn-based food products due to their high abundance in corn after harvest. Thermophilic fungi in corn-based food products were isolated using serial dilutions. Dilutions were plated on corn meal agar (CMA) and Emerson yeast starch agar (EYSA) and incubated at 45°C for 1 week. Fungal identification was carried out using microscopy and DNA sequencing. Fungi were isolated from all the corn-based food products tested. A total number of 36 cultures from various products including corn flour, corn flakes, corn bread, corn meal and corn starch were isolated. Sequencing showed that the different corn-based food products are colonized by thermophilic fungi including *Rhizomucor pusillus*, *Thermomyces langinosus*, *Rhizopus microsporus*, *Aspergillus fumigatus*, *Aspergillus waksmani* and *Aspergillus terreus*. Optimal growth temperature experiments were conducted to determine the temperature at which thermophilic fungi grows best and also to differentiate the isolates into thermotolerants and thermophilic fungi. The genera *Rhizopus*, *Rhizomucor* and *Thermomyces* were true thermophile while genus *Aspergillus* was the only thermotolerant. These results indicated the presence of thermophiles in corn products which may have significant implications on human health.
- 11:30am Grad Rm 174** **Phosphatase Activity in *Staphylococcus aureus* Biofilm versus Suspension**  
 \*<sup>1</sup>Kevin Danikowski, <sup>2</sup>Bellur S. Prabhakar, <sup>1</sup>Tong Cheng [<sup>1</sup>Harper College, <sup>2</sup>University of Illinois Chicago]  
*S. aureus* is known for its ability to produce biofilms and its resistance to antibiotic treatment. The mechanism of biofilm formation is not completely understood. Many molecules, such as DNA and polysaccharides, have been identified in the biofilm microenvironment, yet little is known about the enzymes. Here, we studied alkaline phosphatase activity in *S. aureus* grown either in biofilm or suspension. Later, we examined the effect of inhibiting alkaline phosphatase on biofilm production and adhesion. Our results reveal phosphatase activity is significantly increased in biofilm. Additionally, inhibiting phosphatase via orthovanadate resulted in decreased biofilm adhesion similar to that of DNase, an enzyme used to decrease biofilm formation. This indicates alkaline phosphatase is necessary for proper biofilm formation, thus inhibiting *S. aureus* alkaline phosphatase may prove to be a novel therapeutic target for anti-microbial agents.

## PHYSICS, ASTRONOMY, & MATHEMATICS

- 9:30am UG Rm 178** **Variability of a Hydroxyl Maser in a Pre-Planetary Nebula**  
 \*Angelica Strack, Esteban Araya [Western Illinois University]  
 After exhausting the hydrogen and helium in their cores low mass stars begin to expel gas in fast moving winds,

entering into the final phases of their stellar evolution. During this time the stars go from giants and supergiants to planetary nebula. Throughout this time period strong narrow emission lines due to stimulated emission (masers) begin to appear, and the masers can be used to trace the evolution of the stars. CRL618, also known as the Westbrook Nebula, is a prototypical example of a pre-planetary nebula, an object in transition between the supergiant phase and a planetary nebula. CRL618 is characterized by its carbon rich environment, and until 2008 there had been no detection of masers from oxygen species. In 2008, observations conducted with the 305m Arecibo Telescope resulted in detection of a 4765 MHz maser. The maser detection was confirmed in follow up observations a few months after the initial detection. CRL 618 was observed again in 2015 using the Arecibo Telescope to investigate variability and detect and/or set flux density limits of all other OH transitions. Observations were conducted between 1 and 9GHz, but no OH transition was detected during the 2015 observations, including the 4765 MHz OH line. The lack of detection indicates significant variability. The 4765 MHz OH line had a relative velocity of -40km/s with respect to the systemic velocity of the object, suggesting that the maser was tracing the outflow material. Given the short lifetime, and the rare nature of the OH line, our work indicates that OH masers trace a short-lived period of time during the expansion of late-type stars.

## STEM EDUCATION

### 10:30am Grad **Mobile, Touch Screen Technology as an Aid in Mathematics Education**

Rm 178

\*Megan Corbett, Justin Ehrlich [Western Illinois University]

Mathematics scores for elementary-aged students in the United States are generally below average on an international scale. Educators are increasingly looking towards technological solutions to assist in improving student performance. One promising technology is the tablet, which allows engagement of multiple senses, including sight, touch, and sound, creating an exciting and interactive learning environment. Though tablet technology is becoming increasingly present in United States elementary classrooms, there is currently limited research on the integration of tablet technology into the mathematics classroom and its efficacy in aiding students' learning of mathematical concepts. The purpose of the current research is to determine to what extent mobile, touch screen technology engages learners and enhances their understanding of basic mathematical concepts in comparison to a traditional mathematics lesson. To explore this, a game-like educational software application was developed for deployment on iPads in elementary classrooms, where the goal for the user is to correctly create basic arithmetical equations. A case study is currently being conducted that will compare student performance before and after use of the iPad intervention to student performance before and after receiving a traditional lesson as designed by a teacher. Further, students that utilize the iPad intervention will complete a qualitative survey to ascertain engagement while using the device as well as usability of the software. Data that has been collected and any associated findings will be presented. It is hoped that there will be identifiable differences in performance between those students that utilized the software versus those that received a traditional lesson as designed by a teacher to help determine whether this technology can be utilized as an effective mathematics teaching tool in a classroom setting.

### 10:45am **The RU-NECSS Graduate Biology Cohort: A Partnership to Enhance Teacher Training and Build Multi-Level STEM Education Pathways**

Rm 178

\*<sup>1</sup>Robert Seiser, <sup>2</sup>Kathy Bruce, <sup>1</sup>Vicky McKinley [<sup>1</sup>Roosevelt University, <sup>2</sup>Harper College]

How can schools and universities develop and adopt effective teaching practices to improve student learning outcomes and persistence in STEM at all levels? K-12/college partnerships, civic engagement pedagogy and science communication practice provide a means to this end. A recent collaboration between Roosevelt University and the Northwest Educational Council for Student Success (NECSS) provides an example of integrated multi-level science education and teacher development through a focus on "science and society" issues. In-service high school teachers seeking to meet the credentials to teach college-level biology with Harper College were admitted to Roosevelt University as a cohort for an 18-credit hour graduate program in biological science. Through four customized courses, the instructors completed half of a broad-based MS Biology degree while gaining experience in lesson planning, case study/theme development, community engagement, proposal writing, laboratory skills and research methods. Most of the instructors have continued as masters degree-seeking students. The college/university partners gained insights into high school science instructional practice and are now developing more robust pathways for science education through the AS and BS degree. The curriculum was informed by the Next Generation Science Standards, the Vision and Change monograph on

biology education reform, and the SENCER project on civic engagement in science education. Examples of curriculum elements, student work and high school classroom implementation will be provided.

**11:00am Grad Biological Course-Based Undergraduate Research Experiences: An Examination of an Introductory  
Rm 178 Level Implementation**

\*Kenneth Knoth, Kelly Barry [Southern Illinois University Edwardsville]

Unlike traditional "cookbook" laboratory sequences, course-based undergraduate research experiences (CUREs) provide authentic research benefits to an entire course population. Research experiences have been shown to enhance research skills, critical thinking, productivity, retention in science, and more. Conventional research avenues typically include only a handful of upper-level undergraduates working under the guidance of a principal investigator. In contrast, CUREs are designed to give project ownership to all STEM students early in their curriculum. A significant obstacle to curriculum developers is selecting a CURE topic that fits several criteria. An ideal CURE topic requires affordable resources, lab techniques that can be quickly mastered, time for multiple iterations within one semester, and the opportunity to generate new data. Our objective has been to determine the benefits and drawbacks of CURE implementation to the largest audience at Southern Illinois University Edwardsville – the introductory biology laboratory course for biology majors. Here, we utilize the process of converting microalgae lipids into biodiesel as the CURE environment. Data collected from the Spring, Summer, and Fall 2016 pilot phases will be presented.

## ZOOLOGY

**9:00am Pelvic Function in Anuran Jumping: Interspecific Differences in the Kinematics and Motor Control of  
Rm 274 the Iliosacral Articulation During Take-Off and Landing**

\*<sup>1</sup>Richard Essner, <sup>2</sup>Stephen Reilly, <sup>2</sup>Stephane Montuelle, <sup>3</sup>Andre Schmidt, <sup>2</sup>Cornelia Krause, <sup>4</sup>Emily Naylor, <sup>5</sup>Michael Jorgensen [Southern Illinois University Edwardsville, <sup>2</sup>Ohio University, <sup>3</sup>Klinik Bavaria Kreisch, Germany, <sup>4</sup>University of California Riverside, <sup>5</sup>Rocky Vista University]

We compared iliosacral movements and motor patterns during jumping and landing in anurans with "lateral-bender" and "rod-like" pelvic designs. Muscle activity patterns, iliosacral anteroposterior (AP) movements and sagittal bending of the pelvis were quantified in the lateral bending *Ascaphus* (Leiopelmatidae) and *Rhinella* (Bufonidae) and the rod-like *Lithobates* (Ranidae). All species exhibited sagittal extension during take-off; however, trunk elevation occurred significantly earlier in the rod-like pelvis. *Piriformis* muscles depressed the urostyle whereas *longissimus dorsi* muscles elevated the trunk during take-off. *Coccygeoliliacus* muscles produced anterior translation of the sacrum on the ilia. A new model illustrates how AP translation facilitates trunk extension in lateral-benders thought to have limited sagittal bending. During landing, AP translation patterns are similar, as impact forces slide the sacrum from its posterior to anterior limits. Sagittal flexion during landing differs among taxa and AP translation during landing may dampen impact forces, especially in *Rhinella* in which pelvic function is tuned to forelimb-landing dynamics. The flexibility of the lateral-bender pelvis helps to explain retention of this basal configuration in many anurans. The novel function of the rod-like pelvis may be to increase the rate of trunk elevation relative to faster rates of energy release from the hind limbs, enabling them to jump farther.

**9:15am UG Diet of Wintering Short-eared Owls (*Asio flammeus*) in the Grand Prairie Region of Illinois  
Rm 274**

\*Shelby Melzer, Tih-Fen Ting [University of Illinois Springfield]

Short-eared owl (*Asio flammeus*) is a state-endangered species with an overlapping breeding and wintering range in Illinois. This owl species has experienced population declines over much of its range in North America since 1960s. Specifically, habitat loss and fragmentation at wintering grounds, and in places where the owls occur year-round, is considered a major threat for the short-eared owl. Examination of diet of short-eared owls can help shed light on the influence of prey in habitat selection of wintering owls, particularly in fragmented landscapes. From January through March of 2016, collection of owl pellets occurred in conjunction with the surveys of wintering short-eared owls in the Grand Prairie Region of Illinois with a landscape dominated by agriculture. A total of 331 prey items from 245 owl pellets were identified from eight of the 16 survey sites. Based on the skulls in the pellets, six different species of small mammals were readily identifiable, including meadow vole (*Microtus pennsylvanicus*), prairie vole (*Microtus ochrogaster*), deer mouse (*Peromyscus maniculatus*), white-footed mouse

(*Peromyscus leucopus*), northern short-tailed shrew (*Blarina brevicauda*), and North American least shrew (*Cryptotis parva*). Meadow vole was the most common prey species, accounting for 60.73% of total prey items. Prairie vole was next with 19.64% while deer mice and white-footed mice together accounted for nearly 10% of total prey items. Short-eared owls are known to prefer meadow voles as their prey of choice. Our investigation suggests that meadow voles, along with prairie voles, still are prey species of significance for wintering short-eared owls even in agriculture-dominated landscapes.

**9:30am Grad Movement Ecology of Franklin's Ground Squirrels (*Poliocitellus franklinii*) in a Fragmented Landscape**  
**Rm 274**

\*Molly Levy, Tih-Fen Ting [University of Illinois Springfield]

Movement and dispersal ability have often been considered an inherent ability of animals, but research has suggested that an individual's ability to move is also affected by extrinsic factors, such as habitat fragmentation and weather condition. Due to habitat loss and fragmentation, the Franklin's ground squirrel (*Poliocitellus franklinii*), a state-threatened species in Illinois, is often found in isolated habitat patches in fragmented landscapes. As habitat fragmentation increases, persistence of a species depends upon the ability of individuals to traverse an inhospitable landscape for resource acquisition and exchange of genetic material. We investigated movement patterns of juvenile Franklin's ground squirrels ( $n = 53$ ) via radio telemetry from 2013-2016. Locations were recorded 5-6 times per day at regular intervals, allowing for the monitoring of movement patterns, daily movement distance, and dispersal events. Daily movement distances ranged from 0-6,135 m, with periods of peak movement varying between time intervals over the course of a day and between tracking seasons. Daily movement distances were also positively influenced by daily maximum temperature ( $P < 0.0005$ ). Cumulative dispersal distances ranged from 126-15,315 m and varied significantly between tracking seasons with the largest distances observed during the 2013 and 2016 seasons. Body weight positively affected dispersal distances ( $P = 0.01$ ). Within their home ranges, individual juveniles preferred right-of-way habitats while avoiding row-crop agriculture and developed areas. Our preliminary results suggest that the movements and habitat use of juvenile Franklin's ground squirrels are influenced by both intrinsic and extrinsic factors.

**9:45am Grad Agent-Based Modeling of Movement of Franklin's Ground Squirrels (*Poliocitellus franklinii*) in a**  
**Rm 274 Fragmented Landscape**

\*Timothy Mayer, Tih-Fen Ting [University of Illinois Springfield]

To facilitate the recovery of any species at risk, conservation planning of critical habitats in fragmented landscapes is essential. Individual-based, spatially explicit modeling has played increasingly significant role in conservation planning. Franklin's ground squirrel (*Poliocitellus franklinii*) is a species native to Midwestern United States and portions of Canada; this species is listed as state-threatened in Illinois. Populations of Franklin's ground squirrels are considered in decline due to habitat loss and fragmentation. We first investigated potential suitable habitats for Franklin's ground squirrels in Vermilion and Champaign Counties, IL, by employing a MaxEnt modeling approach. Early results suggest that 1-m resolution LiDAR data for terrain slopes, 1-m resolution Supervised Classification Land Cover data from National Agriculture Imagery Program, and proximity to roads at a distance  $\leq 100$  m provide the best-fit habitat suitability model for predicting presence of Franklin's ground squirrels. We next developed an agent-based model (ABM) for the movements of juvenile Franklin's ground squirrels based on four years of radio telemetry data to investigate potential habitat utilization within a given habitat configuration. Further analyses are required to 1) elucidate the effect of habitat configurations (i.e., linear vs. non-linear) on juveniles' movements and 2) inspect the ABM performance by comparing actual movement data obtained via field telemetry with movements based on both stochastic and deterministic models.

**10:30am Grad Mesopredator Habitat Use in a Fragmented Midwestern Landscape**  
**Rm 274**

\*Jeffery Cronin, Tih-Fen Ting [University of Illinois Springfield]

Mesopredators are significant for many ecological communities because of their dual roles within food webs, their diverse behavior and ecology, and their potential to thrive in different environments. Corridor habitats, in the form of linear habitats, often provide connectivity between patches of quality habitat in fragmented landscapes. Few studies on mammalian corridor use have focused on mesopredators. From April through September 2016, we deployed 27 camera traps and collected habitat data in Sangamon County, Illinois, to examine the mesopredator habitat use in a fragmented landscape typical of Central Illinois. We detected raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), coyote (*Canis latrans*), domestic cat (*Felis catus*), red fox (*Vulpes vulpes*), striped skunk (*Mephitis mephitis*), American mink (*Neovison vison*), American badger (*Taxidea taxus*), and long-tailed weasel (*Mustela frenata*) during the survey period. We used single-species, single-season

occupancy modeling to investigate mesopredator habitat use. Precipitation decreased the detection probability of raccoon but had no effect on others. Naïve occupancy was low for a number of species, making occupancy modeling possible only for the coyote, raccoon, and opossum. The amount of bare ground at the sites reduced coyote use. Raccoons preferred non-linear habitat with sizable trees present while the presence of small rodents coincided with the site use by opossums.

10:45am UG  
Rm 274

**Effects of Water Acidification and Pathogen Exposure on Immune Defense in Invasive Cuban Tree Frog (*Osteopilus septentrionalis*) and Native American Bullfrog (*Rana catesbeiana*) Tadpoles**

\*Mackenzie Peck, Travis E. Wilcoxon [Millikin University]

Freshwater acidification, an issue largely linked to industrialization and human activity, threatens freshwater environments and the organisms that inhabit them. The combination of acidification and additional stressors already present in freshwater may increase the threat. We exposed Cuban tree frog (*Osteopilus septentrionalis*) and American bullfrog (*Rana catesbeiana*) tadpoles to acidified water and *Aeromonas hydrophila*, a common water bacterium and amphibian pathogen. We monitored development, growth, and immune defense among tadpoles from different treatments, and performed bacterial killing assays on whole blood samples from these tadpoles. We found that neither acidity nor pathogen exposure, nor a combination of the two, had a significant effect on immune defense in *O. septentrionalis*, as measured by *A. hydrophila* killing ability, when considering varying Gosner developmental stages and snout-to-vent lengths. However, exposure to acidic conditions and/or *A. hydrophila* significantly decreased *A. hydrophila* killing ability in *R. catesbeiana*. Our results could hold implications towards the future of native species as a result of increased tolerance to environmental stressors in invasive species.

11:00am Grad  
Rm 274

**Winter Roost Selection of Short-eared Owls (*Asio flammeus*) in an Agriculture-Dominated Landscape**

\*<sup>1</sup>Elizabeth Errickson, <sup>1</sup>Tih-Fen Ting, <sup>2</sup>Brian Washburn [<sup>1</sup>University of Illinois Springfield, <sup>2</sup>National Wildlife Research Center, Sandusky, Ohio]

Short-eared Owls have experienced a steep decline over much of their North American range during the past half-century. Specifically, habitat loss and degradation at its wintering grounds, and in places where the owls occur year-round, is considered most likely the major threat for the Short-eared Owl. From January through March of 2016, we located and identified forty-seven Short-eared Owl winter roosts in the Grand Prairie Region of Central Illinois that has a landscape dominated by row-crop agriculture. We measured and collected data on microhabitat characteristics and landscape features for each roost location and compared them to an equal number of paired random locations where Short-eared Owls were not found roosting. Early data analysis suggests that Short-eared Owls showed differential use of areas of predominantly smooth brome (*Bromus inermis*) and other short prairie grasses in selecting winter roost locations. Additionally, Short-eared Owl winter roost sites were located further away from roadways compared to random sites. We will investigate the extent of site fidelity to those winter roosting grounds identified during last year's field season after the completion of the current field season.

11:15am Grad  
Rm 274

**Evaluating the Success of Prairie Restorations in Southwest Illinois in Providing Suitable Habitat for Prairie Birds**

\*Aaron Alexander, Peter R. Minchin [Southern Illinois University Edwardsville]

Prairie restoration is crucial to grassland-dependent species because it increases the area of suitable habitat. Grassland bird species are important pollinators and dispersers of plants, and are under significant decline, which make them important priorities for conservation efforts. The objectives of this study are to (1) examine temporal trends in the avian community composition and diversity among prairie restorations, (2) to test whether these trends are heading in the direction of the old growth reference prairie, and (3) to investigate which habitat attributes are the best predictors of the presence and abundance of prairie bird species. I hypothesize that (1) the restorations are on track to attain the bird community composition and diversity of an old growth prairie; (2) changes in vegetation structure over time during restoration provide suitable habitat for particular species of prairie birds. Five 20 m radius sampling plots were established in each of the study sites and utilized for both avian and vegetation sampling. Avian sampling took part in two periods, one spanning the entire avian breeding season from late May into early August, and the other corresponded with avian migration and lasted from September into late October. Plots were divided into regular distance intervals (0-5m, 6-10m, 11-15m, 16-20m) and all birds within as well as those flying over and outside of the plot were recorded. Vegetation characteristics (e.g., litter depth, forb coverage, and vegetation height) were measured along a 40 m transect within each study

plot. Density (birds per hectare) for each plot will be calculated utilizing distance software. Distance software places more importance on those bird observations that are farther away from the observer and puts less weight to those nearby observations, as it is more likely that farther away objects would be missed when sampling. Distance software allows for a more accurate avian density estimate and corrects for the differences in detectability across species. Diversity indices were highest in the youngest restorations before dropping off at the oldest restoration and the reference prairie. Indicator species analysis showed that the northern cardinal, willow flycatcher, indigo bunting, and the ruby-throated hummingbird were indicative of restored prairies less than seven years old, whereas species like the common yellowthroat and the red-winged blackbird signaled older prairie restorations (15-29 years). Field sparrows were found to be indicator species of the old-growth reference prairie used in this study. Non-metric multidimensional scaling showed that each study prairie was different from one another based on their avian communities and that the restorations are not on track to achieve the avian community structure found in the reference prairie. The results of this research will provide valuable information to prairie managers across the region.

11:30am UG  
Rm 274

### **Effects of Elevated Corticosterone on Innate and Adaptive Immunity in Northern Leopard Frog Tadpoles**

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Stress is known to have far-reaching effects on vertebrate immune defenses; however, it remains unclear to what extent stress hormones, such as corticosterone (CORT), influence immune function in larval amphibians. The purpose of this study was to identify whether exogenous CORT has an effect on innate and acquired immunity of Northern Leopard Frog tadpoles, *Lithobates pipiens*, when exposed to an opportunistic pathogen. We hypothesized that by elevating CORT, the tadpole immune defenses would be altered. In order to test innate and acquired immunity within the tadpoles, we conducted two experiments. In the first experiment, we exposed one group to exogenous CORT and maintained a control group without exogenous CORT, with neither exposed to *A. hydrophila*. In the second experiment, we exposed all tadpoles to *A. hydrophila*, but again only exposed one group to exogenous CORT. We used a bacteria killing assay to assess innate immunity and an *A. hydrophila* ELISA to measure IgM and IgY antibodies generated in an acquired immune response. We found that the CORT dosed tadpoles killed significantly more *A. hydrophila* than the control tadpoles. Alternatively, CORT-dosed tadpoles had significantly lower IgM and IgY against *A. hydrophila*. Our findings suggest that stress has differential effects on innate and acquired immunity in larval Northern Leopard Frogs, and that isotype switching and affinity maturation may not be fully developed in these primitive vertebrates.

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