

TRANSACTIONS OF THE ILLINOIS STATE ACADEMY OF SCIENCE

Supplement to Volume 111



**110th Annual Meeting
April 13 – 14, 2018**

**Millikin University
Decatur, Illinois**

Illinois State Academy of Science

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

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110TH ISAS ANNUAL MEETING

April 13 – 14, 2018

Millikin University

Hosts: Travis Wilcoxon & Judy Parrish

MEETING SCHEDULE

Friday, April 13th

- 12noon – 2:00pm ISAS Council Meeting (University Commons, 3rd floor, President's Dining Room, lunch provided)
- 1:00pm – 5:30pm Registration (Griswold Center Lobby)
- 2:20pm – 2:30pm Session A (odd numbers) Poster set-up (Griswold Center Gymnasium)
- 2:30pm – 3:40pm Poster Session A (Griswold Center Gymnasium)
- 3:40pm – 3:50pm Session A Poster take-down (Griswold Center Gymnasium)
- 3:40pm – 3:50pm Session B (even numbers) Poster set-up (Griswold Center Gymnasium)
- 3:50pm – 5:00pm Poster Session B (Griswold Center Gymnasium)
- 5:00pm – 5:10pm Session B Poster take-down (Griswold Center Gymnasium)
- 6:00pm – 7:30pm Dinner Banquet (University Commons, 3rd floor Ballrooms)
- 7:30pm – 9:00pm Keynote Address – Scott McDonald (University Commons, 3rd floor Ballrooms)

Saturday, April 14th

- 7:45am – 9:00am (Leighty-Tabor Science Center, 1st floor, East Lobby)
- 7:45am – 11:45am Registration (Leighty-Tabor Science Center, 1st floor, East Lobby)
- 8:30am – 12:00noon Oral Presentations Begin (Leighty-Tabor Science Center)
- Coffee Breaks depending on Division (see Oral Presentation Schedule)
- 9:00am – 10:30a, STEM Education Workshop (326 Leighty-Tabor Science Center)
- 12noon – 12:30pm Divisions Meetings and Judging Results (Leighty-Tabor Science Center, see Oral Presentation Schedule for appropriate room)
- 12:30pm – 2:00pm Luncheon & Awards Presentations (University Commons, 3rd floor Ballrooms)

CAMPUS MAP – BUILDING & PARKING INFORMATION



Parking on Friday and Saturday – Reserved parking is available in the lot directly south of the University Commons, number 12 on the map. Overflow parking will be available in the following lots: Lot M9 (entrance West Wood Street), Lot M7 (entrance Fairview Avenue), and Lot M11 (entrance West Main Street).

POSTER PRESENTATION SCHEDULE – FRIDAY, APRIL 13, 2018

All Poster Presentations in the Griswold Center Gymnasium

Session A 2:30-3:40pm – Odd Numbers				Session B 3:50-5:00pm – Even Numbers			
#	Division	#	Division	#	Division	#	Division
1	Agriculture	67	Environmental Science	2	Anthro & Archaeology	68	Environmental Science
3	Anthro & Archaeology	69	Environmental Science	4	Botany	70	Environmental Science
5	Botany	71	Environmental Science	6	Botany	72	Environmental Science
7	Botany	73	Environmental Science	8	Botany	74	Health Sciences
9	Botany	75	Health Sciences	10	Cell Biology	76	Health Sciences
11	Cell Biology	77	Health Sciences	12	Cell Biology	78	Health Sciences NOT PRESENTED
13	Cell Biology	79	Microbiology	14	Cell Biology	80	Microbiology
15	Cell Biology	81	Microbiology	16	Cell Biology	82	Microbiology
17	Cell Biology	83	Microbiology	18	Cell Biology	84	Microbiology
19	Cell Biology	85	Microbiology	20	Cell Biology	86	Microbiology
21	Cell Biology	87	Microbiology	22	Cell Biology	88	Microbiology
23	Cell Biology	89	Microbiology	24	Cell Biology	90	Microbiology
25	Cell Biology	91	Microbiology	26	Cell Biology	92	Physics, Math, & Astronomy CANCELLED
27	Cell Biology	93	STEM Education	28	Cell Biology	94	STEM Education
29	Cell Biology	95	STEM Education	30	Cell Biology	96	STEM Education
31	Cell Biology	97	STEM Education	32	Cell Biology	98	Zoology
33	Cell Biology	99	Zoology	34	Cell Biology	100	Zoology
35	Cell Biology	101	Zoology	36	Chemistry	102	Zoology
37	Chemistry	103	Zoology	38	Chemistry	104	Zoology
39	Chemistry	105	Zoology	40	Chemistry	106	Zoology
41	Chemistry	107	Zoology	42	Chemistry	108	Zoology
43	Chemistry	109	Zoology	44	Chemistry	110	Zoology
45	Chemistry	111	Zoology	46	Chemistry	112	Zoology
47	Chemistry	113	Zoology	48	Chemistry CANCELLED	114	Zoology
49	Chemistry	115	Zoology	50	Chemistry	116	Zoology
51	Chemistry	117	Zoology	52	Chemistry	118	Zoology
53	Chemistry	119	Zoology	54	Chemistry	120	Zoology
55	Chemistry	121	Zoology	56	Chemistry	122	Zoology
57	Chemistry	123	Zoology	58	Chemistry	124	Zoology
59	Engineering & Tech	125	Zoology	60	Environmental Science	126	Zoology
61	Environmental Science	127	Zoology	62	Environmental Science	128	Zoology
63	Environmental Science	129	Zoology	64	Environmental Science	130	Zoology
65	Environmental Science	131	Zoology	66	Environmental Science		

Session A: Poster set-up, 2:20-2:30; Poster take-down, 3:40-3:50

Session B: Poster set-up, 3:40-3:50; Poster take-down, 5:00-5:10

ORAL PRESENTATION ROOM SCHEDULE – SATURDAY, APRIL 14, 2018

All Oral Presentations in Leighty-Tabor Science Center

	Room 209	Room 115	Room 208	Room 221	Room 001
8:30am	Anthro & Archeology				Zoology
8:45am	Anthro & Archeology				Zoology
9:00am	BREAK	Botany	Cellular Biology		Zoology
9:15am	Environmental Sci	Botany	Cellular Biology	Health Sciences	Zoology
9:30am	Environmental Sci	Botany	Cellular Biology	Health Sciences	Zoology
9:45am	Environmental Sci	Botany	Cellular Biology	Health Sciences	Zoology
10:00am	Environmental Sci	Botany	Cellular Biology	Health Sciences	Zoology
10:15am	Environmental Sci	Botany	Cellular Biology	Health Sciences	Zoology
10:30am	BREAK	Botany	Cellular Biology	BREAK	BREAK
10:45am	Microbiology	Botany	Cellular Biology	STEM Education	Zoology
11:00am	Microbiology	BREAK	BREAK	STEM Education	Zoology
11:15am	Microbiology	Computer Science	Chemistry	STEM Education	Zoology
11:30am	Microbiology CANCELLED	Computer Science	Chemistry	STEM Education	Zoology
11:45am		Computer Science	Chemistry	STEM Education	Zoology

Division Abbreviations

Anthro & Archeology	Anthropology & Archeology
Cellular Biology	Cellular, Molecular, & Developmental Biology
Engineering & Tech	Engineering & Technology
Environmental Sci	Environmental Science
Physics, Math, & Astronomy	Physics, Mathematics, & Astronomy

Participant Abbreviations

Grad	Graduate Student
UG	Undergraduate Student
None	Regular/Faculty Member

School and Organization Abbreviations

Augustana	Augustana College
Bradley	Bradley University
DePaul	DePaul University
EIU	Eastern Illinois University
Eureka	Eureka College
Greenville	Greenville College
IC	Illinois College
INHS	Illinois Natural History Survey
Loyola	Loyola University Chicago
Millikin	Millikin University
Olivet	Olivet Nazarene University

SIU	Southern Illinois University (Carbondale)
SIU Dental	SIU School of Dental Medicine
SIUe	Southern Illinois University Edwardsville
Southwestern	Southwestern Illinois College
STL Pharmacy	St. Louis College of Pharmacy
STL Zoo	St. Louis Zoo
UI	University of Illinois (Champaign/Urbana)
UIC	University of Illinois Chicago
UIS	University of Illinois Springfield
Wheaton	Wheaton College
WIU	Western Illinois University

POSTER PRESENTATIONS – FRIDAY, APRIL 13, 2018 – GRISWOLD CENTER GYMNASIUM

Time	#	Presenter	Title of Presentation (Posters)
<i>Agriculture</i>			
2:30PM	1	Keely Egelhoff (UG, WIU)	Remote Sensing for Evaluating the Effect of Grafting on Hyperspectral Reflectance of Tomato Plants
<i>Anthropology & Archeology</i>			
3:50PM	2	Miranda Karban (IC)	Ontogeny and Covariation in the Extant Human Occipital Bone
2:30PM	3	Lauren Estes (UG, IC)	Forming Identities Through Bones: Forensic Sex Estimation in Human Skeletons at Illinois College
<i>Botany</i>			
3:50PM	4	Kelly Clark (UG, EIU)	Epidermal Anatomy of Angraecinae (Vandae, Orchidaceae)
2:30PM	5	Christopher Featherstone (Grad, SIUe)	Evaluation of Tallgrass Prairie Restoration Success in Southwestern Illinois
3:50PM	6	Miles Gossett (Grad, SIUe)	Forty Years of Change in the Old-Growth Upland Forests of Southwestern Illinois
2:30PM	7	Eric Janssen (Grad, UI)	The Impacts of Habit Quality and Seed Age on Seed Vitality of the Rare Plant, <i>Synthyris bullii</i>
3:50PM	8	Noah Pyles (UG, SIUe)	The Effect of Sterilization Time on Germination Rates for the Eastern Prairie Fringed Orchid
2:30PM	9	Zach Miles (UG, Millikin)	The Effects of Simulated Herbivory on Cut-Leaf Teasel (<i>Dipsacus laciniatus</i> - Dipsacaceae)
<i>Cell, Molecular, & Developmental Biology</i>			
3:50PM	10	Kevin Krajniak (SIUe)	The Effects of Three Pentapeptides Related to FMRFamide on the Crop-Gizzard of the Earthworm, <i>Lumbricus terrestris</i>
2:30PM	11	Haley Gula (Grad, SIUe)	A Genomic Approach to Locate the <i>mnd</i> Gene that Disrupts Hyphal Growth Pattern in <i>Schizophyllum commune</i>
3:50PM	12	Mark Gudger (Grad, DePaul)	Effect of Gold (I) Phosphines on the Cell Proliferation of MDA-MB-231 Breast Cancer Cells
2:30PM	13	Robin Redline (Grad, DePaul)	Effect of Triaminopyrimidine Analogs on the Cell Proliferation of MDA-MB-231 Breast Cancer Cells
3:50PM	14	Adeyemi Tunde-James Adesanwo (Grad, WIU)	Gene Expression in <i>Spodoptera exigua</i> Caterpillar Correlated to Cannibalism Rate on Methyl Jasmonate-Induced Tomato Plants
2:30PM	15	Bashaier Alharbi (Grad, WIU)	Gene Expression of Tomato Fruitworm (<i>Helicoverpa zea</i>) that Fed on Tomato Plants Infected with the Entomopathogenic Fungus (<i>Beauveria bassiana</i>)
3:50PM	16	Norah Alwuthaynani (Grad, WIU)	The Effect of Bioinoculants on the Gene Expression of Soybean in Response to Salt Stress
2:30PM	17	Iffat Jahan (Grad, EIU)	The Role of CREG1 as a Master Regulator of Liver Function
3:50PM	18	Huda Alzahrani (Grad, EIU)	The Role of Prx1 and Snai2 as Master Regulators of Fibroblast Identity
2:30PM	19	Megan Cooper UG, EIU)	Analysis of Gut Microbiota from <i>Aedes albopictus</i> Mosquitoes Collected in Coles County Illinois
3:50PM	20	Claire Woods (UG, Bradley)	Analysis of the Migration of Wharton's Jelly Umbilical Cord Mesenchymal Stem Cells Towards Cancer Stem Cells and Ovarian, Breast, and Pancreatic Cancer Lineages

Time	#	Presenter	Title of Presentation (Posters)
2:30PM	21	Erica Forbes (UG, Millikin)	Characterization and Variability within <i>Candida parapsilosis</i> Agglutinin-Like Sequence (ALS) Genes
3:50PM	22	Emily Watson (UG, SIUe)	Characterization of Additional Pheromone Receptors in <i>Schizophyllum commune</i>
2:30PM	23	Quinn Nguyen (UG, Millikin)	Characterization of Agglutinin-Like Sequences (ALS) Genes in the Yeast <i>Candida tropicalis</i>
3:50PM	24	Tasmeem Chowdhury (UG, SIUe)	Developmental Stages in <i>Schizophyllum umbrinum</i> for Potential Pheromone Expression
2:30PM	25	Nicholas Roth (UG, IC)	Dkkopf (dkk) Expression in <i>Xenopus laevis</i> Ocular Tissues During Cornea-Lens Regeneration
3:50PM	26	Madison Boeglin (UG, Millikin)	Effects of Herbal Tea Potency on MCF-7 Human Breast Cancer Cells
2:30PM	27	Uchenna Ani (UG, IC)	Examining Wnt Signaling in Post-Metamorphic <i>Xenopus laevis</i> Cornea-Lens Regeneration
3:50PM	28	Sean Kisch (UG, IC)	Generation of Transgenic <i>Xenopus laevis</i> Expressing Constitutively Active Beta-Catenin
2:30PM	29	Ilish Radulovic (UG, SIUe)	Investigating the Function of Titan in Planarian Muscle Development
3:50PM	30	Max Walton (UG, Bradley)	Investigating Zebra Mussel Physiology During Temperature Stress Using Quantitative PCR
2:30PM	31	Jennifer Houser (UG, Bradley)	Investigations into the Neuroprotective Effects of Simvastatin on Adult Murine Neurons Against the Neurologic Stressors Glutamate and Beta-Amyloid
3:50PM	32	Carlee Hoxworth (UG, SIUe)	Isolation of DCL-1 and DCL-2 Genes for Rescue in <i>Schizophyllum commune</i>
2:30PM	33	Brooke Smith (UG, Millikin)	Locating and Characterizing Agglutinin-Like Sequence (ALS) Genes in <i>Candida metapsilosis</i>
3:50PM	34	Jaelyn Conway (UG, Bradley)	Proliferation of LGR5 And LGR6 Stem Cells on PCL-Collagen Nanofiber Scaffolds
2:30PM	35	Arshia JafarNia (UG, IC)	The Social Behavior of Proteins: Power-Law Degree Distribution, Degree Correlation, and Structural Balance in Protein-Protein Interaction Networks
Chemistry			
3:50PM	36	Wei Chean Chuah (Grad, WIU)	Forensic Analysis of Illicit Drugs by Nitrogen Direct Analysis in Real Time Mass Spectrometry (N ₂ DART/MS)
2:30PM	37	Natasha Frig (Grad, WIU)	Quantification of Phenylbutazone in Equine Plasma for Doping Control in Horse Racing by Liquid Chromatography with Ultraviolet Detection
3:50PM	38	Terrence Petry (Grad, WIU)	Quantification of Phenylbutazone in Equine Plasma for Doping Control in Horse Racing Using Molecularly Imprinted Polymer Solid Phase Extraction Followed by Liquid Chromatography with Ultraviolet Detection
2:30PM	39	Olusola Dahunsi (Grad, WIU)	Quantitative Analysis of Limonene Content in Citrus Oil by Gas Chromatography Using Anisole as the Internal Standard
3:50PM	40	Shashi Bhushan Pathipaka (Grad, WIU)	Quantitative Analysis of the Organic Explosive TNT in Water by High Performance Liquid Chromatography with Ultraviolet Detection
2:30PM	41	Ibrahim Al-Dulaimi (Grad, WIU)	Removal of Sulfur Impurities in Crude Oil
3:50PM	42	Mohammed Althugbi (Grad, WIU)	Solid State Synthesis of Advanced Hard Ceramic Materials at Low Temperature
2:30PM	43	Majed Almashnowi (Grad, WIU)	Solid State Synthesis of CoTe

Time	#	Presenter	Title of Presentation (Posters)
3:50PM	44	Matthew Cash (Grad, WIU)	Sorption Dynamics of Cadmium (II) And Chromium (II) Onto Montmorillonite from Mixed Solvent Systems
2:30PM	45	Gregory Deye (Grad, Loyola)	Towards Understanding Reactivity of Organic Surfaces in the Solid State
3:50PM	46	Bethany Esterlen (UG, WIU)	Antioxidant Analysis of Honey
2:30PM	47	Quinn Kruel (UG, WIU)	Comparison of Caffeine Concentration in Teas
3:50PM	48	Korinne Frankford (UG, Millikin)	Compositional, Structural, and Photovoltaic Property Relationships in $\text{Sr}_2\text{ZnW}_{1-x}\text{Mo}_x\text{O}_6$ Materials CANCELLED
2:30PM	49	Paige Noecker (UG, WIU)	Determination of Phosphate Concentration in Water Surrounding a CAFO
3:50PM	50	Christopher Perry (UG, SIUe)	Effect of Substituted Nitrophenols and Furaldehydes on Passerini-Smiles Derived Rearrangements
2:30PM	51	Jacob Worms (UG, SIUe)	Effects of Substituted Amines and Alcoholic Solvents on Oxi-Michael Ugi-Smiles Reaction
3:50PM	52	Nicholas Grunloh (UG, SIUe)	Identification and Quantitation of Soluble Nutritional Compounds in DDGS
2:30PM	53	Samantha Olendorff (UG, SIUe)	Quantitation of Endocrine Disrupting Compounds in Fathead Minnows by LC-MS
3:50PM	54	Hannah Lupton (UG, SIUe)	Seasonal Antibiotic Concentration in Wastewater and Effluent at the Southern Illinois University Treatment Plant
2:30PM	55	Katelyn Nemeth (UG, WIU)	Synthesis of Silver Nanoparticles with Various Capping Agents
3:50PM	56	Chan Myae Lin Latt (UG, IC)	Synthesis, Properties, and Isomerization of Dichlorobisethylenediaminecobalt(III) Chloride, $[\text{Co}(\text{En})_2\text{Cl}_2]\text{Cl}$
2:30PM	57	James Bosonetta (UG, EIU)	Synthesizing β -Aryl Cinnamaldehyde Semicarbazones to Test for Photochromicity
3:50PM	58	Rebecca Haughey (UG, WIU)	Testing for Phosphate Concentration in Soil Near a CAFO
Engineering & Technology			
2:30PM	59	Whitley Sapp (UG, Millikin)	Magnetically Assisted Generator
Environmental Science			
3:50PM	60	Katherine Dreas (Grad, SIUe)	A Needs Assessment of Environmental Education in Regional St. Louis Elementary Classrooms
2:30PM	61	Monica Murphy (Grad, SIUe)	Does an Invasive Plant Mediate Predation Risk Faced by an Undefended Caterpillar Herbivore?
3:50PM	62	Jenn Caldwell (Grad, SIUe)	Evaluation of Storm Water Retention by Native and <i>Sedum</i> Green Roofs
2:30PM	63	Christopher Theodorakis (SIUe)	Evaluation of Total Mercury, Lead, Zinc, and Arsenic Concentration from Fish Fillets, Water, and Sediment from Dunlap Lake in Edwardsville Illinois
3:50PM	64	Grace Wilken (Grad, EIU)	Food Waste to Fresh Food Through Compost
2:30PM	65	Soyeon Lee (Grad, SIUe)	Perfluorooctanesulfonic Acid (PFOS) Modulates Behavioral Changes and Gene Expressions Associated with the <i>Drosophila</i> Circadian Clock
3:50PM	66	Mickey Davis (Grad, SIUe)	Residual Heavy Metal Contamination within Former Coal Transport Corridors
2:30PM	67	Kevin Helenthal (Grad, SIUe)	The Impacts of Artificial Breeding Ponds on the Reproductive Success of Illinois Chorus Frogs (<i>Pseudacris streckeri illinoensis</i>)

Time	#	Presenter	Title of Presentation (Posters)
3:50PM	68	Brooke Wilke (UG, SIUe)	A Semi-Quantitative and Qualitative Analysis of East St. Louis Community Members' Environmental Concerns
2:30PM	69	Nathan Meckel (UG, SIUe)	Characterization of Baseline Fecundity and Locomotor Activity in Three Different Laboratory Strains of <i>Drosophila melanogaster</i>
3:50PM	70	Ryan Johnson (UG, Augustana)	Functions of Ecosystems: Stream Metabolism as an Efficient and Effective Means to Gauge the Health and Understand the Interworking of Urban Streams in a Watershed of Rock Island, IL
2:30PM	71	Roger Mies (UG, IC)	mtDNA Variation Between Populations of Evening Bats (<i>Nycticeius humeralis</i>) in Florida and Illinois
3:50PM	72	Whitney Gray (UG, Millikin)	Relationship Between <i>Salmonella</i> Prevalence and LPS-Binding Antibodies in Red-Eared Slider Turtles (<i>Trachemys scripta</i>)
2:30PM	73	Grant Zeidler (UG, SIUe)	Using Walnut Sawdust Wastes As Cultivation Substrate for Growing Edible Mushrooms
Health Sciences			
3:50PM	74	Jesse Snyder (Grad, SIU Dental)	Electronic Cigarette Juices Induce Inflammation and Morphological Changes in Cell and 3D Tissue Culture
2:30PM	75	Anna Benvenuto (UG, Millikin)	A Review of the Effects of Ankle Tape Versus Ankle Braces on Vertical Leap
3:50PM	76	Jessie Chappel (UG, Greenville)	Examining the Neuromuscular and Cardiovascular Effects of Kava
2:30PM	77	Justin Shiau (UG, SIUe)	Historic Epidemiology in Illinois 1850-1880: Assessment of Diseases in Three Counties
3:50PM	78	Anthony Bryan (UG, Millikin)	The Effect of Vitahawk® Administration on Antioxidant Capacity in Rehabilitating Birds of Prey DISPLAYED, NOT PRESENTED
Microbiology			
2:30PM	79	Vance McCracken (SIUe)	Antibacterial Properties of <i>Verbesina negrensis</i> Extracts Against <i>Helicobacter pylori</i>
3:50PM	80	Scott Holt (WIU)	Growth Assessment of <i>Bifidobacterium</i> on Glucanase-Derived Oligosaccharides
2:30PM	81	Lina Sallam (Grad, EIU)	Biotransformation of Bile Acids by Human Gut Bacteria
3:50PM	82	Audie Perniciaro (Grad, SIUe)	Development of Mouse Models of Necrotizing Enterocolitis
2:30PM	83	Nivedita Pareek (Grad, EIU)	One-Step Differentiation of Group 1 and Group 2 Strains of <i>Oxalobacter formigenes</i> by Multiplex Polymerase Chain Reaction (PCR)
3:50PM	84	Rui Xiao (Grad, SIU)	Symbiont Regulated Host DNA Methylation in <i>Euprymna scolopes</i> - <i>Vibrio fischeri</i> Symbiosis
2:30PM	85	Lindsey Ripper (UG, SIUe)	Can Municipal Wastewater Support the Growth of Microalgae for Biofuel Production?
3:50PM	86	Audrey Rex (UG, EIU)	Detection of Antibiotic Resistance Loci in Wastewater and Fresh Water Samples
2:30PM	87	Sydni Rubio (UG, SIUe)	Investigating Host Specificity of the <i>Burkholderia-Dictyostelium</i> Symbiosis System in Diverse Slime Mold Species
3:50PM	88	Lance Price (UG, SIUe)	New Age of the Phage: Testing the Antibiotic Potential of Bacteriophages in an Amoeba- <i>Burkholderia</i> Symbiotic Model System
2:30PM	89	Besarta Asani (UG, SIUe)	Spectrophotometric Quantification of <i>Chlorella vulgaris</i> Lipids Stained with Oil Red O
3:50PM	90	Izabella Bradford (UG, SIU)	Symbiont Regulation of Host Behaviors in Adult Animals of the <i>Euprymna scolopes</i> - <i>Vibrio fischeri</i> Symbiosis

Time	#	Presenter	Title of Presentation (Posters)
2:30PM	91	Andrew Tresslar (UG, SIUe)	The Dose Makes the Poison: Analyzing Dosage Effects of Intracellular <i>Burkholderia</i> Infection
Physics, Mathematics, & Astronomy			
3:50PM	92	Dominic Marco (UG, Millikin)	Magnetically Assisted Bike CANCELLED
STEM Education			
2:30PM	93	Elaine Abusharbain (SIUe)	Design of an Undergraduate Interdisciplinary Studies Course on Sustainability and Action Strategies
3:50PM	94	Kelly Barry (SIUe)	Pilot Phase Analysis of A CURE Implementation in a Large Enrollment Introductory Biology Laboratory Course
2:30PM	95	Kristal Deming (Grad, SIU)	Do Hands-On Science Activities Contribute to Positive Attitude and Learning Gains for Students in Middle School Science?
3:50PM	96	Andrew Morgan (Grad, SIU)	NGSS in a High School Chemistry Class Using Tardigrades to Enhance Engagement
2:30PM	97	Ashley Farthing (UG, SIUe)	Incorporating Elementary Literacy and Science Education: A Pollination Study
Zoology			
3:50PM	98	Dennis Ruez, Jr. (UIS)	Dental Variation and Population Dynamics of a Late Blancan (Late Pliocene) Cotton Rat (<i>Sigmodon curtisi</i>)
2:30PM	99	Cecilia Hennessy (Eureka)	Dietary Choices of Franklin's Ground Squirrels (<i>Poliocitellus franklinii</i>) in Central Illinois
3:50PM	100	Emerick Fulton (Millikin)	Operant Conditioning in Response to a Negative Shock Stimulus in Mealworm Beetles, <i>Tenebrio molitor</i> (Coleoptera: Tenebrionidae)
2:30PM	101	Jason Williams (SIUe)	Repeated Freezing Negatively Impacts Immune Defense in the Goldenrod Gall Fly, <i>Eurosta solidaginis</i>
3:50PM	102	Holly Dunderdale (Grad, SIU)	Scientific Research in the Classroom
2:30PM	103	Brittany Neier (STL Zoo)	The Curious Case of <i>Ophidiomyces ophiodiicola</i> and a Translocated Northern Copperhead (<i>Agkistrodon contortrix</i>)
3:50PM	104	Alexander Smith (Grad, SIUe)	Effects of Shell Size, Shape, and Density on the Crush Resistance of a Freshwater Snail
2:30PM	105	Jeremy Howard (Grad, SIUe)	Examination of Movement Patterns in the Southern Flying Squirrel (<i>Glaucomys volans</i>) in an Urbanized Environment
3:50PM	106	Brittany Rakers (Grad, SIUe)	Growth Hormone and Insulin-Like Growth Factor I Mediate Differences in Body Size Among <i>Anolis</i> Lizards
2:30PM	107	Rachel Lubbinga (Grad, SIUe)	Habitat Modeling of the Four-Toed Salamander, <i>Hemidactylium scutatum</i> , in Missouri and Illinois
3:50PM	108	Samantha Sorrick (Grad, SIUe)	Home Range and Microhabitat Preferences of the Eastern Box Turtle, <i>Terrapene carolina</i> , in Southwestern Illinois
2:30PM	109	Savanna Reeves (Grad, SIUe)	Morphological Correlates of Frenum Presence in Darters (Percidae: <i>Etheostoma</i>)
3:50PM	110	Nick Wells (Grad, SIUe)	Spatial and Temporal Patterns of Abundance and Diversity of Arthropods in Leaf Litter Communities of Mature and Regrowth Oak-Hickory Forest in Southern Illinois
2:30PM	111	Nasser Ben Qasem (Grad, WIU)	The Development and Analysis of Microsatellite DNA Markers in Spiny and Smooth Soft Shell Turtles
3:50PM	112	Logan Hartley-Sanguinett (UG, SIUe)	A Comparison of Muscle Activity During Feeding and Jumping Behavior in the Northern Leopard Frog, <i>Lithobates pipiens</i>

Time	#	Presenter	Title of Presentation (Posters)
2:30PM	113	Emily Feagans (UG, SIUe)	A Kinematic Comparison of Feeding and Jumping Behavior in the Northern Leopard Frog, <i>Lithobates pipiens</i>
3:50PM	114	Aundrea Marsh (UG, Millikin)	Aggregation and Sheltering Behavior of <i>Armadillidium nasatum</i> and <i>Aramadillidium vulgare</i> (Isopoda: Armadillidiidae) Groups Exposed to Fluorescent, UV, and Infrared Light
2:30PM	115	Samantha Hayes (UG, SIUe)	Amphibian Diversity and Abundance in Old Artificial Ponds on the SIUE Campus
3:50PM	116	Joseph Roesch (UG, IC)	Assessing the Function of Distress Calls in Cuban Fruit-Eating Bats (<i>Brachyphylla nana</i>)
2:30PM	117	Devin Roy (UG, SIUe)	Comparative Skull Morphology in Canidae and Felidae: Data from <i>Lynx rufus</i> and <i>Canis lupus</i>
3:50PM	118	An Nguyen (UG, SIUe)	Cranial Integration in <i>Lynx canadensis</i>
2:30PM	119	Owen Pulver (UG, Millikin)	Detection of West Nile Virus in Clinic-Admitted Raptor Species in Central Illinois
3:50PM	120	Douglas Sherrill (UG, Millikin)	Effect of Partial Blindness on the Hunting Ability of <i>Pardosa milvina</i> (Araneae: Lycosidae) and <i>Salticus scenicus</i> (Araneae: Salticidae) in a Controlled Environment
2:30PM	121	Nick Topping (UG, Bradley)	Investigating the Seasonal Patterns of Zebra Mussel Growth and Survivability Using Field Enclosures
3:50PM	122	Daniel Miller (UG, SIUe)	Morphological Integration in Bobcat (<i>Lynx rufus</i>) and Canada Lynx (<i>Lynx canadensis</i>) Mandible Form
2:30PM	123	Gabrielle Smith (UG, SIUe)	Morphometric Analysis of Wings in Three Different Fruit Fly Strains
3:50PM	124	Nicole Linskey (UG, SIUe)	Study of Phototaxis in a Cave-Dwelling Population of Physid Snails
2:30PM	125	Brad Richards (UG, SIUe)	The Effect of Elevated and Variable Winter Temperature on Diapause Progression and Metabolic Reserves in the Goldenrod Gall Fly, <i>Eurosta solidaginis</i>
3:50PM	126	Cooper Collings (UG, Millikin)	The Effects of Caffeine and Sertraline on Spatial Learning in Goldfish, <i>Carassius auratus</i> (Cypriniformes: Cyprinidae)
2:30PM	127	McKenna Conforti (UG, Olivet)	The Effects of Cattle Grazing on the Health of Bumble Bee (<i>Bombus</i> spp.) Populations in a Historical Tallgrass Prairie Ecosystem
3:50PM	128	Haylie Lading (UG, Millikin)	The Effects of Diet and Predator Induced Stress on Tadpole, <i>Pseudacris triseriata</i> , Development and Tail Morphology
2:30PM	129	Kimberly Zralka (UG, Olivet)	The Role of Endangered Oak (<i>Quercus</i> spp.) Savanna Characteristics in Supporting Red-Headed Woodpecker (<i>Melanerpes erythrocephalus</i> L.) Populations
3:50PM	130	Caylee Miller (UG, IC)	Using Guano to Analyze Stress Hormones in Female, Reproductive Big Brown Bats (<i>Eptesicus fuscus</i>)
2:30PM	131	Shannon Meckel (UG, SIUe)	Variable Winter Temperature Increases Adult Female Size and Survival in the Goldenrod Gall Fly, <i>Eurosta solidaginis</i>

ORAL PRESENTATIONS – SATURDAY, APRIL 14, 2018 – LEIGHTY-TABOR SCIENCE CENTER

Time	Room	Presenter	Title of Presentation
Anthropology & Archeology			
8:30AM	209	Dennis Lawler (SIUe)	Life Lessons Taught by Foxes: Differential Diagnosis
8:45AM	209	Jerome Thomas (UG, IC)	Assessing Occipital Bone Morphology and Brain Growth in a Developmental Study of Extant Humans
Botany			
9:00AM	115	Brenda Molano-Flores (INHS)	Assessment of Climate Change Vulnerability for Rare Illinois Plants
9:15AM	115	Kurt Schulz (SIUe)	Not Quite <i>fait accompli</i> : Whole Plant Shade Tolerance of Amur Honeysuckle (<i>Lonicera maackii</i>)
9:30AM	115	Kayla Tatum (Grad, SIUe)	Cross Species Compatibility of the Fungal Associates of the Federally Threatened Eastern Prairie Fringed Orchid
9:45AM	115	Brandon Schack (Grad, SIUe)	Photosynthetic Characteristics and Growth Performance of Invasive Understory Shrubs Across a Light Gradient
10:00AM	115	Jacob Schaafsma (UG, Wheaton)	Comparing Oogenesis in Two Ecomorphs of the Giant Kelp <i>Macrocystis pyrifera</i> in Response to Iron Nutrition
10:15AM	115	Adam Herdman (UG, IC)	Ghost Orchid (<i>Dendrophylax lindenii</i>) Habitats in Florida and Cuba: Year Three of a Four-Year Survey
10:30AM	115	Hunter Levingston (UG, EIU)	Leaf Anatomy of Aeridinae (Vandaeae, Orchidaceae)
10:45AM	115	Rachel Helmich (UG, IC)	Viability of Orchid Endophytes in Prolonged Cool (4-6° C) Storage for Conservation Purposes
Cellular, Molecular, & Developmental Biology			
9:00AM	208	Tyler Parks (Grad, EIU)	An Efficient Protocol for Root Transformation in <i>Helianthus annuus</i> Using <i>Agrobacterium rhizogenes</i>
9:15AM	208	Lucero Villarreal Rodriguez (Grad, SIUe)	Characterization of Planarian Homologs of Human Xeroderma Pigmentosum Genes and Their Function in Repairing UV Damage
9:30AM	208	Daniel Karcher (Grad, SIUe)	Determining the Function of Two Predicted <i>dicer</i> -like Genes in the Model Mushroom Fungus <i>Schizophyllum commune</i>
9:45AM	208	Faisal Alsubaie (Grad, WIU)	Gene Expression Profile of the Corn Earworm After Feeding on Different Types of Corn Plant Tissues
10:00AM	208	Jessica Haines (Grad, SIUe)	Screening for Genes Involved in Planarian Memory Using RNAi Knockdown Techniques
10:15AM	208	Devansh Singh (Grad, EIU)	Study on Intracellular Calcium-Mediated Generation of Platelet-Derived Microparticles
10:30AM	208	Kaitlyn Stanton (UG, SIUe)	Evaluation of Genes Linked to Alzheimer's Disease in <i>Schmidtea mediterranea</i> Using RNAi Knockdown
10:45AM	208	Elyse Schnabel (UG, Millikin)	The Effects of Ammonium Sulfate on Stress Physiology and Innate Immunity of Western Mosquito Fish (<i>Gambusia affinis</i>)
Chemistry			
11:15AM	208	Clayton Donald (UG, SIUe)	Antibiotic Concentration in Wastewater and Effluent Affected Streams in Southwest Illinois
11:30AM	208	Nicolas Revelt (UG, SIUe)	Isocyanide and Phenol Substituent Variants in the Tandem Ugi-Smiles Diels-Alder Reaction

Time	Room	Presenter	Title of Presentation
11:45AM	208	Nicole Walker (UG, WIU)	Synthesis of Group VI Carbonyl Compounds Containing Phosphine Ligands for CO ₂ Reduction
Computer Science			
11:15AM	115	In Lee (WIU)	A Cournot Game for Cloud Providers' Non-Cooperative Competition
11:30AM	115	Laura Palmieri (Grad, UIC)	Alleviating Partisan Gerrymandering: Can Math and Computers Help to Eliminate Wasted Votes?
11:45AM	115	Alamin Mohammed (Grad, WIU)	Enhancing Anonymous Routing in Smart Community Wireless Ad-hoc Networks
Environmental Science			
9:15AM	209	Christopher Theodorakis (SIUe)	Effects of Military Activity and Habitat Quality on DNA Damage and Oxidative Stress in the Largest Population of the Federally Threatened Gopher Tortoise
9:30AM	209	Zhi-Qing Lin (SIUe)	On Developing Bioindicators of Metal Pollution in the Lower Illinois River
9:45AM	209	Ben Greenfield (SIUe)	Place-Based Exposure Science Research in the Metro-East St. Louis Region
10:00AM	209	Margaret Gross (Grad, WIU)	True Metabolizable Energy of Submersed Aquatic Vegetation for Ducks
10:15AM	209	Katelyn Toigo (UG, SIU)	Habitat Value in Mid-Sized Rivers in Illinois
Health Sciences			
9:15AM	221	Dennis Lawler (SIUe)	If a Space to Live Exists, Something Will Live There: Managing Free-Roaming Cats - I
9:30AM	221	Dennis Lawler (SIUe)	If a Space to Live Exists, Something Will Live There: Managing Free-Roaming Cats - II. Modeling studies
9:45AM	221	Chukwuebuka Ogwo (Grad, WIU)	Prevalence and Correlates of Dental Anxiety Among Western Illinois University Students
10:00AM	221	Mallory Wright (UG, SIUe)	TWIST Regulates EMT Processes and Influences Salivary Gland Progression
10:15AM	221	Callie Mincy (UG, SIUe)	Unique Cohorts of Cells within Salivary Gland Cancers Exhibit Aggressive Behaviors
Microbiology			
10:45AM	209	Sunil Pandey (Grad, EIU)	Detection of Beta-lactamase Loci in Municipal Wastewater Samples
11:00AM	209	Jae Claywell (Grad, SIU)	Inhibition of the Protein Phosphatase Cpp1 Alters Development of <i>Chlamydia trachomatis</i>
11:15AM	209	Shruti Ojha (Grad, WIU)	Role of Fungal Volatiles and Diffusible Compounds Produced by <i>Trichoderma</i> on Plant Growth
11:30AM	209	Jacob Miller (Grad, SIUe)	Using Flow Cytometry and Confocal Microscopy to Analyze Intracellular Infection Parameters Using a Model Prokaryotic - Eukaryotic System CANCELLED
STEM Education			
10:45AM	221	Jessica Lucas (SIU)	Plant Science Learning Activities for Biomedical Students
11:00AM	221	Dana Morrone (STL Pharmacy)	Tying the Knot: Assessing Student Performance in a New 5-Semester Undergraduate Threaded Chemistry Curriculum
11:15AM	221	Elisabeth Knierim (Grad, SIUe)	Using Modeling to Gain a Better Understanding of Chemistry Concepts
11:30AM	221	Matthew Vangunten (UG, Millikin)	Introducing Microfluidics to Undergraduate Students using 3D printing

Time	Room	Presenter	Title of Presentation
11:45AM	221	Killian L Tracey (UG, WIU)	Solid State Synthesis Educational Lab Development
Zoology			
8:30AM	001	Travis Wilcoxon (Millikin)	Fluctuating Asymmetry, Corticosterone, and Lead Toxicity in Juvenile Birds of Prey
8:45AM	001	Robert Weck (Southwestern)	Life History Patterns of the Illinois State Endangered Enigmatic Cavesnail, <i>Fontigens antroecetes</i> , Revealed Through Captive Breeding Under Simulated Cave Conditions
9:00AM	001	Tih-Fen Ting (UIS)	Winter Diet of Short-eared Owls (<i>Asio flammeus</i>) in the Grand Prairie Region of Illinois, U.S.A.
9:15AM	001	Dillan Laaker (Grad, SIUe)	Avian Use of Floodplain Forest Communities Along the Upper Mississippi River
9:30AM	001	Kassandra Karssen (Grad, SIUe)	Comparison of Resource Utilization in a Native Versus a Headstarted Population of Ornate Box Turtles, <i>Terrapene ornata ornata</i> , in Northern Illinois
9:45AM	001	Andrew Bouton (Grad, WIU)	Developing a Plasma Lipid Metabolite Index for Canvasbacks
10:00AM	001	Edward Davis (Grad, WIU)	Estimating Density of Bobcats in Midwestern Landscapes Using Spatial Capture-Recapture Models
10:15AM	001	Rachel Sullivan (Grad, SIUe)	Handedness is Not Linked to Asynchronous Locomotion in a Basal Anuran
10:45AM	001	Therin Bradshaw (Grad, WIU)	Marsh Bird Use of Wetlands Managed for Waterfowl in Illinois
11:00AM	001	Ben Wedeking (Grad, SIUe)	Stream Gradient Morphological Variation in the Pectoral Fins of Sculpin
11:15AM	001	Malina Przygoda (Grad, EIU)	The Impact of Color on Longear Sunfish (<i>Lepomis megalotis</i>) Behavior
11:30AM	001	Courtney Olson (UG, Millikin)	Effects of Rehabilitation Setting on Stress Physiology in Red Tailed Hawks (<i>Buteo jamaicensis</i>), Cooper's Hawk (<i>Accipiter cooperii</i>), Great Horned Owls (<i>Bubo virginianus</i>), and American Kestrels (<i>Falco sparverius</i>)
11:45AM	001	Erica Marquez (UG, WIU)	The Effects of Environmental Coloration on Spatial Learning in Male Lab Mice (<i>Mus musculus</i>)

KEYNOTE ADDRESS – SCOTT McDONALD
FRIDAY, APRIL 13 AT 7:30PM, UNIVERSITY COMMONS, 3RD FLOOR BALLROOMS



Scott McDonald
Director Biofuels Development
Archer Daniels Midland Company

Scott McDonald is Director of Biofuels Development for Archer Daniels Midland Company. In this role, his responsibilities include identification and development of projects and novel product applications which will expand the use of biofuels and bio-based products into the marketplace. As part of this role, he leads the biofuels technical services team which provides technical support to ADM's customer base as well as industry expertise to regulatory agencies and nongovernmental organizations.

He is also the principal investigator and director of the projects:

1. "CO₂ Capture from Biofuels Production and Sequestration by Injection into the Mt. Simon Reservoir," large-scale demonstration of industrial carbon capture and storage projects from industrial sources, a U.S. Department of Energy-National Energy Technology Laboratory Project, Phase I, and II 2009-2019.
2. "Intelligent Monitoring Systems and Advanced Well Integrity and Mitigation", a demonstration of an advanced CCS monitoring system that increases monitoring sensitivity and reliability through the use of an integrated system, a U.S. Department of Energy-National Energy Technology Laboratory Project, 2016- 2018.
3. Co-Principal Investigator: CarbonSAFE Nebraska Project: "Integrated Mid- Continent Stacked Carbon Storage Hub" DE-FE-0029264. a U.S. Department of Energy Carbon Storage Program, 2016-2018.

Prior to joining ADM, he was the commercial trading manager for TOTAL, a refining and petrochemical company where his job responsibilities included trading and risk management for various feed and finished product streams for the company's US refining and petrochemical assets. His 20-year career has included trading and risk management, business development, economics and planning, fuels formulation, and unit process design, startup, and operation.

STEM EDUCATION WORKSHOP – SATURDAY, APRIL 14, 9:00AM-10:30AM
LEIGHTY-TABOR SCIENCE CENTER, RM 326

Hosted by Jessica Lucas from Southern Illinois University, the STEM Division will be hosting a STEM Education Workshop, *Engaging Students with Tardigrades (Water Bears) in the Classroom*, from 9:00-10:30am in Room 326 of the Leighty-Tabor Science Center.

Students are intrinsically excited by tardigrades which are charismatic microscopic animals. Teachers can leverage student enthusiasm to teach them multiple aspects of math and science. Here expert teachers will demonstrate how to harvest and view tardigrades from outdoor samples. Teachers will share tips and experiences to help you actively engage your students in cross-disciplinary lessons.

MESSAGE FROM THE VICE PRESIDENTS

Thank you to all presenters and participants for making this among the largest Annual Meetings of Illinois State Academy of Science over the past 10 years. We hope that your experience at Millikin University is a good one and we hope that you will join us again next year at Bradley University in Peoria. I know your meeting Vice President and site host for 2019, Jennifer Jost, will work to make sure you have an excellent meeting experience in 2019.

We also need to thank the students in the Millikin University Organizational Leadership Graduating Class of 2018. This group of hard working and talented students have coordinated all aspects of the Annual Meeting, including the space usage, acquisition of conference swag, catering arrangements, hotel accommodations, and printing of this program. We are very grateful that they chose coordination of our Annual Meeting as their Senior Capstone project.

We also extend a special thank you to Tere North, the ISAS Webmaster, manager of the *Transactions of the Illinois State Academy of Science*, and the one responsible for assembling the scientific program after all of the abstracts come through the online system. The Academy benefits immensely from her work and leadership.

Thank you again for participating in the 2018 Annual Meeting and we hope to see you next year in Peoria!

Travis Wilcoxen
 Judy Parrish
 Vice Presidents of the Annual Meeting

SPECIAL THANKS

The Organizational Leadership Graduating Class of 2018 would like to give special thanks to the Illinois State Academy of Science for allowing us to plan this year's Annual Meeting at Millikin University. This has been a valuable learning experience helping to merge the classroom to a real-world performance learning experience. An enormous thank you to Travis Wilcoxon, Vice President for 2018 Annual Meeting. His belief and support through this process has been our steady anchor. Travis, thank you for this opportunity!

Also, please take a moment of your time to acknowledge the businesses below. It is with their gracious donations that helped in making the 2018 Annual Meeting a success.



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Of course, we must not forget to thank Millikin University and all of the teachers, professors, and doctors that have ingrained in us the skills required to complete our Capstone project. Since there are too many to thank individually, we must just say THANK YOU!

Lastly, we must ask you, the participants of the 2018 Annual Meeting, to do us a favor. Can you each please take a few moments in order to complete a survey that will assist us in analyzing this event?

Please scan this QR Code to complete our survey. Thank you!



POSTER PRESENTATION ABSTRACTS

2:30-3:30pm or 3:40-5:00pm, Friday, April 13, 2017, in Griswold Center Gymnasium

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

AGRICULTURE

- 1 2:30pm UG Remote Sensing for Evaluating the Effect of Grafting on Hyperspectral Reflectance of Tomato Plants**
 *Keely Egelhoff, Dan Atherton, Shelby Henning [WIU]
 Grafting of vegetable plants has increased in popularity as a method to increase resistance to soil-borne diseases and improve crop yield worldwide (USDA-SCRI, 2018). Grafting varieties that have characteristics like high yield, superior flavor, and increased fruit quality onto rootstocks with properties such as enhanced disease resistance and vigorous root systems combine the positive qualities of both plants (Purdue Extension, 2018). Though studies have demonstrated rootstocks may influence physiological functioning of the scion through grafting, data is lacking if the practice also contributes to changes in spectral reflectance. The objective of this study was to determine if grafting influences spectral reflectance of tomato plants. To accomplish this objective, several rootstock and scion combinations were compared to their non-grafted counterparts using spectral reflectance data captured three times over six weeks (14-day intervals). Spectra were analyzed using cluster analysis, normalized difference vegetative index (NDVI), and principal component analysis (PCA). Results are being processed and will be included in the poster presentation.

ANTHROPOLOGY & ARCHEOLOGY

- 2 3:50pm Ontogeny and Covariation in the Extant Human Occipital Bone**
 *Miranda Karban [Illinois College]
 Midsagittal occipital bone shape varies within extant human populations, with some individuals having pronounced convexity of the occipital squama, and others having taller, more smoothly rounded occipital squamae. The developmental patterning associated with occipital bone convexity remains unknown. Some previous studies have suggested that occipital squama convexity may be associated with cranial vault or basicranial breadth, basicranial flexion, midfacial prognathism, or cranial dolichocephaly during embryonic or childhood development. The goal of this study is to assess these patterns of cranial covariation in a longitudinal sample of extant humans. This study's sample includes 156 longitudinal growth study radiographs from 26 European-derived extant human subjects (16 males, 10 females). Each subject is represented by frontal and lateral radiographs, each at three non-overlapping age points spanning from 3.0 to 20.4 years. The chosen subjects represent the extremes of adult variation in midsagittal occipital squama convexity, with 16 subjects (9 males, 7 females) possessing markedly convex occipital squamae and 10 subjects (7 males, 3 females) possessing tall, flat occipital squamae. Landmarks and sliding semi-landmarks were digitized along the midsagittal and midcoronal planes, and two-block partial least squares analysis and permutation procedure were used to assess patterns of cranial covariation. Cranial breadth, basicranial breadth, midcoronal cranial vault shape, midfacial prognathism, and basicranial angle were not found to covary significantly with midsagittal occipital bone morphology at any of the sampled age points. However, a significant pattern of covariation was found between occipital bone convexity and low, elongated frontal and parietal bones. This pattern was found to be significant in both males and females, and was found to exist from the earliest available age point. These results, therefore, support the hypothesis that occipital bone convexity develops in association with a distinct pattern of neurocranial elongation.
- 3 2:30pm UG Forming Identities Through Bones: Forensic Sex Estimation in Human Skeletons at Illinois College**
 *Lauren Estes, Brooke Bauer, Basundhara Raj, Miranda Karban [Illinois College]
 Forensic anthropology, the examination and identification of human skeletal remains, is a rapidly developing discipline within the field of forensic science. Skeletal analysis plays an important role in medicolegal investigations, especially in cases of extreme decomposition, when soft tissue no longer aids in identification. These methods are also important in identifying victims of mass disasters, when the chances of finding

commingled skeletal remains are high. In this study, the methods of forensic anthropology were used to estimate sex in two unidentified human skeletons (IC 0001 and IC 0002) housed in the Illinois College anatomy laboratory. Anthroposcopic traits of the innominate, including the ventral arc, subpubic concavity, and medial aspect of the ischio-pubic ramus, were first scored. Anthroposcopic traits of the skull, including the nuchal crest, mastoid process, supraorbital margin, supraorbital ridge, and the mental eminence, were also scored. Pelvic and cranial scores were subjected to logistic regression analysis to estimate sex. Based on these traits, IC 0001 was found to be female, and IC 0002 was found to be male. While the size and rugosity of muscle attachment sites on the skull can provide useful information for estimating sex, interobserver error was found to be higher when scoring skull traits compared to pelvic traits. The assessed pelvic traits reveal functional differences between males and females, with the female pelvis adapted to accommodate child birth. These traits, therefore, represent the best skeletal indicators of sex. The results of this study caution against relying too heavily on a small number of traits, particularly cranial traits, when estimating sex. For example, while IC 0001 was found to possess large, robust mastoid processes, the other traits of the skull, as well as all of the scored pelvic traits, revealed this skeleton to be female. This study represents the first step in creating a full biological profile for the Illinois College anatomy laboratory skeletons.

BOTANY

4 3:50pm UG

Epidermal Anatomy of Angraecinae (Vandaeae, Orchidaceae)

*Kelly Clark, Barbara Carlswald [Eastern Illinois University]

The orchid family (Orchidaceae) are a large, diverse group of flowering plants that are distributed worldwide on every continent except Antarctica. Angraecinae, a subtribe of vandaceous orchids that occur mainly in tropical Africa and the Mascarene Archipelago, have recently had their phylogeny reexamined using molecular techniques. The goal of my research was to use these phylogenetic analyses in determining patterns of structural evolution in epidermal anatomy of select species in Angraecinae. Preserved leaves stored in 70% ethanol from 58 species were used. Both the adaxial and abaxial epidermises were examined using leaf scrapings made with a single-edged razor blade and stained using safranin. Permanent slides of each leaf scraping were made using Permount and then examined on a brightfield Zeiss Axioskop 40 with an attached AmScope MU300 digital camera. In general, I found that adaxial epidermal cells were larger than abaxial epidermal cells in the same leaf. However, epidermal anatomy between species showed very little variation in terms of trichome structure, regular epidermal shape, or stomatal configuration. Stomatal position was the primary difference found among species and varied from amphistomatal (adaxial and abaxial) to hypostomatal (abaxial only). Other noticeable differences were variations of cell shapes among species and the differences in subsidiary cell patterns.

5 2:30pm Grad

Evaluation of Tallgrass Prairie Restoration Success in Southwestern Illinois

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

Restoration of tallgrass prairies at sites where they existed prior to European settlement is crucial for the conservation of prairie plant species, and provides an opportunity for us to better understand how tallgrass prairie communities are assembled and how they function. Most restoration projects have a similar goal of recreating the species composition of plant communities found in reference sites, which are usually remnants of tallgrass prairie. It is important to evaluate the success of restorations by assessing progress towards reference conditions. The main objective of my research is to assess local prairie restorations of increasing age in southwestern Illinois using plant community composition, richness, diversity, forb to grass ratio, and percent exotic species cover to evaluate progress toward a remnant reference prairie. The reference site is Horn's Prairie Grove near Ramsey, IL. The restoration sites to be examined are an 8 y-old prairie restoration adjacent to Horn's Prairie, 9 and 17 y-old restoration sites at The Nature Institute in Godfrey, IL, and a 31 y-old restoration near Gordon Moore Park in Alton, IL. At each restoration site, 50 quadrats (1 m²) will be randomly placed avoiding seeps and wetter areas. At Horn's Prairie Grove, 200 randomly placed quadrats (1 m²) will be sampled (given its larger area and heterogeneity). During the two sampling periods to include early (May-June) and late (August-September) growing season all plant species within each quadrat will be identified and given a percent cover score on a modified Braun-Blanquet scale. Species richness, Simpson diversity, forb:grass ratio, and percent exotic cover will be plotted against restoration age, and generalized linear models will be used to test whether they are approaching reference

site conditions. Trajectory Analysis will be used to test if plant community composition in restoration sites is changing with time in the direction of the reference prairie. The species composition, richness, and diversity of the 8 y. restoration adjacent to Horn's Prairie will be compared with those of the 9 y restoration at Godfrey to assess the effect of proximity to potential seed sources. The hypotheses to be tested are: (1) Horn's Prairie Grove has higher richness, diversity, and forb:grass ratio, and lower percent exotic species cover than all of the restoration sites; (2) the chronosequence of 9 y, 17 y, and 31 y restorations at Godfrey and Alton suggests a trajectory of change in the direction of Horn's Prairie Grove; and (3) the 8 y restoration adjacent to Horn's Prairie Grove has higher richness, and diversity than the 9 y restoration at Godfrey and has a species composition closer to Horn's Prairie Grove.

6 3:50pm Grad

Forty Years of Change in the Old-Growth Upland Forests of Southwestern Illinois

*Miles Gossett, Peter R. Minchin [Southern Illinois University Edwardsville]

From 1975 to 1978, the Illinois Department of Natural Resources (IDNR) surveyed high quality natural areas in Illinois as part of the Illinois Natural Areas Inventory (INAI). For my study I am going to resurvey some of the highest quality dry mesic, mesic, and wet mesic upland oak-hickory forests in southwestern Illinois. Oak-hickory forests are ecosystems that have evolved to burn periodically. Periodic fires are necessary for canopy species such as *Quercus rubra* (red oak) to maintain its dominance. In the absence of fires, other fire-intolerant species, e.g. *Acer saccharum* (sugar maple), can take over. Sugar maple is shade tolerant. It is able to grow to the mid-story and quickly reach the canopy when a canopy tree falls. In the shrub layer, invasive species such as *Lonicera maackii* (bush honeysuckle) can outcompete native shrubs and herbaceous species. In my research, I will measure the change in the composition of the woody species in selected forest sites that span the moisture gradient from dry mesic to wet mesic. I will follow the sampling protocol used in the original survey. Trees (DBH ≥ 10 cm) will be sampled in twenty 250 m² plots along a transect. The original transects were marked on transparency overlays placed on top of aerial photos. I will relocate these transects, as near as possible to their original location, by correlating the aerial photos with present-day imagery in Google Earth. Trees will be identified to species, and I will record their DBH. Smaller concentric plots (20 m²) will be used to sample the shrub layer (woody plants over 1 m tall with a DBH < 10 cm). The species of the shrubs and the number of stems will be recorded. I will compare the resurvey data to the data from the original survey. The hypotheses to be tested are: (1) shade-intolerant, fire-dependent species such as red oak have declined in dominance and are not recruiting saplings in the understory; (2) sugar maple has increased in the canopy; (3) the dominance of sugar maple increases along the moisture gradient, with the highest increases in wet mesic forest; (4) the invasive Bush honeysuckle has increased in abundance in the shrub layer; and (5) that this increase in abundance has been higher the closer the forest is to an urbanized area.

7 2:30pm Grad

The Impacts of Habit Quality and Seed Age on Seed Vitality of the Rare Plant, *Synthyris bullii*

*¹Eric Janssen, ²David N. Zaya, ²Brenda Molano-Flores [¹University of Illinois, ²Illinois Natural History Survey]

Habitat loss and degradation is one of the biggest issues leading to species loss. In the Midwestern US the remaining prairies and savannas are highly fragmented and degraded due to human disturbance. Habitat degradation can result in decreased seed vitality by reducing maternal fitness. Understanding how habitat quality at seed development and length of seed storage affect seedling development is important to the conservation and reintroduction of a species. We examined how these variables impacted seed germination, time to germination, and seedling survival of *Synthyris bullii* (Plantaginaceae), a rare plant endemic to the Midwestern US under greenhouse conditions. Seed germination was higher for seeds of plants from open and semi-shaded sites (5.6 \pm 0.7% and 4.7 \pm 0.8%, respectively) compared to shaded sites (0.9 \pm 0.2%). Seed germination was highest for seeds from 2011 (5.7 \pm 0.8%), lower for seeds from 2009 and 2010 (3.6 \pm 0.8% and 2.5 \pm 0.4%, respectively), and lowest for seeds from 2008 (<0.1%). Seeds germinated faster from open and semi-shaded sites (28.8 \pm 0.7 and 28.1 \pm 1.2 days, respectively) compared to shaded sites (33.4 \pm 1.8). Younger seeds germinated faster than older seeds (2011-2009: 26.9 \pm 0.4, 30.2 \pm 1.1, and 33.0 \pm 1.8 days). Only one seed germinated for 2008 (56 days). Seedling survival was higher for seed from open sites (39.0 \pm 4.8%) compared to semi-shaded and shaded sites (32.7 \pm 6.1% and 31.9 \pm 8.6%, respectively). Seedling survival decreased with seed age (2011-2009: 41.8 \pm 4.8%, 30.4 \pm 6.5%, and 29.1 \pm 7.1%). In general, younger seeds from open habitats were the most likely to germinate and survive. Woody species encroachment should be removed and seeds should be planted within 8 years of collection to maximize the persistence and recruitment potential of

Synthyris bullii.

8 3:50pm UG

The Effect of Sterilization Time on Germination Rates for the Eastern Prairie Fringed Orchid

*Noah Pyles, Kayla Tatum, Elizabeth Esselman [Southern Illinois University Edwardsville]

The Eastern Prairie Fringed Orchid (*Platanthera leucophaea*) is currently listed as a U.S. federally species. It was a once common and widespread species in wetlands, prairies, and fens throughout the upper central United States. This species has experienced great decline due to habitat loss, pollinator loss, and over-collection. Despite conservation efforts aimed at habitat restoration, hand pollination to reduce inbreeding depression, and artificial seed sowing into suitable habitats, the species continues to struggle. All terrestrial orchids require a mycorrhiza relationship in order for the seeds to germinate. Current researchers are investigating this relationship, however, in order to evaluate this relationship *in vitro* the seeds must be surface sterilized. A significant problem in studying the mycorrhizal relationship between these seeds is that it can take three to five months before the seed germinates. Common techniques involve utilizing a 10% sterilization fluid for 2 minutes; previous unpublished research suggests that other terrestrial orchid seeds can germinate in a shorter amount of time after being soaked in the sterilization fluid for several hours. The purpose of this study is to determine if and when Eastern prairie fringed orchid seeds will germinate after being subjected to longer sterilization times (2 minutes -240 minutes).

9 2:30pm UG

The Effects of Simulated Herbivory on Cut-Leaf Teasel (*Dipsacus laciniatus* - Dipsacaceae)

*Zach Miles, Judy Parrish [Millikin University]

When plants are under attack from herbivores they have two options to defend themselves. They can produce secondary chemicals that acts as a toxin for herbivores, or simply increase their photosynthetic rate in order to outgrow the herbivory. Cut-leaf teasel (*Dipsacus laciniatus*) is a plant that possesses the ability to produce these secondary chemicals as a defense mechanism, causing it to become a noxious weed that has begun taking over many states in the Midwest United States. In addition to the secondary chemicals it produces, it is a plant that has very few predators and can produce new flowers quickly after being cut. With flower heads that can produce more than 3000 seeds, it is important to fully understand how this plant functions. Cut-leaf teasel's ability to regrow very rapidly after being cut down indicates that it may raise its photosynthetic rate for compensatory growth, as do soybeans. However, it also produces chemicals for defense, which requires the plant to reduce its photosynthetic rate in order to produce these chemicals. We used an LCI infrared CO₂ gas analyzer to compare photosynthetic rates of adjacent damaged and undamaged leaves on the same rosette, repeated on ten different plants. A 0.5 cm diameter hole punch mimicked herbivory, with approximately 30% of leaf area removed, avoiding major veins. We found no significant difference between the damaged leaf and the undamaged control leaf of the same plant. This fits the hypothesis that plant species such as Cut-leaf teasel, which produce chemicals for defense, do not use increased photosynthetic rates to compensate for damage. Their ability to regrow quickly is likely due to large storage taproots.

CELLULAR, MOLECULAR, & DEVELOPMENTAL BIOLOGY

10 3:50pm

The Effects of Three Pentapeptides Related to FMRFamide on the Crop-Gizzard of the Earthworm, *Lumbricus terrestris*

*Kevin Krajniak, McKenzie Youngblood, Lauren Mueth, Aswathay Krishnakumar [Southern Illinois University Edwardsville]

FMRFamide-related peptides (FaRPs) have been isolated from or predicted in a variety of annelids. Peptides containing the C-terminal sequence YVRFamide have been suggested in worms from both Polychaeta and Clitellata. Previous work in our lab using the isolated crop-gizzard of the earthworm, *Lumbricus terrestris*, showed that polychaete AGAYVRFamide was excitatory, while clitellate APKQYVRFamide and PAKHYVRFamide were inhibitory on the contraction amplitude. In the same experiments we found YVRFamide, the tetrapeptide core in all three peptides, was excitatory. In this study we used AYVRFamide, QYVRFamide, and HYVRFamide on the isolated crop-gizzard to determine whether the additional amino acid on the N-terminal caused a response similar to the full peptide sequence or YVRFamide. The crop-gizzard was removed, placed in a tissue bath filled with saline, and attached to a force transducer connected to a computer using Iworx software to record the contractions. Increasing concentrations of peptide were put

into the tissue bath and the resulting changes in contraction rate and amplitude were used to create log-concentration response curves. Both AYVRFamide and QYVRFamide caused a decrease in amplitude with a threshold between 1 to 10 nM. HYVRFamide caused a biphasic change in amplitude with a decrease in amplitude at 1 nM and an increase in amplitude at 1 μ M. Thus the addition of the next amino acid on the N-terminal of YVRFamide did not always restore the activity observed with the full peptide sequence. This suggests that the crop-gizzard receptor requires a more complete sequence than five amino acids to restore the response. In the future we will examine the effects of adding back another amino acid to the N-terminal.

11 2:30pm Grad **A Genomic Approach to Locate the *mnd* Gene that Disrupts Hyphal Growth Pattern in *Schizophyllum commune***

*Haley Gula, Thomas Fowler [Southern Illinois University Edwardsville]

Reproduction in the fungus *Schizophyllum commune* is accomplished after mating by the development of a fruiting body followed by the release of basidiospores. A mutation in the gene *mnd* that disrupts reproduction of *S. commune* was discovered and described by Leonard and colleagues (1978) in the strain HK28. This mutation causes dense, round, expanding masses of hyphae to form and in mated fungi it has been shown to overgrow the fruiting bodies to stop reproduction. The mechanism of the *mnd* phenotype is currently unknown. A previous study proposed that a pheromone receptor-like gene called *prl1* was involved with mound formation, but our further experimentation using PCR suggested its presence was not required for mound formation. Only five of ten colonies showing mounds gave positive PCR results for the presence of *prl1*. One of three colonies not showing mounds also gave a positive result for *prl1*. This suggested that *prl1* is not necessary for the formation of mounds. Another suggestion in the literature is that internuclear recombination involving the *mnd* mutation might account for the pattern of mound formation in dikaryons. In crosses with a *ku80* deletion strain void of the non-homologous end joining repair pathway, it seemed that *mnd* showed chance linkage with the *ku80* gene. Further matings to test recombination frequencies did not support linkage between *mnd* and *ku80*, with 28 of 57 HK28 x *ku80*-deletion strain progeny competent of forming mounds. These crosses instead confirmed the incomplete penetrance of *mnd* in monokaryons previously reported. These results lead us to attempt a more traditional method to locate the *mnd* gene within the genome. Using draft genome sequences of other *Schizophyllum commune* strains and other basidiomycete species, we plan to connect the linkage and physical maps of *Schizophyllum commune* to locate the *mnd* gene.

12 3:50pm Grad **Effect of Gold (I) Phosphines on the Cell Proliferation of MDA-MB-231 Breast Cancer Cells**

*Mark Gudger, Elizabeth Cretens, Kyle A. Grice, Talitha Rajah [DePaul University]

Cisplatin, though an effective carcinogenic chemotherapeutic agent has the drawback of the development of cisplatin resistance by cancer cells. This led to the exploration of other metal-based compounds as chemotherapeutic agents against cancer cells. Of interest were gold metals compounds as possible anti-cancer agents. This was largely due to the similar molecular geometry of gold (III) compounds to that of cisplatin. However, in physiological conditions, gold (III) complexes are highly unstable, reducing from gold (III) to gold (I) compounds. Initial investigations for anti-cancer activity *in vitro* with the anti-rheumatoid arthritis drug, auranofin [2,3,4,6-tetra-o-acetyl-L-thio-b-D-glycopyranp-sato-S-(triethyl-phosphine)-gold], has led to the study of other gold compounds for potential anti-cancer effects, including the synthetic precursor to auranofin, triethylphosphine gold (I) chloride. Studies have elucidated their possible interactions with select thiol and selenol enzymes, such as thioredoxin reductase, an enzyme crucial to redox reactions that also moderates cell proliferation and apoptosis. This is the first study to investigate a series of gold(I) phosphines, triethylphosphine gold (I) chloride (PET_3AuCl), triphenylphosphine gold (I) chloride (PPh_3AuCl), and 1,3,5-triaza-7-phosphaadamantane gold (I) chloride [PTAAuCl] on the cell proliferation of MDA-MB-231, a triple negative, aggressive, human breast cancer cell line. To study the effect of the gold (I) phosphines on cell proliferation of MDA-MB-231 cells, an MTT (3-[4,5-dimethyl-thiazolyl]-2,5-diphenyl-2H-tetrazolium bromide) assay was performed. The cells were starved in serum free media and then exposed to the gold(I) phosphines (PET_3AuCl , PPh_3AuCl , PTAAuCl and auranofin) at different concentrations of 1 to 200 μ M for 24 h. Cell viability (10-100 mM) was approximately 10% or less versus control for all compounds tested except PTAAuCl . PET_3AuCl , PPh_3AuCl , and auranofin were further tested at concentrations of 1, 2.5, 5, 7.5, and 10 μ M. At these concentrations, PET_3AuCl showed significant decreases of 34, 58, 87, 98, and 99%, respectively. PPh_3AuCl showed significant decreases of 0, 6, 49, 72, and 74%, respectively. Auranofin showed significant decreases in cell viability of 9, 43, 73, 93, and 94%, respectively. Using probit analysis, the estimated IC_{50}

values for PET_3AuCl , PPh_3AuCl , $(\text{PTA})\text{AuCl}$, and auranofin 2.86, 1.70, 6.05, 83.4, and 2.86 mM, respectively. This is the first study to suggest that PET_3AuCl , PPh_3AuCl , and $(\text{PTA})\text{AuCl}$ can inhibit MDA-MB-231 breast cancer cell proliferation at low micromolar concentrations. These results are significant as they highlight the potential of PET_3AuCl , PPh_3AuCl , and $(\text{PTA})\text{AuCl}$ as chemotherapeutic agents for metastatic breast cancer. Future studies will investigate the role of these compounds in the induction of apoptosis and interactions with relevant enzymes such as thioredoxin reductase.

- 13 2:30pm Grad Effect of Triaminopyrimidine Analogs on the Cell Proliferation of MDA-MB-231 Breast Cancer Cells**
 *Robin Redline, Lauren Ritzel, Caitlin Karver, Talitha Rajah [DePaul University]
 Breast cancer is the second leading cause of cancer death in women, behind lung cancer. Triple negative breast cancer makes up about 10 to 20% of breast cancer diagnoses in women according to the National Breast Cancer Organization. Triple negative breast cancer is aggressive and does not respond to common breast cancer treatments such as hormone therapy, therefore there is a need for new treatments. A class of small heterocyclic compounds, triaminopyrimidines, has been shown to be strong inhibitors of inflammatory caspases. Triaminopyrimidines are multi-ring molecules with a pyrimidine ring in the center surrounded by three amine groups. Adding a R-group via nucleophilic substitution forms triaminopyrimidine analogs (Kent, 2016). Four analogs, each with a unique R-group were synthesized at DePaul University (Kent, 2016). These compounds were tested for their ability to decrease cell proliferation in the triple negative breast cancer cell line, MDA-MB-231. Cells were seeded in 24-well tissue culture plates and treated with the following triaminopyrimidine compounds: MB-1-19 (4-methylpyridine), CK-1-41 (ethylbenzene), CK-1-29 (3-methoxy), CK-1-37 (alkyl). Each compound was tested at the following concentrations: 1nM, 100nM, 1μM, 10μM, 20μM, for 24, 48, and 72 hours. The MTT (3-[4, 5-dimethylthiazol-2-yl]-2, 5-diphenyltetrazolium bromide) assay was used to determine cell proliferation. After the addition of MTT, the cells were washed and the dye was eluted at 570nm. Cell proliferation was calculated as a percent of the control. Compounds MB-1-19 and CK-1-29 did not show significant decreases in cell proliferation. Compound CK-1-41 showed a 91% decrease in cell proliferation at a concentration of 20μM and incubation period of 72 hours. Compound CK-1-37 showed a 88% decrease in cell proliferation at a 20μM concentration and incubation period of 48 hours. Structural differences between the compounds, such as the lack of nitrogen or methoxy groups and the presence of alkyl and ethyl benzene groups may determine effectiveness in inhibiting cell proliferation of MDA-MB-231 breast cancer cells.
- 14 3:50pm Grad Gene Expression in *Spodoptera exigua* Caterpillar Correlated to Cannibalism Rate on Methyl Jasmonate-Induced Tomato Plants**
 *Adeyemi Tunde-James Adesanwo, Richard Musser, Sue Hum-Musser [Western Illinois University]
 Cannibalism in caterpillars may be a way for a generalist herbivore to compensate for plant defenses. Our laboratory investigated *Spodoptera exigua* and *Helicoverpa zea* cannibalism in the presences feeding on artificial diet, control tomato leaves, and tomato leaves treated with methyl jasmonate (MeJA) in different cups respectively with each cup having five *S. exigua* caterpillars under appropriate temperature and light conditions. Preliminary results for *S. exigua* showed that cannibalism increased among the caterpillars in the presence of MeJA treated tomato leaves. Gene expression showed that compensatory genes such as proteases were particularly stimulated in caterpillars that fed on MeJA treated tomato leaves alone and not necessarily as high for caterpillars of other treatments. This alteration of genes and the cannibalistic feature possess a potential pathway to identifying the weaker spot of the generalist herbivore. The additional preliminary result suggests that there is a trend that some genes are correlated to cannibalism treatments and induced plant defenses compared to the untreated plants. This is one of the first studies to investigate the connection of cannibalism in relation to plant defenses. The objective of this research is to investigate the impact of induced cannibalism on the containment of this generalist herbivore on vulnerable food crops.
- 15 2:30pm Grad Gene Expression of Tomato Fruitworm (*Helicoverpa zea*) that Fed on Tomato Plants Infected with the Entomopathogenic Fungus (*Beauveria bassiana*)**
 *Bashaier Alharbi, Richard Musser, Sue Hum-Musser [Western Illinois University]
 Tomato fruitworm (*Helicoverpa zea*) is a major agricultural pest of the New World amongst the 381 already described species of the Heliothinae subfamily. Its geographical distribution is widely distributed in South and North America, making it an important economic pest in both continents. *Beauveria bassiana* is an

entomopathogenic fungus, which improves plant immunity and resistance against herbivorous insects. However, the study of the gene expression related to induced defense, and other physiological mechanisms of *H. zea* fed with wounded tomato plants that has been colonized with the entomopathogenic fungus has not been described. The objective of this project was to determine the effect of *B. bassiana* on the larvae while feeding on tomato and determine the growth and gene expression of the caterpillars that fed on wounded tomato plant in the presence and absence of the endophytic fungi. At four week old, tomato plants were separated into two groups, half sprayed with water that served as the control treatment, while the other half were inoculated with *B. bassiana* GHA fungi to the tomato plant roots and leaves. At 8 weeks old, both the control treatment and test treatment plants were exposed to third instar tomato fruitworm, giving rise to four treatments of control non-wounded no-fungus (CNW) tomato plant, control wounded no-fungus (CW), fungus non-wounded (FNW) and fungus wounded (FW) tomato plants. After three days of feeding RNA was extracted and reverse transcribed into cDNA. Real time- quantitative polymerase chain reaction was conducted on the cDNA to determine the gene expression of the fruitworm and its response to colonization of the tomato plants. We found significantly different pattern of gene expression in the results of this study should provide new insight on specific stimulation of these insect genes and how *B. bassiana* infection has a detrimental effect on the caterpillar's overall defense mechanisms and forms a protective treatment for the tomato plant in place of using synthetic chemical pesticides.

16 3:50pm Grad The Effect of Bioinoculants on the Gene Expression of Soybean in Response to Salt Stress

*Norah Alwuthaynani, Nicholas Emory, Richard Musser, Sue Hum-Musser [Western Illinois University]

An important food source for animal and human consumption is soybean. It is the most second cultivated crop in the USA. US farmers have been successful in improving their yield; this improvement due to using new varieties, crop management practices...etc. Some farmers prefer natural fertilization it is organic and potentially less expensive. The microorganisms found around the roots of the plant that help the plant are called plant growth promoting rhizobacteria. Biostart® is the biological fertilizer that the manufacturer claims it enhances the growth and helps the plants resist the environmental stress. The objective of my study is to assess gene expression for abiotic defense genes. When soybean seeds are treated with Biostart® and 0mM or 75mM of salt. Total RNA extraction, cDNA synthesis, and real-time quantitative polymerase chain reaction were done to examine the gene expression. There were changes in the gene expression for each treatment. There was a significant difference in gene expression in several genes encoding antioxidants, metabolism, defense in the salt and/or Biostart®-treated seedlings compared to the other treatments. The research data will inform us on the pathways affected by these treatments and may be helpful to reduce the synthetic fertilizers usage and their costs. Scientists can use their knowledge to produce sustainable biocontrol products as part of soybean management plan as well.

17 2:30pm Grad The Role of CREG1 as a Master Regulator of Liver Function

*Iffat Jahan [Eastern Illinois University]

Mammalian development involves a complex system of regulatory signals and reactions resulting in highly differentiated cell types with specific structure and function. The liver is a major organ that has been studied extensively to understand underlying genetic processes responsible for specification, establishment and maintenance of tissue identity. Hepatoma and hepatoma variant cell lines have been used as a model to understand genetic networks responsible for liver function. Whole genome microarray analysis of hepatocyte cell lines has revealed candidate genes that may serve as regulators or master regulators of liver specificity. In two previous studies, the role of candidate gene Cellular Repressor of E1A Stimulated Gene (CREG1) on regulation of liver-specific gene expression was determined using transfection studies combined with utilization of quantitative real-time polymerase chain reaction (qRT-PCR). Both studies found strong activation (10-100-fold) of transcription factor *Hnf6* and the downstream gene *Serpina1* (a marker gene used to identify liver function). These findings suggested that CREG1 might act through HNF6 to regulate *Serpina1* via a Locus Control Region (LCR). However, while one study showed that of CREG1 overexpression in a hepatoma variant cell line resulted in modest activation of liver-specific transcription factors *Hnf1*, *Hnf4* and *Hnf3*, the second study suggested robust activation of these genes as measured by qRT-PCR. In the current study, a CREG1 expression vector was reintroduced into two variant cell lines and gene activation profiles monitored to establish validity of the previous studies.

- 18 3:50pm Grad The Role of Prrx1 and Snai2 as Master Regulators of Fibroblast Identity**
 *Huda Alzahrani [Eastern Illinois University]
 Mammalian development involves a complex system of regulatory signals and reactions, leading to the creation of distinct tissues with specific structures and functions controlled by various gene expression profiles. Tissue-specific gene expression is by controlled specific combinations of transcription factors and cofactors that dictate cell differentiation via activation and repression of genes in mammalian cells. Whole genome microarray analyses of fibroblasts have revealed candidate genes that may serve as master regulators of fibroblast identity, such as PRRX1 and SNAI2 that activate downstream genes such as BMP3, Twist, Shox2, CFOS, Slug, SEMA3A, Sppl, and Col1a1. A previous study showed that PRRX1 and SNAI2 play important roles in activating expression of fibroblast identity using somatic cell hybrids as model systems. Based on these results, we sought to examine the role of PRRX1 and SNAI2 in affecting the phenotype of liver-derived cells using hepatoma cells as a model system. Expression plasmids containing PRRX1 and SNAI2 expression cassettes were transfected separately into FG14 rat hepatoma cells using a standard transfection technique, then G418-resistant clones were selected (pooled and individually) and monitored for over-expression of PRRX1 and SNAI2. RNA was extracted and used to synthesize cDNA. Quantitative real-time polymerase chain reaction (qPCR) was carried out using specific primer pairs and signals normalized to GAPDH mRNA levels. qPCR analysis revealed that both PRRX1 and SNAI2 were successfully over-expressed in pooled FG14 transfectants and individual clones compared to the non-transfected cells. Next we monitored expression of several genes known to be important in hepatic and fibroblast function. Results show that SNAI2 strongly activated Slug expression in FG14 hepatoma cells, as well as activated Twist expression. Although several other fibroblast genes (BMP3, Shox2, CFOS, Slug, SEMA3A, Sppl, and Col1a1) were relatively unaffected. Prrx1 overexpression resulted in activation of Cfos expression in FG14 hepatoma, but not other genes tested. Based on these findings we hypothesized that overexpression of fibroblast-specific transcription factor PRRX1 and SNAI2 would result in loss of hepatoma phenotype. We therefore monitored expression of a panel of hepatoma-specific genes using qPCR analysis. Results show that several hepatoma related genes are repressed by these transcription factors leading to partial loss of the hepatic phenotype. Thus, these results suggest that candidate core PRRX1 and SNAI2 serve as a useful starting point for studying transcriptional control of cell identity and reprogramming of mammalian cell types.
- 19 2:30pm UG Analysis of Gut Microbiota from *Aedes albopictus* Mosquitoes Collected in Coles County Illinois**
 *¹Megan Cooper, ¹Antony Oluoch, ²Raymond Kim, [¹Eastern Illinois University, ²University of Illinois]
 Mosquitoes of the genus *Aedes albopictus* are vectors of a wide number of human viral diseases including West Nile, Dengue, Chikungunya, and (lately) Zika virus. Mosquito midguts play a central role in pathogen transmission. After a blood meal, there occurs crucial intermediate development/replication at this site before eventual dissemination into secondary sites such as salivary glands. The midgut can modify and impede vector transmission via the influence of digestive enzymes and innate immunity. Recently, a large body of evidence has suggested that the midgut bacterial composition can vary within and between mosquito species, and that these can affect vector susceptibility to antigen through multiple mechanisms, and thereby influence transmission efficiency. This study will present the range of bacterial species in the midguts of mosquito samples derived from various locations in Coles County.
- 20 3:50pm UG Analysis of the Migration of Wharton's Jelly Umbilical Cord Mesenchymal Stem Cells Towards Cancer Stem Cells and Ovarian, Breast, and Pancreatic Cancer Lineages**
 *Claire Woods, Katherine Kessler, Craig Cady [Bradley University]
 According to the World Health Organization, cancer is the second leading cause of death globally. Traditional chemotherapy treats cancer by targeting rapidly growing cells, but this method often results in adverse effects such as nausea, vomiting, and hair loss. Furthermore, cancer stem cells (CSCs) are especially resistant to traditional chemotherapy and have been shown to cause recurrence of cancer due to their tumorigenic and metastatic properties. Wharton's Jelly umbilical cord mesenchymal stem cells (WJs) exhibit migratory behaviors toward inflammation, which occurs at sites of cancer. This makes WJs a strong candidate for cell-based localized therapy, which is a more direct treatment that is capable of eliminating systemic effects associated with current cancer therapies. In this study, WJs were utilized in a migration assay with cancer conditioned media from ovarian, breast, and pancreatic cancer as well as cancer stem cells. Analysis of the migration assay revealed that the WJs successfully migrated towards the HEY conditioned media. However,

migration did not occur with the breast cancer conditioned media. Ongoing studies are investigating the inflammation of different cancer lineages as well as CSCs and the subsequent effectiveness of the migratory qualities of WJs.

21 2:30pm UG

Characterization and Variability within *Candida parapsilosis* Agglutinin-Like Sequence (ALS) Genes

*¹Erica Forbes, ²Soon-Hwan Oh, ²Lois Hoyer, ¹Laura Zimmerman [¹Millikin University, ²University of Illinois]

Yeast infections are associated with various *Candida* species, *C. albicans* being the most prevalent and understood. However, the second most common *Candida* species found in infections is *C. parapsilosis*. An important virulent property of *C. albicans* is the presence of agglutinin-like sequence proteins, which allow for cell to host adhesion. Using the BLAST feature on the *Candida* Genome Browser, five ALS genes were discovered in *C. parapsilosis*. Each gene was separated into a C-terminal, tandem repeat, and N-terminal domain. PCR products of each domain were analyzed across five strains of *C. parapsilosis* using gel electrophoresis and Sanger sequencing. Variability of tandem repeat and C-terminal lengths were discovered in four genes and allelic differences were seen in two genes. Sequencing results showed that the published genome was assembled correctly and has accurate nucleotide sequence for each ALS gene. These results show that the pathogenicity of *C. parapsilosis* cannot be easily predicted due to the variability of length in domains and allelic differences.

22 3:50pm UG

Characterization of Additional Pheromone Receptors in *Schizophyllum commune*

*Emily Watson, Thomas Fowler [Southern Illinois University Edwardsville]

Schizophyllum commune, a model mushroom-producing basidiomycete, has the potential to create thousands of unique mating types due to genetic variation within merely four loci (A α , A β , B α , and B β). B α and B β loci contain multiple pheromone receptors, which are used to communicate with a corresponding sexual mating type. It is unknown if the pheromones are used for other functions within *S. commune*. The B α and B β mating-type loci have been shown to be within several kilobases of one another. Several pheromones secreted by *S. commune* can activate more than one receptor concurrently. The objective of this work is to characterize additional B α and B β receptors in order to gain knowledge on the complicated recognition of mates within this species. Multiple strains of *S. commune* from an extensive library were propagated to acquire DNA from strains that included the B β 2 receptor, which activates signaling alongside receptors coded in B α 4, B α 5 B α 6, and B α 7strains. With the assistance of NCBI and CLUSTAL alignments, degenerate PCR primers were designed in order to seek out unknown receptors. PCR was used to amplify putative pheromone receptor gene fragments from B α 5, B α 6, and B α 7strains. Cloning techniques are being used in order to analyze and confirm the identity of the PCR products.

23 2:30pm UG

Characterization of Agglutinin-Like Sequences (ALS) Genes in the Yeast *Candida tropicalis*

*¹Quinn Nguyen, ²Soon-Hwan Oh, ²Lois Hoyer [¹Millikin University, ²University of Illinois Veterinary Medicine]

Candida tropicalis is becoming one of the more prominent *Candida* species residing within human populations due to their innate resistance to azole-derivatives, an antifungal that is commonly used in human health. Additionally, it has been seen that this species can induce fungemia in individuals with neutropenia or malignancy. Additionally, they are commonly found to adhere to abiotic surfaces and hydrophobic cell surfaces, as they have high adhesion profile and strong ability to form biofilms. ALS genes have been identified and established in *C. albicans* as adherents that are associated with the different *Candida*-related infections (CRIs), such as candidemia and candidiasis. This project used Oxford Nanopore Sequencing to assemble the genome for the MYA-4303 strain of *C. tropicalis*. Afterwards, ALS genes were identified and verified through polymerase chain reaction and additional sequencing. 12 Als proteins were identified, 1 of which lacked a cleavage site for secretory peptide and 3 of which lacked a GPI anchor. These are suggestive of possible different causes of pathogenesis of CRIs from *C. tropicalis*. Results from this study should encourage additional research, including transcriptional analysis of these genes and the order of expression, if one exists, in order to better understand how these genes work together.

24 3:50pm UG

Developmental Stages in *Schizophyllum umbrinum* for Potential Pheromone Expression

*Tasmeem Chowdhury, Thomas Fowler [Southern Illinois University Edwardsville]

Pheromones and G-protein-linked receptors are partially responsible for determining sexual development in the fungus *Schizophyllum commune*. Pheromone signaling indicates one aspect of compatibility between potential heterothallic mates. *Schizophyllum umbrinum* is a fungus that has a homothallic lifecycle and produces fertile fruiting bodies. It also has pheromone and receptor genes similar to *S. commune*, but their functions in *S. umbrinum* are unknown. When cultivating *S. umbrinum*, we observed that it proceeds through four distinct maturation phases on the colonies: white mycelium, orange-pigmented mycelium, young non-sporulating mushroom, and mature sporulating mushroom. We also observed that the presence of orange-pigment in the mycelium is an indicator of potential development of fruiting bodies. Since the stages are so distinct, we predicted that there are differences in gene expression between them. We collected tissue from each stage and extracted RNA in order to build cDNA libraries. The cDNA libraries will help us study these stages better and determine in which stage of *S. umbrinum* development the pheromones and receptors are being expressed. This should help us to hypothesize the function of these putative pheromones and receptors in homothallic *Schizophyllum umbrinum* development.

25 2:30pm UG

Dkkopf (dkk) Expression in *Xenopus laevis* Ocular Tissues During Cornea-Lens Regeneration

*Nicholas Roth, Paul W. Hamilton [Illinois College]

Xenopus laevis tadpoles have the ability to completely regenerate the lens of the eye from the cornea epithelium, making it one of the simplest organ regeneration systems to study. When the entire lens is surgically removed, the neural retina sends inductive signals to the cornea epithelium to initiate formation of the new lens. This represents a rare example of *de novo* regeneration, a form of regeneration that does not require residual stem cells of the lost or damaged tissue. Recent work has identified the canonical Wnt/beta-catenin signaling pathway to be involved in this process. In order for cornea-lens regeneration to occur, Wnt/beta-catenin signaling must be reduced. However, the protein responsible for this inhibition remains unknown. One well known group of Wnt inhibitors are the Dickkopf (DKK) proteins, but the expression of these genes (*dkk1*, *dkk2*, and *dkk3*) have not yet been investigated during cornea-lens regeneration. Custom intron-flanking primers were designed to amplify gene expression via reverse transcription polymerase chain reaction (RT-PCR) of RNA collected from *Xenopus* cornea and retina tissue during regeneration. All three genes are expressed in *Xenopus laevis* ocular tissue, making them potential candidates for future functional studies.

26 3:50pm UG

Effects of Herbal Tea Potency on MCF-7 Human Breast Cancer Cells

*Madison Boeglin, Jennifer Schroeder [Millikin University]

Breast cancer is one of the leading causes of death in women. Green, black, and oolong teas have an effect on breast cancer cell communication and lower cell viability using polyphenols, which stabilize free radicals and reactive oxidative species (ROS). This research will give us further understanding regarding breast cancer cell viability through treatment with green, black, and oolong teas. This study will also provide understanding of the oxidative stress the cells undergo when treated with the teas. MCF-7 human breast cancer cells were treated with either green, black, or oolong tea dilutions for 48 hours. After treatment, remaining viable cells were quantified through a colorimetric MTT assay with a microplate reader at 570 nm. The cells treated with tea dilutions had significantly fewer viable cells when compared to the distilled water control. In general, the more concentrated teas had less viable cells. A ROS-Glo assay determined that cells treated with black and oolong tea showed lower levels of hydrogen peroxide in comparison to the control and green tea. Thus, they are better at lowering sources of oxidative stress than green tea. Further research is necessary to determine if tea treatments alter the gene expression of the oxidation-reduction pathway for hydrogen peroxide.

27 2:30pm UG

Examining Wnt Signaling in Post-Metamorphic *Xenopus laevis* Cornea-Lens Regeneration

*Uchenna Ani, Paul W. Hamilton [Illinois College]

Xenopus laevis (the African clawed frog) tadpoles have the ability to undergo *de novo* lens regeneration from stem cells of the cornea epithelium. After surgically removing the lens, factors that induce lens regeneration are produced by the neural retina and stimulate the basal layer of the cornea epithelium to form a new lens that eventually detaches. While the mature cornea of a post-metamorphic frog is not capable of regenerating *in vivo*, recent work has demonstrated that the basal layer of the cornea epithelium is still capable of producing lens proteins when cultured in the presence of neural retina. One large question in the field is

whether this initial regenerative response utilizes the same signaling mechanisms as previously published in tadpoles. It is known that the Wnt/beta-catenin signaling pathway must be inhibited in order for lens regeneration to occur in tadpoles, but it remains unclear if this is also true for the lens protein expression observed in post-metamorphic cornea. To address this question, cornea fragments from post-metamorphic froglets were surgically removed and placed into the lentectomized eyecups of tadpoles. Eyes were then removed and cultured in the presence of 1-azakenpaullone, a small molecule activator of the Wnt/beta-catenin signaling pathway, for 14 days. Eyes were then fixed and sectioned for histological analysis. Successful cases of lens protein expression in the cornea were scored by immunofluorescence using an anti-lens antibody, providing insight into the conservation of signaling mechanisms between these two systems.

28 3:50pm UG

Generation of Transgenic *Xenopus laevis* Expressing Constitutively Active Beta-Catenin

*Sean Kisch, Paul W. Hamilton [Illinois College]

The African clawed frog, *Xenopus laevis*, is an ideal system for research regarding the cellular regeneration of the lens in the eye. The lens has the ability to regenerate *de novo* from cornea epithelial cells after induction from the retina. This is of interest because *de novo* regeneration is a rare form of regeneration that is not dependent on residual stem cells of the lost tissue. The Wnt/beta-catenin signaling pathway plays an important role during cornea-lens regeneration in *Xenopus*. In order for the lens to regenerate, the Wnt/beta-catenin signaling pathway must be inhibited by the cytoplasmic degradation of beta-catenin. However, previous studies have not demonstrated whether this inhibition is necessary in the cornea epithelium, retina, or both. In order to address this question, an inducible transgene expressing beta-catenin was needed. Through molecular cloning, a novel transgene was generated with a constitutively active beta-catenin mutant under the control of a heat-shock promoter. This mutant beta-catenin also carries a C-terminal GFP tag, allowing for visualization of beta-catenin *in vivo*. Using this new transgene, transgenic embryos were successfully generated by sperm nuclear injection of unfertilized *Xenopus* eggs. After receiving a heat-shock, these transgenic embryos not only expressed GFP-tagged beta-catenin, but beta-catenin overexpression was also confirmed by the production of a secondary body axis.

29 2:30pm UG

Investigating the Function of Titan in Planarian Muscle Development

*Ilish Radulovic, Amy Hubert [Southern Illinois University Edwardsville]

Familial dilated cardiomyopathy is a disease that results in enlargement and weakening of the heart, reducing its ability to pump blood through the body and resulting in eventual heart failure and death. Mutations in titan, a protein involved in sarcomere development and regulation of muscle contraction, account for over 20% of familial dilated cardiomyopathy cases. In order to better understand the role of Titan in muscle function, we decided to characterize the homolog of this gene in the planarian *Schmidtea mediterranea*. Planarians are a popular model system for studies of development and regeneration due to their simple body structure and ease of experimental manipulation in the lab. These worms contain a pool of stem cells spread throughout their body that allows them to regenerate in response to wounding or amputation. tBLASTn searches of the human Titan protein against the *S. mediterranea* transcriptome identified a single homolog, with an e-value of 0.0 and 99% query coverage, indicating that the gene is highly conserved. We have cloned a segment of this gene into a vector for expression of double-stranded RNA to induce knockdown by RNA interference (RNAi) in the worms. We will feed the worms bacterial pellets containing the dsRNA three times over a duration of one week and then cut them to induce regeneration. We will observe the worms as they regenerate new muscles, monitoring them for changes in movement, behavior, and body posture. After 10 days of regeneration, we will stain the worms with a muscle-specific antibody to assess muscle structure in the newly formed tissue. We hope that this study will further our understanding of the role of Titan in muscle formation and cardiac disease.

30 3:50pm UG

Investigating Zebra Mussel Physiology During Temperature Stress Using Quantitative PCR

*Max Walton, Sam Gerbic, Jennifer Jost [Bradley University]

Many invertebrate species experience physiological changes as environmental factors, like temperature, change. Increased water temperatures, including those predicted due to climate change, can impact the overall aquatic conditions. Given that invertebrate species are commercially important, indicators of ecosystem health, and include several invasive species, there is a great interest in understanding the changes in cellular physiology that allow these animals to cope with environmental stressors. The invasive zebra mussel, *Dreissena polymorpha*, was used as a model organism to see the impact of temperature changes on

the cellular physiology of the zebra mussel. The levels of four cellular stress markers were evaluated: heat shock protein (HSP) 70 and 90, which both play a role as assist proteins after cellular damage, AMP-activated protein kinase (AMPK) as a measure of energy levels and metabolic balance, and actin, which serves as a baseline for comparison. One major objective was to determine the optimal methodology for RNA isolation, and after many variations, we developed a protocol that yields consistent results. We successfully converted mRNA to cDNA for our markers of interest and amplified using specific primers. DNA sequencing of these products confirmed we are targeting the genes of interest. Our second objective was to use quantitative real-time PCR to measure the mRNA levels of these four markers. We ran a preliminary experiment with mussels (n=15 per temperature) held at 10°C or exposed to 90 minutes of heat stress at 26°C. We anticipate completing the qPCR within the next few weeks. We predict the levels of all three stress markers (AMPK, HSP70, and HSP90) will be higher in the heat stressed mussels than in those kept at cool ambient river conditions.

31 2:30pm UG

Investigations into the Neuroprotective Effects of Simvastatin on Adult Murine Neurons Against the Neurologic Stressors Glutamate and Beta-Amyloid

*Jennifer Houser, Alyssa Beck, Craig Cady [Bradley University]

Simvastatin is a widely used cholesterol-lowering drug, and in recent patient studies has been shown to have neuroprotective effects against neurodegenerative diseases, such as Parkinson's Disease or Alzheimer's Disease. Glutamate and beta-amyloid are important neurotoxic stressors, relevant to many neurodegenerative diseases, including Parkinson's and Alzheimer's Disease. In this study, primary adult neurons were isolated and cultured from the hippocampus and cortex of adult mice. Cultured neurons received a 12-hour pre-treatment of simvastatin, and then exposed to glutamate or beta-amyloid with continual simvastatin treatment. Morphometric analysis and Alamar Blue assay were used to evaluate neuronal stress. Simvastatin failed to show protection against the neurological stressors glutamate and beta-amyloid. Ongoing studies are investigating longer statin pretreatment period, effects of other types of statins and other neuroprotective agents, including stem cell produced exosomes.

32 3:50pm UG

Isolation of DCL-1 and DCL-2 Genes for Rescue in *Schizophyllum commune*

*Carlee Hoxworth, Daniel Karcher, Thomas Fowler [Southern Illinois University Edwardsville]

Schizophyllum commune is a mushroom-forming basidiomycete that had its genome sequenced in 2010. Coded within this genome are DCL-1 and DCL-2, two proteins in *S. commune* that appear to be homologous to Dicer proteins that are involved in RNA interference (RNAi) in other organisms. This homology is presumed due to the presence of multiple well conserved domains. RNAi is an intracellular mechanism in eukaryotes in which small fragments of RNA are used to identify complementary RNA targets for degradation to protect the cell against viruses and transposable elements, or to regulate gene expression. In previous experiments, DCL-1 and DCL-2 genes were successfully knocked out from *S. commune* using homologous recombination and a plasmid containing a phleomycin resistance cassette. It is predicted that if these DCL proteins do perform RNAi functions, successful restoration of the genes that encode these proteins should reinstate function to the knockout mutants. A hygromycin resistance marker gene has been successfully amplified via PCR and is ready to be used as a selective marker in transformations. A full-length DCL-1-containing DNA fragment was successfully amplified through PCR from the SKO2-14 strain of *S. commune*. Isolation of a full-length DCL-2 gene via nested PCR is underway. Wild-type DCL genes will be inserted into plasmid vectors. Once both wild-type DCL-1 and DCL-2 clones are successfully obtained, they will be reintroduced into the knockout mutants to assist in analysis of the roles of the DCL-1 and DCL-2 proteins in *S. commune*.

33 2:30pm UG

Locating and Characterizing Agglutinin-Like Sequence (ALS) Genes in *Candida metapsilosis*

*¹Brooke Smith, ²Soon Hwan Oh, ²Lois Hoyer, ¹Laura Zimmerman [¹Millikin University, ²University of Illinois]

Many of the pathogenic yeast species that infect humans belong to the *Candida* genus. While *Candida albicans* is the most common and best understood species in this genus, other species are becoming more prevalent with the widespread use of antifungal agents. One such species, *Candida metapsilosis*, has only recently been recognized as its own species, having previously been grouped with *Candida orthopsilosis* and *Candida parapsilosis*. Since then, efforts have been made to sequence the genome of *C. metapsilosis* and better understand its virulent properties. One important virulent characteristic is the ability to adhere to host cells, which has been attributed to the presence of agglutinin-like sequence (ALS) genes that are known to

encode adhesins in *C. albicans*. In this study, the *C. metapsilosis* genome was analyzed and potential ALS genes were located. Three ALS genes were found and amplified in the type strain, and the products were sequenced to confirm size and find allelic variation. The genes were also amplified in four additional *C. metapsilosis* strains to determine variability between strains, however, no variation was observed between the strains tested. The results of this study could be used in the development of an antifungal drug that targets the ALS gene family to treat yeast infections.

34 3:50pm UG

Proliferation of LGR5 And LGR6 Stem Cells on PCL-Collagen Nanofiber Scaffolds

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

Recent efforts to show clinical relevance of autologous stem cell-based therapies have demonstrated a need for cell scaffolding as substrates for tissue regeneration. Polycaprolactone (PCL) is a FDA approved, biocompatible, and clinically relevant biomaterial. The present work focuses on integrating type 1 collagen fibers into an electrospun PCL nanofiber matrix to enhance biocompatibility as well as cell adhesion and proliferation. Integration of collagen into the PCL matrix was verified by scanning electron microscopy. Current studies focus on optimizing proliferation of LGR5 and LGR6 stem cells on nanomaterial by varying plating density and collagen concentration. LGR5 and LGR6 are epithelial tissue and hair follicle precursor cells, and are clinically relevant for traumatic injury treatment and tissue regeneration. These data show PCL-collagen nanofiber cell scaffolds to be a promising innovation for the future of tissue regeneration.

35 2:30pm UG

The Social Behavior of Proteins: Power-Law Degree Distribution, Degree Correlation, and Structural Balance in Protein-Protein Interaction Networks

*Arshia JafarNia, Keenan M.L. Mack [Illinois College]

By imagining that each protein in an organism represents a node and each molecular interaction between proteins represent edges between those nodes, the whole structure of a functioning proteome can be visualized as a network. It has been observed that many naturally occurring networks, such as protein-protein interaction networks, are often organized such that they have a power-law degree distribution, meaning there are relatively few highly connected nodes and many sparsely connected nodes. The best explanation of this pattern involves preferential attachment of new nodes to already popular nodes during network assembly. While this does generate a power-law degree distribution, it does not explain another common observation of many naturally occurring networks. In particular, protein-protein interaction networks tend to have negative degree correlation, meaning highly connected nodes tend to be connected to relatively sparsely connected nodes. Preferential attachment generates no degree correlation. Thus, developing a first-principles network assembly algorithm that can generate both degree correlation and a power-law degree distribution would be an important step in understanding how proteomes are assembled. A possible way of generating degree correlation is network rewiring, which is the swapping of edges between nodes. In this way, the number of connections at each node can be maintained, thus maintaining the degree distribution, but which nodes are connected by edges are shuffled. The concept of structural balance has been used to explain just such observed shuffling in social networks. Structural balance predicts that certain patterns of connections between three nodes in the network are unstable and favor rewiring. We propose that a similar mechanism may be operating in protein-protein interaction networks. Thus, we have examined published protein-protein interaction networks for power-law degree distribution, degree correlation, and transitivity, which is an expected signature of structural balance. We have then compared those measures with randomly assembled networks of similar size and density to see if real world networks do in fact exhibit those important structural characteristics.

CHEMISTRY

- 36 3:50pm Grad Forensic Analysis of Illicit Drugs by Nitrogen Direct Analysis in Real Time Mass Spectrometry (N₂ DART/MS)**
 *¹Wei Chean Chuah, ¹Liguo Song, ¹Jeffrey D. Quick, ²Sheher Mohsin, ²Ben Owen, ³Edward Remsen, ⁴John E. Bartmess [¹Western Illinois University, ²Agilent Technologies, ³Bradley University, ⁴University of Tennessee]
 Currently, helium gas is popularly used in DART/MS. Theoretically, He DART-MS should have the best sensitivity because He is an inert gas that occupies a front position in the periodic table, therefore producing metastable species with the highest internal energy, i.e. long-lived He 2³S electronic excited state atoms with an internal energy of 19.8 eV. However, when He gas is not readily available, e.g. during space missions or forensic analysis of illicit drugs at the crime scene, nitrogen gas is the best option because it is the next inert gas behind He in the periodic table. In this study, N₂ DART/TOFMS with a JEOL AccuTOF™ mass spectrometer was first used to analyze ten commonly abused drugs, i.e. (±)-amphetamine, cocaine, diazepam, heroin, lysergic acid diethylamide (LSD), (±)-3,4-methylenedioxymethamphetamine (MDMA), phencyclidine (PCP), psilocin, testosterone, and Δ⁹-tetrahydrocannabinol (THC), in order to test the ionizing capability of N₂ DART towards compounds with diverse functional groups, optimize the instrumental conditions for forensic analysis of illicit drugs, estimate the limit of detection (LOD) of the analysis, and develop a general analytical protocol for the analysis. Under optimum conditions, the LOD of N₂ DART/TOFMS was determined to be approximately 10 mg/mL. Because the sampling volume was approximately 1 mL, the LOD of N₂ DART/TOFMS was approximately 10 pg in quantities. The general analytical protocol took approximately 3 minutes in the analysis of each commonly abused drugs. All the commonly abused drugs were positively identified at 10mg/mL because the experimentally measured monoisotopic mass of multiple ions, predominately the [M+H]⁺ ion, from each drug were within ±5 mDa of the theoretically calculated monoisotopic mass. No time-consuming and labor-intensive sample preparation steps were required during the analysis. The general analytical protocol was then applied in tablet analysis of six prescriptions drugs, i.e. clonazepam 1 mg, cyclobenzaprine 10 mg, metaxalone 800 mg, oxycodone/acetaminophen 5/325 mg, tramadol/APAP 37.5/325 mg and zolpidem 10 mg. It was found that while N₂ DART was able to efficiently ionize and subsequently identify the active ingredients in the tablets, it practically omitted the inactive ingredients. Therefore, it was concluded that the general analytical protocol was able to be utilized in the analysis of seized drugs because they are mixtures with similar complexity as the tablets. N₂ DART/QTOFMS with an Agilent 6550 mass spectrometer was further used to analyze ten commonly abused drugs at 10 mg/mL in order to test the applicability of N₂ DART on different MS platforms. First, all the commonly abused drugs were positively identified by TOFMS of the [M+H]⁺ ions with their monoisotopic mass and isotopic pattern. Then, they were further positively identified by QTOF MS/MS of the [M+H]⁺ ions at collision induced dissociation (CID) at 10.0 and 20.0 V. The obtained mass spectra were automatically matched with the Agilent Forensic Toxicology Personal Compound Database and Library (PCDL).
- 37 2:30pm Grad Quantification of Phenylbutazone in Equine Plasma for Doping Control in Horse Racing by Liquid Chromatography with Ultraviolet Detection**
 *Natasha Frig, Ravi Lella, Terrence Petry [Western Illinois University]
 A liquid chromatography separation with ultraviolet detection (LC-UV) for the analysis of phenylbutazone (PBZ) in equine plasma has been developed. Baseline separation of PBZ from interfering compounds possibly found in equine plasma which include oxyphenbutazone (OPBZ), a hydroxylated metabolite of PBZ through the hepatic oxidative metabolism, and other commonly used non-steroidal anti-inflammatory drugs (NSAIDs) for horses, i.e. diclofenac, flunixin, ketoprofen, meclofenamic acid and naproxen, and possible internal standards to correct for any possible analyte loss during sample preparation, i.e. tolafenamic acid and ibuprofen, has been successfully achieved. A mobile phase system of methanol:water containing 0.1% acetic acid has been systematically optimized for separation under gradient and isocratic conditions, using a Kinetex® C18 column from Phenomenex. It has been discovered that while methanol provides the necessary selectivity for the separation, acetonitrile prevents specific interactions of the NSAIDs with the stationary phase. Consequently, the optimized mobile phase consists of 70% 95:5 methanol:acetonitrile and 30% water with 0.1% acetic acid under isocratic conditions. With an optimized mobile phase, the desired separation has been completed within 16 minutes.

- 38 3:50pm Grad Quantification of Phenylbutazone in Equine Plasma for Doping Control in Horse Racing Using Molecularly Imprinted Polymer Solid Phase Extraction Followed by Liquid Chromatography with Ultraviolet Detection**
 *Terrence Petry, Ligu Song [Western Illinois University]
 In this study, a method using molecularly imprinted polymer solid phase extraction (MIP-SPE) followed by liquid chromatography ultraviolet detection (LC-UV) for the analysis of phenylbutazone (PBZ) and its metabolite oxyphenbutazone (OPBZ) in equine plasma has been developed. By using MIP-SPE, commonly regulated non-steroidal anti-inflammatory drugs (NSAIDs) by the United States Equestrian Federation (USEF), i.e. PBZ, OPBZ, diclofenac, flunixin, ketoprofen, meclofenamic acid and naproxen, and an internal standard, i.e. tolafenamic acid, were first selectively extracted. Then, baseline separation of PBZ, OPBZ from other NSAIDs, internal standard, and residual components of equine plasma was achieved using LC-UV. Finally, the developed method was validated with regard to its linearity, accuracy, and precision. The preliminary validation has proven that the method has met the requirements by the racing jurisdictions
- 39 2:30pm Grad Quantitative Analysis of Limonene Content in Citrus Oil by Gas Chromatography Using Anisole as the Internal Standard**
 *Olusola Dahunsi, Ligu Song [Western Illinois University]
 An experiment to integrate three significant topics in analytical chemistry and related disciplines, i.e. gas chromatography (GC), external calibrations, and internal calibrations, has been successfully developed in the quantitative analysis of limonene content in citrus oil using anisole as the internal standard. Through this experiment, students are exposed to GC instrumentation, the optimization of GC separation, the advantages and disadvantages of external versus internal calibration, and the selection criteria of an internal calibration standard. The technique and chemicals used in this experiment are simple, safe and easy. The experimental results show that this experiment is an ideal laboratory assignment for students at the undergraduate level
- 40 3:50pm Grad Quantitative Analysis of the Organic Explosive TNT in Water by High Performance Liquid Chromatography with Ultraviolet Detection**
 *Shashi Bhushan Pathipaka, Samantha Schultz [Western Illinois University]
 In this study, a method using high performance liquid chromatography with ultraviolet detection (HPLC/UV) has been developed for the quantitative analysis of the organic explosive TNT in water samples. To avoid interference by other organic explosives, baseline separation of TNT from the other thirteen priority organic explosives defined by EPA were achieved using a C18 reversed-phase column. Subsequent quantification were accomplished through external calibration. Briefly, a series of TNT standard solutions prepared in HPLC mobile phase were analyzed by HPLC/UV and a TNT peak area versus concentration plot was fitted to a linear equation. After a TNT contaminated water sample was analyzed by HPLC/UV under identical conditions, the TNT concentration was calculated by using the linear equation and the TNT peak area. HPLC baseline separation of TNT from the other 13 priority organic explosives defined by EPA using a C18 column has been successfully achieved. Quantitative analysis of the organic explosive TNT in water samples has been successfully achieved using external standard calibration. The quantitative method has achieved a limit of quantification (LOQ) of 0.25 ppm and a precision of 2.95%.
- 41 2:30pm Grad Removal of Sulfur Impurities in Crude Oil**
 *Ibrahim Al-Dulaimi [Western Illinois University]
 The majority of liquid petroleum products are derived from crude oil. A refinery is used to separate crude oil into different products which are used in everyday life. Crude oil is tested prior to entering the refinery for the amount of sulfur present in the oil. Sulfur is a major problem in crude oil as it is the principle chemical in crude oil which corrodes refinery pipes. Sulfur is also the principle chemical which poisons the catalyst used to purify the oil and help break the larger compounds down into smaller compounds. If sulfur is left in the oil one combustion product is SO_3 which when released into the atmosphere where it reacts with water to form H_2SO_4 (acid rain). The goal of this work is to detect one of the more common families of compounds in crude oil, mercaptans. Our goal is to solid phase extraction to remove the sulfur impurity and leave the pure crude oil behind. The effectiveness of the process will be tested using gas chromatography.

- 42 3:50pm Grad Solid State Synthesis of Advanced Hard Ceramic Materials at Low Temperature**
 *Mohammed Althubuqi [Western Illinois University]
 Ceramics materials have been known for many years. An important early example of a traditional ceramic material is clay, which was and still is used to manufacture pottery and building bricks. Ceramic materials can exhibit a variety of properties; one property of ceramic materials is they are often hard materials. Current research on advanced ceramics is aimed at altering the nanostructure of the materials. These nanoceramic materials have many applications due to their hardness, wear resistance, corrosion resistance, and thermal stability. Metal oxides, metal nitrides, and metal carbides are examples of advanced ceramics. Metal carbides specially among other ceramics have unique properties. Silicon carbide (SiC) and Titanium carbide (TiC) are examples of these hard materials. These materials are usually synthesized via high temperature, $T > 1000\text{ }^{\circ}\text{C}$, solid state methods. This research is exploring the low-high temperature synthesis of these materials in the nano regime. One of method aimed at synthesizing hard materials at low temperatures ($<1000\text{ }^{\circ}\text{C}$) is solid state synthesis using flux or molten salts such as KBr, NaBr, NaCl, KCl, and LiCl. These flux methods allow for the reactants to have greater surface contact facilitating the reaction. Materials are characterized using a scanning electron microscope equipped with an energy dispersive X-ray spectrometer (SEM/EDS). This allows for the collection of a high resolution image and for qualitative stoichiometry of the elements.
- 43 2:30pm Grad Solid State Synthesis of CoTe**
 *Majed Almashnowi, Brian J. Bellott [Western Illinois University]
 Solid state materials are typically materials which are highly ordered and formed at high temperatures. There are many different synthetic techniques used to synthesize solid state materials. This research focuses on the ceramic method for the synthesis of solid state materials. The ceramic method uses high temperatures and closed reaction vessels to complete the synthesis. Our goal is not only to synthesize materials, but also synthesize single crystals of those materials. We examine the crystallinity of the crystals using optical microscopy. If we deem a material of high enough quality, we then subject the sample to scanning electron microscopy (SEM) to get more high resolution pictures and conduct some qualitative elemental analysis of the samples using energy dispersive spectroscopy (EDS).
- 44 3:50pm Grad Sorption Dynamics of Cadmium (II) And Chromium (II) Onto Montmorillonite from Mixed Solvent Systems**
 *Matthew Cash, Amanda Hagen, James S. McConnell [Western Illinois University]
 Transition metals have been used as catalysts in industrial chemistry extensively and continue to be used today. Since catalysts are untransformed or regenerated and only affect the reaction rate, they are often discarded as waste. Most industrial chemical waste is either sent to a special landfill or a disposal pond where organic chemicals will decompose over a long period or inorganics will be reabsorbed into the environment. This causes an inherent risk to living organisms. Transition metals may, inadvertently, be reintroduced into the environment causing contamination. Mixed solvent systems are routine in industrial chemistry. Mixed acetone and water systems will be used in our experiments are 0/100, 25/75, 50/50, 75/25, and 100/0 (% by volume) ratios. Cadmium (II) and chromium (II) sorption dynamics will be examined using sodium saturated montmorillonite. Our hypothesis is that the sodium saturated clay will preferentially adsorb the transition metals from mixed solvent systems. To test this hypothesis the transition metals chromium (II) and cadmium (II) will be prepared using analytical standards. Smectite clays are the best choice for the absorbent since they have a very large surface area and a negative charge. The sodium saturated montmorillonite will be treated with ratios of chromium (II) and cadmium (II) in mixed solvent solutions and equilibrated for twenty-four hours. The supernatant solution will be analyzed to determine the equilibria concentrations of solutionphase sodium, chromium, and cadmium.
- 45 2:30pm Grad Towards Understanding Reactivity of Organic Surfaces in the Solid State**
 *¹Gregory Deye, ²Juvinch Vicente, ¹Shawn M. Dalke, ¹Selma Piranej, ²Jixin Chen, ¹Jacob W. Ciszek [¹Loyola University Chicago, ²Ohio University]
- Organic materials are integral in the design of modern electronics, and properties such as flexibility and low-cost large-area processing have given them ground to compete with amorphous silicon, the conventional inorganic semiconductor material. In these electronic devices, there are multiple layers of organic and metal films, and device performance depends on the metal/organic and metal/metal interfaces. Example weaknesses at the interfaces include poor adhesion between layers and charge injection barriers. To mitigate

these interfacial issues, it is necessary to engineer the chemistry on the surface. Unfortunately, there is minimal precedence for performing chemistry on organic surfaces. One method, which conveniently takes advantage of the abundant π -electrons from the organic semiconductor, is the Diels-Alder reaction. Using this chemistry, important principles guiding reactivity can be determined. In this poster presentation, the effect of thermal perturbation on a relatively weak crystal lattice, pentacene, is described. To this end, both surface and subsurface reaction regimes reconciled the restructuring of the surface over a narrow temperature range. The second aim of this poster investigates classical reaction models, solid-state and solution, to see if they offer any mechanistic insights regarding reactivity and if they can be used to predict reactions on other surfaces. Polarization modulation infrared reflection absorption spectroscopy (PM-IRRAS) and atomic force microscopy (AFM) allow for the determination of successful adsorbate reaction and changes in film topology, respectively.

46 3:50pm UG

Antioxidant Analysis of Honey

*Bethany Esterlen [Western Illinois University]

Current research has been focused on comparing store bought honey to honey obtained directly from local beekeepers. Honey that is store bought is heavily filtered and processed. Filtered honey has been processed to the extent that all or most of the fine particles, pollen grains, air bubbles and other materials normally found in suspension have been removed. However, this is not the case of honey that is obtained raw from beekeepers, where the degree of processing varies. Currently we have been working on developing a standardized method for processing store bought honey and honey obtained directly from bee keepers. Since each of the different honeys is treated differently a standard method had to be developed. This will allow for direct comparison of the honeys. The antioxidant concentrations of the honeys will be determined using two different methods.

47 2:30pm UG

Comparison of Caffeine Concentration in Teas

*Quinn Kruehl, Brian J. Bellott [Western Illinois University]

Cold brew tea has become increasingly popular recently compared to a traditional hot brew. Typical brewing temperatures for hot brewed teas range from 71°C to 100°C depending on the type of tea. Steep time, which is the amount of time that the tea leaves are allowed to soak in the water, ranges from 3 to 7 minutes for hot brewed, depending on the type of tea. Cold brewed tea differs in the amount of tea used and the steep time. Since cold water is not as efficient at extracting the pleasant chemicals from the tea leaves compared to hot water, the steep time is drastically increased, usually twelve hours or greater, and the amount of leaves used is typically increased by a factor of four. In this research project, a standard curve for caffeine is constructed using solutions with a known concentration of caffeine. A method for brewing both hot and cold teas is also standardized. The caffeine component is isolated from each tea sample using a developed solid phase extraction method. Then, the isolated caffeine samples are injected into the column of a gas chromatography instrument with a flame ionization detector. The solid phase extraction method yields few interferences in the GC chromatogram produced. The caffeine peak areas are then compared to the standard curve to determine the concentration in the particular samples of tea.

48 3:50pm UG

Compositional, Structural, and Photovoltaic Property Relationships in $\text{Sr}_2\text{ZnW}_{1-x}\text{Mo}_x\text{O}_6$ Materials

*Korinne Frankford, Abigail Cardascio, Paris Barnes [Millikin University]

CANCELLED $\text{Sr}_2\text{ZnW}_{1-x}\text{Mo}_x\text{O}_6$ double perovskites are being investigated for their interesting optical properties. Previous studies revealed that the W^{6+} -to- Mo^{6+} ratio present in the material affects its light reflectance spectrum. These measurements were conducted on $\text{Sr}_2\text{ZnW}_{1-x}\text{Mo}_x\text{O}_6$ compounds prepared without considering the potential loss of zinc oxide (ZnO). ZnO is significantly volatile at 1100°C, which was the final heating temperature used to prepare the $\text{Sr}_2\text{ZnW}_{1-x}\text{Mo}_x\text{O}_6$ compositions. A total of five compounds were synthesized with x values between 0 and 1. Compounds with similar x values were synthesized using muffling techniques to prevent zinc loss. Each compound was analyzed using X-ray powder diffraction and diffuse reflectance spectroscopy. This poster discusses how compositional variation affects the perovskite structure and ultimately the efficiency to convert light energy to electrical energy.

49 2:30pm UG

Determination of Phosphate Concentration in Water Surrounding a CAFO

*Paige Noecker [Western Illinois University]

Phosphate concentration in water is an accurate representation of how healthy an ecosystem is. If there is an increased phosphate concentration, there are more nutrients in the water for organisms like algae to grow. The growth of algae can destroy ecosystems by absorbing all the nutrients and overpopulating the area to the point in which other organisms cannot survive. Sampling water from a natural source in two locations and comparing them gives an idea if a location between the two is adding to the phosphate concentration. The location of study is a confined animal feeding operation (CAFO). Animals produce a lot of waste, and because there are so many within a CAFO, not all waste can be used as fertilizer. This waste is normally placed in a treatment pool where the water released from this area should be treated and safe for the environment. The problem is that sometimes there are leaks in the pool, so the untreated waste gets into the environment. The method of measuring the concentration of the phosphates is a colorimetric method of Sawyer and Mallarino. Visible light spectroscopy is used to analyze the samples at a wavelength of 470 nm. After creating a calibration curve of known phosphate concentrations, the best fit line is used to calculate the concentration of phosphates in the unknown samples. If there is an increase in the concentration of phosphate downstream compared to upstream of the CAFO, it is likely an indication that there are leaks from the treatment pool of the CAFO.

50 3:50pm UG

Effect of Substituted Nitrophenols and Furaldehydes on Passerini-Smiles Derived Rearrangements

*Christopher Perry, Sara B. Luesse [Southern Illinois University Edwardsville]

Efficient methods to aid the assembly of complex heterocyclic products are important for the preparation of novel, biologically-active compounds. The Passerini-Smiles reaction is a three-component coupling reaction of a phenol, aldehyde, and isocyanide. Previous work led to the observation of unexpected, novel products from a rearrangement process. Recent efforts have focused on the use of bromo-substituted nitrophenols to explore conditions that provide standard or rearranged Passerini-Smiles adducts. Preliminary efforts have led to increased yields for reactions that include 5-methyl-2-furaldehyde as a reaction component.

51 2:30pm UG

Effects of Substituted Amines and Alcoholic Solvents on Oxi-Michael Ugi-Smiles Reaction

*Jacob Worms, Sarah B. Luesse [Southern Illinois University Edwardsville]

The Ugi-Smiles multicomponent coupling reaction utilizes an amine, an aldehyde, phenol, and isocyanide in a one-pot reaction to create a complex α -aminoamide scaffold. In the presence of a conjugated aldehyde, an alcoholic solvent participated as a reaction component, leading to the observation of a novel five-component Oxy-Michael Ugi-Smiles reaction. Current efforts aim to explore the effects of variation in the amine and alcohol components on this reaction. These studies also explore changes in reaction conditions, both to optimize product formation and gain a greater understanding of the reaction pathway. The Ugi-Smiles multicomponent coupling reaction utilizes an amine, an aldehyde, phenol, and isocyanide in a one-pot reaction to create a complex α -aminoamide scaffold. In the presence of a conjugated aldehyde, an alcoholic solvent participated as a reaction component, leading to the observation of a novel five-component Oxy-Michael Ugi-Smiles reaction. Current efforts aim to explore the effects of variation in the amine and alcohol components on this reaction. These studies also explore changes in reaction conditions, both to optimize product formation and gain a greater understanding of the reaction pathway.

52 3:50pm UG

Identification and Quantitation of Soluble Nutritional Compounds in DDGS*¹Nicholas Grunloh, ¹Sara Bilskey, ²Kaitlin Lasseigne, ²Yan Zhang, ¹Kevin Tucker[¹Southern Illinois University Edwardsville, ²National Corn-to-Ethanol Research Center]

The corn-to-ethanol production involves the saccharification of starch in corn, which provides abundant glucose and polysaccharides for the metabolic process of yeast. The yeast fermentation process leads to the production of ethanol and carbon dioxide, as well as a highly nutritional fermentation broth, including proteins, oils, and phytochemicals derived from intrinsic ingredients from corn, and additional nutrients due to yeast growth. To identify and quantify the nutrients in the corn-to-ethanol co-products is a great challenge. Currently, high performance liquid chromatography with a refractive index detector (HPLC/RI) is the most common commercial analytical method for the identification and quantitation of the nutrients in the fermentation broth, but this method has low sensitivity and specificity; consequently, some of the key sugar compounds reported routinely, such as glucose and polysaccharides, have been questioned for their

identification, and very likely, there are other nutritional compounds related to protein and oil. Utilizing liquid chromatography in conjunction with mass spectrometry (HPLC/MS/MS) will help to better identify and quantify the valuable nutritional compounds and provide sound scientific data for the techno-economic analysis on the extraction from DDGS. In addition, scale up of the production of the highly valuable nutrients as food and feed ingredients may be realized. A fermentation broth sample was collected from a fermenter at the end of the corn-to-ethanol fermentation process at the National Corn-to-Ethanol Research Center. The filtered liquid of the sample was analyzed on both HPLC/RI and HPLC/MS/MS. Glucose and oligosaccharides were quantified in the fermentation sample using HPLC/RI, and the same sample was analyzed on HPLC/MS/MS to verify the identification and quantitation of the key sugar compounds. Identifications made using the RI chromatogram have been questioned based on the HPLC/MS/MS results. While glucose was identified and quantified on RI, it is possible that other sugar monomers are present in the sample, eluting either at the same time or as unidentified peaks on the chromatogram. In addition to the unidentified monosaccharides, this problem is believed to occur for several polysaccharides found in the fermentation broth based on the HPLC/MS/MS data. It is likely that numerous nutritional compounds formed from the corn-to-ethanol fermentation are preserved in the DDGS, but were never identified or quantified. No HPLC/MS/MS work has been performed on the fermentation broth from corn-to-ethanol production before. With better sensitivity and selectivity, HPLC/MS/MS will likely provide data to change the identification and quantitation of some of the key sugar compounds in fermentation broth for the biofuel industry, and provide more nutritional compound information in the fermentation broth as well.

53 2:30pm UG

Quantitation of Endocrine Disrupting Compounds in Fathead Minnows by LC-MS

*Samantha Olendorff, Rachel Davis, Bobbi Porter, Hannah Lupton, Sarah Rizzo, Kevin Tucker [Southern Illinois University Edwardsville]

Endocrine disrupting compounds (EDCs) are chemicals that can block or mimic natural hormones in the endocrine system. EDCs enter the environment through the disposal of unwanted drugs after their intended use, through excretion. EDCs are resistant to biodegradation and are highly water soluble, leading to limited removal by wastewater treatment plants and efficient transfer to aquatic environments. As a result, the compounds can easily enter the environment biologically active and risk exposure to aquatic organisms; affecting their behavior, anatomy, and physiology. There is, however, insufficient research on the effects of EDCs on aquatic vertebrates to have a full understanding of the damage done to these organisms by EDC pollution. Exposing fathead minnows at environmentally relevant concentrations allows for an accurate model of how EDCs affect and accumulate in aquatic vertebrates. Mimicking singular exposures for seven EDCs at seven days will represent how EDC pollution affects aquatic wildlife during acute exposure events. After exposure, the minnows will be homogenized for quantitative analysis by LCMS. The results show after seven days of exposures there is accumulation of EDCs at significant levels even at sub-parts-per-billion levels of exposure.

54 3:50pm UG

Seasonal Antibiotic Concentration in Wastewater and Effluent at the Southern Illinois University Treatment Plant

*Hannah Lupton, Clayton Donald, Jillian Rhomberg, Qianqian Zhang, Danielle Smith, Kevin Tucker [Southern Illinois University Edwardsville]

Antibiotic resistance is a topic of growing concern within the scientific and medical communities. The presence of antibiotics in environmental settings are thought to be potential places that give rise to the generation of antibiotic resistance. The concentration of antibiotics in primary wastewater and wastewater effluent from the Southern Illinois University Edwardsville Environmental Resources Training Center (ERTC) wastewater facility were sampled over three seasons: fall, winter, and summer. The antibiotics of interest were extracted from the samples via solid phase extraction (SPE) and quantified using liquid chromatography-mass spectrometry (LC-MS). This project aimed to both determine if a correlation exists between antibiotic concentration and season, and to test the efficiency of current wastewater treatment practices to remove contaminants like antibiotics by testing the wastewater before and after it was treated.

55 2:30pm UG

Synthesis of Silver Nanoparticles with Various Capping Agents

*Katelyn Nemeth [Western Illinois University]

Silver nanoparticles have unique physical, chemical, and optical properties that can be used in optical sensing applications. Optical sensors can be used in chemical warfare by analyzing the change in energy of various

nerve agents. The geometry of the nanoparticles has a direct influence on the optical properties of the particles and their sensing abilities. A nanoparticle that has more faces in its geometry is more ideal for chemical sensing. Therefore, the desired geometry will be a cube, and not a sphere. Their geometries can be determined and optimized through the use of capping agents. By using capping agents that contain different salts, the synthesis for making the ideal silver nanocube can be determined. The capping agents used were cetyltrimethylammonium chloride and hexadecyltrimethylammonium bromide. These capping agents were used at different concentrations. The nanoparticles were analyzed by UV/VIS to characterize the nanoparticles. The ideal capping agent and its corresponding concentration was determined for the ideal synthesis of a silver nanocube for chemical sensing.

56 3:50pm UG

Synthesis, Properties, and Isomerization of Dichlorobisethylenediaminecobalt(III) Chloride, $[\text{Co}(\text{En})_2\text{Cl}_2]\text{Cl}$

*Chan Myae Lin Latt, Jocelyn Lanorio [Illinois College]

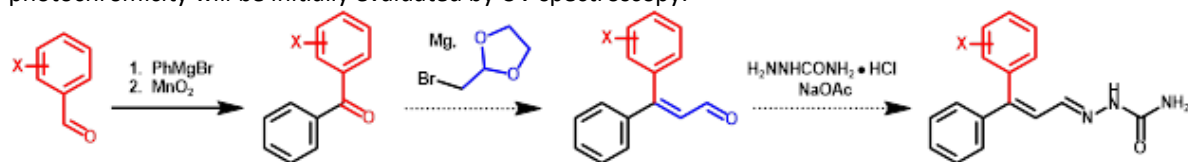
Geometric isomerism is an intricate dynamic process that occurs in many organic and inorganic complexes. Numerous studies have been done involving cobalt(III) octahedral complexes due to the relative inertness of the cobalt (3+) center. These complexes allow observation of *trans-cis* isomerism, and can serve as ideal systems in answering the following questions: how are cobalt(III) octahedral complexes, their properties, and transformations understood in terms of what is known about atomic and molecular structure? How fast is the isomerization process in cobalt(III) complexes? What governs the rate of isomerism in these complexes? Synthesis and characterization of *trans*- $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$, the kinetic product, were performed. This complex was heated to produce the thermodynamic product, *cis*- $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$. Magnetic susceptibility, UV-Vis, and IR spectroscopic techniques were utilized to probe the electronic, magnetic, and light absorption properties of the two geometric isomers. The magnetic susceptibility data first confirmed the number of d electrons and its electron configuration, the spectrochemical effect of the ligands attached, and the magnetic properties of $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$. UV-Vis spectra shows absorptions that are assignable using the d^6 Tanabe-Sugano diagram. *Trans*- $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$ is a green complex that absorbs in the region of 618 nm, while the *cis* isomer is purple in color and absorbs in the region of 509 nm. The *cis* isomer exhibited stability once formed. The transformation of *trans* to *cis*- $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$ at different temperatures was monitored using UV-Vis spectroscopy to calculate the rate constant and kinetic parameters of the isomerization process.

57 2:30pm UG

Synthesizing β -Aryl Cinnamaldehyde Semicarbazones to Test for Photochromicity

*James Bosonetta, Edward M Treadwell [Eastern Illinois University]

The photochromicity of organic molecules has been a point of interest for many years in regards to creating new materials such as transitional lenses. To further explore the photochromicity of cinnamaldehyde semicarbazones, a series of β -aryl cinnamaldehydes are to be synthesized via a four-step process. A total of 9 aromatic aldehydes were treated with the Grignard reagent PhMgBr to synthesize benzhydrols with yields up to 68% after recrystallization. Four of these benzhydrols were oxidized with MnO_2 to give the diaryl ketones with yields up to 83.5%; these benzhydrols are needed to attach the remaining 2 carbons by a second Grignard reaction with a protected β -bromoacetaldehyde. It is envisioned that an acidic work-up for this step will also accomplish the hydrolysis and elimination reactions, to give the sought cinnamaldehyde products. Treatment of these with semicarbazide HCl will yield the target semicarbazones. The purity and identity of the products were evaluated by melting point and ^1H and ^{13}C NMR spectroscopy, while the photochromicity will be initially evaluated by UV spectroscopy.



58 3:50pm UG

Testing for Phosphate Concentration in Soil Near a CAFO

*Rebecca Haughey [Western Illinois University]

There are many contained animal feeding operations (CAFO) around the country, some close to schools. These CAFO produce a lot of waste which is stored on site or is taken away, but sometimes this waste is not always contained. There may be leaks which causes increased levels of phosphates in the soil along a stream

nearby. This research is looking at these CAFO's and testing to see if there are any leaks in their storage system, specifically looking at the phosphate concentration in the soil along a stream nearby. A higher concentration of phosphates is one indication that there may be a potential leak. Phosphates naturally occur in soil but a high concentration of phosphates is harmful to the plant life and the water in streams. The soil samples will be taken from upstream and downstream from the CAFO. The upstream soil samples will be a baseline for how much phosphates are naturally occurring in the soil and the downstream samples are what may or may not have an increased amount of phosphates. These samples will be analyzed to obtain a concentration of the phosphates, the concentration of the soil, both upstream and downstream, will be compared to one another. If the concentration is significantly greater downstream than upstream there could potentially be a leak in the storage containers.

ENGINEERING & TECHNOLOGY

59 2:30pm UG

Magnetically Assisted Generator

*Whitley Sapp, Dominic Marco, Cody Emberton, Marshall Youngblood, Arnaud Muhire, Kaze Murego, Stella Mutoni [Millikin University]

We test a magnetically assisted generator (MAG), involving a series of permanent magnets of alternating polarity that act in concert with a pair of springs and a flywheel. We report on measurements of 1) the input force and oscillation amplitude required to achieve resonance, 2) the weight of the MAG components, 3) the strength of the magnets used in the MAG, 4) the revolution rate of the MAG generator wheel, and 5) the ratio of output to input power for the MAG.

ENVIRONMENTAL SCIENCE

60 3:50pm Grad

A Needs Assessment of Environmental Education in Regional St. Louis Elementary Classrooms

*Katherine Dreas, Elaine Abusharbain [Southern Illinois University Edwardsville]

Environmental education (EE) is a crucial curriculum for a world facing climate change and major environmental issues, providing a deeper understanding of these issues and developing problem-solving skills needed to address them. In an era of increasing environmental crises with global impacts, much of the American public have low environmental literacy and little exposure to and understanding of the natural world, which may be amplified in urban areas. EE at the elementary school level can promote environmental literacy and conservation as well as develop critical thinking and academic and social growth. Relevant and essential as it may be, effective EE is often lacking in schools. A needs assessment of environmental education in elementary classrooms was conducted in St. Louis, Missouri and regional areas including St. Louis County, Missouri and Metro East, Illinois. In order to explore the status of EE in the St. Louis region, the assessment involved collecting both quantitative and qualitative data through teacher surveys and personal interviews, respectively. Anonymous online surveys were dispersed to hundreds of local elementary teachers that teach within third, fourth, and fifth grades. Survey questions asked teachers for their perspectives on EE's relevancy and place in their schools and about challenges that may exist in teaching this curriculum, such as self-efficacy of the subject, time available to include EE in current lesson plans and curriculum, and funding for materials, field trips, and other education components. Personal interviews were conducted from a small pool of survey participants who chose to take part in the interview. The interviews investigated teachers' perceptions of EE (including a review of an example EE lesson), challenges they may face in implementing curriculum, and the type of support teachers need in delivering EE in their classrooms. Preliminary results will be presented on the trends in the data, correlations between variables, and other findings from quantitative and qualitative data analysis. This research aims to provide an understanding of the challenges of teaching EE and to identify the support schools need to improve EE delivery in the St. Louis region.

61 2:30pm Grad

Does an Invasive Plant Mediate Predation Risk Faced by an Undefended Caterpillar Herbivore?

*Monica Murphy, Maria Lommel, Paul Brunkow [Southern Illinois University Edwardsville]

Sericea lespedeza (*Lespedeza cuneata*) is an invasive species in Illinois and other parts of the United States. Many studies have shown that *L. cuneata* outcompetes native plant species and that it can affect grazing animals. *L. cuneata* also grows in a form quite different from that of many different native plant species,

forming dense thickets of woody stems up to five feet tall. The purpose of this study is to discover if the growth form of *L. cuneata* can affect predation rates on geometrid moth larvae, an important but undefended insect herbivore, in a natural setting. Clay caterpillar models were used to assess predation risk in two separate fields, one field dominated by species exhibiting a more native growth pattern and the other heavily colonized by *L. cuneata*. 150 models were placed in each field along transects arranged perpendicular to the nearest tree line, and then checked each day for 6 days. Damaged caterpillars were removed when observed, and the total number of damaged caterpillars was compared between fields. Logistic regression found no significant difference in predation risk between the two fields and no significant difference in predation risk with distance from the tree line. Additional trials will be performed, but our preliminary evidence suggests that geometrid larvae face the same risk of predation in *L. cuneata* stands as in stands of native species. In this respect, at least, *L. cuneata* is not expected to affect the relationship between an important herbivore and its various arthropod and vertebrate predators.

62 3:50pm Grad

Evaluation of Storm Water Retention by Native and *Sedum* Green Roofs

*Jenn Caldwell, Susan Morgan, Zhi-Qing. Lin, Serdar. Celik, and Bill Retzlaff [Southern Illinois University Edwardsville]

Green roofs are an established best management practice (BMP) for storm water mitigation due to their capability in retaining storm water runoff. A green roof's ability to retain storm water depends on a variety of factors such as the intensity of the rain event, vegetation type, and substrate depth. The purpose of this study was to evaluate storm water retention of green roof systems planting with natives and *Sedums* at three substrate depths (10, 15, and 20 cm). There were initially four native species: *S. cryplandrus*, *B. gracilis*, *P. pallidus*, and *B. curtipendula* and six *Sedum* species: *S. spurium*, *S. sexangulare*, *S. kamatschaticum*, *S. album*, *S. Immergrunchen*, and *S. reflexum* planted in their corresponding green roof at 10, 15, and 20 cm growth media depths. On June 20th, 2017 six *B. curtipendula*, plants were added to each Native BIPs at 10,15, 20 cm. Storm water retention was monitored from September 9th to December 5th, 2017. Early results indicate that green roof systems planted with Native species seem to be retaining slightly more storm runoff compared to green roof systems planted with *Sedum* species.

63 2:30pm

Evaluation of Total Mercury, Lead, Zinc, and Arsenic Concentration from Fish Fillets, Water, and Sediment from Dunlap Lake in Edwardsville Illinois

*Christopher Theodorakis, Chima Okalanwa, Zhi-Qin Lin [Southern Illinois University Edwardsville]

Total mercury, lead, zinc, and arsenic concentration was determined in fish fillets, water and sediments collected from Dunlap Lake, a private lake in Edwardsville Illinois. The heavy metals (Zn, Pb, Hg, and As) in fish fillets, lake water and sediment were measured using inductively-coupled plasma mass-spectrometry. Heavy metal concentrations in fillets varied among the species. The mean zinc concentration was highest (55.1 mg/kg) in redear sunfish (*Lepomis microlophus*) and lowest (31.0 mg/kg) in largemouth bass (*Micropterus salmoides*). Lead (Pb) concentrations in the fish fillets varied from 0.754 mg/kg in yellow bullhead (*Ameiurus natalis*) to 0.606 mg/kg in common carp (*Cyprinus carpio*). Mean total mercury in fillets ranged from 0.423 (largemouth bass) to 0.097 mg/kg (channel catfish, *Ictalurus punctatus*). Mean total arsenic concentration in fish fillets was highest in common carp (2.56 mg/kg) and lowest in walleye (*Sander vitreus*) and channel catfish (1.23 mg/kg). There were statistically-significant differences between the species for Hg and As concentrations ($p_{Pb} > p_{As} > p_{Hg}$). The mean metal concentrations in the water were below the National Ambient Water Quality Criteria, and in fillet they were below the FDA action limits. However, the concentrations of Hg in some largemouth bass exceeded the FDA action limit, so further monitoring is warranted. The Dunlap Lake Property Owners Association has made a recommendation of "Catch and Release Only" for largemouth bass due to concerns for potential mercury health effects.

64 3:50pm Grad

Food Waste to Fresh Food Through Compost

*Grace Wilken, Thomas Canam, Nichole Hugo, Peter Liu [Eastern Illinois University]

Each year in the US, we throw away almost half of our food, equaling millions of tons and billions of dollars. Food waste is the largest contributor to municipal solid waste in landfills, where it releases flammable greenhouse gases into the environment. At the same time, we use millions of tons of agricultural fertilizer, which too often runs off into waterways and causes environmental problems downstream. This project aims to reduce food waste going into landfill-trash on Eastern Illinois University's (EIU) campus by processing food waste from the dining halls into usable compost. The compost is further used as a soil amendment to grow

produce on campus, reducing the need for fossil fuels used in transporting non-local produce. Our team has collaborated with the City of Charleston Wastewater Treatment Plant (WWTP) to create a proof-of-concept compost pile consisting of EIU food waste and the City of Charleston landscape waste (mulch), hopefully adding WWTP sludge in the future. The finished compost was combined with low-nutrient commercial potting soil in various ratios to test the effect of the compost on plant growth and productivity. Some of this mixture is also used successfully to grow fresh local produce for a café on EIU campus. The results of the project will serve as a test model for further expansion of composting at EIU and the Charleston community. The project will also explore the benefits of compost as a natural, local, and economical soil amendment in an effort to limit food waste in our landfill, reduce fossil fuel consumption, and mitigate nutrient runoff associated with agriculture.

- 65 2:30pm Grad Perfluorooctanesulfonic Acid (PFOS) Modulates Behavioral Changes and Gene Expressions Associated with the *Drosophila* Circadian Clock**
 *Soyeon Lee, Ki-Bae Hong, Yooheon Park, Kyong S. Yoon [Southern Illinois University Edwardsville]
 Behavioral disorders appear to have complex etiologies including both genetic and environmental factors. PFOS, one of the persistent perfluoroalkylated compounds (PFCs), is known to elicit adverse effects in various organisms. Previous studies have demonstrated that PFOS and other PFCs cause neurotoxicity due to the enhanced calcium influx through voltage-gated Ca^{2+} channels (VGCCs), leading to the nerve hyperexcitation and oxidative damages. The aim of this study is to investigate comparative mortality responses of flies treated with different concentrations of PFOS. Additionally, behavioral modifications and gene transcript levels in newly emerged adult flies reared on sublethal PFOS during the larval stages are currently assessed. Based on our preliminary findings, it is clear that PFOS (20 μM , 100 μM , and 200 μM) is toxic to flies in a concentration dependent manner ($p < 0.05$). Adult male flies exposed to sublethal amounts of PFOS until the end of the larval stage showed significantly decreased locomotor activity during the subjective day time ($p < 0.05$), and exhibited prominently delayed (~ 4 hr) peak transcriptions of per gene. The outcomes in this study are expected to provide behavioral, biochemical and molecular biological evidence for further understanding of PFOS neurotoxicity and its impact on the fly circadian rhythm.
- 66 3:50pm Grad Residual Heavy Metal Contamination within Former Coal Transport Corridors**
 *Mickey Davis, Ben Greenfield, Zhi-Qing Lin, Kurt Schulz [Southern Illinois University Edwardsville]
 Below ground coal mining operations in the Edwardsville, IL (38.81N 89.95W) area began in 1857 and ceased in the 1960s. The mining operations and the subsequent rail transport released large quantities of heavy metal contaminants into the surrounding soil. At the end of the mining era, the former railways transporting coal were converted into paved recreational trails. This study sought to determine if high levels of As, Pb, Ni, Zn, and Cu appeared along the current recreational trails. Fifty-six soil samples were taken from seven coal loading sites at depths of 5 and 15 cm. A modified 3050B EPA method was used to extract metals from soil prior to analysis by mass spectrophotometry. Initial values showed that one site had the high levels of As and elevated levels of Pb and Zn. Manova analysis showed that the entire complex of contamination varies at the level of the site, but not at location or location within the site. Depth of the sample and the distance from the trail were also not significant factors. Principle Components Analysis illustrates that there is no systematic correlation pattern between contaminants; individual sites represented unique combinations. The average heavy metal values found at the study sites were lower than US EPA SSL and IEPA SSL values, with arsenic being the only exception. Based on this study, the sites, locations within sites and even “hotspots” are not cause for alarm.
- 67 2:30pm Grad The Impacts of Artificial Breeding Ponds on the Reproductive Success of Illinois Chorus Frogs (*Pseudacris streckeri illinoensis*)**
 *Kevin Helenthal, Richard Essner [Southern Illinois University Edwardsville]
 Populations of the Illinois Chorus Frog (*Pseudacris streckeri illinoensis*), a subspecies of Strecker’s Chorus Frog (*Pseudacris streckeri*), have been declining across their range in Southeast Missouri, Southern and Central Illinois, and Northern Arkansas due to increasing urban and agricultural development in those areas. This decline has led to their status as a threatened species in Illinois. While the Illinois Department of Natural Resources (IDNR) has been making efforts over the past two decades to restore the native sand prairie that this fossorial frog spends most of the year burrowing through for food and shelter, progress with restoring their ephemeral breeding ponds has often been very expensive and offered little benefit to the reproductive

success of this frog. The Sand Road Wetland Compensation Site (SRWCS) represents the highest quality sand prairie habitat remaining for Illinois chorus frogs in Madison County, IL. Unfortunately, the wetland associated with this site is prone to flooding and attracts large numbers of predators such as bullfrogs (*Rana catesbiana*) and fish, leading to a lack of breeding success on the site and increased mortality through migration across busy roads and unprotected agricultural land. In response, we established an array of artificial breeding ponds in both the wetland and sand prairie areas of the SRWCS in spring 2017. These were evaluated with the following objectives: 1.) Determining which habitat would be most suitable for artificial breeding ponds and 2.) Comparing the effectiveness of pools in both habitats at reducing predation pressure. Although the wetland habitat was severely flooded during most of the study and no Illinois chorus frogs were recorded breeding on the mitigation site this year, the sand prairie ponds did show a greater diversity of frog species, despite also having a greater abundance of macroinvertebrate and bullfrog predators than the wetland ponds. Further evaluations of these pools across multiple breeding seasons, as well as comparisons with ponds off-site where Illinois chorus frogs are known to breed, will have to be conducted to assess whether these artificial breeding ponds will be suitable for the reproductive success of this threatened species.

68 3:50pm UG

A Semi-Quantitative and Qualitative Analysis of East St. Louis Community Members' Environmental Concerns

*Brooke Wilke, Ben K Greenfield [Southern Illinois University Edwardsville]

An interview-based study of residents of East St. Louis is underway to find out information regarding local environmental concerns. The survey includes two components: 1. a semi-quantitative survey regarding East St. Louis (ESTL) community members' perceived levels of environmental knowledge; and 2. semi-structured interviewing about the subjects' environmental concerns. Qualitative interview data will be content analyzed by study researchers. East St. Louis, once a booming industrial city with a large railway, has lost over half of its population as most of the industry phased out during the mid-late 1900's, leaving the city with limited resources and post-industrial environmental hazards, including multiple legacy and current industrial contaminated sites. Today, the population of East St. Louis is over 95% African American and 45% of the population is living in poverty. Learning about which environmental issues the people in the community consider important will provide a basis to help formulate potential future research projects and topics. The underlying premise is that studies of environmental health hazards in this vulnerable community should be based on the needs, concerns, and knowledge of the community, itself. Themes collected thus far from East St. Louis community members include concerns regarding soil, air, and water pollution, lack of resources, aesthetic concerns, roadway conditions, and abandoned properties.

69 2:30pm UG

Characterization of Baseline Fecundity and Locomotor Activity in Three Different Laboratory Strains of *Drosophila melanogaster*

*Nathan Meckel, Samuel Trifon, Ki-Bae Hong, Kyong S Yoon [Southern Illinois University Edwardsville]

The 91-R strain of *Drosophila melanogaster* has been selected with dichlorodiphenyltrichloroethane (DDT) for more than a half century and determined to be highly resistant to DDT. Fitness disadvantage has been frequently reported in this fly strain and many other insecticide-resistant arthropod species. However, underlying mechanisms driving other phenotypic changes, including various behavioral changes under the DDT selection pressures have not been well understood. Current study attempts to determine baseline differences in fecundity and locomotor activity between three different fruit fly strains (CS, 91-C, and 91-R). Fecundity values obtained from the 91-R single-mating pair samples were lower than those obtained from the 91-C and CS single-mating pairs. Comparatively, fecundity responses from the 91-C three-mating pair samples were lower than those obtained from the 91-R and CS three-mating pair samples. These results suggest that the fecundity responses in the absence of DDT selection pressure were different between genetic lines. The subjective nighttime activity of individual flies in the 91-C strain were significantly lower (0.75-fold) than CS flies ($p < 0.05$). CS and 91-C flies exposed to DDT (1 μ g/tube) showed significantly decreased locomotor activity during subjective nighttime (CS: 3.86-fold, $p < 0.01$; 91-C: 3.42-fold, $p < 0.01$) and daytime (CS: 23.47-fold, $p < 0.001$; 91-C: 4.28-fold, $p < 0.01$) compared to 91-R flies, respectively.

70 3:50pm UG

Functions of Ecosystems: Stream Metabolism as an Efficient and Effective Means to Gage the Health and Understand the Interworking of Urban Streams in a Watershed of Rock Island, IL

*Ryan Johnson, Kevin Geedey [Augustana College]

Stream metabolism is a critical functional measure of stream health that integrates physical parameters like slope and discharge, with ecosystem functions like photosynthesis and respiration. Stream metabolism is widely studied; however, urban stream metabolism remains poorly understood. Stream metabolism was measured for five streams ranging from 1st to 5th orders from October 11th to October 18th 2017 and four streams ranging from 1st to 4th order from October 22nd to 25th 2017 located within an approximately 9.3 square kilometer watershed of Rock Island, IL that has an urban to suburban type of development. These measurements were carried out using calibrated HACH water quality multiprobes measuring continuous temperature and oxygen concentrations over five days for the earlier data collection and three days for the later data collection at thirty-minute intervals. Metabolism was estimated using a Monte Carlo Markov Chain approach that took into account irradiance and gas-transfer velocity to estimate the 24 hr average and time stepped community respiration, gross primary production, and the total mass flux of O₂ by gas exchange. This data was then compared with previously collected physical and chemical data from each site. All sites were characterized by relatively low rates of gross primary production that were far less than community respiration, a pattern that indicates a reliance on energy input from outside the stream rather than in stream photosynthesis. Variation in respiration and photosynthesis were poorly explained by the existing water quality data for the sites (range of R² data). However, two of the sites experienced transient drops in dissolved oxygen to at or near 0 mg/l. When those two sites are removed from the analysis, total Phosphate concentration (mg/l) and fecal coliform were both negatively related to integrated community respiration (R² value of .4965 and .53 respectively). These transient drops in oxygen remain unexplained but show the importance of continuous monitoring for capturing potentially critical ecosystem events.

71 2:30pm UG

mtDNA Variation Between Populations of Evening Bats (*Nycticeius humeralis*) in Florida and Illinois

*Roger Mies, Bryan Arnold [Illinois College]

Nycticeius humeralis, the evening bat, is a species that is found throughout the Midwestern and Southeastern United States ranging from the east coast to Nebraska and from southern Michigan into northern Mexico. The goal of this research is to investigate population genetics of evening bats by comparing the variable mtDNA control regions of widespread populations in Illinois and Florida. Bats were captured using mist nets, wing punches were taken and preserved in ethanol, and DNA was later extracted for PCR. Utilizing mitochondrial DNA primers, PCR was used to amplify the control region of the sampled bats which were then sequenced and edited. Haplotypes were then determined by the following guidelines: number of repeats of an 81-bp segment of the control region, single nucleotide polymorphisms within the last 81 base-pair repeat (hypervariable region), and single nucleotide polymorphisms after the hypervariable region. The analysis of mtDNA sequences thus far has shown variability in haplotypes from the same geographic area and differentiation in haplotypes from Central Illinois and Florida populations. Future research will consist of increasing sample sizes in addition to using nuclear microsatellite DNA primers to gain further insight into the population genetics of evening bats throughout their range.

72 3:50pm UG

Relationship Between *Salmonella* Prevalence and LPS-Binding Antibodies in Red-Eared Slider Turtles (*Trachemys scripta*)

*Whitney Gray [Millikin University]

Reptiles are thought to predominantly utilize their innate response rather than their adaptive component of the immune system. This innate immune system uses natural antibodies (NABs), produced by B-1-like cells, that initiate the immune response against a variety of pathogens. Recent studies have shown that with increased levels of NABs, there is a decreased degree of extracellular parasitic infection of red-eared slider turtles (*Trachemys scripta*). This study was used to determine if NAb level has a similar effect on intracellular parasite infection, more specifically *Salmonella*, on *T. scripta*. Additionally, this study was used to confirm the ability of B-1 cells to isolate NAb upregulation to the GI tract, the common site of *Salmonella* infection. Our results showed a significant difference in cloaca mucosal antibody levels between *T. scripta* positive and negative for *Salmonella* infection, suggesting that the turtles are using increased antibody levels to ward off both extracellular and intracellular infections. From a biological standpoint, this finding is interesting in that it is beneficial for *T. scripta* to expend the energy in creating a large antibody defense prior to infection.

Additionally, our results showed no difference in plasma antibody levels between *T. scripta* positive and negative for *Salmonella* infection, suggesting that both the infection and NAb upregulation was isolated to the GI tract of the turtles.

73 2:30pm UG

Using Walnut Sawdust Wastes As Cultivation Substrate for Growing Edible Mushrooms

*Grant Zeidler, Timothy Schaeffer, Prasanna Shrestha, Zhi-Qing Lin [Southern Illinois University Edwardsville]

Black walnut (*Juglans nigra*) is an important timber species in the United States, and large volumes of walnut sawdust wastes have been generated annually from timber and furniture industries. Because of its juglone chemical composition, walnut sawdust has been excluded from the primary high-value use markets for sawdust waste of other species, and utilized primarily for energy production. Thus, it is important to develop alternative strategies that uses walnut sawdust waste as valuable resources. We hypothesized that walnut sawdust could be used for edible mushroom cultivation, because previous studies showed that allelopathic compound juglone could stimulate the growth of some fungal species. This study examined the feasibility of using walnut sawdust wastes that were amended with different ratios of cereal grain mix, including 100 (sawdust):0 (cereal grain mix), 65:35, 45:55, and 25:75 in 250 g substrate for the growth of two common edible mushrooms Shiitake (*Lentinula edodes*) and Oyster (*Pleurotus ostreatus*). The cereal grain mix included millet, wheat flour, and ground rye grain in a ratio of 6:3:2 (w/w). The results showed that the cereal grain amendment at the ratio of 45:55 provided the highest mushroom yield among the treatments. The biological efficiency (BE=mushroom wet weight/substrate dry weight) for the first flush of Shiitake was 55.9%, compared with a BE of 44% of the same substrate composition but containing Oak sawdust. The biological efficiency for Oyster mushroom was 20.7% in the same treatment, indicating that walnut sawdust is an inefficient medium for the growth of Oyster mushroom.

HEALTH SCIENCES

74 3:50pm Grad

Electronic Cigarette Juices Induce Inflammation and Morphological Changes in Cell and 3D Tissue Culture

*Jesse Snyder, Barbara McCracken [Southern Illinois University School of Dental Medicine]

Tobacco use has been linked to inflammation and cellular damage within the oral cavity. This inflammatory response can lead to further complications, such as periodontitis and tooth loss. Recently, electronic nicotine delivery systems (ENDS) have become popular as an alternative to smoking conventional cigarettes. There is a popular belief that ENDS are safer than conventional cigarettes and the various flavors available are attractive to people as young as middle-school. Unfortunately, there is little research on how ENDS affect human cells. This lack of knowledge prevents oral healthcare clinicians from accurately counseling their patients. Preliminary studies in our lab indicate exposure to ENDS liquids (E-juice) increases inflammatory responses in both cell and tissue culture models. Studies were performed with a 3D gingival epithelium model (Epi-Gingival). To determine cytotoxic effects of E-juice, an MTT assay was performed with E-juice, with and without nicotine (0 or 18mg/ml). Tissue viability remained above 70% after 18 hours of continuous exposure to the E-juices. For cytokine analysis, tissues were exposed for 20 minutes to E-juice with or without nicotine. After exposure, tissues were washed with PBS then incubated with normal medium for 4, 24, and 48 hours. Tissues under both conditions showed an increase in IL-8 and IL-1b production at 24 and 48 hours post-treatment. In addition to our 3D tissue models, human gingival fibroblasts and primary gingival epithelial cells (HGF-1 and PGK; ATCC) were exposed to varying concentrations of E-juice, with or without nicotine, and photographed at various time points to evaluate morphological changes. Rapid changes in the morphology of both fibroblasts and epithelial cells were observed. Our initial studies indicate that oral cells may be adversely affected by exposure to E-juices and further study is required to provide useable information for clinicians.

75 2:30pm UG

A Review of the Effects of Ankle Tape Versus Ankle Braces on Vertical Leap

*Anna Benvenuto, Travis Wilcoxon [Millikin University]

Ankle sprains are one of the most common injuries among athletes. In order to prevent ankle sprains, ankle taping and bracing are widely used, especially in those that have a history of ankle sprains. The intentions of these ankle treatments include stabilizing the ankle, reducing range of motion, and decreasing pain during

performance. Based on the uses of ankle tape and ankle bracing, we hypothesized that ankle taping and bracing would not have a significant effect on ankle instability when performing a vertical jump. We completed a review of 45 studies that were found to assess ankle tape and ankle bracing. Of those 45 studies, ten used vertical jump height as a measurement to test ankle instability with either ankle tape or ankle brace support and were included in a meta-analysis. Across all ten studies, six studies included ankle tape, while all ten included ankle bracing. The remaining 35 studies either used different tests of performance or data could not be extracted from them. We found no significant effect on vertical jump height when comparing ankle bracing, taping, and no bracing or taping. We concluded that ankle taping or bracing does not have an effect on vertical leap, and that, in general, there is no significant effect of taping or bracing and performance.

76 3:50pm UG

Examining the Neuromuscular and Cardiovascular Effects of Kava

*¹Jessie Chappel, ²Olivia Casanueva, ¹Bwarenaba Kautu

[¹Greenville College, ²Babraham Institute-United Kingdom]

Kava is a tranquilizing beverage from the South Pacific Islands that contains lipophilic compounds called kavalactones. The neurobiological effects of kavalactones include but are not limited to sedation and anxiolysis. Previously, we have shown that kavalactones modulate the transmission of acetylcholine (ACh) at the *C. elegans* neuromuscular junction (NMJ) (Kautu and Phillips et al. 2017). Such result prompted us to hypothesize that kavalactones may have exacerbated ACh (excitatory) neurotransmission through inhibition of acetylcholinesterase (AChE). In this current study, we showed that *C. elegans* nematodes harboring loss-of-function mutations in certain AChE genes displayed hypersensitivity to kavalactones and aldicarb (an AChE inhibitor). These results suggest that kavalactones may impact ACh signaling via AChE. In a parallel experiment, we also examined the effects of kavalactones on a bullfrog's heart and found that kavalactones showed significant impact on cardiac activity. Overall, our findings may explain the mechanism(s) underlying the anxiolytic and sedative effects of kavalactones.

77 2:30pm UG

Historic Epidemiology in Illinois 1850-1880: Assessment of Diseases in Three Counties

*Justin Shiau, Huy Huynh, Benjamin Harsin, Luci Kohn

[Southern Illinois University Edwardsville]

The historical patterns of infectious diseases and mortality provides a means of examining factors which shaped populations. Disease exposure and mortality patterns are known to have differed with overall population size in the nineteenth century, with higher mortality in areas with greater population. Population history, nutrition, migration and environment also were influencing factors. This study examines patterns of mortality associated with infectious diseases in three Illinois counties between 1850 and 1880. Mortality schedules were published with the United States Census records in 1850-1880. Records for the Illinois counties of Madison, St. Clair, as well as 1860 and 1880 records for Champaign County were obtained from Ancestry.com. Data include the age, sex, birth year, birth place, month and year of death, and cause of death for each individual. Biological and seasonal patterns of deaths due to disease were assessed. These data included relatively large populations near major rivers (Madison and St. Clair Counties) and relatively small prairie populations (Champaign). These results provide insights into the health and growth of these early Illinois communities.

78 3:50pm UG

The Effect of Vitahawk® Administration on Antioxidant Capacity in Rehabilitating Birds of Prey

*¹Anthony Bryan, ¹Travis Wilcoxon, ²Jacques Nuzzo, ²Jane Seitz

[¹Millikin University, ²Illinois Raptor Center]

DISPLAYED, NOT PRESENTED Antioxidants play a key role in protecting cells by inhibiting harmful oxidants, or free radicals, produced by metabolic processes. Antioxidants are especially important in vertebrates that are ill or are overcoming injury, such as birds of prey, also known as raptors, that are taken into captivity for rehabilitation. In addition to the stress associated with injury, these animals incur the additional stress of being handled, which may drastically reduce their antioxidant capacity. In order to bring the raptors antioxidant levels into balance, a healthy diet is necessary. In many zoos and rehabilitation centers, the dietary supplement Vitahawk® is administered to boost Vitamin A, C, E, K, and B in captive birds. The objective of our study was to determine if Vitahawk® actually improves antioxidant and cardiovascular health in birds undergoing rehabilitation. Blood samples from birds were taken at admission and release to be used in a Total Antioxidant Capacity (TAC) assay to determine differences between antioxidant capacity levels.

Independent of species, raptors receiving Vitahawk® did not have a significantly greater increase in TAC from admission to release, although there was an overall increase in TAC from admission to release. We found that birds had an approximately 22% increase in antioxidant capacity from their time of admission to release, supporting that a normal rehabilitation diet increases antioxidant capacity.

MICROBIOLOGY

79 2:30pm

Antibacterial Properties of *Verbesina negrensis* Extracts Against *Helicobacter pylori*

*Vance McCracken, Dzifa Amengor, Marcelo Nieto [Southern Illinois University Edwardsville]
Helicobacter pylori is a bacterium that can cause chronic gastritis and gastrointestinal cancers in some infected people due to the overexpression of inflammatory cytokines and oxidative stress resulting from accumulation of reactive oxygen species. *H. pylori* infection is treatable with antibiotics and proton pump inhibitors. However, treatments for *H. pylori* are increasingly failing due the rise of resistant strains of the bacteria to regularly used antibiotics. *Verbesina negrensis* is a plant that is routinely used in the treatment of gastrointestinal illnesses. The purpose of this study is to evaluate the anti-*Helicobacter* properties of *V. negrensis* to determine whether it is a viable treatment option for *H. pylori* infection. Dried aerial parts of the plant were ground and macerated for 48 hours with n-hexane, followed by chloroform (CHCl₃) and then ethanol (EtOH) to allow the soluble biologically active chemicals of the plant to be fully extracted into the appropriate solvent based on polarity. The most active extracts from *V. negrensis* were fractionated using column chromatography and tested against *H. pylori* using disk diffusion and microbroth dilution assays to determine their minimum inhibitory and bactericidal concentrations. Human gastric epithelial cell line NCI-N87 was used the model system for testing. MTT assays were used to determine the cytotoxicity of the test compounds on the NCI-N87 cells. Our antimicrobial susceptibility testing shows that *V. negrensis* has antimicrobial properties against *H. pylori*.

80 3:50pm

Growth Assessment of *Bifidobacterium* on Glucansucrase-Derived Oligosaccharides

*¹Scott Holt, ²Chris Skory, ²Greg Cote [¹Western Illinois University, ²USDA Agricultural Research Service]

Prebiotics are dietary supplements used to selectively stimulate the growth of beneficial intestinal bacteria such as *Bifidobacterium* in humans and animals. Maintenance of beneficial intestinal bacteria may provide ecological-based, health-promoting factors such as disease suppression and improved metabolism. A promising source of potential prebiotic supplements is through enzymatic synthesis of oligosaccharides using microbial glucansucrase enzymes. Glucansucrases can be used to prepare a seemingly endless variety of potential prebiotic oligosaccharides containing various linkage structures and monosaccharide components. In this study, six oligosaccharide products synthesized by bacterial glucansucrases were assessed for their ability to support bacterial growth (growth rate, $\mu \text{ h}^{-1}$) and biomass (cell dry weight, mg ml^{-1}) formation using two *Bifidobacterium* species commonly associated with the gastrointestinal tract of animals. Each growth assessment was performed in triplicate and reported as the mean. Overall, oligosaccharide products Sucromalt (Cargill, Inc) and isomelezitose supported the highest growth rates for *B. adolescentis* ($0.60, 0.69 \mu \text{ h}^{-1}$) and *B. pseudocatenulatum* ($0.66, 0.52 \mu \text{ h}^{-1}$) when compared to glucose ($0.51, 0.37 \mu \text{ h}^{-1}$). The raffinose-derived and gentiobiose-derived oligosaccharide products supported the lowest growth rates for the listed species. In addition to growth rate, isomelezitose also supported the highest biomass formation for both *Bifidobacterium* species ($497, 464 \text{ mg ml}^{-1}$) when compared to glucose and the other oligosaccharides. The raffinose-derived product, however, supported the second highest biomass formation for both species ($404, 416 \text{ mg ml}^{-1}$) even though the growth rates were lowest indicating a slow but steady metabolism of this supplement. In summary, the Sucromalt, isomelezitose, and raffinose products supported significant growth of intestinal *Bifidobacterium* and are good candidates for further studies of their prebiotic potential.

81 2:30pm Grad

Biotransformation of Bile Acids by Human Gut Bacteria

*¹Lina Sallam, ²Heidi Doden, ²Greta Doden, ²Jason Ridion, ¹Steven Daniel, ²L. Ly [¹Eastern Illinois University, ²University of Illinois]

Human gut microbiota has been known as a two-edge sword; it is either benefiting an individual health or causing various infectious diseases. Normally, bacterial density in the small intestine approximates 10^5

colony-forming units (CFU) per g of gut contents, while in the large intestine bacterial densities can reach up to 10^{12} CFU per g. Bile acids, especially the primary form derived from the liver via cholesterol, are one group of enzymes that can be metabolically transformed by human gut anaerobes. One of these transformations is the conversion of primary bile acids to secondary bile acids by 7 α -dehydroxylating gut bacteria such as *Clostridium scindens*, *Clostridium hylemonae*, and *Clostridium hiranonis*. In addition to their removal of the 7 α -hydroxyl group of primary bile acids, these anaerobes metabolize bile acid derivatives via 3 α - and 7 α -hydroxysteroid dehydrogenases (HSDH). Studies to date have not reported if these organisms are capable of converting 12-ketolithocholate (12-oxoDCA) to deoxycholate (DCA). The focus of this study was to determine the ability of *C. scindens* ATCC 35704, *C. hiranonis* DSM 13275, and *C. hylemonae* DSM 15053 to reduce 12-oxoDCA to DCA during growth, to identify 12 α -HSDH genes in three organisms, and to express, purify, and characterize the 12 α -HSDH gene products (proteins) of these organisms. These organisms were grown anaerobically at 37°C in brain heart infusion (BHI) broth. Bile acids, prepared in methanol, were added to BHI broth to a final concentration of 0.1 mM. Following growth, cultures were extracted with ethyl acetate; extracts were dried, re-suspended in methanol, and subjected to thin-layer chromatography (TLC) for the detection of bile acids. In addition, 12 α -HSDH recombinant enzymes were characterized and purified by affinity chromatography using Strep-Tactin® resin. Kinetic constants (K_m , K_{cat} , V_{max} , and K_{cat}/K_m) were determined for the purified recombinant proteins for all three organisms in the forward and reverse directions. The 12 α -HSDH recombinant enzyme from each strain was shown to reduce 12-oxoDCA to DCA. Moreover, these organisms were able to transform other oxo-bile acids during growth. Consequently, these conversions indicated that these anaerobic organisms possess 12 α -HSDH activity which can impact the metabolism of bile acids.

82 3:50pm Grad

Development of Mouse Models of Necrotizing Enterocolitis

*Audie Perniciaro, Vance McCracken [Southern Illinois University Edwardsville]

Necrotizing enterocolitis (NEC) is a disease with high mortality rate in premature infants characterized by necrosis of the intestines. NEC pathogenesis is multifactorial including intestinal immaturity, formula feeding, and hypoxia/ischemia which ultimately leads to microbial dysbiosis, inflammation, and sepsis. Because current models fail to reliably produce disease, this study aimed to develop a better model for future research. We hypothesized that incorporating inoculum derived from the small intestine, the site first impacted, rather than the cecum, the incidence of disease in treatments would increase and more closely resemble human NEC pathogenesis. We homogenized the inoculum by freezing stocks that could be thawed in lieu of growing new cultures in subsequent studies. Stocks are important for convenience and offer less bacterial variability between studies. In a first experiment, pups were born naturally, dam fed for 72 hours, then gavaged with 10^7 CFU of bacterial inoculum from the small intestine, cecum, or sterile saline. Treatment groups underwent hypoxia, cold stress, and formula feeding while controls continued to be dam fed and housed. As expected, treatment groups had a significant decrease in body mass compared with control, and lower birth weight pups fared worse in terms of outward clinical symptoms associated with disease (diarrhea, abdominal distention, apnea, lethargy). Initial DGGE results of small intestine contents suggest that the microbiota of control vs treatment groups strongly differ with a slight difference between small intestine and cecum inoculum groups. Further investigation using DGGE, sequencing, and histology is needed to strengthen these early concessions. However, if these trends continue, it is an important insight into the possible microbial atmosphere which leads to necrotizing enterocolitis.

83 2:30pm Grad

One-Step Differentiation of Group 1 and Group 2 Strains of *Oxalobacter formigenes* by Multiplex Polymerase Chain Reaction (PCR)

*Nivedita Pareek, Steven Daniel [Eastern Illinois University]

Oxalobacter formigenes is a beneficial gut bacterium that plays an important role in the prevention of kidney stone disease. *O. formigenes* is a strict anaerobic bacterium, residing in the intestinal tract of mammals, with a unique characteristic of using only oxalate as a carbon and energy source. Intestinal oxalate is degraded by *O. formigenes* into formate and carbon dioxide by two cytosolic enzymes, oxalate-CoA transferase and oxalyl-CoA decarboxylase encoded by the *frc* gene and the *oxc* gene, respectively. To date, twenty-one strains of *O. formigenes* have been isolated which are further divided into two groups based on differences in the patterns of cell membrane lipids, cellular proteins, and nucleic acid fragments. In previous studies, strain groupings have been done based on the *oxc* gene using different sets of primers in separate PCR assays. The aim of the current project was to generate a multiplex PCR system, consisting of a multi-primer mix directed

at the *oxc* gene in a single PCR assay, which allows the simultaneous detection of *O. formigenes* as well as the differentiation between group 1 and group 2 strains. Bacterial DNA was isolated using the ZR bacterial DNA extraction miniprep kit from eight pure cultures of *O. formigenes* strains which were grown anaerobically at 37°C in undefined oxalate broth. DNA was extracted from fresh feces collected from two human subjects using the ZR fecal DNA extraction miniprep kit. Amplification of genomic DNA obtained from pure cultures *O. formigenes* by multiplex PCR showed the following products (amplicons): 416 bp for *O. formigenes* groups I and II (species specific); 210 bp for *O. formigenes* group I (group I specific); and 140 bp for *O. formigenes* group II (group II specific). Multiplex PCR of mixed bacterial DNA samples, containing high or low DNA concentrations of each group, yielded the expected 3 amplicons. In addition, the multiplex PCR system was species specific and group I specific for *O. formigenes* in a fecal sample from one subject and species specific and group II specific for *O. formigenes* in a fecal sample from a second subject. Our multiplex PCR system for the detection and differentiation of *O. formigenes* strains is novel, and experiments are currently underway to optimize this convenient one-step approach.

- 84 3:50pm Grad Symbiont Regulated Host DNA Methylation in *Euprymna scolopes* - *Vibrio fischeri* Symbiosis**
 *Rui Xiao, Bethany Rader, Ciara Murabito [Southern Illinois University]
 Advancement in the study of the host-microbe interactions has shown that microbes can regulate long lasting changes in gene expression in host cells to facilitate beneficial symbiosis. through changes in methylation of the host's genomic DNA. The beneficial symbiosis between Hawaiian Bobtail squid, *Euprymna scolopes* and gram negative bioluminescent bacteria *Vibrio fischeri* provides an excellent system for studying beneficial microbes' effect on host DNA methylation. The symbiosis is highly specific, in that only *V. fischeri* colonizes the squid's symbiotic organ from a background of 10^6 diverse bacteria per ml of sea water. We hypothesize that *V. fischeri* plays an important role in regulating host DNA methylation during both juvenile and adult stage. To start to address this hypothesis, our specific aims are 1) Validate that *E. scolopes* methylates its genomic DNA. 2) Identify and quantify DNA methylation machinery genes in squid at transcript level 3) Identify and analyze squid DNA methylation level at both genome level as well as gene specific level. Using methylation restriction PCR, DNA dot blotting, Immunohistochemistry, bisulfite sequencing as well as methylation specific PCR, we have confirmed DNA methylation in our squid, and identified differential methylation in response to symbiosis. We identified 3 putative *E. scolopes* DNA methyltransferases, 1 DNA demethylase, and 3 methylation binding genes, and confirmed that both DNA methyltransferase and DNA demethylase activity in native squid nuclear protein extract. By using both publicly available RNASeq databases and qRT-PCR, we observed that the methylation machinery genes are differentially expressed based on presence of *V. fischeri*. Finally, using High Performance Liquid Chromatography based whole genome nucleotide profiling, we have observed differential DNA methylation profile between aposymbiotic and symbiotic animals for both juveniles and adults. These data will help us better understand the how beneficial microbes are able to influence host biology through regulating host DNA methylation.
- 85 2:30pm UG Can Municipal Wastewater Support the Growth of Microalgae for Biofuel Production?**
 *Lindsey Ripper, Brooke Massey, Chrissie Simmons, Kelly Barry [Southern Illinois University Edwardsville]
 We are examining the growth of *Chlorella vulgaris* in municipal wastewater as an alternative to growth in synthetic media. Currently, algae samples are grown in a synthetic TAP media consisting of defined salts and minerals which is costly to produce. This project was designed to eliminate the use of TAP media by replacing it with water from different stages of the waste water treatment process. If optimal growth occurs, this may potentially replace TAP medium with a more environmentally friendly and cost-efficient growth medium. Water samples were collected from three stages of filtration at the SIUE water treatment facility, using wastewater that was autoclaved for sterilization and wastewater that was not sterilized. Algae growth was measured by absorption at OD₇₅₀. Results indicate that sterilized waste water was less effective at growing the algae than non-sterilized waste water and the most abundant growth was occurred in wastewater collected following the chlorination tank.
- 86 3:50pm UG Detection of Antibiotic Resistance Loci in Wastewater and Fresh Water Samples**
 *Audrey Rex [Eastern Illinois University]
 With the increasing population, comes an increase in treated waste water and with the current waste water treatment plan being over 100 years old, there is cause for concern. The proper treatment of municipal

waste water is crucial to public health. One important issue at waste water treatment plants is the spread of antibiotic genes that enable potential pathogens to become resistant to common drug treatments. β -lactam drugs, such as penicillin and its derivatives like amoxicillin, are the most prescribed antibiotic within the United States. Unfortunately, many organisms carry a β -lactamase gene, which produces an enzyme that destroys the activity of β -lactam antibiotics, thus rendering the prescribed drug for treatment ineffective. Many variants of β -lactamase gene exist, with prevalence differing from organism to organism. At the waste water treatment plants, gastrointestinal waste from the entire municipal area co-mingle, creating a rich environment for β -lactamase genes to be transferred from one organism to another. This type of spreading of genes across species is called lateral gene transfer, which differs from regular genetic pattern of offspring inheriting genes from their parents. It is, therefore, important to monitor and assess the presence and distribution of antibiotic resistance genes like β -lactamase genes to understand better the conditions and prevalence of lateral gene transfer. Through monitoring the outcome of waste water treatment, the spread of antibiotic resistance can be controlled and the waste water treatment plan adjusted. In this project, we will build upon the preliminary data showing the presence of some of these β -lactamase genes at the waste water samples at the Charleston Waste Water Treatment plant. We aim to increase the number of sampling sites along the waste water treatment process to obtain a more refined analysis on the critical steps that facilitate lateral gene transfer. Further, we will increase the statistical significance of our earlier findings through multiple independent repeats throughout the spring semester.

87 2:30pm UG

Investigating Host Specificity of the *Burkholderia*-*Dictyostelium* Symbiosis System in Diverse Slime Mold Species

*Sydni Rubio, Stephanie Bargiel [Southern Illinois University Edwardsville]

In our world, there exists a variety of creatures; from large mammals to microscopic entities, and everything in between. When it comes to studying the biology of these beings, genetic model organisms are used due to several research-compatible characteristics: low-maintenance in a laboratory setting, abundant breeding, and rapid generation turnover. For the microscopic world, *Dictyostelium discoideum* is a consummate species to utilize for studying broad biological processes including symbiosis, which considers the relationship between two species that closely associate. My project focuses on five different *Dictyostelium* species and their symbiotic relationship with three different species of fluorescently labeled *Burkholderia* bacteria. The *Dictyostelium* is exposed to each *Burkholderia* species in a sterile environment under precise host-symbiont population densities. After a short infection period, infection rates and host outcomes are analyzed by flow cytometry and confocal microscopy. We find that *Burkholderia* symbionts have a fairly narrow host range, only infecting certain *Dictyostelium* species. Furthermore, *Burkholderia* impact on *Dictyostelium* fitness seems to be correlated to infection potential. Future experiments will investigate the potential for host range expansion via co-evolution conditions and screen wild *Dictyostelium* species for alternative *Burkholderia* symbiont genotypes.

88 3:50pm UG

New Age of the Phage: Testing the Antibiotic Potential of Bacteriophages in an Amoeba-*Burkholderia* Symbiotic Model System

*Lance Price, Negar Zati-Mahboob [Southern Illinois University Edwardsville]

Viruses have been studied for hundreds of years, and in humans they are of particular interest because they cause disease. They are described as non-living entities with DNA or RNA genomes encapsulated in proteins and can replicate either by lysing cells or integrating their genetic information into the host's genome. Bacteriophages, viruses that target bacteria, are promising as potential alternatives to antibiotics. They are highly selective and only infect a subset of strains from specific bacterial species. Our lab has characterized *Burkholderia*-specific phages isolated from soil collected from various parts of the U.S. We study how these phages interact with the symbiotic relationship established between *Dictyostelium discoideum*, a common amoeba found in the soil, and symbiotic isolates of *Burkholderia*. These *Burkholderia* symbionts will infect amoeba cells, which can be visualized using fluorescently labeled *Burkholderia* strains. We have isolated distinct phages that target strains from three separate *Burkholderia* clades. These phages have been characterized for their host range, storage stability, plaque size, morphology, and replication cycle in host cultures. Currently, we are testing the efficacy of using these phages to cure *Burkholderia* infections in *Dictyostelium discoideum* hosts.

89 2:30pm UG

Spectrophotometric Quantification of *Chlorella vulgaris* Lipids Stained with Oil Red O

*Besarta Asani, Jordyn Grawe, Kelly Barry [Southern Illinois University Edwardsville]

Biofuel production from microalgae has the potential to become a viable alternative energy alternative to fossil fuels. The lipids that accumulate in microalgae can be extracted and chemically converted to biodiesel. Strategies for increasing lipid yields in algae and identifying high lipid-producing algae are important for increasing the efficiency of biofuel production from microalgae. Oil Red O is a dye commonly used to stain adipose tissue. We have developed and are optimizing a procedure for extracting lipids from cells and quantifying lipids produced in cultures of *Chlorella vulgaris* grown in TAP media. This procedure is widely assessable because spectrophotometric quantification of lipids occurs in the visible light spectrum. This rapid and efficient protocol may be applied with different algae and as a tool to determine optimum conditions for optimal lipid yield.

90 3:50pm UG

Symbiont Regulation of Host Behaviors in Adult Animals of the *Euprymna scolopes* - *Vibrio fischeri* Symbiosis

*Izabella Bradford, Bethany Rader [Southern Illinois University]

In recent years, there have been numerous research studies focused on the role of the mammalian intestinal microbiota in the gut – brain axis, specifically in regard to influencing brain function and behavior. The gut – brain axis has previously been established as a route of bidirectional communication between the gastrointestinal tract and the brain. This bidirectional communication has further been delineated into three primary pathways: neural, endocrine, and immunological. In addition, researchers are discovering that the gut-brain axis can function as a conduit enabling bidirectional communication between the microbial species of the intestinal tract and the central nervous system to regulate behavioral and cognitive homeostasis. The present study utilizes the binary beneficial association between the luminous bacteria, *Vibrio fischeri*, and the Hawaiian bobtail squid, *Euprymna scolopes*, to explore both symbiont regulation of host behaviors and regulation of neural pathways implicated in communication between the mammalian intestinal microbiota and the central nervous system. We found that ventilation frequencies for lab raised adult animals and cured adult animals occur at a lesser rate than wild-caught symbiotic adult animals. We observed that defense behavior against a threatening stimulus for lab raised adult animals increased more during the day and the night than wild-caught symbiotic adult animals. In addition, we conducted a survey of various adult animal tissues for the expression of the neurotransmitters acetylcholine and glutamine synthetase, and the neurotransmitter receptor N-methyl-D-aspartate in wild-caught symbiotic and cured adult animals. We found differential expression of many tissues and more distinct expression patterns in other tissues between wild-caught symbiotic and cured animals. These data suggest that *V. fischeri* may be able to directly communicate with *E. scolopes*' brain in a potential light organ – brain axis.

91 2:30pm UG

The Dose Makes the Poison: Analyzing Dosage Effects of Intracellular *Burkholderia* Infection

*Andrew Tresslar, Suzanne DiSalvo, Jake Miller [Southern Illinois University Edwardsville]

Symbiosis is ubiquitous in nature and defined as the interactions between two or more differing organisms living in close physical proximity. Symbiotic interactions span across a spectrum, ranging from parasitic to mutualistic. Outcomes of symbiosis may be shaped by the genetic makeup of the host or symbiont, meaning that dynamic genotypes in a host and or symbiont population may lead to similarly dynamic symbiotic outcomes. In addition to variation of genotype, contextual environmental conditions may contribute to variations in outcome, with factors such as host and symbiont prevalence or longevity of partnership exposure impacting both the host and symbiont. To better understand symbiotic systems, *Dictyostelium* is used as our model organism. *Dictyostelium* is a social amoeba with a life cycle consisting of a vegetative and social stage. When nutrients in its environment become depleted, thousands of amoebae will aggregate together to form a stalk and fruiting body containing spores. Recently, many *Dictyostelium* isolates have been found harboring *Burkholderia* bacteria intracellularly. *Burkholderia* are pervasive in nature and commonly found in symbiotic relationships with a variety of organisms. Currently, there are three known species of *Burkholderia* that have been found to intracellularly infect *Dictyostelium*: *B. hayleyi*, *B. bonniei*, and *B. agricola*. Here, we investigate the effects of infection dosage by challenging *Dictyostelium* with a 5% and .5% concentration of *Burkholderia*. Using spore count assays, in addition to flow cytometry and confocal microscopy, we interrogate the effects of infection dosage across the 3 aforementioned *Burkholderia* species.

PHYSICS, MATHEMATICS, & ASTRONOMY

92 3:50pm UG

Magnetically Assisted Bike

*Dominic Marco, Marshall Youngblood, Cody Emberton, Amaud Muhire, Olga Murego, Stella Mutoni, Whitley Sapp [Millikin University]

CANCELLED We have designed a magnetically assisted bike (MAB) that incorporates a timed electromagnetic system working in concert with permanent neodymium magnets to assist a rider through 360 degrees of pedal revolution. We measure the power generated by the combination of magnets and compare it to the power used by the electromagnet to assess the feasibility of commercializing the MAB.

STEM EDUCATION

93 2:30pm

Design of an Undergraduate Interdisciplinary Studies Course on Sustainability and Action Strategies

*Elaine Abusharbain, Jessica Krim [Southern Illinois University Edwardsville]

Session will describe a course developed as an interdisciplinary studies experience between the school of Education, Health and Human Behavior's Department of Teaching and Learning and the Department of Biology in the College of Arts and Sciences. The goal of the IS experience is to help students understand how real life problems are often solved by knowledge of several disciplines and using this knowledge to compare and contrast the varying epistemologies of the two disciplines. The course focused on solving problems rooted in Earth's sustainability. Students were exposed to concepts on sustainability in the areas of social sustainability, economic and ecological sustainability. Then, a module on action strategies was introduced as a way to solve problems. Categories involved persuasion, eco-management, political action, legal actions, consumerism and civil disobedience. The course of 75 students was divided into groups of 4 for the action projects. Students were coached on how to identify a problem, research potential solutions, research available resources and then take the action all with group consensus. Instructors kept tabs on progress and used formative feedback on Blackboard. The final project that students were required to complete involved stating a problem (around sustainability) that they wanted to address, developing and implementing an action strategy based upon teaching strategies to address this problem, measuring the results, and reflecting upon the process. (In this project, civil disobedience was not allowed as an action for the groups.) Educational pieces on teaching strategies also focused on sustainability. The final projects with images, text, links, videos were posted onto a student-created, public website using Word Press, and also featured on our university's sustainability website at <https://www.siu.edu/sustainability/academics/index.shtml>. Outside evaluators were asked to review and give feedback to the groups via the websites' comment sections, and students were required to evaluate other groups' projects. Some of the actions developed were: a persuasive video on carpooling, an education booth at the student center on food sustainability, a workshop with schoolchildren on the endangered Rusty-Patch Bumblebee, a social media campaign on #litterbugsmeme, and many others which can be viewed at www.eabusha.wordpress.com. Results on learning objectives will be shared.

94 3:50pm

Pilot Phase Analysis of A CURE Implementation in a Large Enrollment Introductory Biology Laboratory Course

*Kelly Barry, Chrissie Simmons, Kenneth Charles Knoth Jr. [Southern Illinois University Edwardsville]

Unlike traditional "cookbook" laboratory sequences, course-based undergraduate research experiences (CUREs) expose entire course populations to the practices of authentic research. CUREs have been shown to increase retention in science and may have their largest impact through large enrollment introductory courses. Our objective has been to determine the benefits and drawbacks of CURE implementation to the largest audience at SIUE – the introductory biology laboratory course for biology majors. A significant obstacle to curriculum developers of an introductory level CURE is selecting a CURE topic that fits several criteria: affordable resources, lab techniques that can be quickly mastered, time for multiple iterations within

one semester, and the opportunity to generate new knowledge. The SIUE CURE focuses on the multidisciplinary process of converting microalgae lipids into biodiesel. CURE participants in the Spring and Fall 2016 pilot phases reported increased project ownership, collaboration, discovery and relevance, iteration, and science identity.

95 2:30pm Grad Do Hands-On Science Activities Contribute to Positive Attitude and Learning Gains for Students in Middle School Science?

*¹Kristal Deming, ¹Tammy Patterson, ²Kenzie Jenkins, ²Emily Peters, ³Melissa Darnell, [¹Southern Illinois University, ²Southern Illinois University Edwardsville, ³Goreville Community Unit School District #1]

The implementation of hands-on science activities in 6th – 8th grade middle school science classes provides students the opportunity to personally experience, explore and interact with science. With the Next Generation Science Standards (NGSS), hands-on activities become a vital part of achieving in-depth content knowledge. Through the Robert Noyce Master Teaching Fellowship program funded by the National Science Foundation, three veteran and two pre-service teachers created a two-week lesson plan focused on the exploration of tardigrades (water bears). This lesson included inquiry-teaching strategies, integrated mathematics to science activities, and differentiated instruction. To assess the impact of the laboratory experience, we implemented pre/posttests on 1) tardigrade biology content knowledge and 2) attitude toward to science. We will present data showing the positive impact of these activities on student attitude and learning gains for middle school science students.

96 3:50pm Grad NGSS in a High School Chemistry Class Using Tardigrades to Enhance Engagement

*¹Andrew Morgan, ²Rachel Towne [¹Southern Illinois University, ²Southern Illinois University Edwardsville]

Although many teachers seek to engage 100% of their students in active learning, this goal is often difficult. To meet the Next Generation Science Standards (NGSS) that emphasize student engagement, we incorporated tardigrades (water bears) into our classroom through science activities and experiments. Through a partnership between a preservice and inservice teacher, a four-day 5E lesson plan was designed and implemented to involve high school chemistry students at Freeburg Community High School in tardigrade toxicology research. The focus of this classroom project was to investigate the effects of pH on tardigrade vitality. Students executed experiments by subjecting tardigrades to multiple concentrations of acids and bases, and then they monitored tardigrade behavior and survival microscopically. Students predicted that although tardigrades are nearly impossible to kill when in their cryptobiotic state, they are not resistant to dramatic changes in the pH of their environment. Throughout the study, the students became increasingly invested in the outcomes of the project; they were enthralled by the possibility they could contribute knowledge to understudied organisms. The impact of our 5E lesson plan was assessed quantitatively by pre/post tests measuring student's attitudes towards science and their content knowledge about tardigrades. We also observed that Freeburg Community High School students were highly engaged and remained excited by the opportunity to conduct meaningful research and hopefully add to the scientific knowledge of these microorganisms.

97 2:30pm UG Incorporating Elementary Literacy and Science Education: A Pollination Study

*Ashley Farthing [Southern Illinois University Edwardsville]

Often times teachers of elementary students struggle to teach and incorporate secondary subjects, such as science, into their daily curriculum while trying to keep up with the strong demands for literacy and math instruction. While planning and implementing this science unit, I planned to include as many modalities of literacy as possible, proving that literacy instruction can be taught through other subjects, such as science. Students studied pollination and the effects that the different types of pollination had on the environment. Students learned causes and effects of pollination and were able to complete a hands-on activity to show the act of pollination. Students worked to learn the concepts while participating in activities that were heavily literacy based. Students used speaking, listening, writing, and reading all throughout the lessons. While they were completing literacy tasks, students were getting the science knowledge and information that tied into the grade level standard and their age appropriate curriculum. Incorporating other topics into literacy instruction proved to be possible and successful. The students liked the change of every day pace in their literacy topic and responded very well.

ZOOLOGY

98 3:50pm

Dental Variation and Population Dynamics of a Late Blancan (Late Pliocene) Cotton Rat (*Sigmodon curtisi*)

*Dennis Ruez, Jr. [University of Illinois Springfield]

Large samples of the extinct cotton rat *Sigmodon curtisi* provide a unique opportunity to examine variation in the species. Two late Blancan (late Pliocene) localities from the west coast of Florida, Inglis 1A and 1C, have species of *S. curtisi* from individuals of a range of ontogenetic ages. Variation through ontogeny is described qualitatively in terms of the occlusal morphology and quantitatively in the change in size and number of roots. Such descriptions reveal distinct age cohorts within the population from Inglis. These cohorts allow demographic studies of the *Sigmodon* sample, an approach that is seldom possible in small-rodent paleopopulations. Individuals at birth had a life expectancy of only 1.25 months due to the high juvenile mortality seen in rodents. In this population the mortality rate in the first month was 75%, and 80% before the animal reached sexual maturity. Cotton rats that persisted into the second month of life had a total life expectancy of 3.5 months. Population dynamics studies require, among other items, a cyclic birthing regime. Unlike that seen in large mammals, the cyclicity in the Inglis 1C *Sigmodon* population may be the result of extremely rapid and continuous breeding after a reproductive hiatus. If correct, this is the first example of a seasonal curtailment of reproduction in a fossil population.

99 2:30pm

Dietary Choices of Franklin's Ground Squirrels (*Poliocitellus franklinii*) in Central Illinois

*¹Cecilia Hennessy, ¹Elie LeClaire, ²Tih-Fen Tin [¹Eureka College, ²University of Illinois Springfield]

Franklin's ground squirrels (*Poliocitellus franklinii*) are a species in decline, existing in prairie or savanna-like habitats in Illinois. This species has been identified as the most carnivorous ground squirrel among ground squirrel species, due to observed preferences for bird eggs, nestlings, and insects. As part of a larger mark-recapture project, the carcasses of Franklin's ground squirrels that were found road-killed or that died incidentally were collected. Of these carcasses, 12 intact stomachs were removed and stored in 95% ethanol at room temperature. Stomach content analysis was performed by identifying items of 5% (by weight) of the stomach contents, and by calculating the percent volume of the types of items in the sample. Stomach contents were also surveyed for large or unusual items after the 5% was removed for intensive analysis. Preliminary results indicate that stomach contents are highly variable between individuals, with one stomach containing primarily beetle (*Coleoptera* spp.) parts but other stomachs containing primarily plant matter, and some in between. No indication of non-insect animal predation has yet been detected. We intend for our results to supplement knowledge of natural history of Franklin's ground squirrels, and to help us to understand their diet choices in increasingly anthropogenic habitats.

100 3:50pm

Operant Conditioning in Response to a Negative Shock Stimulus in Mealworm Beetles, *Tenebrio molitor* (Coleoptera: Tenebrionidae)

*Emerick Fulton, Marianne Robertson [Millikin University]

We examined whether mealworm beetles (*Tenebrio molitor*) could learn to associate a negative stimulus with one arm of a T-maze as evidenced by avoidance of that arm. Like other insects, *T. molitor* is capable of undergoing operant conditioning to a positive stimulus and has a working memory; however, operant conditioning with a negative stimulus has not been examined in this species. For a control group (n = 40), we placed each beetle individually in a T-maze without electric current applied to either arm. For an experimental group (n = 40), we placed each beetle individually in a T-maze with one arm having a 9-volt current applied to it. Friedman's test showed no significant difference in the number of successes (choosing the side without the current) compared to failures (choosing the side with the current). Beetles had no significant increase in success percentage over time. Thus, the beetles did not exhibit operant conditioning in response to a negative stimulus. This could be due to age, which can affect the immune ability or lack of exposure to this stimulus in the natural environment.

101 2:30pm

Repeated Freezing Negatively Impacts Immune Defense in the Goldenrod Gall Fly, *Eurosta solidaginis*

*Jason Williams, Candace Karnish, Vance McCracken [Southern Illinois University Edwardsville]
Insects are useful models to examine the evolution and function of immunity because they have robust and effective immune defenses. Environmental stress, such as exposure to extreme temperature, likely has a negative impact on insect immune function although this has been underexplored. To determine if repeated low-temperature exposure impacts immunity of the goldenrod gall fly, *Eurosta solidaginis*, we assessed hemolymph antimicrobial activity against either *Bacillus cereus* or *Escherichia coli*. Larvae were subjected to either zero (control), five, or ten diurnal exposures to -18°C, and allowed to recover for 24 or 96 h prior to hemolymph removal and bacterial exposure. To consider if time spent frozen, rather than freezing and thawing, influenced antimicrobial defenses, we also counted hemocytes in larvae exposed to a single, six-day constant freeze. The ability to prevent growth of *B. cereus* was not influenced by number of freezing events or recovery period as those exposed to 0, 5, 10 freezing events or 1 extended freeze averaged 17.7 ± 1.0 colony forming units (CFU) after 24 h of recovery and 17.8 ± 0.8 CFU after 96 h. Interestingly, all treatments had higher CFUs than controls without hemolymph, which averaged 10.5 ± 1.4 CFU ($P < 0.05$). In contrast, inhibition of *E. coli* growth was reduced with repeated freeze cycles. Those exposed to either 5 or 10 freeze events averaged 26.3 ± 2.0 CFU after a 24 h recovery compared to just 15.3 ± 1.4 for controls or those subjected to a single extended freeze. Those exposed to 5 freeze events still had decreased antimicrobial activity (22.9 ± 1.7 CFU) after 96 h of recovery compared to controls (14.9 ± 1.3 CFU). In sum, repeated freezing and thawing negatively impacts goldenrod gall fly hemolymph antimicrobial activity against *E. coli* growth but has minimal effect against *B. cereus*.

102 3:50pm Grad

Scientific Research in the Classroom

*^{1,2}Holly Dunderdale, ³Hannah Jackson, ²Malia Bierman, ²Ashton Randolph, ²Autumn Belt
[¹Southern Illinois University, ²Marion High School, ³Southern Illinois University Edwardsville]
Next Generation Science Standards call for students to engage in the practices that scientists carry out to better understand the natural world. This type of authentic learning experience was implemented by Marion High School Biology students as they investigated relationships between lichen/moss habitats and tardigrade populations. The hope was to make practices of scientific research more attainable for school aged children, improve the overall attitude of students towards science and research, and to increase knowledge of tardigrades and their habitats. Tardigrade research in Illinois has been limited, so students immediately recognized the opportunities for investigating these micro-animals. Students were initially asked to bring in lichen and/or moss samples from locations either at home or throughout Southern Illinois. Tardigrades were isolated from the samples and the genera were identified. Students recognized trends of tardigrade abundance. For example, samples collected from the ground consistently lacked tardigrades; however, tree samples of lichen almost always had a tardigrade population. Students then took this observation to develop a research question: How does the habitat (lichen or moss) affect the tardigrade population? Lichen and moss samples were collected by students from 24 locations throughout Southern Illinois. Student data and attitude changes from this investigation will be shared during the presentation.

103 2:30pm

The Curious Case of *Ophidiomyces ophiodiicola* and a Translocated Northern Copperhead (*Agkistrodon contortrix*)

*¹Brittany Neier, ²Benjamin Jellen [¹St. Louis Zoo, ²St. Louis College of Pharmacy]

The long-term monitoring of health and movements of free-ranging individuals is essential to making evidence-based conservation and management decisions. *Ophidiomyces ophiodiicola*, the main cause of Snake Fungal Disease (SFD), has been observed in snakes throughout North America with the majority of cases occurring in the Midwest and Eastern portion of the United States. More recently, the disease has also been confirmed in Europe making it a global concern. Clinical signs of SFD include inflammation of the skin and muscles, nodule growth, bone infection, and pneumonia. While treatment options are available, a dearth of information exists regarding the long-term success of treated individuals. In 2016, one individual (of 43 total study individuals) was observed with a growth on its left loreal scale which tested positive for SFD. The growth was removed at the Saint Louis Zoo's Animal Hospital and the individual was transported to the College of Veterinary Medicine at the University of Illinois to receive treatment. Upon the successful completion of treatment, the individual was equipped with a radio transmitter and translocated 29.9 km to

our main study site for long-term monitoring. Upon entering hibernation, this snake had increased 12.2% mass since his release and overwintered 13 m from another adult radio-equipped *Agkistrodon contortrix*. It is anticipated that our translocated individual will emerge from hibernation in the spring. Here, we report on the confirmation of SFD in *A. contortrix* in Illinois, successful treatment of the disease, and movements and hibernation of a translocated individual. While more data is needed to determine the long-term success of SFD treatments, the ongoing long-term monitoring of this individual, and other *A. contortrix* in the area, will increase our understanding and application for future conservation and monitoring measures.

104 3:50pm Grad Effects of Shell Size, Shape, and Density on the Crush Resistance of a Freshwater Snail

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

Shell crush resistance is an important determinant of the utility of the shell in preventing predation of freshwater snails. Previous studies have shown that shell shape can affect crush resistance, and that shell density can affect crush resistance. However, recent work in our lab has demonstrated a correlation between shell density and shape, and no previous study has determined the partial contribution of each variable to crush resistance. The present study seeks to expand sampling of *Elimia potosiensis*, a lotic snail from the Meramec River in east-central Missouri, and to expand our analysis of the independent contributions of shell shape and shell density to crush resistance in this species. Recent sampling has revealed that shell shape is more closely related to wet body mass than to measures of shell size, with heavier snails having more rotund shells. New data also reveal the previously observed relationship between shell shape and shell density, with more rotund shells being more dense; however, we did not find the previously observed significant relationship predicting that larger shells were also more dense, after controlling for shape. We plan to provide crush resistance data at the time of the presentation of this work. Separating the contributions of shell shape and shell density to crush resistance will reveal potential trade-offs in the physiology of shell growth and will better inform models of the evolution of shell form in freshwater snails.

105 2:30pm Grad Examination of Movement Patterns in the Southern Flying Squirrel (*Glaucomys volans*) in an Urbanized Environment

*Jeremy Howard, Richard Essner [Southern Illinois University Edwardsville]

Urbanization is one of the biggest challenges conservationists face with forested environments. Deforestation due to infrastructure contributes to an overall loss of species richness and diversity due to fragmentation of habitats, invasive species, and road mortality. Understanding how movement is affected in fragments within urbanized areas is crucial to wildlife conservation. The southern flying squirrel (*Glaucomys volans*), provides insight into the challenges that small mammals face in fragmented forested habitats within the greater St. Louis metropolitan area. Examining the southern flying squirrel in this type of environment helps to better understand if agriculture and development are acting as barriers to movement. The objective of the proposed study is to use radio telemetry to determine how southern flying squirrels move within and among three deciduous forest patches on the campus of Southern Illinois University Edwardsville (SIUE). Movement patterns and home ranges will be estimated and compared for individuals of differing sex and age class. From this, the effects of habitat and life history characteristics on squirrel movement can be better understood. Moreover, the results can then be compared to studies in contiguous habitats to identify the effects that habitat fragmentation has on movement.

106 3:50pm Grad Growth Hormone and Insulin-Like Growth Factor I Mediate Differences in Body Size Among *Anolis* Lizards

*Brittany Rakers, Eric Mueller, Seth Griffis, David Jennings [Southern Illinois University Edwardsville]

Vertebrate body size is primarily regulated by two hormones: growth hormone (GH) and insulin-like growth factors (IGFs). The current work investigates endocrine control of growth in *Anolis* lizards that vary in body size (*A. sagrei*, *A. carolinensis*, *A. equestris*). Plasma GH levels were lowest in *A. sagrei* - the smallest species. GH levels were higher in *A. carolinensis* and *A. equestris*, but did not differ between the two despite body size differences. Within species, GH levels correlated with length in *A. equestris*, but not in *A. sagrei* or *A. carolinensis*. Plasma insulin-like growth factor I (IGF-I) levels were highest in *A. equestris*, but did not differ between *A. sagrei* and *A. carolinensis*. While, these results suggest that changes in GH and IGF-I levels underlie some differences in body size, other growth hormone axis components (GH receptors, IGF-binding proteins) likely mediate body size evolution in these lizards. Future work will examine plasma levels of IGF-2

to determine if hormone levels are correlated with body size among the three species.

- 107 2:30pm Grad Habitat Modeling of the Four-Toed Salamander, *Hemidactylium scutatum*, in Missouri and Illinois**
 *Rachel Lubbinga, Richard Essner [Southern Illinois University Edwardsville]
 The Four-Toed Salamander, *Hemidactylium scutatum*, is listed as a state-threatened species in Illinois. It has a highly disjunct distribution and is considered a glacial relict species that is restricted to cool, damp microclimates. Like many other amphibian species, they are experiencing a large amount of habitat loss due to human activities. For example, human activities often alter the water quality of the surrounding area due to the run off of pesticides, herbicides, and other chemicals. These chemicals can damage the permeable skin of the salamanders themselves. Unfortunately, habitat requirements for this species are poorly known and thus may be preventing an accurate assessment of their conservation status. Identification of suitable habitat is essential for protecting remaining populations. In order to assist in the conservation effort for this species, we will visit sites in Illinois and Missouri where *H. scutatum* has been documented to occur, including sites in Pere Marquette State Park. Several habitat variables will be recorded, including: air temperature 10cm above the ground, distance to nearest body of water, water and soil pH, primary species of vegetation, and slope of the terrain. We will then develop a predictive habitat model for this species in order to identify suitable habitat.
- 108 3:50pm Grad Home Range and Microhabitat Preferences of the Eastern Box Turtle, *Terrapene carolina*, in Southwestern Illinois**
 *Samantha Sorrick, Richard Essner [Southern Illinois University Edwardsville]
 The Eastern box turtle, *Terrapene carolina*, is a species that has seen a decline in numbers of ~30% in the last several decades, despite the fact that in some areas it is still seen as common. It is listed as vulnerable by the IUCN, due to a range of factors including habitat loss. This is an especially important factor in suburban forest habitats such as the campus of Southern Illinois University Edwardsville (SIUE), which have become highly fragmented. In order to create management plans to conserve this species, populations must be monitored and assessments of their habitat use should be studied. The objectives of this study were to determine: 1) the home range of turtles by sex (male versus female) and age (size) class (juvenile, adult); 2) microhabitat preferences; and 3) daily and seasonal activity patterns for a population of Eastern box turtles on the SIUE campus. Data were collected from late July to late October 2017 in Bluebell Woods, a 75-acre second-growth forest. Individual measurements were taken at the time of capture, including: carapace length and width, plastron length and width, and body mass. The sex of each turtle was also determined. Radio telemetry was used to collect home range data. Turtles were caught opportunistically in Bluebell Woods, fitted with a transmitter, and tracked weekly (when possible) with a radio receiver. Individuals were notched on their marginal scutes so that they could be uniquely identified. In order to study microhabitat preferences of the turtles, a 1 m² plot was observed at each tracking location. Debris type, debris density, and soil temperature were recorded for the plot. In addition, random compass bearings (0-360°) and distances (1-10 m) were used to record microhabitat data from four additional plots surrounding the initial plot. This approach provided a measure by which to compare preferred with non-preferred microhabitat. Finally, a Thermachron iButton, programmed to record temperature twice per hour was attached to the carapace of each individual.
- 109 2:30pm Grad Morphological Correlates of Frenum Presence in Darters (Percidae: *Etheostoma*)**
 *Savanna Reeves, Paul Brunkow [Southern Illinois University Edwardsville]
 The frenum, a fleshy connection between the upper lip and the cranium observed in darters, is a highly derived character whose function is unknown. The purpose of the present study was to examine external and internal correlates of frenum development in three representative darters: Missouri saddled (*Etheostoma tetrazonum*), greenside (*E. blennioides*) and Johnny (*E. nigrum*). These species vary in the development of the frenum from fully developed (saddled darters) to completely absent (Johnny darters). We measured several external characters, focusing especially on the head region, and several cranial characters in cleared and stained specimens. Factor analysis was used to compare external and internal multivariate shape variables separately among these species. Greenside and Johnny darters differed significantly from saddled darters in having overall relatively smaller external characters in the head region; Johnny and saddled darters differed significantly from greenside darters in having smaller eyes and longer snouts. Greenside and Johnny darters also had higher snout curvature than saddled darters. For internal characters, all three taxa differed significantly in having relatively small cranial characters relative to skull length and long, narrow ascending

processes (greenside) or large cranial characters with short, wide ascending processes (saddled). We see these data and comparisons as providing a framework for functional hypotheses concerning frenum function in darters. Future work should include sampling of more darter species, and especially increased sampling of greenside darter populations, among which frenum development is known to vary intraspecifically.

110 3:50pm Grad

Spatial and Temporal Patterns of Abundance and Diversity of Arthropods in Leaf Litter Communities of Mature and Regrowth Oak-Hickory Forest in Southern Illinois

*Nick Wells, Heather Bible, Melisa Hillman, Jason Williams, Peter Minchin [Southern Illinois University Edwardsville]

Assemblages of arthropods offer information regarding macro- and microhabitat variation and are frequently used as bioindicators in studies of restoration and conservation. Our research contributes baseline data on leaf litter arthropod communities in oak-hickory forests in the ~370-acre nature preserve located on the Southern Illinois University Edwardsville campus. We are continuing to analyze the arthropod content of pitfall traps placed from May until October 2013 in existing permanent vegetation monitoring plots, three in mature forest and three in regrowth forest established in the 1970s. Traps, consisting of plastic drink cups inserted into holes made with a bulb planter, were placed biweekly and removed after seven days. Each trap contained ~150 ml of diluted ethylene glycol. Previous work examined the composition and diversity of Orthopterans between the mature and regrowth forest, however the current work is analyzing all arthropods collected. When processing of samples is complete, we expect to definitively test our hypothesis that leaf litter arthropod communities differ with forest age and also characterize both the variation in communities between forest types and seasonal changes in abundance of taxa.

111 2:30pm Grad

The Development and Analysis of Microsatellite DNA Markers in Spiny and Smooth Soft Shell Turtles

*Nasser Ben Qasem, Michael A Romano [Western Illinois University]

Conservation of wildlife biodiversity has been a major concern within the scientific community since the 1992. Convention on Biodiversity. One of the primary tasks of species preservation is maintaining genetic diversity in natural populations. On the other side, the increase in inbreeding leads to the worsening of the adaptive properties of species (Hamilton 2004). Molecular methods have been widely recognized as one of the best for assessment of genetic biodiversity.

A very special issue is the conservation of long-lived organisms due to their generation times (up to 40 years, or more), which means that their population can become extinct due to external factors long before genetic characterization can be performed (McGaugh et al. 2008). That is why such studies require more informative and quicker methods of acquiring data that do not require long census-type studies.

Today, the study of genetic material has been a valuable tool for acquiring such data. One of the simplest and most popular is genetic profiling with microsatellite DNA markers. The biggest advantages of microsatellite markers is their abundance of polymorphisms, possessing bi- and multi-allelic characteristics, thus suitable for tracing the genome in an individual organism or a group (Allendorf et al. 2013; Loughheed, et al., 2000; Pesole, et al., 1999). This study is focused on testing the DNA markers in two species of soft-shelled turtles, one of which is endangered in Illinois, in order to study their genetic structure. It is expected that the work will contribute to conservation genetics of these two long-lived organisms in terms of understanding population structure.

112 3:50pm UG

A Comparison of Muscle Activity During Feeding and Jumping Behavior in the Northern Leopard Frog, *Lithobates pipiens*

*Logan Hartley-Sanguinett, Emily Feagans, Richard Essner, Candace Johnson [Southern Illinois University Edwardsville]

Anuran jumping requires rapid and synchronous hind limb extension. However, the ancestral tetrapod bauplan is designed around asynchronous locomotion (i.e., lateral undulation). The origin of synchronous locomotion, which includes jumping and frog-kick swimming, remains enigmatic. One possible explanation is that synchronous locomotion was modified from a pre-existing behavior, i.e., preadaptation. Lunge feeding has been proposed as a possible precursor to jumping in anurans, since it also involves rapid, synchronous hind limb extension and is the ancestral feeding condition for frogs. In order to assess the potential for homology between jumping and feeding, we filmed the Northern Leopard Frog, *Lithobates pipiens*, during

feeding and jumping behavior and examined muscle activity patterns for three muscles—one hind limb extensor, the plantaris, and two epaxials, the coccygeiliacus from the caudopelvis, and the longissimus dorsi from the back. The results of this study indicated that the two behaviors exhibited similar muscle activity patterns. However, mean amplitudes were significantly higher during jumping. The similarity in muscle activity of the two behaviors supports the hypothesis that jumping and feeding are homologous behaviors.

113 2:30pm UG

A Kinematic Comparison of Feeding and Jumping Behavior in the Northern Leopard Frog, *Lithobates pipiens*

*Emily Feagans, Logan Hartley-Sanguinett, Candace Johnson, Richard Essner [Southern Illinois University Edwardsville]

Anuran jumping requires rapid and synchronous hind limb extension. However, the ancestral tetrapod bauplan is designed around asynchronous locomotion (i.e., lateral undulation). The origin of synchronous locomotion, which includes jumping and frog-kick swimming, remains enigmatic. One possible explanation is that synchronous locomotion was modified from a pre-existing behavior, i.e., preadaptation. Lunge feeding has been proposed as a possible precursor to jumping in anurans, since it also involves rapid, synchronous hind limb extension and is the ancestral feeding condition for frogs. In order to assess the potential for homology between jumping and feeding, we filmed the Northern Leopard Frog, *Lithobates pipiens*, during feeding and jumping behavior and examined a suite of angular and timing variables for the body and limbs. The results of this study indicated that the two behaviors were generally similar. However, hind limb excursion and maximum angles were significantly lower during lunge feeding. The kinematic similarity of the two behaviors supports the hypothesis that jumping and feeding are homologous behaviors.

114 3:50pm UG

Aggregation and Sheltering Behavior of *Armadillidium nasatum* and *Aramadillidium vulgare* (Isopoda: Armadillidiidae) Groups Exposed to Fluorescent, UV, and Infrared Light

*Aundrea Marsh, Marianne Robertson [Millikin University]

Terrestrial isopods are gregarious invertebrates, aggregating in colonies. Isopod aggregation and sheltering behavior have been observed under fluorescent and color filtered light, but UV light and infrared light conditions have not been examined. Visible light is composed of wavelengths 400-700 nm, UV light is composed of UVA (315-400 nm) and UVB (280-315 nm) spectras, and infrared light is greater than 700 nm. Our objectives are to observe aggregation and sheltering behavior of terrestrial isopods under fluorescent light, under fluorescent light with UV conditions, and fluorescent light with infrared conditions. We randomly assigned *Armadillidium vulgare* into 15 groups of 10 individuals. We housed each woodlouse individually and released each group of 10 individuals into a 14.5 cm diameter x 1 cm height area with a 2.5 cm diameter circular piece of black paper taped to the top middle of the lid. This was used to block light, thus serve as a shelter. We hung lights 80 cm above the arenas from ring stands. We recorded sheltering and aggregation behaviors every 15 minutes for 45 minutes. This procedure was repeated using *Armadillidium nasatum*. Aggregation and shelter choice are socially selected, reflective of their negatively phototactic nature.

115 2:30pm UG

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

*¹Samantha Hayes, ¹Aja Martin, ¹Lisa Hebenstreit, ²Sean Terrill, ¹Eric Mueller, ¹David Jennings [¹Southern Illinois University Edwardsville, ²University of Massachusetts-Amherst]

Amphibian populations are used as indicators of environmental quality, and declines in both diversity and abundance are well documented. We surveyed two ponds located in close proximity (<150m) to each other on the SIUE campus from the periods of June - November 2015, March - November 2016, March 2017 - November 2017, and March 2018 - present. At each pond, three drift fences (0.36 x 5m) with pitfall and funnel traps were installed. Six minnow traps were placed along pond margins at the same approximate depth. Ponds were similar in overall diversity. Seasonally, ponds differed in abundance, with higher numbers of amphibians in the open pond during summer. During our survey period, both ponds were used by a variety of amphibians, and breeding individuals of most species were evident. Despite differences in pond features, similar species were present in both ponds. Compared to previous years, diversity and abundance was dramatically lower in all ponds in 2017. Future work is needed to document changes in water level and composition and assess their affects on changes in abundance and diversity.

116 3:50pm UG

Assessing the Function of Distress Calls in Cuban Fruit-Eating Bats (*Brachyphylla nana*)

*Joseph Roesch, Bryan Arnold [Illinois College]

Most bat species are highly social and utilize a variety of calls to communicate with each other including distress calls that warn other bats of potential threats. The function of these calls in different species may vary and could include eliciting help or acting as a warning signal to avoid the threat. In this study, the distress calls of Cuban fruit-eating bats (*Brachyphylla nana*), a common species in the Caribbean, were studied with two main goals: to examine the behavioral responses of bats to the distress calls and to examine the structure and variability of the calls among different bats. The study took place in La Barca Cave in Guanahacabibes National Park, Cuba. Bats were captured in the cave using a hand net and brought to an isolated chamber where we documented age, sex, forearm length, and recorded distress and echolocation calls from each captured bat. The recorded distress calls and a pink noise control were used in a playback experiment inside the cave to analyze how bats respond to distress calls. An infrared video camera and ultrasonic microphone were used during the duration of the playback to determine if there were any changes in bat behavior, such as an increase in calls observed, bats flying by the speaker, or bats leaving the area. To assess variability in call structure, we used Avisoft SASLab pro to analyze 20 different spectral and temporal characteristics of the recorded calls and utilized factor analysis to reduce the dimensionality in the data set. Twenty distress calls from 10 males and 10 females were analyzed along with echolocation calls from 6 bats. Preliminary results suggest that call structure is somewhat variable with limited evidence that call characteristics are unique to specific individuals. Our playback study suggests that the distress calls serve a social function in that the number of bats approaching the speaker increased during distress call playbacks relative to the control. Future work will include building on these results to further explore *Brachyphylla nana* anti-predatory behavior and social communication.

117 2:30pm UG

Comparative Skull Morphology in Canidae and Felidae: Data from *Lynx rufus* and *Canis lupus*

*Devin Roy, Luci Kohn [Southern Illinois University Edwardsville]

The skull is a complex structure that supports numerous functions, including vision, olfaction, feeding, and protection of the brain. These structures can be used to examine the results of selection on these structures. *Lynx* and *Canis* are both carnivores, but have evolved into significantly different forms. Past research has shown that skull morphology is linked to diet changes during development and bite force when killing prey. In this study, we examine the functional and morphological differences between the *Lynx rufus* and the *Canis lupus*, with particular emphasis on structures related to feeding. A Microscribe G2X digitizer was used to record three-dimensional coordinates for each of the 29 landmarks used on the skulls of 46 *Lynx rufus* (18 female, 22 male, and 6 unknown sex), and the landmarks were used to calculate 45 distances describing regions of the cranial base, cranial vault, the face, and the palate. Comparable dimensions were measured on 29 *Canis lupus* (14 females, 15 males). Data were adjusted for overall size difference, dimensions of the functional regions were tested for significant differences between *L. rufus* and *C. lupus*. Results provide insights into the evolutionary differences between Felids and Canids.

118 3:50pm UG

Cranial Integration in *Lynx canadensis*

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

Few morphological studies consider the integrated form of the skull and mandible. The skull and mandible are derived from different tissues. The skull supports a range of functions including supporting the brain, olfaction, and vision. The skull also coordinates functions associated with feeding and hunting with the mandible. This study examines the morphological coordination of skull and mandibles form of *Lynx canadensis* in order to gain a better understanding of relationship between form and function of these structures. The sample for this study includes the skull and mandible of 55 *Lynx canadensis*. Three-dimensional coordinates of 29 skull landmarks were recorded using a Microscribe G2X. Two-dimensional coordinates of 16 mandible landmarks were recorded from photographs using ImageJ. Distances between landmarks representing dimensions of the face, cranial vault, cranial base and mandible were calculated. Integration is estimated by correlation of dimensions within a region, and regions that are integrated will be highly correlated. These results provide insights into the forces influencing the evolution of the skull and mandible.

119 2:30pm UG

Detection of West Nile Virus in Clinic-Admitted Raptor Species in Central Illinois

*¹Owen Pulver, ¹Travis E. Wilcoxon, ²Jacques T. Nuzzo, ²Jane Seitz [¹Millikin University, ²Illinois Raptor Center]

West Nile Virus (WNV) is a disease that is commonly found in avian species in the Midwest. WNV commonly follows a bird-mosquito-bird transmission pattern, with birds serving as amplifying hosts. Plasma samples from raptor species that were admitted to a rehabilitation clinic in Central Illinois were analyzed for WNV immunoglobulin Y (IgY) antibodies using an Enzyme-Linked Immunosorbent Assay (ELISA). In all, 244 birds from seven different raptor species were tested. From our survey, we found that 20.0% of Bald Eagles (*Haliaeetus leucocephalus*), 21.2% of Barred Owls (*Strix varia*), 27.4% of Cooper's Hawks (*Accipiter cooperii*), 31.6% of Eastern Screech Owls (*Megascops asio*), 33.8% of Great-Horned Owls (*Bubo virginianus*), 17.4% of American Kestrels (*Falco sparverius*), and 45.0% Red-Tailed Hawks (*Buteo jamaicensis*) were seropositive for WNV antibodies. Data were then analyzed for possible patterns of infection between years, among species, and among other studies. In general, our data compared favorably to a study done in Wisconsin within adult birds. When compared to a study in Wisconsin, our study had a much higher prevalence in all species that were tested in both studies, which may be a product of a longer active vector season in Central Illinois.

120 3:50pm UG

Effect of Partial Blindness on the Hunting Ability of *Pardosa milvina* (Araneae: Lycosidae) and *Salticus scenicus* (Araneae: Salticidae) in a Controlled Environment

*Douglas Sherrill, Marianne Robertson [Millikin University]

I conducted this study on *Pardosa milvina*, a member of the Lycosidae family of spiders, and on *Salticus scenicus*, a member of the Salticidae family of spiders. These are both species of sight based active hunters. I performed my *P. milvina* observations on three groups of 15 individuals, a control that I didn't mask, experimental 1 with only the anterior median eyes unmasked, and experimental 2 with only the anterior median eyes masked. I performed my *S. scenicus* observations on 5 groups of 18 individuals, each group having one pair of eyes uncovered, and the control having all eyes uncovered. The secondary eyes consist of the anterior lateral, posterior lateral, and posterior median eyes. The anterior median eyes, known as primary eyes, are used primarily for stationary focus and defined vision, while the secondary eyes track motion. I hypothesized that all masked groups would attack from closer to prey than the control, would take longer to capture prey, and would take more attempts to capture their prey on average than the control group. My data supported these hypotheses as all experimental groups had a significantly higher contact/attempt ratio than the control, and experimental 1 from both groups took significantly longer on average to capture prey than the control group.

121 2:30pm UG

Investigating the Seasonal Patterns of Zebra Mussel Growth and Survivability Using Field Enclosures

*Nick Topping, Jennifer Jost [Bradley University]

Sessile invertebrates are unable to relocate when environmental conditions become unfavorable. Since they are conformers, they are also unable to regulate physiology as conditions fluctuate. These species must be able to tolerate environmental variation or risk mortality. The invasive zebra mussel, which is widespread throughout the Illinois River, can be used as a model species for investigating invertebrate physiology during environmental stress. While many studies have examined zebra mussel physiology under a variety of conditions, less is known about what occurs during biologically relevant fluctuations. Our lab has been studying a zebra mussel population at Banner Marsh for several years. But, all of our studies to date have been laboratory based. This project aims to investigate links between ambient conditions (water temperature, water quality, food availability and season) and zebra mussel performance (survival, growth, reproduction, and the levels of several cellular indicators of stress) by tracking zebra mussels over time in their natural habitat. In order to design this experiment, we first need to determine the degree to which environmental conditions vary. We also need to develop a protocol for tracking individual mussels over time. Therefore, the specific objectives of this preliminary project are to measure environmental conditions at regular intervals in Banner marsh and to design and test mussel enclosures for deploying at this site. As a first step, we created a laboratory experiment to determine whether mussel survivability and growth would be negatively impacted by the enclosure itself. We collected mussels, randomly divided them between two replicate aquaria, and maintained the aquaria for a period of five weeks. Within each tank, we randomly distributed mussels either freely within the tank or placed them in the enclosure we anticipate will be used in future field experiments. We tracked survival and change in shell size, tissue mass, and shell mass over time.

122 3:50pm UG

Morphological Integration in Bobcat (*Lynx rufus*) and Canada Lynx (*Lynx canadensis*) Mandible Form

*Daniel Miller [Southern Illinois University Edwardsville]

The mandible is a single bone composed of three functional units: the alveolar process, body, and ramus. These components differ in their developmental patterns and growth rates, but are influenced by similar evolutionary pressures to produce a single bone. The model for development and the embryological origins of the mandible are well documented. However, the degree to which these separate functional units are integrated to form a single, complex morphological structure is less understood. This study tested for within-individual integration between the described regions as well as an interspecific comparison of integration patterns. The sample for this study included the mandibles of 46 bobcats (*L. rufus*) and 48 Canada lynx (*L. canadensis*). The mandible of each individual was photographed from a standardized lateral view. Two-dimensional coordinates of 16 landmarks were recorded from each photograph using ImageJ. These two-dimensional coordinates were used to calculate dimensions describing the mandibular body, ramus, and alveolar process. Correlation between dimensions were estimated for each region. A Mantel test was used to test for morphological integration within each region. There was a low level of integration within each functional unit within each species. Patterns of correlations between dimensions were significantly similar in the two species, which is likely a result of similarities in diet and developmental factors. These results suggest that, for both species of lynx, the regions that make up the mandible act as a single, cohesive functional unit rather than as individual functional units that combine to perform a coordinated function.

123 2:30pm UG

Morphometric Analysis of Wings in Three Different Fruit Fly Strains

*Gabrielle Smith, Brice Wagner, Kyong-Sup Yoon, Luci Kohn [Southern Illinois University Edwardsville]

Wing symmetry in *Drosophila melanogaster* is an important aspect of development and locomotion. Exposure to environmental factors such as dichlorodiphenyltrichloroethane (DDT) has been implicated in disrupting normal development, and may result in fluctuating asymmetry in wing morphology. This study tests for differences in wing dimensions and fluctuating asymmetry in wing form in three strains of *Drosophila melanogaster* – CS, 91C and 91R. We test whether 70 years of selection contribute to an asymmetry in wing vein dimensions in the highly DDT-resistant 91R strain of *Drosophila melanogaster*. Photos for analysis were taken using a Stemi305 light microscope with mounted AxioCam ERc 5s microscope camera and Zeiss ZEN blue computer imaging software. Two dimensional coordinates of 12 landmarks on each wing were recorded using the program Fijiwings 2.2 by ImageJ. These landmarks were used to calculate 11 distances between each landmark, and dimensions were tested for differences between strains and presence of fluctuating asymmetry. There was a significant difference of wing vein dimensions between fly strains resulting from over 70 years of selection for DDT resistance.

124 3:50pm UG

Study of Phototaxis in a Cave-Dwelling Population of Physid Snails*¹Nicole Linskey, ²Olivia Tarantella, ²Robert Weck [¹Southern Illinois University Edwardsville, ²Southwestern Illinois College]

We studied phototaxis, the orientation towards or away from light, in a population of snails from Fogelpole Cave. Located in Monroe County, Fogelpole is Illinois' largest and most biodiverse cave with over 15 miles of known passage. The cave ecosystem includes a snail in the genus *Physa* (likely *Physa gyrina*). Weck and Taylor (2016) determined the population is polymorphic. The majority of snails lack pigmentation (albino) with the remaining snails exhibiting a range of pigmentation. Our experiment focused on the phototactic response of two phenotypes from lab colonies of the species, the albino and fully pigmented morphs. We used modified Petri dishes for the experiment. Two quarters of each Petri dish were covered with black tape to create a darkened environment. The other two quarters were left transparent and the entire dish was exposed to light from a fiber optic lamp. Individual snails were allowed to crawl around a dish for ten minutes. The process was repeated with 30 snails each of the albino and pigmented morphs. The slime trails that remained on the Petri dishes were traced onto paper and scanned to a digital file. The length of the slime trails in the light and dark portions of the petri dish were quantified using Adobe Illustrator. We found no significant difference in the mean light or dark trail lengths for albino ($p = 0.122$) or pigmented morphs ($p = 0.227$). However, we did observe a north directional bias for the albino snails; they had significantly longer trail lengths on the north half of experimental dishes ($p = 0.01$). These findings may warrant future magnetotaxis study for the Fogelpole Cave *Physa* population.

125 2:30pm UG

The Effect of Elevated and Variable Winter Temperature on Diapause Progression and Metabolic Reserves in the Goldenrod Gall Fly, *Eurosta solidaginis*

*Brad Richards, Jason Williams [Southern Illinois University Edwardsville]

Temperate overwintering insects enter a state of suppressed metabolism and development, termed diapause, to survive the dearth of resources. Even though suppressed, overwintering metabolism and the onset of post-diapause development (i.e. breaking diapause) is correlated with exposure temperature. Thus, elevated temperature over the course of a winter, such as what is projected to occur due to climate change, may have profound effect on an insect's rate of development and negatively affect spring energy reserves. To determine the effect of elevated winter temperature on diapause progression and metabolic reserves, we compared metabolic rate and lipid content of larvae of the goldenrod gall fly, *Eurosta solidaginis*, exposed to either average monthly winter temperature or elevated monthly temperature as predicted by climate change models (i.e.: "average-constant" and "elevated-constant" treatments). In addition, to determine the effect of variable winter temperature on the above parameters, we subjected larvae to diurnal cycles that fluctuate between monthly low and high temperature (i.e.: "average-variable" and "elevated-variable" treatments). All animals were in state of diapause when the study began in late November of 2017, but those in the elevated temperature treatments ~doubled their metabolic rate by Jan 15 (averaging 171 ± 12 pL/hr/mg of body mass at 15°C), indicating they had broken diapause. Those in the average temperature treatments broke diapause by Feb 14 (variable treatment) and Apr 12 (constant treatment) respectively. Lipid content of the larvae was similar between all treatments on the dates their group broke diapause, averaging 28 ± 3 μg of lipid per mg of wet mass. Analysis is continuing to determine if lipid use is accelerated in post-diapause animals and if accelerated use is detrimental to spring survival.

126 3:50pm UG

The Effects of Caffeine and Sertraline on Spatial Learning in Goldfish, *Carassius auratus* (Cypriniformes: Cyprinidae)

*Cooper Collings, Marianne Robertson [Millikin University]

An increase in pharmaceutical dumping and water treatment plants' inability to filter all contaminants negatively impact fish populations. Goldfish exhibit spatial learning, but the effects of caffeine and sertraline on spatial learning have not been explored. Our objective was to determine whether the levels of caffeine and sertraline found in nature affect spatial learning in goldfish, *Carassius auratus*. We conducted research with a control group of 15 goldfish under no drug influence, an experimental group of 15 goldfish under the influence of $8.5 \mu\text{g/L}$ of caffeine, and an experimental group of 15 goldfish under the influence of 164 ng/L of sertraline. We tested each goldfish in an X-shaped maze with the correct choice (arm) colored green as a visual cue. We recorded each goldfish's individual time and number of incorrect choices for 10 separate trials per fish. The control group exhibited spatial learning, the caffeine group did not exhibit spatial learning, and the sertraline group exhibited only signs of spatial learning. Inadequate screening of water through treatment plants that empty into streams could negatively impact learning in goldfish.

127 2:30pm UG

The Effects of Cattle Grazing on the Health of Bumble Bee (*Bombus* spp.) Populations in a Historical Tallgrass Prairie Ecosystem

*McKenna Conforti, Derek W. Rosenberger [Olivet Nazarene University]

Bumble bees (*Bombus* spp.) play an important role in the pollination of ecologically and economically significant plants worldwide. In recent years, declines have been observed throughout North America, particularly in the Midwest. Many factors likely contribute to this decline, including the use of pesticides, disease, and habitat loss. Though cattle grazing space is a common use for Midwestern grassland and may result damage to this historic habitat, few studies have assessed the effects of grazing and cattle pasture on bumble bees. None, to our knowledge, have been conducted in North America or have compared cattle pasture to tallgrass prairie, a habitat thought to be optimal for requisite floral resources. In this study, we sought to determine what effects grassland management for cattle pastures and restored prairie have on the community composition of bumble bees at Midewin National Tallgrass Prairie in northeastern Illinois. Abundance, species richness, and diversity were recorded across 40 transects using standard sweep net protocol. We found a statistically significant effect of land use type on abundance, with over three times more bumble bees found in prairie compared to cattle pasture. Species richness was 50% higher in prairie, but diversity was 50% higher in cattle pasture, although there was no statistically significant difference in either measure. These data provide a baseline for further study on land management practices and conservation of bumble bees in the face of habitat loss and decline across the Midwest.

128 3:50pm UG

The Effects of Diet and Predator Induced Stress on Tadpole, *Pseudacris triseriata*, Development and Tail Morphology

*Haylie Lading, Travis E. Wilcoxon [Millikin University]

The presence of a predator never goes unnoticed. Stress triggered by a harmful threat can cause organisms to experience a wide variety of physical and behavioral changes in an attempt to avoid predation. Tadpoles of many species are known to display some degree of anatomical, physiological, and/or behavioral plasticity in order to face the dangers of the environment. Such epigenetic adjustments often carry costs, and thus, require proper nutrients to fuel the bodily changes. The purpose of this study was to examine the impact of predator presence on a fast-developing tadpole species, *Pseudacris triseriata*, when fed diets that vary in nutritional content. We hypothesized that tadpoles fed a high protein diet and exposed to a predator would undergo a quicker metamorphosis rate and develop a tail more effective for predator avoidance. Our experimental group was exposed to a nonlethal predator and fed either a high or low protein diet. The control group had no predator and was fed either the high or low protein diet. We measured overall body length, tail depth at the base and midpoint, and progression through developmental stages over the entire developmental period for this species. We found that tadpoles developed faster in the presence of a predator and did not develop any morphological tail defenses. The differences in development were independent of diet type. As a species with the opportunistic ability to undergo expedited metamorphosis while living in temporary pools of water, our results suggests that it may be more beneficial for *Pseudacris triseriata* tadpoles to develop quicker and leave the pond to avoid a threat rather than invest in morphological changes that enhance escaping from predators in the water.

129 2:30pm UG

The Role of Endangered Oak (*Quercus* spp.) Savanna Characteristics in Supporting Red-Headed Woodpecker (*Melanerpes erythrocephalus* L.) Populations

*Kimberly Zralka, Derek W. Rosenberger [Olivet Nazarene University]

Declines in animal populations worldwide are of critical conservation concern. However, without an understanding of optimal habitat preference, it is often difficult to determine what factors are driving these losses. Red-headed woodpecker (*Melanerpes erythrocephalus* L.) populations have declined by over 70% in the last 50 years, yet in some areas the birds seem to maintain stable populations. The aim of this study was to empirically test the effects of various habitat factors on red-headed woodpecker abundance. We were particularly interested in whether the oak species (*Quercus* sp.) present in largely savanna environments (an endangered ecosystem in the Midwestern United States) affect woodpecker abundance, as this has not been tested to our knowledge, and acorns of oaks are a critical food source for this bird. After conducting 138 point-count surveys and habitat analysis at sites throughout Northeastern Illinois, multiple linear regression with backwards elimination was used to generate a model showing which habitat factors most influenced red-headed woodpecker population density. Our model indicated that number of snags, percent white oak group trees, and percent oaks overall were not significant factors in predicting red-headed woodpecker abundance, however decreasing canopy cover, increasing dead limbs, and increasing red oak group trees at a site were significant factors. These results confirm and expand upon previous studies, suggesting that the oak savanna environment is important to the success of red-headed woodpecker populations. Our findings that percent red oak (primarily black oak *Q. velutina*) group trees, but not white oak group trees, is positively related to woodpecker abundance at a site is of interest, as this may indicate that the optimal habitat requirements of red-headed woodpecker populations are more specific than previously thought. Further research is currently being conducted to better understand this correlation. Overall, knowledge of these factors is important for informing managers in conservation planning for this iconic species in the future.

130 3:50pm UG

Using Guano to Analyze Stress Hormones in Female, Reproductive Big Brown Bats (*Eptesicus fuscus*)

*Caylee Miller, Bryan Arnold [Illinois College]

Corticosterone is a steroid hormone produced by the adrenal cortex and is the major stress hormone produced in non-human mammals. Prolonged circulation of stress hormones can be detrimental for individual health and reproductive success; therefore, monitoring stress levels in wild animal populations is important for conservation. The primary method to measure corticosterone involves taking blood samples which can be harmful. Recently, studies have shifted to a noninvasive method by extracting hormones from fecal samples. While this method is established in larger mammals, it has not been tested extensively in

smaller mammals like bats. In this study, a method of examining corticosterone extracted from guano in reproductive, female big brown bats (*Eptesicus fuscus*) is being studied. Variation in stress levels is being tested by examining corticosterone levels in bats at different points in the reproductive cycle. This will allow us to validate the effectiveness of this method for bat populations by comparing our results to previous studies where corticosterone levels were measured via more traditional methods. Bats were captured using mist nets placed outside a maternity roost at Siloam Springs State Park in Clayton, Illinois at three specific time periods: when bats were pregnant, lactating, and post lactating. Guano samples were stored in 1.5 mL microcentrifuge tubes with 95% ethanol in -80°C freezer until extraction. Corticosterone was extracted, and an enzyme immunoassay kit specifically for measuring corticosterone concentrations in small mammals was used to estimate hormone metabolite concentrations. Results indicate hormone levels changing at different points in the reproductive season with the highest concentrations found during lactation followed next by pregnancy then post lactation. This supports the hypothesis that increased maternal investment has a positive correlation with increased stress levels. Future directions will include continuing to monitor stress hormone levels of the maternity roost, as well as other bat populations to examine potential stress responses to human activities.

131 2:30pm UG

Variable Winter Temperature Increases Adult Female Size and Survival in the Goldenrod Gall Fly, *Eurosta solidaginis*

*Shannon Meckel, Jason Williams [Southern Illinois University Edwardsville]

Immature overwintering insects exposed to elevated winter temperature typically use more metabolic fuels, have reduced survival, and have reduced body size. However, most studies use 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, and potential fecundity, we compared survival, sex ratio, and adult body size 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 temperature 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 adult eclosion was highest for larvae subjected to elevated-variable temperature (54%), while the remaining groups averaged only 30%. Of those that eclosed, a greater proportion of the animals in the elevated-variable group were female (70%) compared to 39% for the elevated constant and 48% for the average temperature treatments. Males were similar in size amongst all treatments with head widths averaging 2.10 ± 0.03 mm, however, females in the average-variable group had larger head widths (2.21 ± 0.04 mm) compared to females in the remaining groups which averaged only 2.11 ± 0.03 mm. In sum, elevated-variable winter temperature enhanced adult survival and percentage of females that survived, while females in the average-variable regime were larger.

ORAL PRESENTATION ABSTRACTS

8:30am – 12noon, Saturday, April 14, 2018, Leighty-Tabor Science Center

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

ANTHROPOLOGY & ARCHEOLOGY

8:30am
Rm 209

Life Lessons Taught by Foxes: Differential Diagnosis

*¹Dennis Lawler, ²Michael A. Etnier, ³Julia Becker, ⁴Kimber Hendrix [¹Southern Illinois University Edwardsville, ²Western Washington University, ³Tippecanoe Animal Hospital, ⁴Wolf Park]

Clinical diagnosis is both science and art, whether the setting is among the living or the deceased. The science of diagnosis, whether modern or archaeological, is rigorous. The stepwise basis of differential diagnosis includes (a) an initial information set to define status, from first information and observations; (b) an expanded data set consisting of structured examination, a problem list, and potential differential diagnoses for each observed problem; (c) a diagnostics information set based on selected further testing; (d) an assessment based on orderly mental synthesis of all information (Lawler DF, IJPP, 2016). In research and clinical environments, consistent application of diagnostic principles requires conscious effort. Skeletal specimens often yield limited historical and environmental data, and misdiagnosis can occur easily. Thus, case illustrations are useful learning tools. Two actual cases will be presented. In the first case, skeletal clearing and examination easily could have suggested a single diagnostic conclusion, whereas having a medical history dictated a very different outcome. In the second case, no historical information was available, but ecological history and clinical knowledge facilitated a short differential diagnosis list. Case 1. Two unrelated 14-year-old female red foxes (*Vulpes vulpes*) were maintained lifetime at a wildlife sanctuary habitat. During the 14th year of each fox, reduced activity and declining ranges of joint motion were noted. Evaluation revealed progressive kidney failure in each; it was known that each had significant osteoarthritis. Postmortem evaluation revealed multifocal osteoarthritis and diseased kidneys in both. Seeing only the extent of arthritic changes in bone alone might have suggested chronic osteoarthritis as a cause for death or humane euthanasia. More information allowed advanced kidney disease to be recognized as the primary problem. Concluding a primary cause of death from skeletal materials alone will lead to numerous incorrect conclusions. This case is a strong argument for plausible differential diagnoses, rather than less supportable single conclusions. Case 2. A wild arctic blue fox (*Vulpes lagopus*) was found dead on a beach area of St. Paul Island (Pribilof Is.). Examination of the cleared skeleton revealed widespread proliferative and degenerative pathology, to the point of severe multifocal osteoarthritis, several healing rib fractures, a healing femur fracture, widened costochondral junctions, focal vertebral bone loss, multifocal vertebral osteoarthritis, thin and pitted skull bones, dental disease, and multifocal but not bilateral loss of bone architecture and joint surface eburnation. Multiple potential differential diagnoses will be discussed, including suspected environmental contributions. This case is a strong argument for more careful exploration of ecological or taphonomic contributions to skeletal disease in deceased subjects.

8:45am
Rm 209

UG

Assessing Occipital Bone Morphology and Brain Growth in a Developmental Study of Extant Humans

*Jerome Thomas, Miranda Karban [Illinois College]

The occipital bun can be defined as a distinct posterior swelling of the occipital squama. This feature has commonly been associated with Neanderthals. However, similar occipital morphology can be seen in some modern humans. The term “hemi-bun” is used to describe the trait in modern humans. Earlier studies make the assertion that the presence of the hemi-bun/occipital bun stems from a developmental process related to the timing of brain and cranial vault growth. Though these previous studies provide a logical explanation for how the hemi-bun/occipital bun develops, these studies have been unable to measure the brain growth of individual subjects. Therefore, the purpose of this study is to directly measure the interaction between cranial capacity and occipital bone shape in a developmental sample of extant humans. A total of 20 subjects (14 males and 6 females) from Iowa Facial Growth Study and University of Toronto Burlington Growth Study were selected based on occipital morphology, with half of the subjects possessing hemi-buns and the remaining subjects lacking hemi-bun anatomy. Lateral and frontal cephalograms from each subject were measured at nine longitudinal age points, spanning from 3.0-20.4 years of age. Cranial measurements were collected using TpsDIG2 computer software, and a roentgenologic formula was used to calculate the cranial capacity of individual subjects. Although the average cranial capacity of bunned subjects was found to be slightly higher than in non-bunned subjects, this difference was not found to be statistically significant. These findings, therefore, do not support the traditionally

cited late cerebral growth spurt hypothesis. Alternatively, future research should focus on hypotheses relating to patterns of cranial and cranial base integration within a developmental framework.

BOTANY

9:00am
Rm 115

Assessment of Climate Change Vulnerability for Rare Illinois Plants

*Brenda Molano-Flores, David N. Zaya, Greg Spyreas, Jill Baty [Illinois Natural History Survey]
Illinois is home to approximately 2,107 native plant species of which about 16 percent are considered threatened or endangered. In addition to the common threats associated with the decline of these species, climate change cannot be ignored. Climate change predictions associated with Illinois have estimated that the conditions in Illinois will resemble present-day summers in Texas by mid to late century. Using the NatureServe's Climate Change Vulnerability Index (CCVI) tool we evaluated the climate change vulnerability for 331 rare plant species. Overall, we found that over 50% of Illinois rare plants are vulnerable to climate change. Barriers to migration are a leading factor associated with vulnerability in Illinois, where 97% of listed species are affected by anthropogenic barriers and 24% are affected by natural barriers. The sensitivity of species to changes in temperature, precipitation, and hydrology are also associated with vulnerability. This study provides insights into the most vulnerable plant species in Illinois and provides much needed information to land managers, policy makers, and researchers. The information on vulnerability to climate change could aid in prioritization of limited resources and development of adaptation strategies for vulnerable species.

9:15am
Rm 115

Not Quite *fait accompli*: Whole Plant Shade Tolerance of Amur Honeysuckle (*Lonicera maackii*)

*Kurt Schulz, Anh Nguyen, Richard Brugam [Southern Illinois University Edwardsville]
In a previous presentation we made the observation that the importance of spring/fall photosynthetic light windows may be exaggerated for invasive Amur honeysuckle (*Lonicera maackii*). We examined the summertime photosynthetic light response of Amur honeysuckle and two native shrub competitors, spicebush (*Lindera benzoin*) and pawpaw (*Asimina triloba*). All three species exhibited classic leaf-level responses to shade and similar photosynthetic patterns on a leaf area basis. On a leaf mass basis honeysuckle produced far lower photosynthetic returns than the natives. Here we extend this work to examine leaf area display against the biomass cost of producing new shoots. Honeysuckle produces 30-45% less leaf area per gram than the two natives. Weighted by photosynthetic light responses, this gives about 30% and 45% advantage in carbon gain to pawpaw and spicebush respectively. This divergence suggests that two very different forest management strategies might be available to control honeysuckle invasion over the long term.

9:30am
Rm 115

Grad Cross Species Compatibility of the Fungal Associates of the Federally Threatened Eastern Prairie Fringed Orchid

*Kayla Tatum, Elizabeth Esselman [Southern Illinois University Edwardsville]
The eastern prairie fringed orchid (*Platanthera leucophaea*) (Orchidaceae) was once a prevalent species in wet prairies, sedge meadows, bogs, and fens throughout the upper Midwestern United States. The orchid is currently listed as a federally threatened species and has experienced great declines over time due to habitat loss, over-collection, and competition with non-native taxa. Previous conservation work suggests that *P. leucophaea* depends on associations with *Ceratorhiza* fungi for germination. What is unknown is if the strains of fungi associated with other orchids will germinate *P. leucophaea* seeds. The purpose of this study is to examine fungal associates of the green-fringed orchid (*Platanthera lacera*), the purple fringeless orchid (*Platanthera peramoena*), and the spring ladies' tresses orchid (*Spiranthes vernalis*), to determine if fungi associated with these orchids will germinate *P. leucophaea* seeds. This new information could be critical for seedling reintroduction and conservation of *P. leucophaea*.

9:45am
Rm 115

Grad Photosynthetic Characteristics and Growth Performance of Invasive Understory Shrubs Across a Light Gradient

*Brandon Schack, Jonathan Clark, Kurt Schulz [Southern Illinois University Edwardsville]
Amur honeysuckle (*Lonicera maackii*) and autumn olive (*Elaeagnus umbellata*) are two invasive Asiatic shrubs that colonize forest understories throughout the eastern U.S. Both species harm native communities and ecosystems in diverse ways. This study seeks to understand the role of shade tolerance as a factor for their dominance over native plants. Seeds of both species were locally collected, germinated, and transplanted to

shade enclosures with 20, 40, 60, 80, and 90% light level reduction. After 21 days acclimation, photosynthetic light response curves were constructed and leaf chlorophyll was measured. Dry mass of leaves, stems, and roots, total leaf count, and stem length were measured just before senescence. Light response curves showed differences between light treatments ($p < 0.05$) but no difference between species. Chlorophyll concentrations did not differ. Across light treatments honeysuckle allocated more mass to leaves than autumn olive ($p < 0.05$), however, there was no difference between species and treatments for stem mass. The difference in leaf mass response compared to stem mass suggests a difference in energy allocation, potentially making honeysuckle a stronger understory competitor than autumn olive.

10:00am UG
Rm 115

Comparing Oogenesis in Two Ecomorphs of the Giant Kelp *Macrocystis pyrifera* in Response to Iron Nutrition

*Jacob Schaafsma, Raymond Lewis [Wheaton College]

The giant kelp, *Macrocystis pyrifera*, is an important member of marine ecosystems in the North Pacific Ocean, from Baja California, to Alaska, and also occurs in the Southern Hemisphere. Furthermore, *M. pyrifera* is the largest algal species, growing to 60 m in length. Giant kelp forests are home to a wide variety of species, such as urchins, shellfish, and sea otters. Two ecomorphs, formerly classified as *M. pyrifera* and *M. integrifolia*, occurring in deeper and shallower waters, respectively, both thrive in Monterey, California. Microscopic gametophytes produce gametes that give rise to the large sporophyte stage. Iron is necessary for the formation of gametes in *Macrocystis* and some other kelps. The objective of this study was to identify concentrations of chelated iron to optimize oogenesis, and to compare the oogenesis responses of *M. pyrifera* and *M. integrifolia*. Gametophytes from Monterey, California were treated with 0 to 13.12 μM of chelated iron (Fe-EDTA), representing 0 to 2x the concentration used in a standard enriched seawater medium. After 14 days, the number of egg cells was counted. Both species had maximum oogenesis at the greatest concentration, 13.12 μM , and minimal in the absence of iron, however for the intermediate concentrations *M. integrifolia* appeared to produce more egg cells than *M. pyrifera*. However, both species appear to respond favorably to relatively low concentrations of iron, reaching approximately 50% of the maximum number of egg cells around 1.64 μM . It is hoped that these data will contribute to understanding physiological responses of *Macrocystis* to iron nutrition, including the possibility that ecotypes in regards to iron concentration occur in different areas, and contribute to studies that are investigating the biochemical pathways of oogenesis in kelps.

10:15am UG
Rm 115

Ghost Orchid (*Dendrophylax lindenii*) Habitats in Florida and Cuba: Year Three of a Four-Year Survey

*¹Adam R. Herdman, ²Ernesto Mújica Benítez, ¹Lawrence W. Zettler, ¹Connor Melton, ³Mark Danaherm [1Illinois College, 2Soroa Orchid Botanical Garden-Cuba, 3Florida Panther National Wildlife Refuge]

The Ghost Orchid, *Dendrophylax lindenii* (Lindl.) Bentham ex Rolfe, is a rare, leafless epiphyte restricted to south Florida and Cuba. Although *D. lindenii* populations in both countries are separated by a mere 200 km, this species appears to occupy two different habitats. In 2015 we began an international, four-year collaboration between our two countries to document and study *D. lindenii* in the Florida Panther National Wildlife Refuge (FPNWR) and Guanahacabibes National Park, Cuba. The aim of the project is to identify and compare the critical biotic and abiotic factors that *D. lindenii* requires to complete its life cycle *in situ*, and to survey existing orchids. These surveys are expected to generate accurate predictions into population longevity. During the first year of the survey (2015), 116 *D. lindenii* individuals were recorded in the FPNWR, whereas only 16 specimens were known to occur there previously. In Cuba, 241 orchids were counted, almost one-third (30.3%) of which were seedlings – nearly double the percentage of seedlings documented in FPNWR (16.4%). In 2016 and 2017, an additional 71 and 157 orchids were recorded in Florida, respectively, raising the total number to 400. Approximately 1/3 of all orchids were reproductive in age in both sites, but fewer than 10% of all available flowers set fruit. In Florida, *D. lindenii* was affixed to just two host tree species - *Fraxinus caroliniana* and *Annona glabra* – most (69%) on the former, whereas in Cuba 18 tree species served this role. More than half (55.2%) of *D. lindenii* in both the FPNWR (55.2%) and Guanahacabibes (52.7%) were documented on the north-facing (NW, N, NE) bark. Molecular analysis (93% match in BLAST) of fungi isolated from FPNWR confirmed that *D. lindenii* associates with basidiomycetes assignable to *Ceratobasidium*. Our ongoing collaboration demonstrates that by working together, the long-term conservation of this rare orchid might be an achievable goal despite lingering political interference.

10:30am UG
Rm 115

Leaf Anatomy of Aeridinae (Vandaeae, Orchidaceae)

*Hunter Levingston, Barbara Carlsward [Eastern Illinois University]

Aeridinae are a diverse subtribe of approximately 1350 orchid species commonly found as epiphytes in tropical Asia. The purpose of my project was to provide a detailed account of the leaf anatomy for characterizing genera in this subtribe and to compare my findings with the “alliances” or clades published in recent molecular phylogenetic analyses. Transverse sections of leaves for 61 species were made on a Reichert sliding microtome at 60-100 µm and stained with safranin and iron-alum hematoxylin. Sections were dehydrated in a graded ethanol series, cleared in limonene and mounted in Permount. Observations were made using a Zeiss Axioskop 40 and an attached AmScope MU300 digital camera. Most genera had isodiametric adaxial epidermal cells in section, but *Phalaenopsis* exhibited rectangular-shaped cells. *Acampe* showed a mixture of isodiametric and rectangular. All genera had isodiametric abaxial epidermal cells in section, except for the rectangular cells in *Phalaenopsis*. All genera showed abaxial stomatal complexes, but only select species from the genera *Aerides*, *Chiloschista*, *Doritis*, *Phalaenopsis*, *Schoenorchis*, and *Seidenfadenia* had adaxial stomatal complexes, as well. *Chiloschista* and *Gastrochilus* had adaxial and abaxial trichomes. *Schoenorchis* only showed trichomes on the adaxial surface, and *Acampe* only had trichomes on its abaxial surface. *Gastrochilus* and some *Phalaenopsis* species showed bulliform cells on both surfaces of the leaf. Every genus displayed collateral organization of vascular bundles. The bundle sheaths of *Acampe*, *Aerides*, *Ascocentrum*, *Cleisostoma*, *Christensonia*, *Gastrochilus*, *Neofinetia*, *Papilionanthe*, *Pelatantheria*, *Renanthera*, *Schoenorchis*, and *Seidenfadenia* were thick-walled. *Adenoncos*, *Chiloschista*, *Doritis*, *Micropera*, and *Smitinandia* show thin-walled bundle sheath cells. *Phalaenopsis* had both thick and thin-walled bundle sheath cells. There were no bundle sheath extensions observed. Fibers were observed in the genera *Aerides*, *Ascocentrum*, *Christensonia*, *Cleisostoma*, *Neofinetia*, *Papilionanthe*, *Renanthera*, *Schoenorchis*, and *Seidenfadenia*. The mesophyll cells located above the midrib were palisade-modified in the genera *Acampe*, *Aerides*, *Christensonia*, *Micorpera*, *Neofinetia*, *Pelatantheria*, *Renanthera*, *Seidenfadenia*, and *Smitinandia*. *Christensonia* and one species in *Aerides* had uniform palisade parenchyma in their mesophyll. Many features observed did not show much differentiation between genera, but several genera, such as *Phalaenopsis* and *Aerides*, did show unique features distinguishing them from other genera.

10:45am UG
Rm 115

Viability of Orchid Endophytes in Prolonged Cool (4-6° C) Storage for Conservation Purposes

*Rachel Helmich, Eve E. Bahler, Lawrence Zettler [Illinois College]

Orchid conservation in this ‘age of extinction’ will likely depend on a blend of three actions to be successful: 1) design and management of natural reserves, taking into account the specialized needs of orchids; 2) establishment of *ex situ* seed and mycorrhiza banks for orchids under immediate threat, and 3) development of techniques for orchid restoration. In action two, the ‘specialized needs’ includes abiotic and biotic factors, the latter of which involves pollinators and mycorrhizal fungi to ensure fruit set and seed germination, respectively. Cryopreservation is often employed by international culture collections (e.g., UAMH in Canada) to preserve important strains of fungi indefinitely and is preferable to continuous subculturing and/or cool storage (i.e., refrigeration). For some researchers, however, cryopreservation may not be a practical option. In this study, we assessed the survival of 100+ orchid endophytes collected in North America that were stored in refrigeration (4-6° C) for several years. The majority of the fungi were basidiomycetes assignable to *Ceratobasidium*, *Tulasnella*, and *Sebacina*. Using agar slants within screw-cap tubes, cultures were maintained on a variety of different media (e.g., oat meal agar, malt agar, potato dextrose agar), with and without subsequent addition of mineral oil. In general, *Tulasnella* strains remained viable for longer periods in cool storage than those assignable to *Ceratobasidium*. For orchids that utilize *Ceratobasidium* to complete their life cycles (e.g., *Platanthera leucophaea*, *Dendrophylax lindenii*), new storage techniques and/or more frequent subculturing may be necessary to maintain the important strains of this genus in a viable state.

CELLULAR, MOLECULAR, & DEVELOPMENTAL BIOLOGY

9:00am Grad
Rm 208

An Efficient Protocol for Root Transformation in *Helianthus annuus* Using *Agrobacterium rhizogenes*

*Tyler Parks, Yordan Yordanov [Eastern Illinois University]

Sunflower, *Helianthus annuus*, is one of the most important oilseed crop in the world. Oil from the seeds is prized for its’ exceptional quality and flavor. Despite this, sunflowers have been forced onto marginal lands, due to disease pressures and economics of that are often semi-arid and non-fertile soil, making it critical to produce more resilient lines and varieties to withstand these new stresses. The recent availability of the sunflower

genome can allow genome-wide characterization of gene families. Stable transformation protocols, which can be used for characterization studies, have been developed for *H. annuus* using *Agrobacterium tumefaciens*, but they present low efficiency and are time-consuming. For this reason, very few functional studies have been done in the sunflower. Composite plants, produced using *Agrobacterium rhizogenes*, are plants with transgenic 'hairy' roots and wild type shoots; offer benefits over creating fully transgenic plants, namely time and money. With plant transformations usually being the rate limiting step gene functional studies of non-model plants, composite plants can alleviate some of this bottleneck. Traditionally produced *in vitro*, the method developed here outlines a less expensive *ex vitro* alternative to produce composite sunflowers for study. The utility of this protocol is validated by genotypic testing, the efficiency of 12 varieties used to manufacture hybrids or used in production. We also performed verification of multiple promoters for the expression of selective markers and genes of interest. The functional characterization of a root specific transcription factor LBD16, via overexpression and RNAi silencing, furthermore bolster the utility of the system. The critical steps and parameters are outlined and discussed further herein.

9:15am
Rm 208

Grad Characterization of Planarian Homologs of Human Xeroderma Pigmentosum Genes and Their Function in Repairing UV Damage

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

Xeroderma Pigmentosum (XP) is a rare hereditary disease 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. Ultra Violet (UV) radiation is the most common source of lesions repaired by this complex. The purpose of this research is to better understand how defects in NER lead to Xeroderma Pigmentosum by characterizing this pathway in *Schmidtea mediterranea*. The planarian flatworm *Schmidtea mediterranea* is an ideal model to perform regeneration studies *in vivo* because of the worms' unlimited restorative and physiological renewal capacities provided by their specialized stem cells called neoblasts. I identified the planarian homologs of all human genes implicated in XP except DDB2 (XPA, ERCC1, ERCC3/XPB, XPC, ERCC2/XPD, ERCC6, ERCC4/XPF, ERCC5/XPG, POLH and RAD2/FEN1). The e-values in the BLAST searches ranged from 0 to 1E-13, indicating that these genes are highly conserved. I used RNA interference (RNAi) to silence the homologs of XP in the presence and absence of UV damage in both intact and cut planarians to elucidate the role of DNA repair in general stem cell function and assess whether NER reparative pathways are important for neoblast maintenance and regeneration. I performed six dsRNA feedings over the course of three weeks to trigger knockdown, and then observed the worms for 14 days to see what phenotypes appeared. The most prevalent phenotypes after UV exposure were head regression, head lysis, curling, ruffling, pigmentation changes, and lesions. These phenotypes indicate that the stem cell population was affected. The UV treatment also interfered with the worms' ability to regenerate correctly, causing asymmetry and development of supernumerary eyes in some cases. These phenotypes occurred with increased frequency and severity in some of the knockdown groups, suggesting that the lack of the gene product made the worms more sensitive to UV damage. Even in the absence of UV treatment, knockdown of XPD/ERCC2 and XPB/ERCC3 caused detrimental phenotypes (curling, ruffling, and head lysis), and head regression was also observed in some unirradiated ERCC6-2 knockdown worms one week after the last RNAi feeding. I am currently using quantitative PCR (qPCR) to measure XP gene expression levels in control and UV-treated worms, with the hypothesis that these genes may be upregulated following UV exposure. 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.

9:30am
Rm 208

Grad Determining the Function of Two Predicted *dicer*-like Genes in the Model Mushroom Fungus *Schizophyllum commune*

*Daniel Karcher, Thomas J Fowler [Southern Illinois University Edwardsville]

RNA interference (RNAi) is a conserved mechanism in eukaryotes by which small (20-30 nt) RNAs guide the silencing of target transcripts. RNAi has been found to function in regulation of gene expression, heterochromatin formation, and genome defense against viruses and transposons. Though the functions and mechanisms of RNAi have been studied extensively in yeasts and filamentous Ascomycetes, comparatively little research has been done in other clades of fungi, like the mushroom-forming Basidiomycetes. Two genes predicted to encode Dicer-like proteins, which catalyze production of small RNAs involved in RNAi, have been identified in the genome of the model Basidiomycete fungus *Schizophyllum commune*. De Jong *et al* (2006) provided evidence that mechanisms for dsRNA-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*-encoding genes is involved in this mechanism of RNA silencing, but it is unknown whether they have functions in genetic regulation or genome protection. Each of the two predicted *dicer* genes was deleted by homologous recombination. Compatible single deletion mutants were crossed to produce progeny lacking both predicted *dicer* genes. Since double mutants were successfully generated, this indicates the *dicer*-like genes are not essential in *S. commune*. Single and double deletion mutant strains are capable of mating, fruiting, and producing viable spores. To determine whether either *dicer*-like gene has an effect on silencing, hairpin RNA-encoding copies of the endogenous gene SC15 were ectopically integrated into the wild type and double mutant genomes. It is predicted that SC15 expression will be silenced in the wild-type transformants, but not in the double mutant.

9:45am
Rm 208

Grad Gene Expression Profile of the Corn Earworm After Feeding on Different Types of Corn Plant Tissues

*Faisal Alsubaie, Richard Musser, Sue Hum-Musser, Kayleigh Diveley, Ammar Al-furaiji [Western Illinois University]

The co-evolution of plant and herbivore insect has been demonstrated to result in the alteration of the insect gene expression due to the consumption of plants. Plants produce defensive components that are usually counteracted by the caterpillars that suppress plant defenses and the production of metabolites, resulting in an evolutionary bidirectional system. This research aims to study the performance, and the gene expression of the corn earworm (*Helicoverpa zea*) after feeding on corn (*Zea mays*) leaves and fruits compared to an artificial diet as the control. Different plant parts, fruits, and leaves were fed to the corn earworm to investigate its gene expression. In this experiment, corn leaves and fruits were used, while the artificial diet was used as the control group. Therefore, three groups of caterpillars were fed on three different diets during the 72-hour bioassay. The differences in caterpillar's weights before and after the expression was calculated. We determinate in the caterpillars in the leaf group weights less than the fruit group and a compared to control group. Then, caterpillars in the three groups were ground using liquid the nitrogen. The RNA then was extracted using the TRIzol. A microarray analysis was conducted to study the *H. zea*'s gene expression. The microarray results indicate that the expression of 1,906 annotated was significantly different in the gene expression. and, 1,334 unknown genes with lower function. In the leaf treatment, 1,973 genes were down-regulated, and 1,267 genes were up-regulated. On the other hand, 1,341 genes were down-regulated, and 1,899 were up-regulated in the fruit treatment. Results show that the gene expression of the genes responsible for digestion, immunity, growth, and detoxification was higher in the leaf group rather than the fruit group. This study gives us a better understanding of the evolutionary interaction between an insect and plant host.

10:00am
Rm 208

Grad Screening for Genes Involved in Planarian Memory Using RNAi Knockdown Techniques

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

Planarians, such as *Schmidtea mediterranea*, are free-living platyhelminths and possess a central nervous system (CNS) consisting of bi-lobed cephalic ganglia and two ventral nerve cords. While their CNS is relatively simple, they exhibit similarities to the CNS of higher organisms, for example, the presence of distinct neuronal subtypes. Planarians can sense tactile and olfactory environmental information; these signals are processed in the brain, directing an appropriate behavioral response. These model organisms can retain memories of environmental familiarity after being habituated to an environment through repeated exposure. The objective of this experiment is to conduct a screen on several planarian genes to see how they affect memory. We have cloned planarian homologs of genes known to cause long-term associative memory (LTAM) effects in *C. elegans*, genes that are highly expressed in the planarian CNS but have no overt knockdown phenotype, as well as genes that are completely unrelated to memory. In previous experiments that we conducted, planarians were habituated to a rough plate for 30 days and then underwent RNAi knockdown of the selected genes and regeneration prior to their memory test. Memory was assayed based on the amount of time each planarian took to reach food on the opposite side of the rough plate from their starting position. Worms that retained memory of the unfamiliar stimulus reached the food more quickly than those that had no memory of the rough surface; this category included worms that were not habituated to the rough surface and those with the knockdown of a gene essential for memory. We are currently trying other methods for testing planarian memory of surface-type exposure, including measuring their preference for smooth or rough quadrants in a divided plate. We hypothesize that if planarians have been habituated to a rough surface, then they will spend more time in the rough quadrants than those that were habituated to a smooth surface. We may design an additional test involving olfactory memory to complement these thigmotaxis-based methods. By gaining an understanding of the molecular basis of memory in

the CNS of a simple organism, we can lay the foundation to explore roles of genes involved in memory in higher organisms.

10:15am Grad
Rm 208

Study on Intracellular Calcium-Mediated Generation of Platelet-Derived Microparticles

*Devansh Singh [Eastern Illinois University]

Platelets are discoid shaped, measuring about 2-4 μm in diameter, peripheral blood cells and are synthesized in bone marrow by the cytoplasmic fragmentation of the precursor bone marrow megakaryocytes. Platelets are enucleated i.e. they lack nucleus and the DNA; they do however contain inherited mRNA's and retains complete machinery for cell movement. Here I have used ionophore A23187 which functions as a mobile ion carrier and also acts as a divalent cation ionophore, allowing these ions to cross cell membranes. Here I have demonstrated the effect of ionophore A23187 on cytosolic calcium flux. It was found that ionophore evoked a dramatic rise in intracellular calcium in platelets. This induced enhancement in the activity of Calpain which is a calcium-dependent thiol protease, the enzymatic activities of which rely on the cytosolic concentration of Calcium. As Calpain activity is known to catalyze Talin degradation, I also found comparable results. We know that Talin is a critical component of platelet cytoskeleton and provides structural stability to the cells. Here I also demonstrated that A23187-induced rise in intracellular calcium was associated with microparticles shredding. Hence the results primarily implicate the effect of intracellular calcium on production of platelet microparticles. Since these microparticles play a variety of important roles coagulation, cellular signaling, vascular injury, and homeostasis, they have been an important topic field of microparticle research.

10:30am UG
Rm 208

Evaluation of Genes Linked to Alzheimer's Disease in *Schmidtea mediterranea* Using RNAi Knockdown

*Kaitlyn Stanton, Amy Hubert [Southern Illinois University Edwardsville]

The planarian *Schmidtea mediterranea* is an excellent model organism that can regenerate using a pool of stem cells maintained throughout their lifetime. These worms also work well for studies of memory and learning because they have a simple nervous system but are capable of being conditioned to show specific behavioral responses based on their past experience. For example, worms with prior exposure to a rough surface are able to reach food more quickly when placed on this surface again compared to worms that are not familiar with the texture. Alzheimer's disease is a form of dementia that has an effect on memory and behavior and is thought to cause problems learning and memorizing new information. The genes presenilin and amyloid beta protein (APP) are involved in early onset Alzheimer's disease. Presenilin is involved in the pathway of cleaving APP, and then APP accumulates in the brain of Alzheimer's patients. We identified the planarian homologs of these genes using BLAST searches and cloned them into a vector for expression of double-stranded RNA to trigger knockdown by RNA interference (RNAi). In this experiment, *Schmidtea mediterranea* will be habituated to either a rough or smooth surface then undergo RNAi knockdown of one of the Alzheimer's-related genes to see if this affects their ability to remember their prior experiences. We expect that if neither gene is important for memory, the planarians that had previous exposure to the rough surface will perform better than those habituated to the smooth surface in subsequent time trials on a rough surface. However, if knocking down the gene does affect memory, the two groups will perform similarly. We hope that this analysis will provide a better understanding of Alzheimer's disease and the genes related to it.

10:45am UG
Rm 208

The Effects of Ammonium Sulfate on Stress Physiology and Innate Immunity of Western Mosquito Fish (*Gambusia affinis*)

*Elyse Schnabel [Millikin University]

Fertilizers can increase yield of crops but may have unintended negative effects on wildlife. We tested the effects of different concentrations of ammonium sulfate fertilizer on the stress physiology and innate immunity of Western Mosquitofish (*Gambusia affinis*). The mosquitofish were exposed to different concentrations of ammonium sulfate fertilizer: 0 ppm, 40 ppm, and 80 ppm. To test the effects of ammonium sulfate on stress physiology, cortisol was collected after one week of exposure and again after two weeks of exposure via water extraction from each fish and quantified with an enzyme immunoassay. There was not a significant change in the amount of cortisol from week one to week two in the control group, but we found a significant increase in the amount of cortisol in the fish exposed to 40 ppm and 80 ppm from week one to week two. There was a not significant difference in survival between the fish exposed to 40 ppm and 80 ppm of ammonium sulfate, but each of those groups had significantly higher mortality than the control group. To test for effects of ammonium sulfate on innate immunity, blood was collected from each fish after one week and we completed a lysozyme activity

assay. The results suggested that a higher concentration of ammonium sulfate induces lower lysozyme activity in the fish. Overall, our results suggest that relatively low amounts of ammonium sulfate runoff into bodies of water are likely to have negative sublethal and lethal effects on small, live-bearing fishes.

CHEMISTRY

11:15am UG
Rm 208

Antibiotic Concentration in Wastewater and Effluent Affected Streams in Southwest Illinois

*Clayton Donald, Qianqian Zhang, Jillian Rhomberg, Kevin Tucker [Southern Illinois University Edwardsville]

Antibiotics have been a primary therapeutic in modern day medicine for many years. Unfortunately, due to a variety of factors, bacteria have begun to outgrow our medications. Antibiotics enter the environment from a variety of sources in a variety of concentrations. This study is aimed at not only establishing an effective method for antibiotic extraction, but also to quantify the concentrations in samples taken from the greater St. Louis area. Samples were taken from the inlet of multiple wastewater treatment plants (WWTPs), primary and effluent, and the outlet during the summer and winter months. Methods of solid phase extraction and liquid chromatography mass spectrometry were used to analyze and quantify the presence of antibiotics from WWTPs. Without knowing specifically what levels of antibiotics are being released into the environment, it is unclear what ecological effects antibiotics are having on bacterial antibiotic resistance and organisms in general. By comparing before and after samples from summer and winter, it is evident that WWTPs are not completely removing antibiotics from wastewater.

11:30am UG
Rm 208

Isocyanide and Phenol Substituent Variants in the Tandem Ugi-Smiles Diels-Alder Reaction

*Nicolas Revelt, Sarah Luesse [Southern Illinois University Edwardsville]

Multicomponent reactions (MCRs) are very useful in organic synthesis due to their unique ability to make complex products from relatively simple reactants at near stoichiometric ratios. One particularly useful MCR is the isocyanide-based MCR (IMCR) which employs the tandem Ugi-Smiles Diels-Alder process to combine an aldehyde, an amine, a phenol, and an isocyanide into a complex scaffold that can be extensively modified based on the unique reagents used, many of which are commercially available. Adding different functional groups to the scaffold, modifying the reactant substituents, or changing the base reagents can produce a variety of large, heterocyclic molecules, many of which resemble pharmaceutical-like compounds with potential biological functions. This work focuses on observing the change in overall yield and diastereospecificity that result when the isocyanide group is altered in combination with various phenol substitutions. The reactions were purified via flash column chromatography and examined via NMR spectroscopy. Some isocyanide variants were found to have greater yield or specificity than others and patterns in phenol substitution were related to the overall yield as well. The examination using IMCR reactions with targeted reagents will allow for more efficient, economic ways to make complex biologically-significant molecules.

11:45am UG
Rm 208

Synthesis of Group VI Carbonyl Compounds Containing Phosphine Ligands for CO₂ Reduction

*Nicole Walker, Brian Bellott [Western Illinois University]

The natural course of the carbon cycle begins with plants taking CO₂ from the atmosphere and converting it into sugars through the process of photosynthesis. It is then converted back into carbon dioxide through the process of glycolysis after animals consume the plants. This cycle has been altered in the past few decades by the increases in deforestation, which lowers the number of trees around to remove CO₂ from the atmosphere, and the burning of fossil fuels, which releases huge quantities of CO₂ back into the atmosphere. This high amount of CO₂ in the atmosphere has led to an acceleration in climate change, as well as an increase in the acidification of the oceans. Some attempts to solve this issue aim to store the CO₂ (carbon sequestration), but this leads to the issue that the carbon is no longer available to participate in the carbon cycle. Another possible solution is to convert the carbon to another form, such as CO. Reduction of CO₂ to CO has the advantage of removing CO₂ from the atmosphere, while also creating something useful, as CO is a chemical feedstock that can be used to manufacture plastics, hydrocarbon fuels, aldehydes, and methane. Unfortunately, the reduction of CO₂ to CO is not a spontaneous reaction under ambient conditions, so a catalyst is needed. Past studies have shown that this reaction can be catalyzed efficiently by transition metal carbonyl complexes containing phosphine ligands. Unfortunately, the most efficient catalysts for this reaction have metal centers of Rhenium or Ruthenium, both of which are too expensive to use on a real-world scale. However, there has been little research done using group VI

metals as metal centers, so this research focuses on synthesizing compounds following the form $M(CO)_5L$ or $M(CO)_4L_2$ (where $M = Cr, Mo, \text{ or } W$ and L is a phosphine ligand) so that their electrochemical properties can be determined. Ideally, at least one compound will be an efficient catalyst for the reduction of CO_2 to CO so the compound can be used to lower the atmospheric CO_2 levels. The method of synthesis varies as there are a number of different compounds being synthesized. The three main methods of removing one or two carbonyl groups from the hexacarbonyl starting material are: heat, reagents (such as $NaBH_4$), or UV light. Removal of the carbonyl group(s) allows the phosphine ligand to attach. In order to characterize the products, Fourier-Transform Infrared Spectroscopy (FTIR) and Nuclear Magnetic Resonance (NMR) are used, and the melting points of the compounds are used for characterization and to determine purity.

COMPUTER SCIENCE

11:15am
Rm 115

A Cournot Game for Cloud Providers' Non-Cooperative Competition

*In Lee [Western Illinois University]

This study develops a Cournot game model for cloud providers offering homogeneous cloud services in a duopoly market. In order to formulate the game model, I first develop a cost-minimizing decision model of a rational cloud customer. The cloud customer purchases public cloud services from the cloud providers who have asymmetric costs. Based on the analysis of the cloud customer's decision model, I derive a nonlinear quantity-dependent price function for the Cournot game. I analyze the cloud providers' non-cooperative competition from the Cournot game perspective under the assumptions of (1) perfect information and (2) imperfect information about their competitor's costs, respectively. I derive Nash equilibrium quantities for the Cournot game and show the impact of the Cournot game on the cloud providers' profits and benefits to the customer compared to a monopoly market situation. Finally, I illustrate how the Nash equilibrium is achieved mathematically with a graphical representation of the Nash equilibrium.

11:30am Grad
Rm 115

Alleviating Partisan Gerrymandering: Can Math and Computers Help to Eliminate Wasted Votes?

*Laura Palmieri, Tanim Chatterjee [University of Illinois Chicago]

Partisan gerrymandering consists of redrawing the district boundaries to give electoral advantage to a political party. In 1986, it was declared unconstitutional and justiciable by the US Supreme Court and, since then, many efforts have been done to find a standard that could be adopted by the Court to quantify gerrymandering and eventually reject a redistricting plan. In previous studies, it was concluded that notions such as quantitative measure of shape compactness and other geometric indices had many limitations, as redistricting policies take into account other constraints, and the algorithms that used those indices were highly computationally complex and made the redistricting process unfeasible. Recently, Stephanopoulos and McGhee introduced Efficiency Gap, a new measure of partisan gerrymandering, which is defined as the ratio of the difference between the parties' wasted votes (in a two-party electoral system) to the total number of votes cast in the election. This metric was found legally convincing by a US Appeals Court in a case appealed in 2017. The outcomes of the elections in the last decade showed the most extreme partisan gerrymandering in the American history and it is very important that the US Supreme Court adopts a standard to quantify gerrymandering and to have more control on the redistricting process. In this research project, we provide a local search algorithm able to "un-gerrymander" the 2012 house district maps for Wisconsin, Virginia and Texas by bringing their efficiency gap to acceptable levels. Due to the computational complexity in finding all the possible redistricting plans, we also proved that it is possible to find a district map, efficiently and in polynomial time, that minimizes the efficiency gap. If the US Supreme Court upholds the decision of lower courts, our work can provide a crucial supporting hand to remove partisan gerrymandering.

11:45am Grad
Rm 115

Enhancing Anonymous Routing in Smart Community Wireless Ad-hoc Networks

*Alamin Mohammed, Sumesh Philip [Western Illinois University]

There is a growing body of knowledge surrounding the autonomy of wireless ad hoc networks in contrast to an infrastructure based network that makes them powerful and ideal for some applications. A smart community, in which a multihop network of smart homes that are interconnected through wireless communication standards such as WiFi (IEEE 802.11) and fourth generation (4G) of mobile telephony, is the focus of this work. This network of homes (people) is so powerful in its implication that, for example, it can be used in areas where police response time is reasonably long by adding a network effect that allows people and security guards to easily work

together in real-time. Further, it promotes trust based on social relationships and it might even enhance those relationships without an extra investment of time and resources. However, one of the challenges in designing such a network is providing sender-receiver relationship anonymity. Even if a sender encrypts a message it sends to a receiver, an adversary can still be able to infer some contextual information from observing the communication path. In this work, we explore the use of anonymous routing for preserving route privacy in a smart community wireless ad hoc network. While it achieves the desired outcome of preserving contextual privacy, anonymous routing is suboptimal in finding routes that optimizes on a routing metric. In addition, it is susceptible to passive attacks from malicious nodes that attempt sinkhole attacks on the network. We improve upon an existing anonymous routing protocol by discovering paths that are hop-optimal, in addition to identifying misbehaving nodes that subject the network to sinkhole attacks. Our solution is able to bypass such malicious nodes, leading to improved and faster packet delivery in anonymously routed smart community wireless networks.

ENVIRONMENTAL SCIENCE

9:15am
Rm 209

Effects of Military Activity and Habitat Quality on DNA Damage and Oxidative Stress in the Largest Population of the Federally Threatened Gopher Tortoise

*¹Christopher Theodorakis, ¹Ashley Hay, ¹Jaimie Rotter, ²S. Marchal Adams [¹Southern Illinois University Edwardsville, ²Oak Ridge National Laboratory]

Department of Defense lands are essential for providing important habitat for threatened, endangered, and at-risk species (TER-S). However, there is little information on the effects of military –related contaminants on TER-S on these lands in field situations. Thus, this study examined genotoxicity and oxidative stress in gopher tortoises (*Gopherus polyphemus*) on Camp Shelby, MS - the largest known population of this species, which is listed as an “endangered species” in Mississippi and a “threatened species” by the U.S. government. Blood was collected from tortoises at 19 different sites on the base with different levels of habitat quality (high-quality and low-quality habitat) and military activity (high, low, and no military activity). Oxidative stress was quantified as lipid peroxidation and GSSG/GSH ratios, while DNA damage was determined using flow cytometry. Our results suggest that: 1) for tortoises residing in low-quality habitats, oxidative stress and DNA damage increased with increasing military activity, while in high-quality habitats, oxidative stress and DNA damage decreased with increasing military activity; 2) in the absence of military activity, tortoises in high-quality habitat had higher levels of oxidative stress and DNA damage than those in low-quality habitat, 3) there were interactions between military activity, habitat quality, and landuse in terms of the amount of observable DNA damage and oxidative stress, and 4) there was not an association between magnitude of biomarker response and soil concentrations of nitro-energetic compounds. These findings have implications for management of gopher tortoises on military lands.

9:30am
Rm 209

On Developing Bioindicators of Metal Pollution in the Lower Illinois River

*¹Zhi-Qing Lin, ¹Kim Shoemaker, ¹Luci Kohn, ²Ben Lubinski [¹Southern Illinois University Edwardsville, ²Great River Field Station]

The Illinois River is an important waterway in the US Midwest and historically contaminated with metal and other toxicants from various industrial and agricultural pollution sources. In previous years the bioaccumulation of selected heavy metals and metalloids in red-eared slider turtle and common fish species in the Lower Illinois River has been studied. The research findings suggest that high potential of bioaccumulation and potential ecotoxicity of toxic metals in aquatic organisms through food chains in the aquatic ecosystem. This study will demonstrate the spatial and temporal variation of metal accumulation in different turtle and fish tissues and the importance of chemical interaction between selenium and mercury in ecological risk assessment. In particular, significant spatial variation was observed in turtle egg shell, but metal accumulation in turtle eggs did not show a significant temporal increase during a 4-year time period. The molar ratio of mercury to selenium in fish muscle tissue molar in non-filter feeder fish species was significantly higher than in filter feeder species, suggesting that Hg toxicity risk in non-filter feeders is higher than filter feeders in the aquatic environment. This study will demonstrate the feasibility of using different biological tissues to bioindicate the water quality in the Lower Illinois River.

9:45am
Rm 209

Place-Based Exposure Science Research in the Metro-East St. Louis Region

*Ben Greenfield, Jarrod N Koski, Kehinde A Olagunju, Oladoyin M Oluaderounmu, Maya R Sante, Brooke L Wilke, Dana M Wynn, Georgia Brace, Sharon Locke [Southern Illinois University Edwardsville]
Exposure science is a subfield of public health that describes human exposure to health-relevant environmental factors. Exposure scientists employ biological and environmental monitoring data to characterize human exposure to stressors (such as pollutants), as well as benefits. Over the past decade, the increasing availability of low cost monitoring instruments, mobile phones, and the internet, have transformed exposure science, enabling students, community members, and scientists to readily collaborate on scalable field data collection projects. In this vein, my research team and collaborators at SIUE has been developing a set of projects at the intersection between environmental monitoring and exposure science, to characterize local human exposures and concerns regarding environmental stressors. These studies focus on the Metro-East St. Louis region, which encompasses a wide range of wealth and poverty, a gradient of current land uses and human activities, and a legacy of historical industrial activity along the Mississippi River. My talk will review some of our developing research activities, including: 1. estimating air particulate matter levels and noise levels at local public auto racing arenas; 2. describing spatial patterns in soil metal concentrations across the local urban to rural gradient; and 3. surveying members of the local university community on their own environmental concerns, including local drinking water and consumption of tap vs. bottled water. The common goal of these studies is to involve students of different backgrounds and levels in meaningful place-based exposure science research.

10:00am Grad
Rm 209

True Metabolizable Energy of Submersed Aquatic Vegetation for Ducks

*¹Margaret Gross, ¹Christopher Jacques, ²Heath Hagy, ¹Sarah McClain, ³Brian Davis, ⁴John Simpson, ⁵Joseph Lancaster, ⁵Aaron Yetter [¹Western Illinois University, ²U.S. Fish & Wildlife Service, ³Mississippi State University, ⁴Winous Point Marsh Conservancy, ⁵INHS Forbes Biological Station]

Wetland vegetation communities provide critical foraging habitat for waterfowl and are disappearing at an alarming rate throughout the Midwest. The loss of wetlands and the submersed aquatic vegetation (SAV) they contain is well documented. However, there is a lack of information about the implications of these losses on energetic carrying capacity for waterfowl. Managers can estimate the energetic carrying capacity for a wetland by determining the energetic value (true metabolizable energy; TME) of foods available to ducks. Although energetic carrying capacity models are sensitive to TMEs, very few TMEs are available for SAV. Most available TME values are from plant seeds and have only been estimated from mallards and blue-winged teal, neither of which primarily consume aquatic vegetation. We estimated TME values of eight common species of SAV for mallards (*Anas platyrhynchos*), gadwall (*Mareca strepera*), and ring-necked ducks (*Aythya collaris*) in order to parameterize energetic carrying capacity models. We used established TME methods which consisted of fasting, feeding ducks a known amount of vegetation, and subsequently collecting their excreta. Excreta was dried, ground, pressed into pellets, and combusted in a Parr 6050 compensated jacket calorimeter to determine gross energy. We then calculated TME from gross energy of raw vegetation and excreta. Preliminary results for mallards indicate that TME was greatest for Canadian waterweed (*Elodea canadensis*; 1.69 ± 0.33 kcal/g) and southern naiad (*Najas guadalupensis*; 1.40 ± 0.43 kcal/g) and lowest for Eurasian watermilfoil (*Myriophyllum spicatum*; -0.53 ± 0.51 kcal/g), which required more energy to process than was assimilated. The TME values for these SAV species will allow wetland managers to more accurately evaluate wetland management practices and refine energetic carrying capacity estimates. Moreover, these values contribute a better understanding of the value of emergent marshes containing SAV for ducks, which potentially could provide as much energy as moist-soil wetlands.

10:15am UG
Rm 209

Habitat Value in Mid-Sized Rivers in Illinois

*¹Katelyn Toigo, ²Eden Effert-Fanta [¹Southern Illinois University, ²Eastern Illinois University]

One of the most important factors affecting the diversity and populations of fish species is the quality and type of habitat. This ongoing research project focuses on the connection between habitat and fish species in mid-sized Illinois rivers, specifically the Kaskaskia and Embarras Rivers. Due to size and fluctuations in water levels, mid-sized rivers have historically presented a challenge in collecting data. As a result, little attention has been given to fish communities and their utilization of habitats in mid-sized rivers compared to larger rivers and small streams. It is hypothesized that more complex habitat features will lead to both greater cover for fish and greater diversity of invertebrates, which will, in turn, lead to greater fish diversity and abundance. Side scan sonar image collection and electrofishing were used to determine fish species' diversities and populations associated with specific substrates, woody debris, and other vegetation or structures present in three reaches of the Kaskaskia

River. The goal is to document trends in the data that can be used to guide restoration by suggesting manipulations to the habitat that will provide conditions more favorable to specific fish species. Upper, middle, and lower reaches of the Kaskaskia River were mapped using side scan sonar in conjunction with a GPS unit to pinpoint locations sampled. Then selected locations were electrofished to collect data on fish species distributions. All data were merged using GIS to detect patterns. Results support the hypothesis that complexity leads to greater diversity and abundance of fish species. The presence of woody debris produced a higher catch rate and greater species richness. Although several fish species had strong associations with woody debris (e.g., crappie and largemouth bass), other species displayed no preference for woody structure. NMDS ordination and ANOSIM revealed significant differences in fish assemblages among all three reaches. The upper reach of the Kaskaskia had the greatest diversity of species, possibly due to lower flow, high water levels, and high levels of woody debris. Future work will complete the mapping of the Kaskaskia and Embarras Rivers to assist near-term restoration and will refine the synthesis of side scan sonar, GPS, and GIS in accurately mapping mid-sized rivers while simplifying, standardizing, and making transferable the use of these technologies in restoring degraded rivers.

HEALTH SCIENCES

9:15am
Rm 221

If a Space to Live Exists, Something Will Live There: Managing Free-Roaming Cats - I

*Dennis Lawler [Southern Illinois University Edwardsville]

Domestic cats are adaptable and successful, with estimated 600 million world-wide. The USA has approximately 93 million owned pet cats, and several tens of millions of un-owned cats that are free-roaming, living either around humans or totally feral. Forces that drive populations in nature are competition for shelter, food, and reproduction. Space vacuums are filled if the necessary elements are present. Available spaces usually are held by the species most able to survive. Roaming un-owned cats can create nuisance problems such as noise and odor. Resolving community complaints and cat health concerns requires considering several options: (a) removal with homing or euthanasia; (b) chemical sterilization; (c) sterilize and return to source area (TVNR – trap, vaccinate, neuter, return). Each method can be controversial in some situations; multiple approaches may be necessary. (a) Extirpation. Recognized corollary issues to extirpation are expense and public opinion. Additionally, species that could move into newly opened space must be considered. For example, while cats, red foxes, raccoons, coyotes, and rats have different life habits, often a given space may offer survival elements that could serve the needs of one or more of these wild species. (b) Chemical sterilization. Availability, government regulations, and environmental contamination are important impediments that can involve one or more state and federal agencies. (c) TVNR can offer significant advantages for area humans, if done properly. However, continuing controversy may result from cat hunting, especially in areas where endangered species are present. Can controversies associated with roaming cats be resolved? Elements of free roaming cat population control include: Public information on health-safety of cats, and bird protection. This first includes vaccinating, micro-chipping, and keeping pet cats indoors. Locating roaming cat populations, estimating numbers to define needed of effort. TVNR failures usually result from poor preparation. Records are needed to gauge progress and adjust effort. Actions that focus only on extirpation usually fail; the space remains and continuous effort is needed. However, near endangered species, some short-term rapid reduction of cat numbers may be needed. Environmental sanitation practices are public health issues also. Problem locations include dumpsters, alleys, household garbage, and restaurant districts: Rodents are food for cats, dogs, foxes, and raccoons. Inedible garbage trash can provide shelter and injury hazards. Expectations are lower cat numbers over time. Fewer kittens equate to less suffering. Human-fed cats reduce cat hunting behaviors, but feral cats and some fed cats continue hunting behavior. Fewer roaming cats lead to reduced urine spraying, odor, noise, and fighting.

9:30am
Rm 221

If a Space to Live Exists, Something Will Live There: Managing Free-Roaming Cats - II. Modeling studies

*Dennis Lawler [Southern Illinois University Edwardsville]

In Part I of this discussion, the problem of free-roaming cats was characterized. In Part II here, a mathematical modeling study of managing free-roaming cats is reported. Cat population management modeling studies often have had limited structure, presumably to avoid complex mathematics. In this study, we used a Monte Carlo simulation program (Vortex version 9.99B) and did not simplify the structure, in order to provide more biologically relevant outcomes. The model used stochastic simulations to compare outcomes among Trap-

Remove (TR), Trap-Neuter-Return (TNR), and two hypothetical methods of chemical contraception. These management approaches were compared in (1) large urban; (2) small urban; (3) rural settings. Each of these settings was defined in terms of population size and density, available resources (food, shelter), survival, connectivity via dispersal and immigration to other populations not being sterilized, and population additions by abandonment. The three population settings varied from high density, resources, and survival (large urban) to low density, more sparse resources, and lower survival. Unmanaged simulated populations could grow 18-20% annually. Restrictions in carrying capacity constrained long term population size. The model was used to evaluate responses to combinations of events. The most consistent findings across models were: TR more frequently led to population decline or elimination (but is unsuitable for several other reasons); sterilizing adults was more effective (probably because of naturally high kitten mortality); unchecked connectivity effectively buffered reductions of population size; under our assumptions, male sterilizations were less effective in lowering population size; continued abandonment was an important factor in maintaining population size; the TR option revealed a need to sterilize 30% of remaining intact cats at each of two yearly time steps, whereas TNR required 40% treatment; a 40% sterilizing rate for naïve cats resulted in 75% sterilization after a decade. The advantage of this work is that we included the full spectrum of demographic influences to achieve a more biologically relevant set of outcomes.

9:45am Grad Prevalence and Correlates of Dental Anxiety Among Western Illinois University Students

Rm 221

***Chukwuebuka Ogwo, Jamie Johnson [Western Illinois University]**

Dental anxiety is a subjective negative reaction to dental treatment. Fear of dental pain has been found to be the main cause of dental anxiety and a major barrier to seeking dental care. Dental anxiety has been linked to dental avoidance resulting in the deterioration of their oral health state. In severe cases of dental anxiety like the dental phobia, the dentist-patient relation may be hampered and sometimes lead to misdiagnoses. To determine the prevalence of dental anxiety, the common causes of dental anxiety and their relation to dental visit among Western Illinois University students. This is a cross-sectional study of 670 randomly selected students on both campuses of Western Illinois University. Two pre-formed questionnaires - Modified Dental Anxiety Scale (MDAS) and Dental Concern Assessment tool (DCA) were used for this study and were delivered electronically via Survey Monkey. Data collected were analyzed both descriptively and inferentially using SPSS version 23. The mean MDAS is 13.41 (SD 5.42) and a prevalence rate of 63.90%. The prevalence of extreme anxiety was 19.50%. Being female increases the odds of having extreme dental anxiety by 2.41. Multiple linear regression analysis showed the frequency of dental visit to be a significant predictor of dental anxiety ($p=0.002$; $CI=0.018-0.180$). There is a positive correlation between fear of dental cost and dental anxiety ($r=0.157$; $p=0.000$). There is a hidden burden of dental anxiety and a worrisome level of dental phobia among Western Illinois University students. Fear of pain and fear of dental cost were the among the major causes of dental anxiety in this population leading to the cost-pain cycle of dental anxiety. This can be addressed through oral health promotion campaigns, provision of dental insurance and preventive dental care in the school clinic and dental outreach services.

10:00am UG TWIST Regulates EMT Processes and Influences Salivary Gland Progression

Rm 221

***^{1,2}Mallory Wright, ²Luke Revelt, ²Kathryn Carter, ²Donald Reed, ²Adrianna Marcuzzi, Anita Joy [¹Southern Illinois University Edwardsville, ²Southern Illinois University School of Dental Medicine]**

The extracellular matrix is a network of proteins secreted by cells that forms a scaffolding for cells. It is also involved with many signaling pathways as it contains surface receptors to transduce signals into the cell. While the extracellular matrix normally regulates tissue development and homeostasis, its dysregulation contributes to neoplastic progression via excessive proliferation, death resistance, and remodeling towards EMT. Due to extracellular matrix's ability to promote cancer progression we seek to understand if placing normal salivary gland cells under the influence of a cancerous extracellular matrix leads to EMT through interactions with the extracellular matrix. Twist is a helix-loop-helix transcription factor, which has been associated with many types of epithelial cancers. Twist overexpression has been implicated in low differentiation, advanced clinical stage, metastasis, and recurrence of various cancers, including oral squamous cell carcinoma. Twist functions as a signal transducer and activator of mitogen-activated protein kinase, Ras, and Wnt signaling, processes that can result in increased proliferation and cancer progression. Our project seeks to evaluate Twist's involvement with the extracellular matrix in inducing EMT. Using a combination of routine immunofluorescence techniques and migration assays, we showed that under the influence of the cancer extracellular matrix, normal cells began to express EMT markers. Silencing of Twist enabled these markers to be decreased in cancer cells and also decreased the migratory capacity of cancer cells. We conclude that Twist could be regulated cancer progression

by enhancing expression of EMT markers and increasing cell migration, and silencing Twist could abrogate cancer progression by decreasing cell migration and eventual metastasis.

10:15am UG
Rm 221

Unique Cohorts of Cells within Salivary Gland Cancers Exhibit Aggressive Behaviors

*¹Callie Mincy, ²Kathryn Carter, ²Donald Reed, ²Adriana Marcuzzi, ²Anita Joy [¹Southern Illinois University Edwardsville, ²Southern Illinois University School of Dental Medicine]

In cancer metastasis, cells lose intercellular connections resulting in increased ability to migrate away from the primary tumor. Prior studies in our laboratory have shown that although salivary gland cancer cells break away from the primary tumor and exhibit higher migratory capacity, they do not migrate individually, but rather as distinct cohorts. Typically, migrating cancer cells lose cell-cell adhesion properties. However we hypothesized that although cancer cells lose their adhesive interactions from the primary tumor, the migrating cohort of cancer cells will over-express cell adhesion molecules to enhance 'stickiness' as they migrate as cohorts. This advancing cohort of cancer cells exhibits increased migratory behaviors that may promote the aggressiveness of certain cancers, making them more likely to metastasize. In addition to increased expression of cell adhesion molecules, we also hypothesized that EMT markers are conjointly upregulated in these cancer cell cohorts, thus enhancing their ability for rapid migration. We further speculated that these behaviors are controlled by the extracellular matrix of the cancer cells themselves, thus being self-regulatory to some extent. Using a combination of routine immunofluorescence techniques and western blotting, we showed that cancer cell cohorts uniquely re-expressed cell adhesion molecules that were typically downregulated in cancer cells. In addition, EMT markers were downregulated in these cohorts as compared to the cancer cells. Using a wound/gap closure two-dimensional migration assay, we showed that although cancer cells exhibit a significantly increased migration rate, the unique cohorts of cancer cells were far more aggressive. We conclude that within a given cancer cell population, there exists cohorts of cells, which behave as cohesive groups exhibiting aggressive migratory capacity. These cancer cell cohorts could potentially be the advancing cells during metastasis, and their presence could mean increased cancer progression associated with poor prognosis.

MICROBIOLOGY

10:45am Grad
Rm 209

Detection of Beta-lactamase Loci in Municipal Wastewater Samples

*Sunil Pandey, Audrey Rex, Muhammed Almalki, Kai Hung [Eastern Illinois University]

The occurrence and spread of antibiotic-resistant genes (ARGs) are pressing public health problems worldwide. A key factor contributing to the spread of ARGs is lateral gene transfer. Wastewater treatment plants (WWTPs) are measured hot spots of microbial diversity and resistance because they receive polluted wastewater from diverse sources and contain a variety of different environments with dense bacterial loads. Due to the man's overuse of antibiotics the genetic capacities of microbes have profited. This helps every source of resistance genes and every means of horizontal gene transmission to develop the multiple mechanism of resistance to each antibiotic used clinically, agriculturally, or by any other medium. In municipal wastewater plants, where gastrointestinal wastes from city residents co-mingle, the probability for lateral gene transfer events is greatly increased. In this study, we use PCR technique to detect four beta-lactamase loci to assess the prevalence of ARGs. Wastewater samples from municipal plant at different stages of treatment as well as water samples from the river upstream and downstream from the release site were collected, followed by total DNA extraction and purification. These were then used as templates in PCR-based detection of beta-lactamase (*bla*) resistance loci. Our data suggested that wastewater samples contain high level of impurity that suppresses PCR reactions. Further, our results showed the presence of 3 loci in influx wastewater but not in the effluent, nor in the river water samples. Up to now we can say there is no detectable levels of ARGs in WWTP effluent samples, upstream and the downstream rivers. These data are vital in understanding the role of WWTPs in contributing to the spread of antibiotic resistance in the environment. The project will continue to collect multiple samples at different stages of water treatment across seasonal changes to offer broader insight into the presence and prevalence of ARGs in municipal wastewater samples.

- 11:00am Grad Rm 209 Inhibition of the Protein Phosphatase Cpp1 Alters Development of *Chlamydia trachomatis***
 *Jae Claywell, Lea Matschke, Kyle Plunkett, Derek Fisher [Southern Illinois University]
Chlamydia are obligate, intracellular Gram negative bacterial pathogens that undergo an essential, but poorly understood, biphasic developmental cycle transitioning between the infectious elementary body and replicative reticulate body. Ser/Thr/Tyr phosphorylation has been increasingly recognized for its role in regulating bacterial physiology and *Chlamydia* encode two Hank's-type kinases, a type 2C protein phosphatase (PP2C; Cpp1), and appear capable of global protein phosphorylation. However, the physiological impact of protein phosphorylation remains enigmatic. In this study, we investigated the *in vivo* role of Cpp1, a PP2C with P-Ser, P-Thr, and P-Tyr substrate specificity, using recombinant protein point mutants and small molecule inhibitors. Recombinant Cpp1 (rCpp1) amino acid point mutants based upon missense mutations identified in *C. trachomatis* mutants with reduced plaque growth phenotypes were purified for *in vitro* enzyme assays. The rCpp1 point mutants exhibited reduced, but not complete loss of phosphatase activity towards pNPP and phosphopeptides. To more directly explore the importance of Cpp1 in chlamydial development, we implemented a chemical "knock-out" approach using derivatives of 5,5'-methylenedisalicylic acid (MDSA). Several MDSA derivatives significantly inhibited Cpp1 activity *in vitro* and reduced growth of *C. trachomatis* L2, *C. trachomatis* D, and *C. muridarum* in a cell culture infection model. Inhibition of *C. trachomatis* L2 growth was more pronounced when treated at earlier infection time points and removal of the inhibitors after 12 hours post infection did not rescue progeny production. Our *in vitro* data with rCpp1 point mutants and *in vivo* inhibition studies with MDSA derivatives revealed that altered Cpp1 activity reduces chlamydial growth and that Cpp1 function is likely crucial for early differentiation events. Collectively, our findings further support the importance of the protein phosphorylation network in chlamydial development and highlight the feasibility of designing more potent PP2C phosphatase inhibitors for *Chlamydia* and other pathogenic bacteria.
- 11:15am Grad Rm 209 Role of Fungal Volatiles and Diffusible Compounds Produced by *Trichoderma* on Plant Growth**
 *Shruti Ojha, Andrea Porras-Alfaro [Western Illinois University]
 Microbial volatile organic compounds (VOCs) play important roles in plants influencing their physiology and development. *Trichoderma* is well known for the production of signal molecules that influence the growth of plants and other fungi. The objective of this research was to compare the effect of different *Trichoderma* species obtained from soil and surface sterilized roots. Fungi were isolated across the USA and *Trichoderma* strains were identified using ITS rRNA, and tested on the dominant arid grass, *Bouteloua gracilis* (blue grama) in a closed chamber experiment. Volatiles emitted by different species of *Trichoderma* exhibited a wide range of effects on plant growth and development. *Trichoderma gamsii* (CK71) and *Trichoderma saturi* (CK1108) showed the greatest growth promoting abilities in *B. gracilis*, with a significant increase on seed germination, plant size, and root development compared to the controls. *Trichoderma* strains were also tested in direct contact germination experiments. The association of the fungi with plant roots was analyzed using microscopy. *B. gracilis* seeds inoculated with *Trichoderma* strains showed an increased root length and proliferation of lateral roots compared to the controls. Microscopy examination of stained roots revealed small round fungal-like structures in cortex and intercellular hyphal growth. *Trichoderma* high abundance in soils across multiple ecosystems as demonstrated by Illumina sequencing and culturing methods showed important ecological functions of these fungi as regulators of plant growth through multiple mechanisms. Future research will be conducted to evaluate factors that influence *Trichoderma*-plant interactions using different growth conditions (e.g. temperature and media).
- 11:30am Grad Rm 209 Using Flow Cytometry and Confocal Microscopy to Analyze Intracellular Infection Parameters Using a Model Prokaryotic - Eukaryotic System**
 *Jacob Miller, Susanne DiSalvo [Southern Illinois University Edwardsville]
CANCELLED Symbiosis is defined as an interaction of two or more organisms. When both parties benefit from this interaction, it is deemed mutualistic, when only one benefits at the cost of the other, it is parasitism. The line between mutualism and parasitism is a continuum that does not always manifest in static outcomes. One factor that plays a role in influencing symbiotic outcomes is the structure of the host and symbiont population. A big question in the field is how initial infections loads, long term population dynamics, and developmental processes impact symbiotic trajectories. This proposal aims to advance our understanding of how these parameters fluctuate and result in distinct outcomes using a promising and easily manipulatable symbiotic model system. Here, we study the interaction between *Burkholderia* bacteria and the social amoeba *Dictyostelium discoideum*. *Burkholderia* is a large genus, comprising species belonging to a pathogenic cluster and a plant beneficial

environmental (PBE) cluster. Three species belonging to the PBE group have been found to naturally infect *D. discoideum*; *B. agricola*, *B. haley*, and *B. bonniei*. *Burkholderia* infections may be beneficial or detrimental for their amoeba host depending upon context and symbiont genotype. Using fluorescently labeled *Burkholderia* cells from each species in combination with flow cytometry and confocal microscopy, we plan to interrogate the population dynamics of host and symbiont cells as well as capture critical steps in the infection cycle.

STEM EDUCATION

10:45am
Rm 221

Plant Science Learning Activities for Biomedical Students

*Jessica Lucas, Laxmi Sagwan, Shayla Gunn, Karen Renzaglia [Southern Illinois University]
Southern Illinois Bridges to the Baccalaureate is a National Institutes of Health program that prepares underserved community college students for success at four-year universities by providing them personalized mentorship, research experiences and social capital. Here we present learning activities specifically designed for these biomedical students that are aligned with the shared core competencies and concepts for undergraduate biology education outlined by the American Association for the Advancement of Science, American Society of Plant Biologists, Botanical Society of America, and National Science Foundation. To engage in the scientific process, select community college students participated in an eight-week summer research experience and preparatory lab class held at Southern Illinois University Carbondale (SIUC). Through plant-based lab activities, students learned the significance of positive and negative controls in experimental design and data analysis. The relationship between structure and function was explored through student-designed experiments on *Arabidopsis* seed coat mucilage. Students used quantitative reasoning to analyze light-microscopy data to compare different *Arabidopsis* genotypes. They then leveraged online gene expression and interactome data sets to interpret their results. Students progressively strengthened their scientific communication skills throughout the program by routine oral presentations and discussions of plant genetics in societal terms. Collaboration skills were emphasized throughout the program as students worked in groups on learning activities. Independence was fostered through individualized research projects that culminated in a capstone scientific poster presentation at the SIUC Summer Research Forum. Student perceived learning gains, as determined by the Classroom Undergraduate Research Experience survey (Lopatto, 2004), show increased interest in earning advanced degrees in biological science.

11:00am
Rm 221

Tying the Knot: Assessing Student Performance in a New 5-Semester Undergraduate Threaded Chemistry Curriculum

*Dana Morrone [St. Louis College of Pharmacy]
The St. Louis College of Pharmacy has generated a new 5-semester chemistry curriculum for our undergraduate students. This threaded curriculum begins in the freshmen year and culminates in a biochemistry course; each four-credit course consists of lecture and lab. Compared with traditional general and organic chemistry in undergraduate years 1-2, chemistry topics are approached in an idiosyncratic manner. In an effort to monitor our new curriculum, we utilize a collection of standardized exams. While ACS standardized exams are sufficient throughout the first four semesters of this curriculum, there was a need to develop an appropriate standardized biochemistry exam. Specifically, we are interested in students' ability to apply principles of chemistry in a biological context upon completing our biochemistry course. For this purpose, we developed a standardized biochemistry exam. This presentation will cover the development, implementation, and results of our threaded chemistry curriculum. The primary focus of this presentation is on our biochemistry course, its standardized exam, and surveys of student study habits. Specifically, we have found that upon completion of our new threaded chemistry curriculum, compared to our previous "traditional" curriculum, our students perform at an equal or better level on the standardized chemistry exams. Further, with the implementation of our novel biochemistry exam, we have a benchmark for monitoring pedagogical or student changes. Preliminary results of student performance as it relates to study habits are presented as well as the results of shifting the biochemistry course to place a greater emphasis on creative problem-solving. We have found our chemistry curriculum to be sufficient for pre-professional healthcare students and suggest it may be a model for others considering modifications in their chemistry curriculum.

11:15am Grad Using Modeling to Gain a Better Understanding of Chemistry Concepts

Rm 221

***Elisabeth Knierim [Southern Illinois University Edwardsville]**

High school students seemingly struggle to grasp chemical concepts and have a disconnect between their macroscopic experiences and what is occurring on submicroscopic level. In an attempt to help students visualize chemical phenomenon, modeling in the forms of 3-D simulations, 2-D drawings, physical models, similes and metaphors were utilized and studied during the course of two units for high school Honors Chemistry classes. Students completed pre-assessments before each unit, practiced various modeling techniques, and then took post-assessments. The pre and post-assessments were analyzed in tangent with the use of dependent t-tests. The data was further reviewed, by means of independent t-tests, to discern if there was a difference in effectiveness of modeling between male and female students. The preliminary data indicates modeling does have a positive impact on student growth in chemistry concepts and that there is no difference in the level of effectiveness of modeling between female and male students.

11:30am UG Introducing Microfluidics to Undergraduate Students using 3D printing

Rm 221

***Matthew Vangunten, Uriah Walker, Kyle Knust [Millikin University]**

Typically microfluidics are taught exclusively in graduate level courses since the equipment traditionally used is expensive including the use of a cleanroom to fabricate the devices. We demonstrate that through the use of 3D printed microfluidic devices we are able to bring microfluidics into undergraduate laboratories. Bringing microfluidics to undergraduate laboratories is achieved through the simplified method of fabrication required to make a 3D printed microfluidic device compared to methods currently used in a cleanroom. With 3D printing, a microfluidic device can be prototyped, printed, and have experiments done using them within hours making it ideal for teaching. Each device printed can be reused and are easily replaced if broken due to the low cost per print. Using the 3D printed devices we were able to demonstrate principles of microfluidics by showing laminar flow and displaying the parabolic flow of fluid inside of the channels.

11:45am UG Solid State Synthesis Educational Lab Development

Rm 221

***Killian L Tracey, Brian J Bellott [Western Illinois University]**

Solid state chemistry is an important rising field of chemistry responsible for important advancements in technology, medicine, and more. For example, liquid crystal display (LCD) screens are used for television, phone, and computer screens. They are more efficient and less expensive to produce. Despite the apparent need for solid state training, many universities and institutions are not establishing a more rigorous solid state education as a part of their undergraduate curriculum for a multitude of reasons (curriculum gridlock, lack of materials and/or equipment needed, etc.). This 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 an educational lab for undergraduate studies. Our goal is to develop an efficient synthesis of several different M_xQ_y combinations, where M is a transition metal and Q is either S, Se, or Te. The processes would be conducted by undergraduate students during the course of two three-hour teaching laboratories. Copper (II) Sulfide is the first solid state process to be developed, as it is known that CuS can be synthesized as crystals and copper and sulfur are elements with known physical and chemical properties. Elements are measured out in specific ratios (1:1, 1:0.8, 1:1.2, etc.), and for some trials, flux of potassium bromide and sodium bromide is added to lower the melting point of the elements to increase the vigor for the reaction. Loading vessels for the reactions are created using quartz tubing and acetone. The quartz tubes are heated to create round bottoms, several drops of acetone are added, and the rounded end of the tube is heated to create the graphene layer. Three layers of graphene are added to protect the components of the reaction while heating the tubes to seal them. Compounds are loaded into quartz loading vessel, sealed under vacuum with a methane-oxygen torch, and loaded into a computer-controlled furnace for one week. In the furnace, the compound is heated from room temperature to 520 °C over roughly two days and then cooled at a rate of 2.36 °C per hour. The slow cool rate of the furnace allows for the largest amount of reaction time so the crystals can form as large as possible. The results are examined and the process adjusted in order to evolve an educational lab with a high success rate.

ZOOLOGY

8:30am
Rm 001

Fluctuating Asymmetry, Corticosterone, and Lead Toxicity in Juvenile Birds of Prey

*¹Travis Wilcoxon, ¹Emily Mihalkanin, ¹Jessica Brinegar, ¹Shelby Chesko, ²Jane Seitz, ²Jacques Nuzzo
[¹Millikin University, ²Illinois Raptor Center]

Though multiple studies have explored the effects of stress on symmetrical growth in birds over short periods of time, there have been comparatively fewer long-term measurements of how stress affects asymmetrical growth, particularly in birds of prey. Fluctuating asymmetry (FA) is known to occur as a product of poor early-life conditions and experience with persistent stressors. One way to quantify stress in birds is to measure corticosterone (CORT) in feathers. Birds deposit CORT into their feathers when first growing the feathers as nestlings and also during molt, but they cannot deposit CORT after that feather is grown. We examined FA in juvenile birds, from four species, admitted to the Illinois Raptor Center for rehabilitation and concurrently measured CORT in feathers. We also measured levels of lead in the blood of each bird to explore a possible link between toxicology and stress or symmetrical growth. Finally, we explored additional downstream consequences, such as parasite prevalence in birds with varying degrees of asymmetry. We found that for juvenile birds, feather CORT showed a positive, linear relationship with asymmetry. However, there was no significant relationship between CORT and asymmetry in adult birds. Blood lead levels were significantly correlated with fluctuating asymmetry, and fluctuating asymmetry was a significant predictor of parasite prevalence for all species. Overall, our findings add to the existing body of evidence that early-life stressors can have long-lasting consequences for birds.

8:45am
Rm 001

Life History Patterns of the Illinois State Endangered Enigmatic Cavesnail, *Fontigens antroecetes*, Revealed Through Captive Breeding Under Simulated Cave Conditions

*¹Robert Weck, ²Nicole Linskey, ¹Olivia Tarantella [¹Southwestern Illinois College, ²Southern Illinois University Edwardsville]

The Enigmatic Cavesnail, *Fontigens antroecetes*, is a minute (2.5-4 mm) cave-limited species listed as state endangered in Illinois. The snail is known from only one cave in Illinois, Stemler Cave, and from 8 caves in the eastern Ozark ecoregion of Missouri. Very little is currently known about the snail's reproductive habits, embryological development, or growth rates. We attempted to gain basic life history information by breeding Enigmatic Cavesnails under simulated cave conditions in the laboratory. Adult snails were collected from Stemler Cave and held in aerated containers of cave water with one or two rocks from the cave stream. Containers of snails were housed in coolers set at 13°C, the average temperature of the cave stream. Three pairs of snails produced 49 embryos in captivity over the course of 26 weeks. All but one embryo were produced by just two snail pairs. Eggs were deposited singly, attached to the underside of rocks within small pits or crevices. Nearly 82% of embryos developed to hatching. Estimated development time ranged from 56.5 to 81 days with a mean of 70.7 days. Almost all lab hatched snails died before reaching adult size. Limited data on growth rates from surviving hatchlings suggest slow growth rates.

9:00am
Rm 001

Winter Diet of Short-eared Owls (*Asio flammeus*) in the Grand Prairie Region of Illinois, U.S.A.

*¹Tih-Fen Ting, ²Brian Washburn [¹University of Illinois Springfield, ²USDA National Wildlife Research Center]

The Short-eared Owl is a state-endangered species with an overlapping breeding and wintering range in Illinois. We investigated the diet of wintering Short-eared Owls in the Grand Prairie Region of Illinois within a landscape dominated by agriculture, an area where little is known about this species. For two winters, during January–March of 2016 and 2017, we collected owl pellets in conjunction with field surveys of wintering Short-eared Owls. We collected and analyzed a total of 379 intact pellets (246 in 2016 and 133 in 2017). Pellets obtained from both winters yielded the same average number of small mammal skulls (1.35 per pellet). Based on the skulls found in the owl pellets, we were able to readily identify six different species of small mammal, 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*). The meadow vole was the most common prey species, accounting for more than half of total prey items identified in each winter (60.8% in 2016 and 57.2% in 2017). Prairie voles were next with 19.6% in 2016, whereas northern short-tailed shrews increased by 12% in 2017. Our surveys of wintering owls covered a total of 3,086 acres in 2016 and 5,027 acres in 2017. There were 53% fewer wintering

Short-eared Owls observed during 2017 compared to 2016. This finding parallels our observation of fewer pellets over the same period. Relative abundance of wintering raptors usually synchronizes with fluctuations in prey densities, likely due to the high mobility of raptors outside of the breeding season.

9:15am
Rm 001

Grad Avian Use of Floodplain Forest Communities Along the Upper Mississippi River

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

Floodplain forests along the Upper Mississippi River System (UMRS) are known to provide valuable habitat for many species of migrating songbirds, including the Cerulean Warbler and other species of concern. The forested islands of the confluence region where the Illinois and Missouri Rivers join the Mississippi vary greatly in their structure and composition, providing a variety of habitats for migrating bird species. Past studies have shown the importance of vertical and horizontal habitat heterogeneity on bird diversity, but few have investigated how bird community composition differs with varying forest structure. Effective management and conservation of these lands by state and federal agencies requires that biologists understand patterns of species use of these different forest communities. The objectives of this study were (1) to discover how bird community composition varies among the floodplain forest communities along the Upper Mississippi River and (2) identify any species indicative of certain habitat types. Using a protocol developed through a partnership with the U.S. Army Corps of Engineers – St. Louis District, Audubon Center at Riverlands, and the Cornell Lab of Ornithology, 10 minute avian point count surveys were conducted from May 15 – June 30 at 95 sampling points located throughout the forested areas of the Upper Mississippi River floodplain. Data collected during the 2017 surveys were added to point count data from the 2015 and 2016 survey seasons. An invaluable tool developed by the U.S. Army Corps of Engineers' forestry division, the Forest Management Geodatabase (FMG) was used to analyze structural complexity and vegetation characteristics at each avian point count site, including canopy height, total basal area, tree species richness, and understory height. Non-metric multidimensional scaling (NMDS) was used to summarize the pattern of avian community composition among sites and analysis of similarities (ANOSIM) was used to test for differences in avian communities among forest types. Indicator species analysis (ISA) was used to identify bird species that characterized each forest type. While NMDS results suggest a high degree of overlap overall between bird communities in different forest structure categories, ANOSIM and ISA identified species that occur significantly more often in forest stands possessing certain structural features. Results showed a number of species known for residing high in the canopy, such as Warbling Vireos and Tennessee Warblers, were utilizing forest stands with an average canopy height less than 30 feet. This suggests a potential plasticity of habitat use in Neotropical migrants in the UMRS and carries many implications for future conservation.

9:30am
Rm 001

Grad Comparison of Resource Utilization in a Native Versus a Headstarted Population of Ornate Box Turtles, *Terrapene ornata ornata*, in Northern Illinois

*Kassandra Karssen, Peteer 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 the LMSP to increase the population. This involves hatching and raising OBT's for at least a year so that they are larger and less vulnerable when released. The objectives of my research were to locate and collect data on both wild born and headstart turtles to see if headstarting is a viable way to increase their population. I hypothesized that headstarted individuals are just as successful as wild born individuals in aspects such as survival and seasonal growth. This assumes they are foraging successfully and surviving in the wild. During my study, I collected data on carapace length, plastron length, weight, number of growth rings, and sex. By collecting these data at the beginning and end of the field season I was able to calculate growth rates for turtles of known ages, survivability, and also make comparisons between headstart individuals and wild individuals. Growth rings were found to be useful in determining if the individuals were an adult or subadult or wild born versus headstart but not for determining age. Upon analysis of the data collected, growth amongst individuals showed no significant difference in wild born versus headstarted turtles, however there is a difference in home range size. Vegetation data did not show a distinct preference in cover composition, rather it indicated that there are at least three types of vegetation composition that are utilized. The results of this research will provide valuable information to guide headstart efforts for other threatened species of turtles in the United States and throughout the world.

- 9:45am Rm 001 Grad Developing a Plasma Lipid Metabolite Index for Canvasbacks**
 *¹Andrew Bouton, ¹Eric J. Smith, ¹Christopher N. Jacques, ²Heath M. Hagy, ³Michael J. Anteau, ⁴Randy V. Smith [¹Western Illinois University, ²U.S. Fish and Wildlife Service, ³U.S. Geological Service, ⁴Illinois Department of Natural Resources]
 The canvasback (*Aythya valisineria*) is a wetland-obligate species that is dependent on submerged aquatic vegetation (SAV), namely tubers, moist-soil seeds, and aquatic invertebrates. Since the 1950s, fluctuations in canvasback populations may be due, in part, to changes in wetland quality and abundance at migration stopover sites and wintering areas. Wetland loss and degradation can lead to declining food resources, which in turn has direct implications for migratory waterfowl. Thus, a need to provide high-quality habitat for wetland-obligate species is paramount for management and conservation efforts. As such, a greater understanding of the fate of acquired nutrients (e.g., catabolized or accumulated) as lipid reserves may be useful in assessing habitat quality of key migration stopover areas for large-bodied diving ducks like canvasbacks. Plasma metabolites can be useful to index daily mass change in wild birds. It is important to understand lipid-reserve dynamics in migrating birds for habitat assessment and conservation. Studies on small passerines and lesser scaup have shown that plasma lipid metabolites (triglyceride, beta-hydroxybutyrate) can be used to estimate short term mass changes. We developed an index of the relationship between plasma lipid metabolite levels and daily mass change by capturing canvasbacks on Pool 19 of the Mississippi River and conducting feeding and fasting trials on 60 individuals (15 males and 15 females each) during March 2017. Our index predicted 77% of the variation, with triglycerides being positively correlated and beta-hydroxybutyrate being negatively correlated with mass change (daily mass change = $-130.22 + 52.62(\text{TRIG}) - 81.17(\text{BOHB}_{\text{in}})$). Our index can be used to predict changes in lipid reserves of wild canvasbacks and indicate quality of forage at stopover areas.
- 10:00am Rm 001 Grad Estimating Density of Bobcats in Midwestern Landscapes Using Spatial Capture-Recapture Models**
 *Edward Davis, Christopher Jacques [Western Illinois University]
 A variety of increasingly sophisticated methods are available for estimating population density from capture-recapture studies. Among these, spatial capture-recapture (SCR) models provide a rigorous analytical technique for inference that extends standard closed population models to include a spatially explicit model by accounting for the distribution of individuals in space. Spatial capture-recapture models rely on spatial information readily available with camera data and use distance between traps and animal activity centers to model spatially explicit (i.e., camera trap) encounter probabilities and have been used in population density estimation for a range of carnivores. We used Bayesian analyses to evaluate the utility of SCR models for estimating density of bobcats in an agriculturally dominated landscape of west-central Illinois. We defined the continuous state space by overlaying the trap array on a square region extending 5 to 20 km beyond camera traps in each cardinal direction. We deployed 50 camera stations over a 77-day period from 1 February–18 April 2017. We captured 23 uniquely identifiable bobcats 115 times and recaptured these same individuals 92 times. Our analysis revealed a slight effect on the posterior distribution of density for the 5-km continuous state-space model, though posterior summary statistics for the 10-km, 15-km, and 20-km continuous state-space models were similar. Densities ranged from 1.44–1.57 bobcats per 100 km² with a 95% posterior interval of 1.07 to 1.90. Variation in the state-space extending beyond trap arrays affect bobcat density estimates and should be sufficiently large to minimize encountering individuals with activity centers (i.e., home ranges) beyond the state-space boundary. Increased size of home ranges of bobcats across Midwestern landscapes may necessitate the use of relatively coarser survey grids in SCR models to account for frequent movements to and from the state space or whose core areas are positioned beyond camera survey unit boundaries.
- 10:15am Rm 001 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 three behaviors, righting response, trot-swimming and jumping, 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. To further support this theory we gathered similar studies using anurans and mapped handedness characteristics.

10:45am Grad Marsh Bird Use of Wetlands Managed for Waterfowl in Illinois

Rm 001

*¹Therin Bradshaw, ¹Christopher N. Jacques, ²Heath M. Hagy [¹Western Illinois University, ²U.S. Fish and Wildlife Service]

Wetland management in the Midwest is often used to increase energetic carrying capacity for waterfowl, primarily dabbling ducks. Other conservation initiatives encourage multi-species design and management, but often waterfowl are a primary focal group. It is widely assumed that waterfowl management activities benefit other birds, but few studies have quantified those benefits or evaluated tradeoffs among management strategies for multiple species. A key assumption of several conservation planning documents is that waterbird (e.g., shorebird, secretive marsh bird) habitat and population objectives can be accomplished by fulfilling waterfowl habitat objectives (e.g., shorebirds and waterbirds). However, few researchers have examined the relationship between wetlands managed for waterfowl and the provision of habitat for other migratory birds, especially in the breeding season. In fact, the Illinois Department of Natural Resources Wetlands Campaign identifies the “contribution of moist-soil management to wildlife objectives” as an important information gap which requires additional research. Overall, marsh birds are an understudied guild of wetland-associated species that can be valuable indicators of wetland health and condition. As wetlands have declined in Illinois, likely so have marsh birds due to habitat loss. Wetlands managed for other species (e.g., dabbling ducks) have the potential to provide benefits to marsh birds collectively or a subset of species (e.g., rails). For this project, we determined marsh bird use across a wide range of wetland types (e.g., emergent, non-vegetated, riparian), hydrologic regimes (e.g., temporary, seasonal, semi-permanent), management practices (e.g., active, passive, unmanaged), and past disturbance regimes (e.g., natural and restored, impounded and unimpounded) in Illinois during late spring and early summer of 2015, 2016 and now 2017. Our objectives are to 1) compare marsh bird use of wetland impoundments managed for waterfowl across a continuum of management intensities and strategies to predict how these actions can increase use by both groups, 2) compare marsh bird use of restored and natural wetlands, and 3) determine characteristics of wetlands and the surrounding landscape that influence marsh bird use of restored wetlands. Additionally, we surveyed marsh birds using the standard protocols on wetlands concurrently surveyed within the Illinois Critical Trends Assessment Program (CTAP) for comparison of methodologies.

11:00am Grad Stream Gradient Morphological Variation in the Pectoral Fins of Sculpin

Rm 001

*Ben Wedeking, Paul Brunkow [Southern Illinois University Edwardsville]

The pectoral fin of sculpin (Scorpaeniformes: Cottoidea) is a highly derived and specialized structure in both marine and freshwater species, configured so as to provide superior anchoring ability in fast water environments. A recent study in marine species found significant morphological variation to be correlated with hydrodynamic demands associated with various near shore habitats. However, no such comparisons exist among or within freshwater species to our knowledge. The River Continuum Concept predicts changes in hydrologic environment along a headwater-to-tailwater gradient in streams and rivers, and the purpose of the present work is to describe morphological variation in pectoral fins in mottled sculpin (*Cottus bairdii*) along a gradient in the Meramec River of east-central Missouri. Mottled sculpin were collected by electrofishing and preserved in the field from three sites representing an upstream-to-downstream gradient. One pectoral fin was dissected from each specimen and photographed in a relaxed, fully extended state. Using ANCOVA with standard length as a covariate, there was no significant difference between sites in pectoral fin height. However, size-adjusted total fin area and fin aspect ratio did differ significantly among sites, with the upstream site having the lowest values. The downstream site had the smallest relative ventral fin area (the area of the fin that may be the most functionally significant with respect to station holding) after controlling for both standard length and total fin area. These preliminary results

suggest that there may be functional morphological variation within a freshwater sculpin species along a stream gradient that aligns with interspecific variation already documented.

11:15am Grad
Rm 001

The Impact of Color on Longear Sunfish (*Lepomis megalotis*) Behavior

*Malina Przygoda, Anabela Maia [Eastern Illinois University]

When present, coloration is the dominating factor for mate choice, ranking higher than size and mating display. Since conspecific coloration is such a key importance, this study is on the bias of Longear Sunfish (*Lepomis megalotis*) toward the specific colors found of their own species. As an example of color bias, carotenoids often produce an attractive red, yellow, or orange color, and are also correlated with better immune health and antioxidants. Since the healthier the mate, the higher chances the offspring have to survive, there is an evolutionary advantage in choosing the right mate. It is hypothesized that in brightly colored fish such as the Longear Sunfish, where females choose colorful males and males compete amongst each other for females, specific cues and patterns of color will elicit different biases when involved in conspecific interaction. We photographed a brightly colored Longear Sunfish male and manipulated the image to filter different color channels: red, blue and yellow. We also traced the image and created conspecific, single colored shapes of red, blue, and yellow. We then tested ten *L. megalotis*, one at a time, placing them in a tank where one of the seven random conspecific images (control, red shape, blue shape, yellow shape, red image, blue image, or yellow image) was shown on the left or right side of the tank (randomized by flipping a coin) and distance of the fish from the image was recorded. Control experiments were performed with a full color printed photograph of the brightly colored male. In the control trial, males reacted by moving over two-thirds of the tank length away from the image. Our data shows that there are significant differences between the trials with the image of the original conspecific coloration (control) and with the filtered images and shapes. The males tend to create more space between themselves and the control conspecific image than with the filtered images. However, they created more distance between themselves and the red shape than they did with the control. Individuals were not a predictor of the distance to the image presented. This shows that there was a strong negative bias towards that of the red color, which indicates that males are cuing in visually on the red coloration as a sign of dominance, thus causing the fish to distance itself from the image.

11:30am UG
Rm 001

Effects of Rehabilitation Setting on Stress Physiology in Red Tailed Hawks (*Buteo jamaicensis*), Cooper's Hawk (*Accipiter cooperii*), Great Horned Owls (*Bubo virginianus*), and American Kestrels (*Falco sparverius*)

*¹Courtney Olson, ¹Travis Wilcoxon, ²Jacques Nuzzo, ²Jane Seitz [¹Millikin University, ²Illinois Raptor Center]

In rehabilitation situations, the environment in which the rehabilitation occurs is known to play an important role in success. Ideally, the chosen rehabilitation setting will decrease recovery time and decrease stress. We assessed the effects of two different rehabilitation settings on time to release and stress physiology in birds of prey admitted to the Illinois Raptor Center from January 2014 to December 2017. The use of white blood cell differential such as heterophil-to-lymphocyte ratios is a well-supported method for assessing stress. We analyzed blood smears via microscopy, counting each heterophil and lymphocyte within 50 fields or until a combined 50 cells were counted. We hypothesized that birds in open-air cages will be less stressed than birds in slatted and dark cages, and thus, have greater reductions in heterophil to lymphocyte ratio (H:L) from admission to release. Cage type did not have an effect on H:L, which did not support our hypothesis. We also hypothesized that birds housed in the cages with slatted interior walls will have shorter lengths of stay. While H:L was not affected, our results demonstrate that birds at the Illinois Raptor Center spent less time in recovery in the slatted cages, supporting our hypothesis. Overall, this study reveals the importance of reducing feather damage for timely release of rehabilitated birds and that a cage designed to reduce feather damage does not influence stress physiology of the bird.

11:45am UG
Rm 001

The Effects of Environmental Coloration on Spatial Learning in Male Lab Mice (*Mus musculus*)

*Erica Marquez, Victoria Livingston [Western Illinois University]

This study is a correlation research study to determine differences in the effect of environmental variables on the spatial awareness of mice. The effect of colored environments has an unclear impact on the spatial awareness of lab mice. The results of this study may impact mouse husbandry both in the pet and laboratory sectors. Three groups of 10-week-old male lab mice with six mice in each group were procured from the lab mice colony at Western Illinois University. The control group (C1) was placed in all white and beige environment. The second

control group (C2) was placed in an all-black environment. The experimental group (EG) was placed in an all colored environment. At 14 weeks old the mice began to run trials through the maze once a week and their progress was tracked. C1 ran the maze most effectively with the lowest average times and faults consistently. There were no notable behavioral changes from standard lab mice behavior in this group. They demonstrated ease in their environment and appeared to be in acceptable overall health. C2 was the second most effective group. They learned the maze with more faults but still showed consistent improvement over time. The mice in C2 were more skittish and hid more often than the C1 group but still were overall comfortable in their environment. EG had poor maze times when compared to the other groups and a significantly higher number of faults. Violent behavioral changes were noted in the experimental group in addition to the inferior maze times. The mice in EG were aggressive and often wounded over territorial disputes. They were much smaller compared to the other groups and showed signs of alopecia. This was correlated to an increase in stress and resulted in inferior performance. The conclusion based on the data is that the color of the environment is affecting the maze times. Future research will continue to examine the correlation of environmental variables and their impact on spatial awareness.