TRANSACTIONS OF THE ILLINOIS STATE ACADEMY OF SCIENCE

Supplement to Volume 112

111th Annual Meeting
April 5 – 6, 2019

Bradley University
Peoria, Illinois

Illinois State Academy of Science

Founded 1907

Affiliated with the Illinois State Museum
Springfield, IL

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111th ISAS Annual Meeting

April 5 – 6, 2019
Bradley University
Host: Jennifer Jost

MEETING SCHEDULE

Friday, April 5th

- 12noon – 2:00pm ISAS Council Meeting (Executive Suite, Basement, Michel Student Center, lunch provided)
- 1:00pm – 5:30pm Registration (Olin Hall 1st Floor Foyer)
- 2:00pm – 2:15pm Session A (odd numbers) *Poster set-up* (Olin Hall 1st & 2nd Floor)
- 2:15pm – 3:45pm Poster Session A (Olin Hall 1st & 2nd Floor)
- 3:45pm – 4:00pm Session A *Poster take-down* (Olin Hall 1st & 2nd Floor)
- 3:45pm – 4:00pm Session B (even numbers) *Poster set-up* (Olin Hall 1st & 2nd Floor)
- 4:00pm – 5:30pm Poster Session B (Olin Hall 1st & 2nd Floor)
- 5:30pm – 5:45pm Session B *Poster take-down* (Olin Hall 1st & 2nd Floor)
- 6:30pm – 7:30pm Dinner Banquet (Peplow Pavilion, 3rd Floor, Hayden-Clark Alumni Center)
- 7:30pm – 9:00pm Keynote Address – Craig Cady (Peplow Pavilion, 3rd Floor, Hayden-Clark Alumni Center)

Saturday, April 6th

- 8:00am – 9:00am Continental Breakfast (Olin Hall, 1st Floor Foyer)
- 8:00am – 12:00noon Registration (Olin Hall 1st Floor Foyer)
- 9:00am – 11:40am Oral Presentations Begin (Olin Hall, Rooms 024, 149, 164, & 245)
  Coffee Breaks depending on Division (see Oral Presentation Schedule)
- 11:40am – 12:00noon Divisions Meetings and Judging Results (Olin Hall, Rooms 024, 149, 164, & 245)
- 12:15pm – 2:00pm Luncheon & Awards Presentations (Michel Student Center Ballroom, 2nd Floor)

CAMPUS MAP – BUILDING & PARKING INFORMATION

On the map to the right, **X** marks the spot.

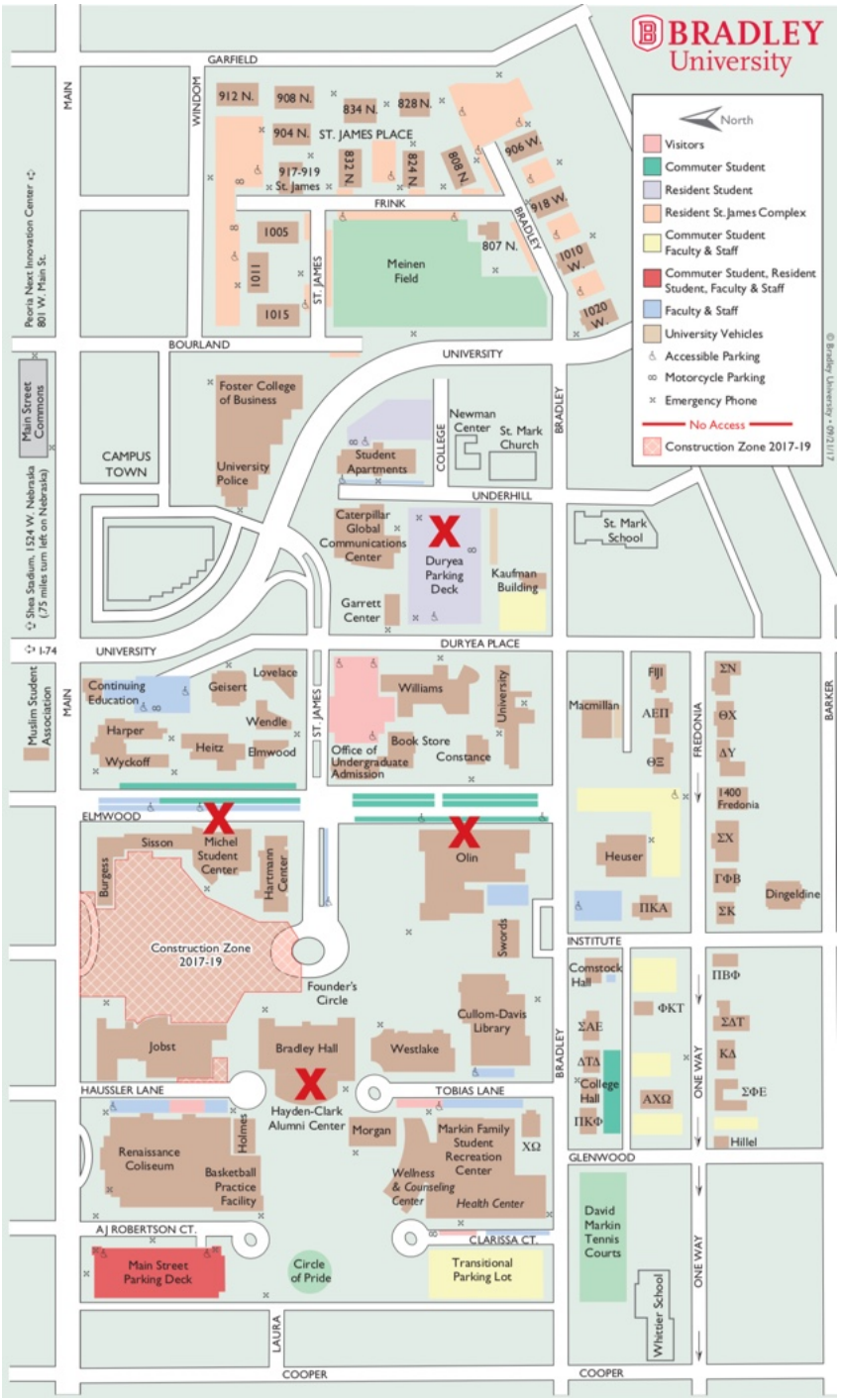
X Duryea Parking Deck
- Friday reserved parking

X Michel Student Center
- Friday ISAS Council Meeting
- Saturday Luncheon and Awards Presentation

X Olin Hall
- Registration both Days
- Poster Presentations on Friday
- Oral Presentations on Saturday

X Hayden-Clark Alumni Center

Peplow Pavilion
- Friday Dinner Banquet and Keynote Address



Parking on Friday
- Reserved parking is available in the Duryea Parking Deck (indicated with red **X** on map) located at 814 N. Duryea Place, Peoria, IL 61625.
- The entrance to the garage is at the northwest corner of the deck (on N. Duryea Place).

Parking on Saturday
- You may use any open spot in any Bradley lot on campus on Saturday.

POSTER PRESENTATION SCHEDULE – FRIDAY, APRIL 5, 2019

All Poster Presentations in the Olin Hall – 1st & 2nd Floor

Session A – 2:15-3:45pm – Odd Numbers				Session B – 4:00-5:30pm – Even Numbers			
#	**Division**	**#**	**Division**	**#**	**Division**	**#**	**Division**
1	Anthro & Archaeology	61	Environmental Science	2	Anthro & Archaeology	62	Environmental Science
3	Anthro & Archaeology	63	Environmental Science	4	Anthro & Archaeology	64	Environmental Science
5	Botany	65	Health Sciences	6	Botany	66	Health Sciences
7	Botany	67	Health Sciences	8	Botany	68	Health Sciences
9	Cell Biology	69	Microbiology	10	Cell Biology	70	Microbiology
11	Cell Biology	71	Microbiology	12	Cell Biology	72	Microbiology
13	Cell Biology	73	Microbiology	14	Cell Biology	74	Microbiology
15	Cell Biology	75	Microbiology	16	Cell Biology	76	Microbiology
17	Cell Biology	77	Microbiology	18	Cell Biology	78	Microbiology
19	Cell Biology	79	Microbiology	20	Cell Biology	80	Microbiology
21	Cell Biology	81	Microbiology	22	Cell Biology	82	Physics, Math, & Astronomy
23	Cell Biology	83	Physics, Math, & Astronomy	24	Cell Biology	84	Physics, Math, & Astronomy
25	Cell Biology	85	Physics, Math, & Astronomy	26	Cell Biology	86	Physics, Math, & Astronomy
27	Cell Biology	87	Physics, Math, & Astronomy	28	Cell Biology	88	Physics, Math, & Astronomy
29	Chemistry	89	Physics, Math, & Astronomy	30	Chemistry	118	Physics, Math, & Astronomy
31	Chemistry	91	Zoology	32	Chemistry	90	STEM Education
33	Chemistry	93	Zoology	34	Chemistry	92	Zoology
35	Chemistry	95	Zoology	36	Chemistry	94	Zoology
37	Chemistry	97	Zoology	38	Chemistry	96	Zoology
39	Chemistry	99	Zoology	40	Chemistry	98	Zoology
41	Chemistry	101	Zoology	42	Chemistry	100	Zoology
43	Chemistry	103	Zoology	44	Chemistry	102	Zoology
45	Chemistry	105	Zoology	46	Earth Science	104	Zoology
47	Environmental Science	107	Zoology	48	Environmental Science	106	Zoology
49	Environmental Science	109	Zoology	50	Environmental Science	108	Zoology
51	Environmental Science	111	Zoology	52	Environmental Science	110	Zoology
53	Environmental Science	113	Zoology	54	Environmental Science	112	Zoology
55	Environmental Science	115	Zoology	56	Environmental Science	114	Zoology
57	Environmental Science			58	Environmental Science	116	Zoology
59	Environmental Science			60	Environmental Science		

Session A: Poster set-up, 2:00-2:15; Poster take-down, 3:45-4:00
Session B: Poster set-up, 3:45-4:00; Poster take-down, 5:30-5:45

ORAL PRESENTATION ROOM SCHEDULE – SATURDAY, APRIL 6, 2019

All Oral Presentations in Olin Hall

	Room 164	Room 149	Room 245	Room 218
9:00am	Cellular Biology	Environmental Science		
9:20am	Cellular Biology	Environmental Science	Microbiology	Zoology
9:40am	Cellular Biology	Environmental Science	Microbiology	Zoology
10:00am	**BREAK**	**BREAK**	Microbiology	Zoology
10:20am	Cellular Biology	Environmental Science	**BREAK**	**BREAK**
10:40am	Cellular Biology	Environmental Science	Health Sciences	Agriculture
11:00am	Cellular Biology	Environmental Science	Health Sciences	Botany
11:20am	Cellular Biology	Environmental Science	Computer Science	Botany
11:40am	**Division Meeting**	**Division Meeting**	**Division Meeting**	**Division Meeting**

ABBREVIATIONS USED IN PROGRAM

Division Abbreviations

Cellular Biology	Cellular, Molecular, & Developmental Biology

Participant Abbreviations

UG	Undergraduate Student
Grad	Graduate Student
None	Regular/Faculty Member

School and Organization Abbreviations

BioEco	BioEco Research & Monitoring Center
Bradley	Bradley University
EIU	Eastern Illinois University
Eureka	Eureka College
GSU	Governors State University
IC	Illinois College

Millikin	Millikin University
SIU Dental	Southern Illinois University School of Dental Medicine
SIUe	Southern Illinois University Edwardsville
UIUC	University of Illinois (Champaign/Urbana)
Wesleyan	Illinois Wesleyan University
WIU	Western Illinois University

POSTER PRESENTATIONS – FRIDAY, APRIL 5, 2019 – OLIN HALL, 1ST & 2ND FLOOR

Presentations with Co-Presenters denoted by *

Time	#	Presenter	Title of Presentation (Posters)
		Anthropology & Archeology	
2:15PM	**1**	Miguel Tellez (IC, UG)	Estimating Sex Using Human Growth Study Cephalograms
4:00PM	**2**	Brenna Garland (IC, UG)	Geometric Morphometric Analysis of the Human Mental Eminence: Development and Sexual Dimorphism
2:15PM	**3**	Megan Price (IC, UG)	*Homo sapiens* Nasal Aperture Shape
4:00PM	**4**	Lauren Estes (IC, UG)	Scoring External Occipital Protuberance Prominence in Extant Human Growth Study Cephalograms
		Botany	
2:15PM	**5**	Taylor Wise (SIUe, Grad)	Survey for Allelochemicals in Soils beneath Native and Non-Native Shrubs
4:00PM	**6**	Monica Berviller (SIUe, Grad)	Allelopathic Potential of Fresh Leaf Extracts from Japanese Hop (*Humulus japonicus*)
2:15PM	**7**	Erin Siekmann (EIU, Grad)	A Simplified System for Studying Sunflower Roots Architecture
4:00PM	**8**	Sara A. Johnson (UIUC, Grad)	Effect of Soluble Salt on the Germination of *Thuja occidentalis*
		Cell, Molecular, & Developmental Biology	
2:15PM	**9**	Erica Periandri (SIUe, UG)	Identification of the Causative Mutant Locus in *Gravity Persistent Signal 5*
4:00PM	**10**	MacKenzie Scroggins (EIU, UG)	Genomic Dysregulation by Overexpression of Transcription Factors
2:15PM	**11**	Viet Bui (EIU, Grad)	Xylan Metabolism by *Caulobacter crescentus*
4:00PM	**12**	Kevin Krajniak (SIUe)	The Effects of Lumbricus 1 and Oxytocin on the Same Isolated Earthworm Crop-Gizzard
2:15PM	**13**	Nadh Alsubaie (EIU, Grad)	The Transcriptional Response of White-Rot Fungi to Plant Biomass
4:00PM	**14**	Sarah McMillan (Bradley, UG)	Exploring the Role of Trehalose and Trehalose-6-Phosphate Synthase in Oxidative Stress Response in *Fusarium verticillioides*
2:15PM	**15**	Kelsey Roberts (WIU, UG)	The Effects of Heavy Metal Pollution on DNA Expression of *Spirodela polyrhiza* in the Mississippi River
4:00PM	**16**	Haley Hardtke (Bradley, UG)	Exploring the Effects of Phenolic Compounds and Oxidative Stressors on *Fusarium verticillioides*
2:15PM	**17**	Linus Amante (SIUe, UG)	The Gravitropic Response in Arabidopsis *phototropin 1* and *phototropin 2* Mutants
4:00PM	**18**	Jaclyn Conway (Bradley, UG)	Development of a Novel Nerve Damage Treatment
2:15PM	**19**	Jackie Spathies (EIU, UG)	Uridine Promotes Neurite Outgrowth in Neuro2a Cells
4:00PM	**20**	Haley Gula (SIU, Grad)	Tying Together Genetic and Physical Maps of *Schizophyllum commune* to Locate the *mnd* Gene
2:15PM	**21**	Eric Huntemann (IC, UG)	Investigating the Role of the Cornea Stroma During *X. laevis* Lens Regeneration
4:00PM	**22**	Jordyn Grawe (SIUe, Grad)	The Potential Involvement of *Berberine Bridge Enzyme-Like* Genes in *Arabidopsis thaliana* Leaf Development
2:15PM	**23**	Kyle Warnecke (SIUe, UG)	A CRISPR/Cas9 Approach to Target a Critical Region of the *GGPPS11* Gene in *A. thaliana*
4:00PM	**24**	Molly Smith (SIUe, UG)	Inducing Mutations in the GGPPS Family of *Arabidopsis thaliana* Using CRISPR/CAS9
2:15PM	**25**	Abby Brown (SIUe, UG)	The Impact of Light Intensity on Chlorophyll levels in the ggpps11-1 Mutant of *Arabidopsis thaliana*

Time	#	Presenter	Title of Presentation (Posters)
4:00PM	**26**	Derik Rickher (SIUe, UG)	Restoration of Wild-Type Phenotype in Variegated ggpps-11 *Arabidopsis thaliana* Using GGPPS Localization from Outside Chloroplast
2:15PM	**27**	Derick Isaac Lamptey (EIU, Grad)	In the Heat of the Moment: Physiological Tradeoffs of Fishes Living in Warming Waters
4:00PM	**28**	Rajeev Roy (WIU, Grad)	Expression of a Hemagglutinin Targeting Peptide on Modified Coat Protein VIII of Fd-tet Phage
		Chemistry	
2:15PM	**29**	Darby Duffy (WIU, UG)	Concentrations of Antioxidants in Tea
4:00PM	**30**	Deanna P. Valdebenito (WIU, Grad)	How Changing Different Variables in Foam Synthesis Affects its Cell Morphology
2:15PM	**31**	Hailemariam Mitiku (Bradley, UG)	Cloning and Expression of a Human Gene for Keratin, a Fibrous Protein, in Yeast
4:00PM	**32**	Airelle Alejandre (WIU, UG)	Synthesis of Metal Chalcogenide Materials for Energy Applications
2:15PM	**33**	Schaefer Roach (WIU, UG)	Synthesis of Iron Telluride
4:00PM	**34**	Katelyn Nemeth (WIU, Grad)	Synthesis of Silver Nanoparticles with Capping Agents with Different Capping Agents
2:15PM	**35**	Adeola Adesoro (WIU, Grad)	Mechanistic Investigations of Oxidation of Doubly Vinylic Alcohols Using Water-Soluble *o*-Iodoxybenzoic Acid (IBX) Derivatives
4:00PM	**36**	Rebecca Haughey (WIU, Grad)	Determination of Phosphate and Nitrate Concentration in Soil and Water Samples
2:15PM	**37**	Terrence Petry (WIU, Grad)	Quantitative Analysis of Limonene Content in Citrus Oil by Gas Chromatography Using Acetophenone as the Internal Standard
4:00PM	**38**	Dalton Moss (WIU, UG)	Total Flavonoid Concentration in Tea
2:15PM	**39**	Alexandra Brisbin (WIU, Grad)	Quantitative Analysis of the Organic Explosive HMX in Water by High Performance Liquid Chromatography with Ultraviolet Detection
4:00PM	**40**	Tiwalola Ogunleye (WIU, Grad)	Quantification of Naproxen in Equine Plasma for Doping Control in Horse Racing using High Performance Liquid Chromatography with UV Detection Coupled with Strong Anion Solid Phase
2:15PM	**41**	Frank Lin (WIU, Grad)	Quantification of Phenylbutazone in Equine Plasma for Doping Control in Horse Racing using Strong Anion Exchange Solid Phase Extraction Followed by Liquid Chromatography with UV Detection
4:00PM	**42**	Saamia Salik (Millikin, UG)	Chemically Enhanced Sedimentation to Remove Phosphorus from Wastewater
2:15PM	**43**	Kyle Murphy (Grad, WIU)	Synthesis of AAk_2SnQ_4X
4:00PM	**44**	Sirikarn Phuangthong (IC, UG)	Synthesis of Air-Stable Ruthenium and Nickel Catalysts
2:15PM	**45**	Madeleine Peterson (Bradley, UG)	Regioselectivity, Chemoselectivity, and Stereoselectivity in Organic Chemistry
		Earth Science	
4:00PM	**46***	Jacob Watson (EIU, UG)	Pier Scouring
		Environmental Science	
2:15PM	**47**	Jenny Le (EIU, UG)	Ideal Compost and Peat Moss Mix for Best Plant Growth & Soil Nutrients
4:00PM	**48**	Brady H. Burden (SIUe, UG)	Modeling Potential Lead Exposure Sources to Mexico City Children
2:15PM	**49**	Jannatul Ferdous (SIUe, Grad)	Comparing Spatial Patterns of Heavy Metal Concentrations in Soil to Sources and Demographics across Madison and St. Clair Counties (Illinois, USA)
4:00PM	**50**	Victoria Hyrczyk (Bradley, UG)	The Effects of Topical Application of 5-HTP on Aggressive Behaviors in the Stalk-Eyed Fly, *Teleopsis dalmanni*

Time	#	Presenter	Title of Presentation (Posters)
2:15PM	51	Tyler Columbara (SIUe, UG)	Bioaccumulation of Selenium, Mercury, and Arsenic in Fish Fillets from the Midwestern Market: Elemental Interactions for Human Health
4:00PM	52	Tochukwu Ekwonna (SIUe, Grad)	Remediation of Selenium-Contaminated Wastewater Using Municipal Biosolids and Drinking Water Treatment Residuals
2:15PM	53	Nicholas Wells (SIUe, Grad)	Changes in Bird Community Structure Due to Anthropogenic Noise in an Old Growth Forest
4:00PM	54	Amanda Fix (SIUe, UG)	Determination and Characterization of Perfluorooctane Sulfonate Neurotoxicity in Fruit Flies
2:15PM	55	Kristina Springer (SIUe, UG)	Determination of Sublethal Concentrations and Effects of Imidacloprid in Female *Drosophila melanogaster*
4:00PM	56	Kiernan Robinson (Bradley, UG)	Effects of Food Resource Levels on Parasitism in Larval Frogs
2:15PM	57	Krystal Atkins (EIU, UG)	*Aedes* Mosquitoes in Coles County
4:00PM	58	Mario Lara (EIU, UG)	*Culex* Mosquito Species in Coles County, Illinois
2:15PM	59	Prasanna Shrestha (SIUe, Grad)	Impacts of Land Use and Land Cover Changes on Hydrological Regimes of the Richland Creek Watershed, Southern Illinois, using a GIS-based Hydrologic Model
4:00PM	60	Kimberlea Johnson (Eureka, UG)	Prairie Management and Interpretation at Eureka College
2:15PM	61	Erin Lukens (Millikin, UG)	Effects of Elevated Salinity on Cuban Treefrog (*Osteopilus septontrionalis*) Aldosterone Levels, Growth, and Development
4:00PM	62	Kaitlyn Hild (Eureka, UG)	Implementing a Composting System on a Small College Campus
2:15PM	63	Katy Everett (Eureka)	Solar Energy System Site Assessment of Eureka College
4:00PM	64	Luke Brodahl (Eureka, UG)	Management and Research of *Amur* Honeysuckle Removal on Growth of Spring Ephemerals at Eureka Lake Park
Health Sciences			
2:15PM	65	Jennifer Folami (EIU, UG)	Genotyping the Human Leukocyte Antigen *DQB1* Gene in Patients with Narcolepsy
4:00PM	66	Raisa Zamacona Gonzalez (Millikin, UG)	Isotype Switching and Spleen Development in *Rana catesbeiana*
2:15PM	67	Kaitlyn Stanton (SIU-Dental, Grad)	Activated Zinc Mouth Rinse Reduces Inflammatory Cytokine Expression in a Gingival Epithelium Injury Model
4:00PM	68	Anthony Bryan (Millikin, UG)	Enhanced Hematological Condition in Birds of Prey Undergoing Rehabilitation is Independent of Vitamin Supplementation **NOT PRESENTED**
Microbiology			
2:15PM	69	Maya Webber (Bradley, UG)	Recombinant Expression of Putative Chloramphenicol/Florfenicol Efflux Pump Proteins
4:00PM	70	Colleen Miller (Bradley, UG)	Investigation of the Potential Regulatory Role of the 5' Untranslated Region in Regulation of a Putative, Florfenicol-Resistance Efflux Pump Protein using a Reporter Gene Assay
2:15PM	71	Xiomy-Janiria Pinchi-Davila (WIU, Grad)	Description of Novel Endophytic Taxa within the Pleosporales and Evaluation of their Role on Plant Growth
4:00PM	72	Emmaline Cler (EIU, UG)	Detecting Antibiotic Resistance Loci in Wastewater
2:15PM	73	Jennifer Houser (Bradley, UG)	Antibiotic Properties of Newly Synthesized δ-Lactone Derivative
4:00PM	74	Paige Bangle (SIUe, Grad)	An Amoebae-Bacteria-Phage Matryoshka Doll: Investigating Bacteria-Bacteriophage Coevolution Dynamics within a Eukaryotic Host System
2:15PM	75	Negar Zati-Mahboob (SIUe, Grad)	Bacteriophage Treatment in a Social Amoebae Host Reduces *Burkholderia bonniea* Bacterial Infections
4:00PM	76	Jacob Hanes (Millikin, UG)	Use of Combined Phage Exposure in Minimizing the Development of Anti-Phage Resistance in *Klebsiella pneumoniae*

Time	#	Presenter	Title of Presentation (Posters)
2:15PM	**77**	Angie Garces (SIUe, Grad)	*Helicobacter canadensis* Induces Inflammatory Response in Colonic Epithelial Cells
4:00PM	**78**	Androw Sawiris (EIU, Grad)	Comparison of Vancomycin (*vanA*)and B-lactam (^{bla}*NDM1*) Antibiotic Resistance Genes in the Charleston Water Treatment Plant
2:15PM	**79**	Cameron Basquez-Pfeifer (Bradley, UG)	Investigating AbrB Phosphorylation by the Kinase PrkC as a Mechanism of Regulation of *ahpA* by *Abr*B in Biofilms of *Bacillus subtilis*
4:00PM	**80**	Maggie Rusiecka (Bradley, UG)	Investigating the Ability of *Bacillus subtilis* Tpx and Bcp to Detoxify Peroxides and Other Oxidants
2:15PM	**81**	Scott Holt (WIU)	Analysis of Beneficial Bacterial Populations from Chinese Longbeans
Physics, Mathematics, & Astronomy			
4:00PM	**82**	Sadie Nickles (WIU, UG)	Variation of Refractive Index and the Optical Band Gap in Lead Borate Glasses
2:15PM	**83**	Clara Barclay (WIU, UG)	Compositional Dependence of Fluorescence Properties in Rare-Earth Ion-Doped Bismuth Borate Glasses
4:00PM	**84**	Michael Adetunji (WIU, Grad)	Optical Properties of Samarium (Sm) and Europium (Eu) Co-Doped Bismuth Telluro-Borate Glasses
2:15PM	**85**	John Turton (WIU, UG)	Variation of the Refractive Index of Barium Bismuth Borate Glasses
4:00PM	**86**	Lucas Elliot (WIU, UG)	Variation of Sm^{3+}Fluorescence with Excitation Wavelength in Strontium Bismuth Borate Glasses
2:15PM	**87**	Madison Peyton (IC, UG)	Using Solar Pathfinder Technology to Quantify Solar Panels
4:00PM	**88***	Luigi Erba (IC, UG)	Simultaneous Morse Code Telegraphy using Arduino UNOs
2:15PM	**89**	Elijah Rhoad (IC, UG)	Analysis of a Double Pendulum through Long Exposure Photography
4:00	**118**	Juta Wowoe (IC, UG)	Energy Requirements and Production Methods of Conventional Solar Panels
STEM Education			
4:00PM	**90**	Jocelyn Lanorio (IC)	"Green" General Chemistry Laboratory Experiment Showing the Difference between Ionic and Molecular Compounds
Zoology			
2:15PM	**91**	Haley Gouchenour (SIUe, UG)	Comparison of Mandible Form in Swift Fox *Vulpes velox* and Gray Wolves *Canis lupus*
4:00PM	**92**	Hannah Carter (SIUe, UG)	Morphological Differences between Ancient Dogs, Modern Coyotes, and Wolves: Data from Mandibles
2:15PM	**93**	Mikaylin Bent (SIUe, UG)	Cranial Growth in Raccoons *Procyon lotor*
4:00PM	**94**	Samuel Taylor (EIU, UG)	Characteristics of American Crow (*Corvus brachyrhynchos*) Roosts
2:15PM	**95**	Megan Ormsby (SIUe, UG)	Lateralization Tests in a Basal Anuran the Rocky Mountain Tailed Frog, *Ascaphus montanus*
4:00PM	**96**	Nick Topping (Bradley, Grad)	Comparing Habitat Conditions to Zebra Mussel Growth and Survivability using Field Enclosures
2:15PM	**97**	Amber Bouren (SIUe, Grad)	The Effect of Age on Cold Tolerance of the Fruit Fly, *Drosophila melanogaster*
4:00PM	**98**	Jeremy Howard (SIUe, Grad)	Diurnal Temperature Cycles Reduced Egg Laying and Altered Media Choice in *Drosophila melanogaster*
2:15PM	**99**	Kylee Fall (WIU, UG)	Comparison of Bone Ossification in the Forelimb and Hindlimb of *Alligator mississippiensis*
4:00PM	**100**	Jiaxin Deng (EIU, Grad)	Haplotype Diversity of Antistrophus Gall Wasps (Cynpoidea: Cynipidae) Associated with Two Silphium Species and Implication for Host Mediated Speciation
2:15PM	**101**	Katherine Wiesehan (SIUe, Grad)	Conservation Status of the State-Threatened Illinois Chorus Frog, *Pseudacris illinoensis*, in Southwestern Illinois
4:00PM	**102**	Kelly J. McKay (BioEco)	Evaluating the Drivers of Bird-Window Collisions at the University of Wisconsin–Platteville

Time	#	Presenter	Title of Presentation (Posters)
2:15PM	**103**	Kelly J. McKay (BioEco)	Persistence of Bird Carcasses Resulting from Window Collisions in an Urban Landscape
4:00PM	**104**	Jack McKermitt (Wesleyan, UG)	Relative Abundance and Habitat Associations of American Badgers *Taxidea taxus* and Plains Pocket Gophers *Geomys bursarius* in McLean County
2:15PM	**105**	Dylan Gladson (SIUe, UG)	The Origin of Ants: Circumventing the Hegemony of Wings
4:00PM	**106**	David Seidel (SIUe, Grad)	Evaluating the Use of Barnhart Silos for Reintroducing Hatchery-Reared Juvenile Mussels in Two Central Illinois Watersheds
2:15PM	**107**	Caitlin Mrowiec (EIU, Grad)	Nocturnal Movement and Roost Coalescence in the American Crow
4:00PM	**108**	Kyle Mustiful-Brumfield (WIU, UG)	Alligator Ossification Rates – Clearing and Staining
2:15PM	**109**	Alyssa Koffman (Millikin, UG)	Sub-Lethal Effects of Lead Poisoning on Multiple Species of Raptors in Central Illinois
4:00PM	**110**	Sabrina Doyle (IC, UG)	The Effects of Prescribed Burns on Bat Activity and Species Composition in a Forested Landscape
2:15PM	**111**	Samuel Billig (Millikin, UG)	Time Course of Immunomodulatory Effects of Stress in Northern Leopard Frog Tadpoles
4:00PM	**112**	Meredith Artime (Millikin, UG)	Seroprevalence of *Pasteurella multocida*, the Causative Agent of Avian Cholera, among Free-Living Birds in Central Illinois
2:15PM	**113**	Logan Bader (Millikin, UG)	Seroprevalence of *Borrelia burgdorferi* in Songbirds and Raptors in Central Illinois
4:00PM	**114**	Jacquelyn Spence (Millikin, UG)	Effects of Cypermethrin on Neurophysiology, Development, and Behavior of Cuban Treefrog Tadpoles (*Osteopilus septentrionalis*)
2:15PM	**115**	Kaitlyn Hild (Eureka, UG)	Dietary Choices of Franklin's Ground Squirrels (*Poliocitellus franklinii*) in Central Illinois
4:00PM	**116**	Hana Parker (SIUe, UG)	The Effects of Artificial Breeding Pools on the Reproductive Success of Illinois Chorus Frogs (*Pseudacris streckeri illinoensis*)

ORAL PRESENTATIONS – SATURDAY, APRIL 6, 2019 – OLIN HALL, RMS 024, 149, 164, & 245

Presentations with Co-Presenters denoted by *

Time	Room	Presenter	Title of Presentation
		Agriculture	
10:40AM	**024**	Opeyemi Oduniyi (WIU, Grad)	Growth and Gene Expression of Soybean during Germination under High Salinity Stress and Salicylic Acid
		Botany	
11:00AM	**024**	Kurt Schulz (SIUe)	Quantile Regression: A Better Analysis of Responses to Invasion and Competition
11:20AM	**024**	Nicholas Emory (WIU, Grad)	Gene Expression of Soybeans (*Glycine max*) in Response to Inoculation with *Trichoderma* Fungi
		Cellular, Molecular, & Developmental Biology	
9:00AM	**164**	Jack Blank (Bradley, UG)	The Characterization of Highly Adaptable Biocompatabile Nanomaterials for the Integration, Differentiation, and Transplantation of Stem Cells
9:20AM	**164**	Jessica Haines (SIUe, Grad)	The Optimization and Application of Behavioral Analysis on the Planarian Flatworm *Schmidtea mediterranea*
9:40AM	**164**	Michael Oni (WIU, Grad)	Modification of Peptide J18 for Enhanced Ovarian Cancer Cells Targeting
10:20AM	**164**	Yordan Yordanov (EIU)	A Simple and Efficient System to Study Sunflower Roots Response to Nutrient Limitations
10:40AM	**164**	Deshaun Laughlin (EIU, UG)	Cloning of *rol* Genes Region from *Agrobacterium rhizogenes* strain K599
11:00AM	**164**	Bayan Aljamal (WIU, Grad)	Gene Expression of Corn Earworm (*Helicoverpa zea*) when Infected with *Pseudomonas aeruginosa* Bacteria
11:20AM	**164**	Hashni Epa Vidana Gamage (EIU, Grad)	Sulfamethoxazole Retards Growth and Reproduction in *C. elegans* by Inhibiting Folate Biosynthesis
		Computer Science	
11:20AM	**245***	Justin Dody (Grad, WIU)	Virtualizing and Visualizing Social Interactions for Teaching Social Skills
		Environmental Science	
9:00AM	**149**	Erin Shamley (SIUe, Grad)	Home Range and Spatial Ecology of the Eastern Box Turtle, *Terrapene carolina*, at Southern Illinois University Edwardsville
9:20AM	**149**	Ben K. Greenfield (SIUe)	Elevated Particulate Matter and Noise Exposure for Spectators at Outdoor Motorsport Events
9:40AM	**149**	Carl Namini (SIUe, UG)	Exposures to Perfluorooctane Sulfonate Elicit Neurotoxicity in *Drosophila melanogaster*
10:20AM	**149**	Kyong Yoon (SIUe)	Exposure to Sublethal Ivermectin is Responsible for Increased ROS, MDA, and DNA Damage in Fruit Flies
10:40AM	**149**	Grace Wilken (EIU, Grad)	The EIU Compost Project: Recycling Food Waste to Grow More Food
11:00AM	**149**	Stephani Sather (GSU, Grad)	Effect of Deer Browse on Plant Communities
11:20AM	**149**	John Marino (Bradley)	Quantifying Effects of Biotic and Abiotic Factors on Lake Michigan Zooplankton from Field Time Series Data
		Health Sciences	
10:40AM	**245**	Callie Mincy (SIUe, Grad)	Cancer Cohort Matrix Induces Adhesion Molecule Expression Differences in Salivary Gland Cells
11:00AM	**245**	Hailey Freres (SIUe, Grad)	Does Osteopontin Regulate TWIST Expression in Salivary Gland Cancer?
		Microbiology	
9:20AM	**245**	Maria-Jose Romero-Jimenez (WIU, Grad)	Multigene Characterization of *Darksidea* Isolates and Description of a New Species

Time	Room	Presenter	Title of Presentation
9:40AM	**245**	Audrey Rex (EIU, UG)	Detection of Antibiotic Resistance Loci in Waste Water and Fresh Water
10:00AM	**245**	Allyson Isenhower (Millikin, UG)	Agglutinin-Like Sequence Genes in *Meyerozyma guilliermondii*
Zoology			
9:20AM	**024**	Jeremy Howard (SIUe, Grad)	Movement and Microhabitat Selection in Southern Flying Squirrels (*Glaucomys volans*)
9:40AM	**024**	Naomi Klingbeil (Millikin, UG)	Does Length of Stay in Rehabilitation Influence the Magnitude of the Acute Stress Response in Birds of Prey?
10:00AM	**024**	Owen Pulver (Millikin, UG)	Seasonal and Inter-Species Variation in Seroprevalence of West Nile Virus in Clinic-Admitted Raptors in Central Illinois

KEYNOTE ADDRESS – CRAIG CADY, PH.D.
FRIDAY, APRIL 5 AT 7:30PM, PEPLOW PAVILION, 3RD FLOOR, HAYDEN-CLARK ALUMNI CENTER

Craig Cady, Ph.D., Associate Professor
Director, Bohlander Stem Cell Research Laboratory
Biology Department
Bradley University

Dr. Cady's primary research interest is neurophysiology, and he completed an NIH fellowship in the Neurology Department at Southern Illinois University School of Medicine investigating the effects of aging on the brain as related to neurodegenerative diseases such as Alzheimer's disease.

He has published papers on age-related changes in neuron function, how to extend neuron survival and how estrogen protects the brain from neurodegenerative disease.

As the director of the Bohlander Stem Cell Research Laboratory in the Biology Department at Bradley University he is actively investigating a diverse range of topics in regenerative medicine beyond neurodegenerative diseases.

Current research projects include investigating an autologous stem cell based therapy for ovarian and pancreatic cancer, producing cardiomyocytes and pacemaker cells from hiPS stem cells, creating parathyroid hormone producing cells from adult stem cells, and utilizing nanofiber materials to enhance the production of mature cells from stem cells for transplantation.

Dr. Cady's laboratory worked with an international team which was the first to transplant a nanofiber trachea lined with stem cells into a 3-year-old girl born without a functioning trachea.

MESSAGE FROM THE VICE PRESIDENT

Thank you to all the presenters and participants for the 2019 Annual Meeting of the Illinois State Academy of Science. I hope that your visit to Bradley University is enriching and that you have a great experience.

I also hope that you will join us again next year when our current President, Laura Corey, serves as Vice President for the 2020 Annual Meeting at Illinois College in Jacksonville.

I would like to thank the Bradley University Center for STEM Education, the College of Liberal Arts and Sciences Dean's office, and the Provost's office for their help in planning and scheduling this event; Bradley's President, Gary Roberts, for taking the time to welcome this year's participants to Bradley's campus; and the departments of Biology, Chemistry, and Physics for allowing us to share their space during the event.

I would also like to offer 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 2019 Annual Meeting and we hope to see you next year at Illinois College!

Jennifer Jost

Vice President of the Annual Meeting

POSTER PRESENTATION ABSTRACTS

2:15-3:45pm or 4:00-5:30pm, Friday, April 5, 2019, in Olin Hall

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

ANTHROPOLOGY & ARCHEOLOGY

1 2:15pm UG **Estimating Sex Using Human Growth Study Cephalograms**

*Miguel Tellez, Miranda Karban [Illinois College]

Background: Identifying sex is one of the most important parts of a forensic skeletal profile, and many other traits, like ancestry and stature, vary according to the sex of the individual. The goal of this experiment was to see if the sex of a dry skull can be accurately estimated using lateral and frontal cephalograms.

Methods: This study's sample includes frontal and lateral cephalograms from 113 South and Central American-derived extant human skulls housed at the Forensic Anthropology Research Facility at Texas State University. Three cranial traits, including mastoid process prominence, nuchal area rugosity, and glabella protrusion, were scored on a published scale of 1 through 5, with a score of 1 being more gracile (feminine) and 5 being more robust (masculine). Logistic regression was used to estimate sex for each subject, and these estimates were compared to anthropological reports generated at Texas State University using the physical remains.

Results: The results of this experiment indicate a 72% accuracy rate in estimating sex from cephalograms. Of the three scored traits, the mastoid process was found to be the most reliable. The addition of pelvic radiographs would likely substantially increase the level of accuracy.

This study provides a better understanding of the reliability of using cephalograms to estimate sex, and could potentially help forensic anthropologists determine the sex of individuals without the remains having to be physically present.

2 4:00pm UG **Geometric Morphometric Analysis of the Human Mental Eminence: Development and Sexual Dimorphism**

*Brenna Garland, Miranda Karban [Illinois College]

Background: In this study, geometric morphometric methods were used to assess sexual dimorphism of the human mental at three different age groups. The shape of the mental eminence is commonly used as a sex-related trait in forensic anthropology, but it is currently unknown whether this variation can be identified in cephalograms (cranial x-rays).

Methods: Lateral cephalograms of the nineteen longitudinal growth study subjects were measured, with each subject represented at three different age groups. The youngest age group consisted of subjects 8.0-10.0 years, the middle group ranged from 12.0-13.5 years, and the oldest age group ranged from 16.6-19.6 years. A total of 28 landmarks and semi-landmarks were collected along the inferior mandible, from infradentale to gonion. Generalized Procrustes analysis and relative wrap analysis were used to investigate the pattern of shape variation within each age group, and Procrustes ANOVA with andomized residual permutation procedure was used to test the significance of shape variation between males and females.

Results: Sexual dimorphism of the mental eminence shape was not found to be statically significant at any of the three measured age groups. These results suggest that inferior mandibular measurements taken from lateral cephalograms should not be used to estimate sex in a forensic context. Sexual dimorphism might instead be better studied by looking at the breadth of the mental eminence, measured using frontal cephalograms.

3 2:15pm UG ***Homo sapiens* Nasal Aperture Shape**

*Megan Price, Miranda Karban [Illinois College]

Background: The nasal aperture is one of the cranial traits that is not commonly cited as a sexually dimorphic trait. In fact, there is a lack of previous studies linking this trait and sexual dimorphism. Certain angles can be used to observe anteroinferior growth of the nasal bones, such as the SNR angle. The study aims to investigate the differences in male and female nasal aperture shape in young adults.

Methods: A sample of 30 individuals (15 males and 15 females) from a University of Toronto Burlington Growth Study were observed. Frontal cephalograms were used to observe the nasal aperture of these 30 individuals. Subjects were between 18 years and 18 years and 3 months. Nasal apertures of each subject were plotted with 3 landmarks and 15 sliding semilandmarks. Generalized Procrustes analysis and relative warp analysis were used to investigate nasal aperture shape variation within the sample. Lateral cephalograms were also observed to collect angles between the landmarks sella, nasion, and rhinion (SNR angle). T tests and Shapiro-Wilk normality tests were also used to judge variation of the SNR angles between males and females.

Conclusion: No statistically significant sexual dimorphism was found in either nasal aperture shape or SNR angle. As a study that has never been conducted before, this information could be helpful to show trends observed byotorhinolaryngologists. This could lead to future prediction of male and female nose shape and/or deformities.

4 4:00pm UG **Scoring External Occipital Protuberance Prominence in Extant Human Growth Study Cephalograms**

*Lauren Estes, Miranda Karban [Illinois College]

Background: The external occipital protuberance (EOP), a nuchal ligament and muscle attachment point on the posterior occipital squama, is often cited as a sexually dimorphic trait, with a more robust, “hooked” protuberance thought to be indicative of male sex. Growth and development of this trait, however, are not well understood, and the trait has not, to our knowledge, been studied in a longitudinal growth sample. Development of this trait was observed in longitudinal craniofacial growth records.

Methods: EOP prominence was scored in a longitudinal growth sample of extant human lateral cephalograms. A total of 100 subjects (47 female, 53 male) were each scored at 3 age points spanning from 11.5 to 20.5 years. Subjects at each age were assigned an EOP score of 1 (not visible) through 4 (hooked) based on the protuberance’s rugosity and curvature. T-tests were used to assess whether significant differences exist between male and female scores at each age group.

Results: No significant sexual dimorphism was found in EOP scores for the youngest age group (range: 11.5 - 12.4 years), but sexual dimorphism in the second (13.7 - 16.8 years) and third (18.0 - 20.6 years) age groups were found to be significant. These results reveal the expected pattern that sex-related variation in this trait emerges at puberty. Interestingly, 8.51% of sampled adult female subjects were found to possess a prominent hooked protuberance. This finding has important implications in the forensic field, showing that investigators should not rely solely on the EOP when estimating sex.

BOTANY

5 2:15pm Grad **Survey for Allelochemicals in Soils beneath Native and Non-Native Shrubs**

*Taylor Wise, Kurt Schulz, Jonathan Clark [Southern Illinois University Edwardsville]

Allelopathy is the release of toxic materials by plants, with the express function of inhibiting or killing nearby plant competitors. Many native and non-native plant species have allelopathic effects on nearby vegetation. Allelopathy can be detrimental to plant communities by impairing individual species while allowing invasive species to dominate, decreasing native plant diversity. The aim of this study was to investigate the allelopathic potential of four widespread native and nonnative species in the region. There is considerable literature on the alleged allelopathic effects of many plant species. However, the literature focuses on using plant tissue (leaf, root, shoot, etc.) extracts to perform germination and growth assays. This is not how

allelochemicals interact with plants in nature.

Soil samples were obtained from beneath four (two native, two non-native) species with potential allelopathic capabilities. The native species being *Asimina triloba* and *Cornus drummondii* and non-native species *Lespedeza cuneata* and *Lonicera maackii.* Samples were stored frozen until needed. A basic germination assay was performed using extracts created from the soil samples. Extracts were produced with distilled water and centrifuged before filtration through 0.22µM Millipore filters to remove contaminants. A sterile water control was used. The native *Elymus canadensis* and a non-native *Lactuca sativa* were used as target species to measure total germination.

No significant differences were present between extracts and the control. *Elymus*had significantly lower germination rates than *Lactuca.* There were significant differences between replicates, but there was no significant replicate x extract interaction. This evidence does not support the claim that allelochemicals from these species are interacting with neighboring species through the soil. However, there are many different forms and concentrations of allelochemicals available in nature. Furthermore, different allelochemicals interact in different ways and can have a variety of effects on neighboring species (i.e. not just effecting germination). Future studies could take a more in depth look at these factors and interactions and give a much better understanding of allelochemicals truly released into the environment.

6 4:00pm Grad **Allelopathic Potential of Fresh Leaf Extracts from Japanese Hop (*Humulus japonicus*)**

* Monica Berviller, Kurt Schulz [Southern Illinois University Edwardsville]

Japanese hop (*Humulus japonicus*) is an herbaceous vine found in wet, lowland soil, typically on the outskirts of forests. Hop vines expand rapidly to form dense, monospecific stands. This pattern suggests allelopathic tendencies which might delay or prevent seed germination of the other species vying for the same area. To test this, seeds of three different species, radish (*Raphanus raphanistrum* subsp. *sativus*), lettuce (*Lactuca sativa*), and tall fescue (*Festuca arundinacea*), were planted in a sand medium and irrigated with either water or a solution of hop leaf extract. Seeds were incubated under cool white fluorescent light (ca. 150 µmol photons m^{-2} s^{-1}) at ca. 25℃ with a 16/8 hour light/dark cycle. Germinated seeds were tallied every two to three days until germination ceased. Germination was expressed as the proportion of germinated seeds in each plate. The data were analyzed by ANOVA; significance levels were verified by permutation because some model assumptions were violated. Seeds of fescue and radish treated with the extract had lower germination rates and germinated much slower than the control. We suggest Japanese hop may have allelopathic tendencies that allow it to suppress its competition and overtake an area.

7 2:15pm Grad **A Simplified System for Studying Sunflower Roots Architecture**

*Erin Siekmann, Yordan Yordanov [Eastern Illinois University]

Roots have multiple important functions for plants survival and adaptation. Every species and variety have specific, genetically determined characteristics of root growth and architecture. The root system of the cultivated sunflower is poorly characterized, and little is known of the genetic factors influence the roots growth and physiology. An important prerequisite for study roots is the simple and reproducible system for documenting and characterization of the roots parameters. *In vitro* culture provides an excellent controlled environment for studying the young plants roots. To optimize the screening of the large number of plants we use the semi-automated software system that produce data of many parameters (e.g., length, lateral number, order, total length etc.) from digital scans of the root system. Within this study, we analyzed roots of multiple sunflower varieties using a simple test-tube filter bridges system. By comparing the root systems of different varieties, we were able to identify two varieties that had significantly more developed root system and several varieties that had significantly less developed roots. We plant to cross varieties with the most contrasting root parameters for further genetic characterization of the QTL loci involved in the sunflower roots' growth and development.

8 4:00pm Grad **Effect of Soluble Salt on the Germination of *Thuja occidentalis***

*Sara A. Johnson, Eric D. Janssen, Patricia A. Dickerson, Brenda S. Molano-Flores [University of Illinois Urbana-Champaign]

Excessive salt concentrations in the soil and water table can have damaging effects on the health of roadside and neighboring plant communities. Concentrated salt levels have proven to be detrimental to the growth

and reproduction of various plant species. *Thuja occidentalis* L.(Cupressaceae), commonly known as Arborvitae or the Eastern White Cedar, is formerly an Illinois threatened species restricted to northeast Illinois. Seeds from two populations near the Illinois Tollway were collected to assess the impact of road salt on *T. occidentalis* germination: Trout Park and the Chicago Junior School site in Cook County, Illinois. These populations have notable differences in population size, adult health, and seedling recruitment. While the underlying reasons behind the population differences are unknown, soil testing has shown that the less vigorous population (Trout Park) has higher concentrations of chloride and sodium. In addition, *T. occidentalis* seeds from Chicago Botanic Garden and Morton Arboretum were collected away from the Illinois Tollway. To assess which salt concentrations could limit *T. occidentalis* germination, a growth chamber study was conducted. Seeds were grown in nine salt solutions with molar concentrations ranging from 0mM to 1000mM. Germination was reduced with an increase in salt concentration. These results demonstrate the impact salt can have on *T. occidentalis* populations. To protect this species, care should be taken to reduce the flow of road run-off into these native populations of *Thuja occidentalis*.

CELLULAR, MOLECULAR, & DEVELOPMENTAL BIOLOGY

9 2:15pm UG **Identification of the Causative Mutant Locus in *Gravity Persistent Signal 5***

Erica Periandri, Michele Thole, Jessica Westerhold, Elisa Morales, Michael Vierling, Jared Ross, Darron R. Luesse [Southern Illinois University Edwardsville]

Gravity is a constant stimulus that affects plant growth and development. When reoriented by 90 degrees with respect to gravity at room temperature, plants rapidly alter their growth direction. If this reorientation is performed at 4°C, the plant fails to immediately respond. After return to room temperature in a vertical orientation results in delayed curvature. This is known as the gravity persistent signal (GPS) response. The *gravity persistence signal5* (*gps5*) mutation in *Arabidopsis* causes hypergravitropism after exposure to a cold gravity reorientation. The goal of this research is to identify the gene within the *gps5*mutant that causes this phenotype. Genome sequencing and microarray analysis have identified 4 candidate genes with potential insertions. To determine which of the candidate genes causes the *gps5*mutation, we are taking a multi-step approach. First, we are using PCR to screen *gps5*mutants to determine if any of the four candidate mutant genes contain a T-DNA insert. We have also identified, and are screening, additional T-DNA lines obtained from ABRC. They are being examined for GPS response abnormalities. Finally, wild-type constructs for each gene are being assembled for transformation rescue of the *gps5*mutant phenotype.

10 4:00pm UG **Genomic Dysregulation by Overexpression of Transcription Factors**

*MacKenzie Scroggins, Gary Bulla [Eastern Illinois University]

As one of the major organs, the liver plays vital roles in the homeostasis of an individual. Being able to identify master regulator genes, genes whose product can affect the activation or deactivation of other genes, will enrich our understanding of hepatic function and liver disease. Previously, our lab used genome-wide microarray data to identify several transcription factors that may play a key role in liver expression. Here we ask whether overexpression of these transcription factors in a non-liver cell would result in liver phenotype activation or general disruption of gene regulation. To this end, we stably introduced six transcription factors which we identified as being liver–specific into a non-liver cell line, followed by whole-genome expression analysis. As controls, we introduced a neo-plasmid to monitor general plasmid effects, as well as the HNF1a gene, previously shown to rescue liver-specific gene expression. Results show that introduction of the neo plasmid alone resulted in 9 genes activated and 58 genes repressed by ≥2.5 fold. Overexpression of transcription factors resulted in between 320 and 664 genes activated, and 158 and 348 genes repressed by ≥2.5 fold even after controlled for the neo plasmid data. In some cases, we observed much overlap. For example, 41 genes were activated by 4 of 4 transcription factors (HHEX, CREG, CREB, and HNF6), with CREG and CREB sharing activation of an additional 94 genes. Focusing on only hepatic genes, each of transcription factors activated between 13 and 35 liver-specific genes. However, there was little overlap between which genes were activated in each case. These results suggest that while over-expression of transcription factors may activate tissue-specific genes, there is also a general dysregulation of gene expression that must be considered when interpreting data.

11 2:15pm Grad **Xylan Metabolism by *Caulobacter crescentus***

*Viet Bui, Gopal Periyannan [Eastern Illinois University]

Breakdown of lignocellulose polysaccharides of the plant biomass using microorganisms remains as a promising method to produce renewable energy and materials. *Caulobacter crescentus* is a gram-negative oligotrophic bacterium with adaptive physiological responses, like slow growth or complete arrest of cell cycle; the presence of sessile and motile progenies, with the sessile cells growing stalk to enhance nutrient uptake for growth in low-nutrient conditions. Reported types of carbon sources that *C. crescentus* can utilize include cellobiose, maltose, and xylose but no polysaccharide utilization has been reported. Database analyses indicate *C. crescentus* has a repertoire of glycosyl hydrolases and carbohydrate-modifying enzymes, along with membrane-bound transporter proteins for efficient breakdown of xylan. Growth and metabolic properties of *C. crescentus* in M2 minimal medium containing xylan as the sole carbon source was investigated. Growth curves of *C. crescentus* in xylan show typical phases as seen in other mono- and disaccharide carbon sources in similar conditions. 2D gel electrophoresis based proteomic and genomic analyses revealed several glycoside hydrolases including xylosidases as well as TonB-dependent receptor mediated transporters that might work in tandem to aid in importing xylo-oligosaccharides across the outer membrane. Enzyme assay using p-nitrophenol xylopyranoside substrate show high expression of membrane-component xylosidases on second day of growth on xylan substrate, which is also the beginning of its log phase. Chromatography and 1H-NMR analysis of the extracellular medium combined with enzyme assay data suggest xylan binding onto the bacterial surface and uptake across the outer membrane.

12 4:00pm **The Effects of Lumbricus 1 and Oxytocin on the Same Isolated Earthworm Crop-Gizzard**

*Kevin Krajniak, Nicholas Swanson, Zachary Tepen [Southern Illinois University Edwardsville]

Annetocin, an oxytocin related peptide isolated from the earthworm *Eisenia fetida*, excites the isolated crop-gizzard. Our lab showed that this peptide and other oxytocin related peptides also stimulated the crop-gizzard of *Lumbricus terrestris*. Two oxytocin related peptides are predicted in the genes of the earthworm of *Lumbricus rubellus*, Lumbricus 1 and 2. Therefore, we tested Lumbricus 1 and oxytocin on the crop-gizzard of the related species *L. terrestris*. The crop-gizzard was removed from the animal, placed in a tissue bath filled with earthworm saline, and attached to a force transducer, which was connected to a computer using Iworx software to record the contractions. Since the earthworms we use are wild types, we tested both Lumbricus 1 and oxytocin on the same tissue preparations. We began by adding 50 µl of the lowest concentration of Lumbricus 1 (1nM). Once the tissue had sufficient time to respond (5 minutes) the bath was washed with fresh saline and a new baseline was established. This was followed by 50 µl of the lowest concentration of oxytocin (1nM). For the rest of the experiment we continued to alternate the administration of increasing concentrations of each peptide. The results of these trials were used to construct log-concentration response curves for each peptide. Both Lumbricus 1 and oxytocin caused an increase in contraction amplitude of the isolated earthworm crop-gizzard. When comparing oxytocin to Lumbricus 1 the oxytocin had a lower potency, but a higher efficacy than Lumbricus 1. These results suggest that these peptides may bind to the same receptors in the crop-gizzard. These results also suggest that although the receptor has a greater affinity for Lumbricus 1, it does not activate the response as fully as oxytocin.

13 2:15pm Grad **The Transcriptional Response of White-Rot Fungi to Plant Biomass**

*Nadh Alsubaie, Mashael Alaradi, Maha Alanazi [Eastern Illinois University]

Recent studies have demonstrated the efficacy of white-rot fungi as direct biological pretreatment agents that can decrease the costs associated with lignocellulose deconstruction while reducing negative impacts on the environment. However, the molecular mechanisms used by these fungi that drive the deconstruction of biomass are still largely unknown. Our study explored the gene expression patterns of white-rot fungi (*Trametes versicolor* and *Phanerochaete chrysosporium*) during direct pretreatment of chemically diverse lignocellulosic biomass: *Acer* spp. (maple wood), *Miscanthus* x *giganteus* (miscanthus stems), and *Helianthus argophyllus* (silverleaf sunflower stems). The results indicate that both white-rot fungi species have similar gene expression patterns in response to each substrate, but the responses differ when comparing expression profiles between substrates. For example, both species of white-rot fungi upregulate a relatively small set of genes coding for hydrolases and peroxidases when growing on maple wood compared to a much larger group of these genes when growing on sunflower stems. This study also revealed several previously uncharacterized proteins that seem to play a crucial role in lignocellulose deconstruction on all three lignocellulose substrates. Collectively, these results provide a better understanding of the biochemical

mechanisms used by white-rot fungi to deconstruct recalcitrant biomass, while also revealing novel proteins that may be part of future enzymatic cocktails for lignocellulose digestion at industrial scales.

14 4:00pm UG **Exploring the Role of Trehalose and Trehalose-6-Phosphate Synthase in Oxidative Stress Response in *Fusarium verticillioides***

*[1]Sarah McMillan, [1]Julia Long, [2]Daren W. Brown, [1]Kristi L. McQuade [[1]Bradley University, [2]USDA-ARS-NCAUR]

Fusarium verticillioides is a filamentous fungus that infects maize, leading to crop losses and contamination with carcinogenic secondary metabolites known as fumonisins. We are studying the role of trehalose in stress response in *F. verticillioides*. Trehalose-6-phosphate (T6P) synthase catalyzes the first of two steps in trehalose synthesis, and a mutant lacking the gene that codes for T6P synthase does not produce trehalose. We report here that treatment with menadione or hydrogen peroxide (both oxidative stressors) inhibits germination of the mutant strain (*Δtps1*) more than the wild-type strain. To explore whether the sensitivity of *Δtps1* to oxidative stress is caused by the lack of trehalose per se, or instead by the absence of a secondary function of the T6P synthase protein, we are studying mutant strains that express catalytically inactive forms of T6P synthase. Treatment with menadione or hydrogen peroxide inhibits growth of the catalytic mutant strains more than the wild-type strain but less than *Δtps1*, suggesting that trehalose itself is indeed critical for oxidative stress tolerance in *F. verticillioides* and that a secondary function of T6P synthase may also be involved. The effects of oxidative stress on T6P synthase expression are also being explored.

15 2:15pm UG **The Effects of Heavy Metal Pollution on DNA Expression of *Spirodela polyrhiza* in the Mississippi River**

*Kelsey Roberts, Victoria Livingston [Western Illinois University]

The duckweed (*Spirodela polyrhiza*) is an aquatic plant found in most rivers and aquatic basins and have been used in studies that focus on methods of phytoremediation. They are commonly tested for their ability to clean contaminated sources of water (Sharma et al., 2015). When exposed to chemicals, the plant experiences “bleaching”, where the plant loses its green color due to damage in the chloroplasts. A study of bioindicators of lead exposure on duckweed found that greater concentrations of metals in water leads to lesser levels of pigmentation. These physical changes may involve changes in the plants DNA, especially in their chloroplasts where these green pigments are contained. Despite these phenotypic changes being observed, few studies have been conducted to observe actual changes of DNA expression in the plant. This research was done to identify any adjustments in the expression of genes in relation to their photosynthetic processes. Two populations of *Spirodela polyrhiza*, one from the polluted Nahant marsh in the Mississippi River and the other in Rice Lake Wisconsin were pulverized and had their RNA extracted. Expression of photosynthetic genes were examined via qPCR.

16 4:00pm UG **Exploring the Effects of Phenolic Compounds and Oxidative Stressors on *Fusarium verticillioides***

*[1]Haley Hardtke, [1]Miah Montes, [2]Daren Brown, [1]Kristi McQuade [[1]Bradley University, [2]USDA-ARS-NCAUR]

Trehalose is a disaccharide accumulated by fungi and other organisms under conditions of stress. Previous work published by our lab showed that a strain of the maize pathogenic fungus *Fusarium verticillioides* lacking trehalose is less pathogenic on maize seedlings than the wild-type strain, suggesting that the trehalose-null strain may be compromised in its ability to tolerate defense mechanisms launched by the maize during the process of infection. In this study, we test this possibility by exploring the effects of phenolic compounds or oxidative stressors, both associated with plant defense, on the growth and germination of mutant strains of *F. verticillioides* that lack one or more genes involved in the synthesis or degradation of trehalose. Our data indicate that disruption of trehalose metabolism affects the germination and growth rate of *F. verticillioides*, but does not significantly affect its sensitivity to phenolic acids. Effects of altered trehalose metabolism on sensitivity to oxidative stress are also being explored.

17 2:15pm UG **The Gravitropic Response in Arabidopsis *phototropin 1* and *phototropin 2* Mutants**

Linus Amante, Darron R. Luesse [Southern Illinois University Edwardsville]

Plants use an array of tools to tailor their growth in response to environmental signals. One such response is phototropism, which utilizes the photoreceptors PHOTOTROPIN 1 and 2 (PHOT1 and PHOT2). Recently,

transcriptomic data obtained aboard the International Space Station showed an enrichment in PHOT1 and PHOT2 mRNA in dark-grown seedlings, suggesting that these photoreceptors may also play a role in the gravity response. The goal of this work is to observe gravitropism of *phot1* and *phot2* single mutants as well as *phot1phot2* double mutant roots and hypocotyls. Arabidopsis seedlings were grown horizontally for one week and then exposed to a 90 degree reorientation. Images of roots were captured every hour for 24 hours. Total curvature at each time point was calculated using ImageJ. Preliminary results indicate that wild-type roots curve more than *phot1, phot2,* or *phot1phot2* double mutants beginning around 10 hours after gravistimulation. In addition, *phot1phot2* roots lagged behind the other genotypes between four and eight hours. Data collection for hypocotyl gravitropism is ongoing. These results suggest that the Phototropin family of genes in Arabidopsis may play a role outside of blue-light responses.

18 4:00pm UG **Development of a Novel Nerve Damage Treatment**

*[1]Jaclyn Conway, [1]Jack Blank, [1]Kalyani Nair, [2]Ashim Gupta, [2]Michael Ruebhausen, [1]Craig Cady
[[1]Bradley University, [2]Institute of Plastic Surgery – Southern Illinois University School of Medicine]

Nerve damage presents as a major clinical problem. As stem cell based therapies become increasingly clinically relevant, biocompatible cell scaffolds that prevent migration of stem cells from the treatment site and allow for surgical manipulation become of more interest. Polycaprolactone (PCL) is a highly biocompatible and clinically relevant biomaterial. The present work focuses on incorporating agents known to promote neurodifferentiation, retinoic acid (RA) and valproic acid (VA), into an electrospun PCL nanofiber matrix to enhance biocompatibility as well as cell adhesion and proliferation. Mesenchymal stem cells possess a high differentiation potential and can provide autologous treatment options to patients. This study aims to optimize the neurodifferentiation promoting nanomaterial and verify rBMSC differentiation to neurons via immunocytochemistry. The data shows promise for the future of nanofiber cell scaffold use in neural regeneration.

19 2:15pm UG **Uridine Promotes Neurite Outgrowth in Neuro2a Cells**

*Jackie Spathies, Britto Nathan [Eastern Illinois University]

Background: Neurodegenerative diseases such as Alzheimer's disease and Parkinson's disease are the main causes of age-related dementia. These diseases can be due to neuronal cell death and impairment of neurite outgrowth. Giant oyster mushroom (GOM), *Pleurotus giganteus*, is used as a nootropic that can prevent the onset of dementia. The underline mechanism behind the medicinal property of GOM is unclear. Previous studies have shown that GOM has a high concentration of uridine. In this study, we examined the effects of uridine on neurite outgrowth in Neuro-2a (N2a) neuroblastoma cell line.

Result: In preliminary studies, we examined the effects of various concentrations of uridine on neurite outgrowth in N2a cells. We found that uridine significantly promoted neurite outgrowth at 100 mm. Treatment of N2a cultures for 48 hours with 100 mm uridine significantly increased the percentage of neurite-bearing cells and also increased neurite extension.

Conclusion: Our preliminary results suggest that uridine significantly promoted neurite outgrowth in N2a cells. Future studies are required to identify the mechanism behind uridine therapeutic potential on neurodegenerative diseases.

20 4:00pm Grad **Tying Together Genetic and Physical Maps of *Schizophyllum commune* to Locate the *mnd* Gene**

Haley Gula, Thomas Fowler [Southern Illinois University Edwardsville]

Schizophyllum commune is a basidiomycete fungus that reproduces after mating by developing a fruiting body to generate spores. A mutant gene that disrupts reproduction in the strain HK28 of *S. commune* was discovered by Leonard and colleagues (1978). This gene was named *mnd* because the mutation causes dense, round masses of hyphae, mounds, to form on fungal colonies. Mated, heterozygous fungi with the mutation can grow both mounds and fruiting bodies, however in some cases the mounds can overgrow the fruiting bodies to halt reproduction. The mechanism of the *mnd* phenotype is currently unknown. Genetic mapping linked *arg2* and *ade2* to *mnd* (Gaber & Leonard, 1981). We are using *ade2* as a guide to tie genetic and physical maps together to ultimately identify *mnd* in the genome. Previously, *ade2* was isolated (Froeliger, Munoz-Rivas, Specht, Ullrich, & Novotny, 1987), but the position of *ade2* was not annotated in the genome sequence of *S. commune* (Ohm et al. 2010; DOE-JGI Mycocosm). The plasmid that previously complemented

an *ade2* mutant but was not further characterized was obtained (*pAde2*, a gift from Dr. K. Bartholomew, Sacred Heart University) and partially sequenced. The enzyme encoded by *ade2,* phosphoribosyl pyrophosphate amidotransferase, was identified with a BLAST search of the *S. commune* genome V.3.0. (Ohm et al. 2010; DOE-JGI Mycocosm). A mutant *ade2* strain (SIUE20-1) was complemented and additional PCR with the *ade2* plasmid showed that we have tied the plasmid's *ade2* gene to the 4.4 Mb Scaffold 1 of the genome sequence. A fosmid library of HK28 genomic DNA was constructed to screen for *mnd* via PCR. This will allow us to walk or skip in the genome of *S. commune* from *ade2* toward *mnd.*

21 2:15pm UG **Investigating the Role of the Cornea Stroma During *X. laevis* Lens Regeneration**

*Eric Huntemann, Paul Hamilton [Illinois College]

The African clawed frog, *Xenopus laevis*, has the uncommon ability to regenerate a lens even in the absence of lens stem cells. During the larval stages of development, surgical removal of the lens allows signals from the retina to travel to the cornea epithelium, inducing a lens to regenerate from cells in the basal layer of the cornea epithelium. However, by the time that metamorphosis is complete, the juvenile *X. laevis* has lost the ability to naturally regenerate a lens. During this time, the area between the cornea epithelium and cornea endothelium significantly changes as it fills in with stroma (substantia propria). After this point, *X. laevis* does not appear to have the ability to naturally regenerate a lens; however, basal cells of the cornea epithelium are still able to express lens proteins when post-metamorphic cornea fragments are cultured in the presence of the larval retina. These epithelial cells still appear to be responding to regenerative cues, but are unable to organize into a lentoid. It is possible that the emergence of the stroma acts as a physical barrier that is preventing a new lens from forming. To test this hypothesis, a collagenase enzyme was used to break down collagen fibers of the stroma in an attempt to disrupt the structural integrity of the corneal stroma. Collllagenase treated juvenile cornea fragments were cultured in the presence of larval neural retina at ambient temperature and analyzed for the presence of lens protein expressing cells via immunofluorescence.

22 4:00pm Grad **The Potential Involvement of *Berberine Bridge Enzyme-Like* Genes in *Arabidopsis thaliana* Leaf Development**

*Jordyn Grawe, Darron Luesse, Allison Newton [Southern Illinois University Edwardsville]

Arabidopsis thaliana contains a family of 28 *Berberine Bridge Enzyme-Like* genes (*BBE-Ls*) of mostly unknown function, named for their structural relationship to the Berberine Bridge Enzyme from *Berberis vulgaris*. In the *Berberis* genus, these enzymes are involved in the synthesis of the secondary metabolite berberine, which is generated in response to plant stress. *A. thaliana* does not produce berberine itself, but exogenous application results in alterations to leaf development. In addition, 12 of the 28 *BBE-Ls* are mis-regulated in mutant*ggpps11-1*, which displays altered chlorophyll production as well as leaf margin abnormalities. The goal of this work is to address the hypothesis that *BBE-Ls* are involved in leaf patterning and development in *A. thaliana*. T-DNA insertion mutations have been obtained and confirmed for 27 of the *BBE-Ls*. In addition, double mutants have been generated for some closely related pairs. Mutant leaf shape is being examined using the LAMINA imaging program to determine if loss of individual *BBE-L* activity impacts leaf architecture. Quantitative Reverse Transcriptase PCR (qRT-PCR) is being performed to examine the transcript levels of known polarity-determining genes in *bbe-1* mutants compared to wild type. Results could link *BBE-L* genes to leaf development through the isoprenoid pathway.

23 2:15pm UG **A CRISPR/Cas9 Approach to Target a Critical Region of the *GGPPS11* Gene in *A. thaliana***

*Kyle Warnecke, Darron Luesse [Southern Illinois University Edwardsville]

Geranylgeranyl pyrophosphate synthases (GGPPS) are enzymes that catalyze the condensation of farnesyl pyrophosphate and isopentyl pyrophosphate to produce geranylgeranyl pyrophosphate, a twenty-carbon molecule that is used in many subsequent biochemical pathways to produce carotenoids, gibberellins, tocopherols and chlorophylls, among others. Of ten functional GGPPS-coding homologs present in *Arabidopsis thaliana,* only *GGPPS11* has been shown to be critical to the plant's development. Two highly conserved regions in all GGPPS enzymes that are involved in substrate binding include the first aspartate-rich motif (FARM) and the second aspartate-rich motif (SARM), which line opposite sides of the active site cavity. A point mutation in the *GGPPS11* gene immediately downstream of the FARM results in a temperature-sensitive variegated phenotype. How the mutant can still retain partial functionality, and why a lower temperature leads to the restoration of GGPPS activity remains unclear. To determine if similar mutations downstream of the SARM may also lead to partial loss-of-function phenotypes, we are using a CRISPR/Cas9

approach to target a site downstream of the *GGPPS11* SARM in *A. thaliana* with the goal of isolating mutants in the region. The Cas9 protein is known to create a double strand break in the targeted DNA sequence, which then triggers the non-homologous end joining repair pathway in *A. thaliana,* which often leads to various indel (insertions and deletions) mutations. Transformed lines will be screened using an RFLP approach. Mutants will be examined for alterations in chlorophyll concentration, variegation, and other potential developmental abnormalities.

24 4:00pm UG **Inducing Mutations in the GGPPS Family of *Arabidopsis thaliana* Using CRISPR/CAS9**

*Molly Smith, Darron Luesse [Southern Illinois University Edwardsville]

The synthesis of the GGPP, a branchpoint compound downstream of the MEP pathway, is required for the synthesis of many plant isoprenoids and metabolites. In *Arabidopsis*, there are 12 GERANYLGERANYL DIPHOSPHATE SYNTHASE (GGPPS) enzymes, however, the bulk of GGPP production is likely catalyzed by GGPPS11 in the plastid. Many of the remaining 11 family members retain enzymatic activity, and are predicted to localize to a variety of cellular compartments including the ER, mitochondria, chloroplast and cytoplasm. The goal of this work is to determine the role these additional family members play in isoprenoid biosynthesis. Because no T-DNA mutants are readily available for several of these genes, we have adopted a CRISPR/CAS9 strategy to generate knockout and point mutations within these genes. Specific CRISPR target sites were identified using the CRISPR-Plant website. Guide RNA targeting sequences were synthesized as primers and ligated into the plasmid pChimera. After confirmation, the sgRNA sequence will be ligated into the plasmid pCAS9, which contains a functional CAS9 enzyme. Wild-type *Arabidopsis* will be transformed with this construct, and subsequent generations will be screened for mutations using an RFLP approach. Ultimately, by knocking out this this gene family member we will see if GGPPS2 impacts plant physiology.

25 2:15pm UG **The Impact of Light Intensity on Chlorophyll levels in the ggpps11-1 Mutant of *Arabidopsis thaliana***

*Abby Brown, Tessa England, Darron Luesse [Southern Illinois University Edwardsville]

The biosynthesis of isoprenoids is an important pathway involved in the production of a variety of compounds including hormones required for development, ubiquinone for respiration, secondary metabolites for defense, and, most importantly for this work, carotenoids and chlorophyll for photosynthesis. Although much is known about chlorophyll biosynthesis, questions remain about how plants prioritize the partitioning of chlorophyll and carotenoid precursor molecules. Within the plastidial MEP pathway, GERANYLGERANYL DIPHOSPHATE SYNTHASE 11 (GGPPS11) is a major producer of the branchpoint compound GGPP. A point mutation in GGPPS11 in *Arabidopsis thaliana* (*ggpps11-1*) causes a variegated leaf phenotype with irregular leaf margins. The severity of variegation has been shown to be temperature dependent. We hypothesize that higher temperatures in conjunction with high light intensity leads to decreased function of GGPPS11 in the mutant, while the lower temperature and light intensity restores function. To test this we measured chlorophyll a, chlorophyll b, and carotenoid levels in plants grown in various temperatures and light intensities. Plants were grown at 12°C, 23°C, and 27°C, with light intensities at 102 µmol $m^{-2}s^{-1}$and 224 µmol $m^{-2}s^{-1}$for each temperature. Spectrophotometer measurements were used to calculate chlorophyll a, chlorophyll b, and carotenoid levels for each plant. Chlorophyll and carotenoid levels from this experiment will provide insight on how environmental conditions such as temperature and light intensity influence GGPPS11 activity in *Arabidopsis thaliana*.

26 4:00pm UG **Restoration of Wild-Type Phenotype in Variegated ggpps-11 *Arabidopsis thaliana* Using GGPPS Localization from Outside Chloroplast**

*Derik Rickher, Toria Trost, Darron Luesse [Southern Illinois University Edwardsville]

In plants, chlorophyll production relies on the isoprenoid pathway to produce key compounds required for its synthesis. Geranylgeranyl diphosphate (GGPP), is a key branchpoint compound required for the synthesis of chlorophyll, but also GA, ABA, carotenoids, and tocopherols. In *Arabidopsis thaliana* the bulk of plastid-produced GGPP is generated by GERANYLGERANYL DIPHOSPHATE SYNTHASE 11 (GGPPS11). T-DNA insertion mutants in *ggpps11* cause albino or embryonic lethal phenotypes, while a point mutation just downstream of a conserved aspartate-rich motif produces a variegated phenotype. However, *Arabidopsis* has 12 GGPPS family members with a variety of specific localizations and expression patterns. The goal of this work is to determine if other GGPPS family members, beginning with GGPPS1 and GGPPS3, can rescue the *ggpps11-1* variegated phenotype when driven behind a 35S promoter and localized to the chloroplast. These GGPPS

genes have a peptide sequence that localizes them to the mitochondria and the endoplasmic reticulum, respectively. A vector construct was made containing a truncated GGPPS gene without its native targeting sequence. A chloroplast targeting sequence is ligated upstream of the GGPPS gene using an engineered restriction site. The plasmid will be transformed into Agrobacterium for floral dip transformation of *A. thaliana*. Offspring will be examined for a restored wild-type phenotype, along with confirmation of plasmid transformation and translation of the modified GGPPS gene.

27 2:15pm Grad **In the Heat of the Moment: Physiological Tradeoffs of Fishes Living in Warming Waters**

*[1]Derick Isaac Lamptey, [1]Eloy Martinez, [1]Robert E. Colombo, [2]Michael A. Menze [[1]Eastern Illinois University, [2]University of Louisville]

Currently, long-term responses of ectotherms to the warming trends observed in tropical regions are unknown, and they are significantly understudied due primarily to the difficulties in specimen and community traceability. In freshwater lakes employed as cooling reservoirs for power plants, increased physiological stress from high water temperature can lead to an increase in mortality, reduce growth and potentially alter the community structure of fishes.

Throughout this study, we employed these lakes as highly tractable systems to assess how elevated thermal regimes can alter the physiology and consequently the ecology of the bluegill sunfish *Lepomis macrochirus*. Previous work documented a significantly reduced lifespan, growth performance, and a shift in the age structure towards younger individuals of *L. macrochirus* population inhabiting a thermally-impacted lake in Illinois, compared to a nearby non-impacted control lake of similar size. Results from our 30-day cross acclimation study showed that *L. machrochirus* were able to regain homeostasis within 4 weeks, as no significant differences in respiration rates were measured in fishes acclimated to 17.5C and 30C. It is hypothesized that thermally-impacted lakes has profound influence in mitochondrial function, where high temperatures could reduce energy transduction efficiency and potentially increase oxidative stress.

This study raises the questions about the causal relationships between physiological performance and habitat temperature, in particular how thresholds in an organism's physiology may modulate their community structure, and consequently their ecological success.

28 4:00pm Grad **Expression of a Hemagglutinin Targeting Peptide on Modified Coat Protein VIII of Fd-tet Phage**

*Rajeev Roy [Western Illinois University]

Bacteriophages are viruses that utilize bacteria as their host. Since 1985 when phage display technology was developed by Dr. George Smith these viruses have been widely used to study protein-ligand interactions, receptor binding sites and identifying peptide and protein-based ligands. The process involves expressing a foreign peptide on the coat proteins of the phage. Coat protein III (cpIII) and coat protein VIII (cp VIII) are commonly used for display. The f3 phage display vectors express five copies of cpIII, which allows expression of a low number of foreign peptides, often providing high-affinity ligands. The f88 phage expresses 150 copies of recombinant cpVIII, which provides an avidity effect in regard to ligand binding.

Previously we identified a novel peptide (TG1) using f3 phage display againsthemagglutinin. The objective of this project is to express TG1 on cpVIII to develop a phage that promotes binding via the high affinity of the peptide and the avidity effect of f88expression. Phage (Fd-tet f88) was grown from cultures (kind gift from Dr. George Smith) by infecting Blukan91 cells in NZ amine yeast (NZY), 0.04µg/mL tetracycline (TET), 100 µg/ml kanamycin (Kan) overnight at 37˚C and 225 rpm. Next, the phage was purified by polyethylene glycol (PEG)/NaCl precipitation and centrifugation (5000rpm, 4˚C, 15 min). The phage DNA was then extracted by adding an equal volume of phenol-chloroform followed by centrifugation (10000 rpm, 4˚C, 5 min). The DNA was precipitated using 0.1 M sodium acetate and 100% ethanol overnight at -20˚C. Precipitated DNA was collected after centrifugation (10000 rpm, 4˚C, 30 min) and washed using 100% ethanol. The final pellet was air dried and dissolved in 100 µL elution buffer (10mM Tris-HCL,pH 8.5). The extracted DNA size (9214 bp) was verified by agarose gel electrophoresis, and the DNA concentration and purity was determined spectrophotometrically at 230, 260 and 280 nm. Next, TG1 DNA will be inserted into the phage vector by double restriction enzyme digestion (HindIII and PstI) followed by ligation using T4 DNA ligase. The ligated product will then be transformed into *E.coli*DH5α via heat shock at 42˚C for 20 s and plated on lysogeny broth (LB) plates with 40 µg/mL tetracycline overnight growth at 37˚C. Next, up to 10 colonies will be

selected for screening of the correct size plasmid using gel electrophoresis. Likewise, verified plasmids will be sequenced (Genscript, NJ) to validate the insertion of TG1. These plasmids will then be utilized to propagate phage particles expressing TG1 in *E.coli*BluKan91 in NZY/TET/KAN medium with 1mM isopropyl β-D-1-thiogalactopyranoside overnight at 37˚C. Expression of TG1 will finally be verified by enzyme linked immunosorbent assay (ELISA) against hemagglutinin.

The objective of this project is to develop a phage that expresses the TG1 peptide on cpVIII to develop a phage particle with both high affinity and avidity for the hemagglutinin target. This may be beneficial in binding to hemagglutinin with a stronger interaction compared to a single peptide.

CHEMISTRY

29 2:15pm UG **Concentrations of Antioxidants in Tea**

*Darby Duffy, Brian Bellott [Western Illinois University]

The antioxidant concentration in a given tea was assessed through the Folin- Ciocalteu assay. A curve using different concentrations of gallic acid was produced with Ultraviolet–visible spectroscopy. Gallic acid was diluted with water to create different concentrations of gallic acid to be tested. The gallic acid was combined with the FC reagent and a sodium carbonate solution in cuvettes. The cuvettes were ran through a UV- Vis. The UV-Vis used light to measure the absorption in a given sample. The cuvettes with the different concentrations of gallic acid were initially ran. Any given tea was then substituted for the gallic acid in the cuvettes to be combined with the FC reagent and sodium carbonate solution. The new set of tea solutions were ran through the UV-Vis to determine the concentration within the tea. The point on the curve was compared to the different gallic acid absorptions to determine the concentration of the tea.

30 4:00pm Grad **How Changing Different Variables in Foam Synthesis Affects its Cell Morphology**

*Deanna P. Valdebenito, Brian J. Bellott [Western Illinois University]

Foam is formed when foaming agents are added to rubber to create a matrix that is filled with air. Depending on what properties one wants for the final material, the formulation must be designed accordingly. It is important to change the formulation in ways that will maintain its thermal properties. One must also keep in consideration the curing rate. For this experiment different reactants were changed in the synthesis of the foam materials being examined. First the foam materials were observed through a Zeiss Microscope, to see the different cells, and whether they were open or closed. Open cell foams can be both low and high densities and are the more flexible foams. Closed cell are the rougher ones, which is caused by more cross-links. Once all the foam samples were observed through Zeiss, they were then observed with a Scanning Electron Microscope. This allowed to see in greater detail the cross-links in the materials. It is important to understand how properties change accordingly with the different reactants used and seeing how these changes affect the cell morphology of the foam, as well as its cross-link density. With this information formulations can be written to cater for specific properties.

31 2:15pm UG **Cloning and Expression of a Human Gene for Keratin, a Fibrous Protein, in Yeast**

*Hailemariam Mitiku, Michael Ward, Michelle Fry [Bradley University]

Alpha-keratin is a fibrous, structural protein that can be found in the skin, hair, nails, and horns of mammals. The coiled-coil structure of α-helical keratin affords strength and resiliency to friction and physical stress, making this protein a prime biopolymer candidate for use in the biomedical field. To obtain sufficient quantities of keratin for analysis of this biopolymer and its potential use in the preparation of functional composites, we cloned KRT genes that encode recombinant GFP-tagged human keratin proteins into a pPICZαC vector for expression in *Pichia pastoris*. The pPICZαC-KRT14-GFP construct (pHAM) was verified by restriction digest and transformed by electroporation into *P. pastoris* wild-type (GS115) and vacuolar protease deficient (SMD1163) strains. Successful integration of linearized pHAM into the alcohol oxidase (AOX) promotor region of the *P. pastoris* genome has been verified using the polymerase chain reaction (PCR). Expression of keratin 14 by the resultant transformants has been induced with methanol. The level of keratin 14 expression and optimum expression conditions are currently being investigated.

32 4:00pm UG **Synthesis of Metal Chalcogenide Materials for Energy Applications**

*Airelle Alejandre, Brian J. Bellott [Western Illinois University]

Solid state is the study of synthesis, structure, and properties of solid phase materials. The band gap theory usually promotes a valence electron bound to an atom to become a conduction electron which can move around the crystal lattice and can carry an electric current. The band gap is also used to observe if the electrons are able to form bonds. It helps to determine the amount of electrical conductivity of a solid. The objective is to understand the energy difference from the top of the valence band and the bottom of the conduction band. And also, to observe if the electrons are to form bands. Using reflux will help the reagents mix and crystallize better. The method is to make test tubes by using borosilicate tubing and cut into 12-inch sections after it is cut into 6-inch sections using a torch to seal one end of the tube. Acetone is used to coat the tube 3 times which provide a barrier form the tube and reagents. The reactants into a tube, heated to 800^{o} C over the course of two weeks. After the reactions, time is complete the samples will be examined using an optical microscope, a scanning electron microscope. In order to determine the stoichiometry of the sample then a spectroscopy detector will be used. Loading the reaction into the tube and after being in a furnace there have been some crystals. Using an optical microscope there was a further investigation of crystals they were formed or anything similar. Using the scanning electron microscope to further analyzed the compound that was made.

33 2:15pm UG **Synthesis of Iron Telluride**

*Schaefer Roach, Brian Bellott [Western Illinois University]

Iron telluride is a useful material for electronic instruments such as MRIs. Iron telluride has a unique property being superconductive at low temperatures. Superconductive materials allow for zero electrical resistance when electricity is applied meaning there is no wasted energy in the process. Other ordinary conductors such as copper has impurities and in turn has some electrical resistance even at temperatures close to absolute zero (Bardeen-Cooper-Schrieffer). Iron telluride can also be used in the research setting with other studies using thin films to test superconductivity. The research objective I have set involves synthesizing large, geometric, single crystals of iron telluride. Iron telluride comes in multiple forms as FeTe, $FeTe_2$, and Fe_2 Te_3. Layered formation of crystals is seen commonly with the typical procedure which shows progress towards single crystal formation. Once a consistent method is discovered, the ability to make single, pure crystals would be auspicious. The process involves the placement of pre-measured amounts of iron and tellurium powder into quartz tubing. The tubing containing the powder is then vacuum sealed by a torch and the sealed tubes are placed into a computer-controlled furnace for approximately one to two weeks depending on the variations being tested). The furnace is run at high temperatures reaching 800 ºC and is subsequently cooled to room temperature. During the time in the furnace, the powders will fuse together which illustrates the concept of solid state synthesis. After the furnace reaction is complete, the tubing is then taken out and the contents are analyzed for the formation of crystals under a Scanning Electron Microscope. The primary step we have to take to create single crystals would be to first vary our procedure through each trial run to synthesize the most desired products possible. This involves a few different avenues for experimentation. One variation would be testing different amounts of each substance used while still considering the ratios of iron and tellurium. The other variation would be changing the time and temperature at which the reactions occur in the computer-controlled furnace. This would mean changing the number of days in which the furnace is at high temperatures and focusing on the time allowed for the cooling to occur which may produce more desirable crystals.

I would like to acknowledge Dr. Brian Bellott and the rest of Bellott Research Group for the support on my project. I would also like to acknowledge the RISE program at Western Illinois University.

34 4:00pm Grad **Synthesis of Silver Nanoparticles with Capping Agents with Different Capping Agents**

*Katelyn Nemeth [Western Illinois University]

Noble metal nanoparticles are known to have unique physical, optical, and chemical properties that are used for an increasing variety of applications, such as chemical/optical sensing, biomedicine, and textiles. Silver nanoparticles are the preferred noble metal for the chemical sensing application due to their ability to identify a red-shift or blue-shift in the air for chemical warfare of nerve agents, such as sarin. To identify these chemical agents, the nanoparticle must have a specific morphology, cubic and between 10-100nm in dimension. To synthesize these nanoparticles with sharper corners and larger face geometry, there are

different variables that can be focused on. These variables are the reducing agent, capping agent, etching agent, temperature, and pH value of the nanoparticles. Capping agents are of focus in this research because of their ability to limit the size and the shape of the nanoparticle during aggregation. To determine the ideal capping agent for synthesis of silver nanoparticles for chemical sensing, two different capping agents with a difference in anion is analyzed at different concentrations. The change in anion and concentration can affect the ability of the agent to seize the aggregation of the nanoparticles and change its morphology. Cetyltrimethylammonium chloride (CTAC) and hexadecyltrimethylammonium bromide (CTAB) are the capping agents varying by concentrations from 10-50mM. The size, geometry, and composition of the nanoparticles are analyzed through UV/VIS and STEM-EDS. Statistical analysis of nanoparticles obtained through ImageJ.

35 2:15pm Grad **Mechanistic Investigations of Oxidation of Doubly Vinylic Alcohols Using Water-Soluble *o*-Iodoxybenzoic Acid (IBX) Derivatives**

*Adeola Adesoro, Thottumkara K. Vinod [Western Illinois University]

o-Iodoxybenzoic acid (IBX), a highly versatile hypervalent iodine (V) reagent has been heralded as a mild and efficient oxidant for a variety of synthetic transformations ranging from oxidation of alcohols to oxidation of amines and oxidative deprotection of dithianes. Mechanistic investigation of the various oxidative transformations using IBX has shown that the reagent can act as a single electron transfer (SET) agent and thus the oxidations employing IBX can either adopt radical or ionic pathways. Recently we have reported the synthesis and use of three water-soluble derivatives of IBX in our laboratory and a careful evaluation of the mechanism of oxidation of alcohols using the water-soluble hypervalent iodine reagents in different solvents, including water, have allowed us to map out a series of feasible and predictable chemoselective oxidations from knowledge of the C-H bond dissociation energies of the bond involved in the oxidation step. Synthesis of a series of doubly allylic, doubly vinylic and mixed allylic-vinylic secondary alcohols are synthesized. A plausible mechanistic reasoning for the chemoselective oxidation of the different alcohol groups will also be presented.

36 4:00pm Grad **Determination of Phosphate and Nitrate Concentration in Soil and Water Samples**

*Rebecca Haughey [Western Illinois University]

Phosphates and nitrates are naturally occurring nutrients that have many beneficial attributes to them and are used in many fertilizers. When the concentration of phosphates and nitrates becomes too high the water and soils become toxic to the organisms around. High concentrations of these nutrients create algae blooms, which allows the algae to grow rapidly which depletes the oxygen in the water. The lack of oxygen in the water can create an anoxic event, which will kill the organisms in the water that do not receive enough oxygen. The main source of phosphate and nitrate pollution is through agriculture fields, and one way to reduce the pollution is to use buffer strips. The strips are buffer regions between agriculture fields and creeks that filter the runoff water from the field before it reaches the water to remove the pollutants from the water. In these buffer strips, the concentration of the phosphates and nitrates should be higher because it is removing these nutrients from the water that passes over them. The goal of this research is to determine the phosphate and nitrate concentration of the soil in the buffer strip as well as the water from a creek near the buffer strip. The concentration of the phosphates in the soil and water will be determined using a colorimetric method called vanadomolybdophosphoric acid. The concentration of the nitrates in the soil extract and in the water were measured using a probe.

37 2:15pm Grad **Quantitative Analysis of Limonene Content in Citrus Oil by Gas Chromatography Using Acetophenone as the Internal Standard**

*Terrence Petry, Jacob Barnhill, Liguo 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 acetophenone 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.

38 4:00pm UG **Quantification of Phenylbutazone in Equine Plasma for Doping Control in Horse Racing Using Total Flavonoid Concentration in Tea**

*Dalton Moss, Brian Bellott [Western Illinois University]

The creation of free radicals is a necessity in multiple disciplines of chemistry. From quantitative techniques to the creation of polymers, there are multiple different uses for these immensely reactive compounds. In human biology, cells create free radicals in its natural process of breaking down and recombining compounds for energy. Studies have been done on the concentration of free radicals in the human body, and the health effects that become more probable due to an increase in the oxidative stress. While the body tries to manage the concentration of these compounds on its own, there exists a class of chemicals known as antioxidants that assist in this process. One specific type of antioxidant commonly found is the flavonoid. Flavonoids are known to be abundant in tea, adding yet another useful health benefit to this drink.

For 3 semesters of research, we have worked to develop a test to quantify the concentration of flavonoids in tea. We have worked with two separate methods, the first of which involved mixing the tea sample with aluminum chloride, sodium nitrite, and sodium hydroxide. This method created an insoluble product in solution, making UV/Vis testing impossible. The second method omitted the sodium hydroxide and sodium nitrite. This method failed to create the target peak compared to a blank of just tea. This semester, our plan is to develop this method more by varying the total time allowed for the reaction before testing, the concentration of the acidic solution of aluminum chloride, or reintroducing sodium nitrite into the system.

39 2:15pm Grad **Quantitative Analysis of the Organic Explosive HMX in Water by High Performance Liquid Chromatography with Ultraviolet Detection**

*Alexandra Brisbin, Wei Chen, Sashi Bhushan Pathipaka, Liquo song [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 HMX in water samples. In order to avoid interference by other organic explosives, baseline separation of HMX 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 HMX standard solutions prepared in HPLC mobile phase were analyzed by HPLC/UV and a HMX peak area versus concentration plot was fitted to a linear equation. After a HMX contaminated water sample was analyzed by HPLC/UV under identical conditions, the HMX concentration was calculated by using the linear equation and the HMX peak area.

40 4:00pm Grad **Quantification of Naproxen in Equine Plasma for Doping Control in Horse Racing using High Performance Liquid Chromatography with UV Detection Coupled with Strong Anion Solid Phase**

*Tiwalola Ogunleye, Madison Chao [Western Illinois University]

Nonsteroidal anti-inflammatory drugs (NSAIDs) are a group of drugs differing in structure and molecular weight but similar in their mechanism of action, side effects and therapeutic properties. A distinct feature of NSAIDs is that they are all acidic with pKa values ranging from 3 to 5, their pharmacological characteristic enables them to act as analgesic and antipyretic which enables them to reduce pain and fever respectively, this analgesic property can allow an injured horse to continue racing as NSAIDs can mask the lameness despite serious injury to tendons and joints.

Naproxen (NAP) like all NSAIDs has the effect to mask lameness thus the need for its use to be monitored in race horses which is enforced by the United States Equestrian Federation (USEF) to ensure animals right to health. With NAP quantification in race Equine plasma, USEF controls doping and concealment of pathological conditions by setting specific thresholds with Naproxen's given as 40µg/ml of plasma to differentiate between its therapeutic use and doping.

Determination of NAP concentration in equine plasma was achieved using High performance Liquid Chromatography (HPLC) using Ultraviolet (UV) Spectroscopy as a means of detection coupled with Strong anion exchange Solid phase extraction (SPE), though other means of detection like the Mass spectrometry had been developed, the UV detection is usually more accessible for Equine plasma drug quantification

In the study, six equine plasma sample spiked with different concentration of NAP and three samples with unknown concentration of Naproxen were first pre-treated by (SPE) to reduce the amount of interference which ensures an easy detection of the drug by HPLC, the pretreated samples were then analyzed with HPLC using a mobile phase composing 68% (95: 5 Methanol: Acetonutrile) and 32% water with 0.1% acetic acid, and injection volume of 20µl, flow rate 1.0 ml/min and UV detection at 254nm, using this column conditions and internal calibration method of Tofenamic acid as the internal standard the concentration of Naproxen in the unknown samples was determined from the calibration curve equation and was obtained to be close to the real values with a %RSD of 1.3.

41 2:15pm Grad **Quantification of Phenylbutazone in Equine Plasma for Doping Control in Horse Racing using Strong Anion Exchange Solid Phase Extraction Followed by Liquid Chromatography with UV Detection**

*Frank Lin, Nicole Heiser [Western Illinois University]

Phenylbutazone (PBZ) is one most commonly administered nonsteroidal anti-inflammatory drugs (NSAIDS) for horses, often prescribed to reduce pain and inflammation for the musculoskeletal and joint regions. However, the misuse of PBZ has sparked a controversy in horseracing over the years, as such drugs can mask the lameness of an injured racehorse, which both endangers the horse and the rider. Today, many different performance associations have set strict regulations on the use of PBZ, as well as many other NSAIDS, in racehorses. For example, the plasma threshold of PBZ for a racehorse in Illinois should not exceed 2.0 µg/mL in a post-race analysis. Additionally, PBZ is often analyzed for in conjunction with its metabolite, oxyphenbutazone (OPBZ).

Many methods have been developed to analyze the levels of NSAIDS in equine plasma, often through chromatographic methods such as liquid chromatography (LC) or gas chromatography (GC), which are then coupled with a detection method such as mass spectrometry (MS). Although MS is a popular detection method due to its high specificity and sensitivity, it is not as accessible for most laboratories. An alternative to this would be to utilize ultraviolet (UV) detection, which is sensitive enough to analyze for NSAIDS like PBZ. However, since UV is less specific than MS, a selective method will have to be developed to compensate for the loss in specificity. Thus, the objective of this study was to develop a method was to selectively extract PBZ and OPBZ from interfering components in equine plasma and achieve a baseline separation of PBZ and OPBZ from other common NSAIDS.

This was achieved through the use of strong anion exchange-solid phase extraction (SAX-SPE) followed by (LC-UV). With SAX-SPE, the NSAIDS of interest (PBZ and OPBZ) and an internal standard (tolfenamic acid) were selectively extracted from equine plasma, and a baseline separation was achieved with LC-UV under optimized LC conditions. The levels of PBZ and OPBZ were quantified with the use of an internal standard calibration curve that was generated from the results. An equine plasma with an unknown concentration of OPBZ and PBZ has also been analyzed in triplicate to validate the method, and the percent relative standard deviation of the analysis was 4.93% and 6.75% for PBZ and OPBZ respectively. Thus, the results demonstrate how this method is able to successfully quantify the levels of PBZ and OPBZ in equine plasma through this method, which can then be applied to common drug testing laboratory settings.

42 4:00pm UG **Chemically Enhanced Sedimentation to Remove Phosphorus from Wastewater**

*[1]Saamia Salik, [1]Kyle Knust, [2]Keith Richard [[1]Millikin University, [2]Sanitary District of Decatur]

High levels of phosphorus within bodies of water can lead to eutrophication, producing odorous, toxic algal blooms and the death of aquatic life. With an abundance of local agricultural processing, the Sanitary District of Decatur (SDD), a wastewater treatment facility located in Decatur, Illinois, averages 30 ppm of phosphorus in influent wastewater, whereas most cities have approximately 5 ppm phosphorus. The SDD currently relies on biological methods to regulate nutrient levels within wastewater. However, biological methods alone are not effective in removing large amounts of phosphorus. Consequently, we investigated chemical sedimentation of influent wastewater as a pathway to lowering phosphorus levels to approximately 10 ppm. When combined with existing biological treatment, this facilitates 1 ppm phosphorus in effluent water. By treating influent with varying dosages of ferric sulfate, ferric chloride, ferrous chloride, aluminum sulfate, or aluminum chloride, we were able to determine which compound most efficiently precipitates phosphorus from wastewater. Importantly, biochemical oxygen demand, pH, turbidity, and mineral level measurements

were performed to ensure chemical sedimentation does not impact subsequent wastewater treatment processes. Our preliminary results demonstrate aluminum sulfate added to influent at a 1:1 molar ratio of Al:P based on influent having 25 ppm phosphorus was most successful in precipitating phosphorus to a level of 10 ppm, which can further be lowered to 1 ppm through subsequent biological treatment.

43 2:15pm Grad **Synthesis of AAk_2SnQ_4X**

*Kyle Murphy, Brian Bellott [Western Illinois University]

The different forms of $CsBa_2SnS_4Cl$ (α-$CsBa_2SnS_4Cl$and β-$CsBa_2SnS_4Cl$) will be compared by reflected light optical microscopy, polarized light optical microscopy, dark field optical microscopy, scanning electron microscopy, and X-ray diffraction. The samples were synthesized by combining the elements in the correct atomic ratios and heated in a computer controlled furnace. In order to produce crystals of significant quality different temperature programs were explored and the products from those reactions will be discussed. Preliminary results of the synthesis of $CsBa_2SnS_4Cl$ will be discussed in terms of what the change of sulfur to selenium does and how it impacts the extended structure of the samples.

44 4:00pm UG **Synthesis of Air-Stable Ruthenium and Nickel Catalysts**

*Sirikarn Phuangthong, Jocelyn Lanorio [Illinois College]

A series of air-stable nickel and ruthenium phosphine complexes have been synthesized and characterized. The phosphine ligands employed include the monodentate triphenylphosphine (PPh_3) and 1,3,5-triaza-7-phosphaadamantane (PTA), and the bidentate 1,2-bis(diphenylphosphino)ethane (dppe). Addition of PTA resulted in more stable complexes both in solution and solid state. Nickel and ruthenium complexes containing the PTA ligand exhibit high water-solubility and are potential catalysts in green solvents such as alcohol, water, or ionic liquids.

45 2:15pm Grad **Regioselectivity, Chemoselectivity, and Stereoselectivity in Organic Chemistry**

*Madeleine Peterson, Dannielle Wentzel, Shawn Montag, Brad Andersh [Bradley University]

Nationally organic chemistry has the reputation of being one of the most difficult courses that Biochemistry, Biology, Chemistry, and “Pre-med” students take. Both students and professionals mistakenly refer to it as a “weed-out” course. The overarching goals of this project are to increase student understanding and interest in the material presented in organic chemistry classes. We have developed two new experiments for undergraduate organic chemistry laboratories based on previous research in our laboratory. The objective of these new experiments, which utilize *N*-bromosuccinimide (NBS), is to help students understand the concepts of regioselectivity, chemoselectivity, and stereoselectivity. In the first experiment, students used ^1H NMR coupling constants to determine the regiochemistry for the reaction between 1,3-dimethoxy benzene and NBS. In the subsequent experiment, *trans*-stilbene is reacted with NBS and students utilize NMR spectroscopy to determine which of two competing reactions, electrophilic aromatic substitution and electrophilic addition, occurs. Comparison of experimental spectra of the product for this reaction to literature values indicates that electrophilic addition via a halonium ion is the major mechanistic pathway. The students' experimental results and data from our efforts to assess these exercises will be presented.

EARTH SCIENCE

46 4:00pm UG **Pier Scouring**

*Jacob Watson Esterlen, *Alexander Kerley [Eastern Illinois University]

Humans alter fluvial environments in both direct and indirect ways. The installation of bridges to facilitate transit across rivers offers convenience, but at the same time has unintended impacts on the river channel. When bridges are constructed, piers are positioned within the channel to increase the structural integrity of the bridge. These piers allow the passage of water while still providing support to the bridge’s main structure. Unfortunately, bridge piers alter the flow of water and, because of this, create scour. Scour, the removal of bed materials and sediment due to an increase in fluid velocity, can weaken the integrity of the channel bed and can lead to bank erosion and possibly bridge failure. Various models have been developed to document the impacts of a bridge pier on a river channel, but these were often conducted using a single bridge pier. To model the impacts that a second bridge pier, in close proximity to the first, would have on a

river channel, a stream table was used to record changes in sediment transport and bed scouring that occurred. Measurements were recorded both near the bridge piers and farther downstream. Control runs of an unaltered stream channel and a stream channel with a single bridge pier were used to establish a baseline, then experimental runs with two bridge piers in close proximity to each other were performed to determine geomorphic effects produced by the presence of the second pier.

ENVIRONMENTAL SCIENCE

47 2:15pm UG **Ideal Compost and Peat Moss Mix for Best Plant Growth & Soil Nutrients**

*Jenny Le, Grace Wilken [Eastern Illinois University]

Compost is an additive to soil that's environmentally friendly and sustainable in growing plants. It involves decaying organic matter, such as vegetables. More sustainable ways are tested to grow plants that can create a cleaner and sustainable cycle to bring back in produce. Peat-moss is an additive to soil, which is known to neutralize the pH of soil. In this research, ratio's of compost to peat moss are measured out and tested for different pH levels. With the different pH levels from the ratio's, the soil nutrients are tested in each batch after to see the different level of nutrients found in the soil. The ideal ratio for the best plant growth is found comparing all of the data collected from pH tests, soil nutrients measurements, and plant growth together.

48 4:00pm UG **Modeling Potential Lead Exposure Sources to Mexico City Children**

*[1]Brady H. Burden, [2]Luis Bautista-Arredondo, [2]Martha María Téllez-Rojo, B[1]en K. Greenfield [[1]Southern Illinois University Edwardsville; [2]Center for Nutrition and Health Research, National Institute of Public Health, Cuernavaca, Morelos, Mexico]

Elevated blood lead levels have been linked to developmental delays in children. Despite long term declines in blood lead levels (BLL) after the leaded gasoline ban, children in Mexico still face an epidemic of 'low level' lead poisoning [Pantic et al. 2018. Int. J. Environ. Res. Public Health, 15, 2153]. We report on the first mechanistic modeling study that compares possible sources of lead exposure for children in the general population of Mexico. We are using the US EPA-developed Integrated Exposure Uptake Biokinetic Model (IEUBK) to compare potential lead sources for exposure to Mexico City children. The IEUBK was developed to predict blood lead levels in children ages 0-7 years old based on data input from multiple sources. Modeled lead sources include ambient outdoor air, soil, indoor dust, in-utero transfer, drinking water, and food. For dietary lead in Mexico, the two main sources are the food itself from lead in irrigation water, and through the preparation and storage of acidic foods in lead-glazed ceramics. A preliminary model run using available data from Mexico City predicted a geometric mean BLL of 1.7 µg/dL and 1.1% of the population over 5 µg/dL. This is lower than the most recent survey by Pantic et al. (2018), who found a geometric mean BLL of 2.0 µg/dL with 8% of the sampled children over 5 µg/dL. This discrepancy may indicate an exposure source not accounted for by the model. Potential sources meriting further examinationinclude dietary exposure from lead glazed ceramics and indoor dust exposure from leaded paints. Our study highlights the need for mechanistic exposure models to complement ongoing epidemiological investigations of childhood lead exposure.

49 2:15pm Grad **Comparing Spatial Patterns of Heavy Metal Concentrations in Soil to Sources and Demographics across Madison and St. Clair Counties (Illinois, USA)**

*Jannatul Ferdous, Jarrod N. Koski, Adriana E. Martinez, Ben K. Greenfield [Southern Illinois University Edwardsville]

Metal contaminated soil is a source of potential human health risk and harmful ecological impact on other living organisms. Spatial analysis of soil contamination patterns helps to prioritize the management of these toxic metal contaminants. We are using GIS and x-ray fluorimetry to determine the spatial pattern of heavy metal soil concentrations across Madison and St. Clair Counties (Illinois, USA). Site selection employed a probabilistic design, spatially stratified based on historic industry. Soil samples are analyzed on-site and in-situ with a Bruker Tracer 5i portable x-ray fluorimeter, with selected samples calibrated in the laboratory using inductively coupled plasma mass spectrometry. We will investigate the spatial distribution of metal contaminants, in comparison to historic and current sources and demographic factors. The data collected

from the soil samples will be spatially compared to sources obtained from EPA's Toxic Release Inventory and Superfund programs. Data will also be compared to demographic indicators obtained from U.S. Census data, to evaluate whether areas with greater poverty, unemployment, or minority populations reside near more contaminated soils. This is the first systematic attempt to compare soil contamination to both sources and demographics in southern Illinois, and may identify heretofore unknown environmental justice concerns.

50 4:00pm UG **The Effects of Topical Application of 5-HTP on Aggressive Behaviors in the Stalk-Eyed Fly, *Teleopsis dalmanni***

*Victoria Hyrczyk, Camryn Kirkham [Bradley University]

Stalk-eyed flies, *Teleopsis dalmanni*, are a sexually dimorphic species in which males have an exaggerated eye span. These eyestalks act as sexual ornaments that indicate reproductive potential to females as well as aid in aggressive encounters between males over resources. Intensity of these aggressive behaviors has been correlated with serotonin (5-HT) levels in the brain of the male. The higher the concentration of 5-HT, the more aggressive the male, and therefore the more likely he is to win an aggressive encounter. Preliminary results showed that topical treatment with 5-HT and the serotonin precursor hydroxytryptophan (5-HTP) elevated serotonin levels in male *T. dalmanni*. For this experiment, we hypothesized that topical treatment with 5-HTP will increase the number and duration of aggressive behaviors in males and will increase the probability of winning a staged encounter with a size-matched opponent. To test this, we staged 10-minute aggressive encounters between size-matched flies topically dosed with either 2mg/mL 5-HTP dissolved in dimethyl sulfoxide (DMSO) or with DMSO alone (control). We compare aggression scores between groups and discuss the effects of topical dosing on the probability of winning an aggressive encounter.

51 2:15pm UG **Bioaccumulation of Selenium, Mercury, and Arsenic in Fish Fillets from the Midwestern Market: Elemental Interactions for Human Health**

*Tyler Columbara, Zhi-Qing Lin [Southern Illinois University Edwardsville]

Selenium (Se) is an essential nutrient element for humans and animals. Selenoproteins play important roles in anti-oxidation and immune system functioning for human health. Because of higher affinity of Hg to selenols, high contents of Se could significantly reduce mercury (Hg) bioavailability and toxicity through the formation of stable mercury selenide (HgSe). Selenium can also interact with arsenic (As) to reduce As toxicity by forming Se-As complex seleno-bis (*S*-glutathionyl) arsinium ion $[(GS_3)_2AsSe]^-$ and also reducing oxidative stress derived from As toxicity by selenoprotein (GPx). This study determined bioaccumulation of Se, Hg and As in fish fillets that are commercially available on the market in the Midwest, including Tilapia, Catfish, Rainbow Trout, Salmon (farmed and wild) and Orange roughy. Preliminary results showed that concentrations of Se, Hg and As in fresh fish fillets ranged from 0.075±0.022 μg/g in Catfish to 0.852±0.108 μg/g in Orange roughy, from <0.0001 μg/g in Catfish and farmed Salmon to 0.2314±0.0697 μg/g in Orange roughy, and from 0.121±0.047 μg/g in farmed Salmon to 1.084±0.074 μg/g in Rainbow trout, respectively. Overall, concentrations of Hg in fish fillets were below the US/WHO food standard of 0.50 μg/g, but elevated concentrations of As were observed in Rainbow trout, wild Salmon and Orange roughy fillets in comparing with the US/WHO food standard of 0.35 μg/g. High molar ratios of Se to Hg were found in all fish fillets, ranging from highest in Tilapia (139.2) to lowest in Orange roughy (10.1), while relatively low molar ratios of Se to As were found in fish fillets, varying from 1.1 in Tilapia to 0.2 in Rainbow trout.

52 4:00pm Grad **Remediation of Selenium-Contaminated Wastewater Using Municipal Biosolids and Drinking Water Treatment Residuals**

*Tochukwu Ekwonna, Olusegun Akindeju, Zhi-Qing Lin [Southern Illinois University Edwardsville]

Municipal wastewater treatment sludge (biosolids) and drinking water treatment residuals (WTRs) are two major municipal solid wastes. This laboratory study explored the feasibility of using biosolids and WTRs to treat selenium (Se)-contaminated industrial wastewater. It was hypothesized that high microbial activity in biosolids could reduce water soluble selenate (SeO_4) or selenite (SeO_3) to water-insoluble elemental Se (Se0), and that high contents of Al, Fe, and Ca hydroxides in WTRs could adsorb and remove SeO_3 from contaminated wastewater. The preliminary results showed that a treatment column of 20 cm long and 9 cm diameter containing sand, biosolids, and WTRs could significantly reduce influent SeO_3 concentration from 1000 ng/mL to 537±137 ng/mL total Se in effluent, showing an average Se concentration reduction of 46% during a 3-day time period and an average removal capacity of 6.3 ng Se /cm^3 hr. The maximum Se concentration reduction (68%) was observed during the time period of 4 to 8 hours after the introduction of

Se-contaminated wastewater.

53 2:15pm Grad **Changes in Bird Community Structure Due to Anthropogenic Noise in an Old Growth Forest**

*Nicholas Wells, Richard Essner [Southern Illinois University Edwardsville]

Unwanted sound has seemingly penetrated every corner of our planet. 83% of land in the lower 48 states is within 1 km of a road. Noise pollution has infiltrated even the most pristine areas causing a negative impact on nature by increasing organisms' levels of stress. Birds are especially susceptible to anthropogenic noise due to its interference with their auditory communication. Bohm Woods State Nature Preserve, located near the campus of Southern Illinois University Edwardsville, is the only remaining old growth forest in Madison County, IL. A 486-bed student housing development is currently being constructed on agricultural land adjacent to Bohm Woods. Human development adjacent to a forest has been found in previous studies to have detrimental effects on bird community structure, especially breeding neotropical migrants. Prior to construction near Bohm Woods, point count surveys were conducted during migration and breeding seasons using 30 previously established survey plots. The purpose of this study was to determine the degree to which adjacent anthropogenic disturbance may affect the diversity, richness, and structure of bird communities before, during, and after construction. Using audio recordings and Geographic Information System (GIS), we will create a sound map to compare sound levels to specific bird communities within Bohm Wood by discovering sound level microhabitats. We recorded sound samples at each survey plot during migration and breeding seasons. Using the statistical software *R*, we can identify the overall amplitude of different sound levels by source. Anthropogenic sources of sound are categorized at pitches within 1-2 kHz; more natural sounds range from 2-11 kHz.

54 4:00pm UG **Determination and Characterization of Perfluorooctane Sulfonate Neurotoxicity in Fruit Flies**

*[1]Amanda Fix, [1]Carl Namini, [1]Yusuf Ali, [1]Ki-Bae Hong, [2]Yooheon Park [[1]Southern Illinois University Edwardsville; [2]Dongguk University, South Korea]

Perfluorooctane sulfonate (PFOS) can be classified as a perfluorinated compound (PFC) constructed of carbon fluorine bonds found accumulating in air, soil, and water on all continents. Previous studies have revealed that PFOS stimulates glutamate-gated NMDA and AMPA receptors leading to increased calcium influx that leads to hyperexcitation. Although determined as a neurotoxicant, detailed molecular actions of PFOS are still to be understood. In present study, we validated neurotoxic effect of PFOS in fruit flies. From exposing three to five-day old male flies to 20 mM PFOS, estimated LT_{10}, $LT_{50,}$ and LT_{90} values were 10.1, 19.7, and 40.5 hr, respectively. Additionally, we are currently investigating if PFOS toxicity is altered in the presence of picrotoxin (PTX) or ivermectin (IVM). This research may shed light on the actions of PFOS in the inhibitory nervous system since PTX and IVM are known modulators of gamma-aminobutyric acid (GABA)-gated chloride channels.

55 2:15pm UG **Determination of Sublethal Concentrations and Effects of Imidacloprid in Female *Drosophila melanogaster***

*Kristina Springer, Kyong Yoon [Southern Illinois University Edwardsville]

Imidacloprid (IMI), a synthetic neonicotinoid, has become one of the most widely used insecticides around the world for protection of agriculture, animal and human health, and anthropogenic structures. Although acute neurotoxic effects of IMI by modulating nAChRs have been relatively well-described, adverse effects from exposures to low or sub-lethal concentrations of IMI have been largely uncharacterized. In present study, ranges of lethal and sublethal concentrations of IMI in female Canton S. strain of *D. melanogaster*were determined using conventional bioassay methods (dermal and oral exposures) over 72 hr. Regardless of exposure methods, prominent mortality responses were observed from flies treated with 0.1 and 1 mM IMI. Estimated LT_{50} values for flies treated with 0.1 and 1 mM IMI in 5 % sucrose were 59.9 and 30.3 hr, respectively. LT_{50} value determined from female flies exposed to 1 mM IMI suspended in the fly medium was 29.8 hr. Additionally, estimated LT_{50} value for flies treated with 1 mM IMI dissolved in ethanol through direct application was 34.3 hr. Flies treated with 0.001 and 0.01 mM IMI regardless of exposure routes showed no mortality responses during the 72 hr bioassay period. The determination of sublethal imidacloprid concentrations in female fruit flies provides a useful concentration range for studying the effects of sublethal exposure on fruit flies. Future research can utilize this data to evaluate biochemical changes in fruit flies that are exposed to sublethal exposures to imidacloprid. Altered levels of reactive oxygen species and epigenetic modifications in flies treated with sublethal IMI are currently being investigated.

56 4:00pm UG **Effects of Food Resource Levels on Parasitism in Larval Frogs**

*Kiernan Robinson, John Marino [Bradley University]

Amphibian populations worldwide are experiencing declines, and some declines could be due partly to parasitic infections, as studies have shown a link between infection levels and mortality. Food resource levels play a major role in larval amphibian growth, development, and survival, and also likely affects susceptibility to parasites. To examine the combined effects of parasite exposure and food resource quality, green frog tadpoles were fed diets differing in protein content (high, medium, or low) and then exposed to different levels of trematode parasites (absent or present). The high protein diet increased final mass and survivorship of tadpoles when parasites where absent but decreased final mass and survivorship when parasites were present. We also expect that a high protein diet will cause infection levels to be increased; dissections to assess infection loads are ongoing. These findings suggest that diet can affect organisms' resistance to parasitic infections, and tradeoffs may exist between allocating resources to growth or defenses against parasitism. These findings have potential implications for conserving amphibians in the face of disease and changing nutrient regimes in their habitats.

57 2:15pm UG ***Aedes* Mosquitoes in Coles County**

*Krystal Atkins, Mario Lara, Anthony Oluoch, Thomas Canam, Chang Hyun Kim [Eastern Illinois University]

The recent outbreak of Zika virus has re-ignited interest in mosquitoes of the genus *Aedes.*These mosquitoes are vectors of a wide number of human viral diseases including *Dengue fever, Yellow fever, West Nile virus, eastern encephalitis virus and Zika Virus.* The most widely distributed species are *Aedes vexans, Ae. aegypti* (Yellow Fever mosquito) *and Ae. albopictus*(Asian Tiger mosquito). Even though some of diseases transmitted by these mosquitoes are rare in the United States, increased international travel (combined with the rapid spread of competent vectors such as *Ae. albopictus*) has created an urgent need to understand vector epidemiology. Between May and October 2017, a survey for Aedes species was carried out in Coles County, Illinois. A total of 3,485 *Aedes* mosquitoes were collected. Overall *Aedes vexans* occurred in the highest proportions (68.9%) among the 8 species collected, followed byAedes japonicus (16.9%) and *Aedes albopictus* (11.4%).

58 4:00pm UG ***Culex* Mosquito Species in Coles County, Illinois**

* Mario Lara, Krystal Atkins, Anthony Oluoch, Thomas Canam, Chang Hyun Kim [Eastern Illinois University]

Culex mosquitoes are responsible for the transmission of diseases of medical and veterinary importance such as *West Nile Virus* and *St Louis Encephalitis Virus*. Several species of this genus have been reported to occur in Illinois. In order to ensure adequate control measures, there is a need to continually update the database for the seasonal and spatial occurrence of these and other mosquito species. Therefore, between April and October 2017, we carried out a survey for *Culex* mosquitoes at six locations in Coles County using both light and gravid traps. A total of 4,352 *Culex* mosquitoes were trapped and sorted by species. *Culex pipiens* and *Culex restuans* were the most frequently encountered species. Largest numbers of mosquitoes caught in July and August.

59 2:15pm Grad **Impacts of Land Use and Land Cover Changes on Hydrological Regimes of the Richland Creek Watershed, Southern Illinois, using a GIS-based Hydrologic Model**

*Prasanna Shrestha, Shunfu Hu [Southern Illinois University Edwardsville]

With increase in population, urbanization has been replacing forest and agricultural lands in many parts of the United States. Urbanization can increase impervious surfaces and thus can impact the hydrological regimes in watersheds. The purpose of this project is to study how land use and land cover (LULC) changes impact the hydrological regime in the Richland Creek Watershed (RCW) located in Metro St. Louis area. The RCW has undergone land use changes from forest land to row-crop agriculture, which is now further being replaced by suburban land uses. The research uses a GIS-based distributed hydrological modelling, namely Hydrologic Engineering Center-GeoHydrologic Modelling System (HEC-GeoHMS). Physical parameters for the RCW are developed in HEC-GeoHMS and then they are used in HEC-HMS model for simulation of runoff hydrographs along with meteorological inputs (precipitation and temperature) and Soil Conservation Service (SCS) curve number (CN) grids. It is anticipated, at subbasin level in the RCW, the most developed with high

impervious surface will generate high runoff compared to areas with no significant change in LULC. This research will contribute to the GIS-based hydrological modeling community and will enhance the understanding of the interactions between LULC changes and hydrological regimes.

60 4:00pm UG **Prairie Management and Interpretation at Eureka College**

*Kimberlea Johnson [Eureka College]

Prairies are a type of grassland habitat consisting of various species of grasses (dominant plants) and forbes, plants with soft stems and broad leaves such as wildflowers. When settlers arrived in Illinois, they incorrectly believed that prairie soil was of poor quality since no trees were growing on it and converted the land using agricultural practices (Illinois DNR). Historically, over 60% of Illinois (approximately 22 million acres) was prairie habitat, yet now it is estimated that only 2,500 acres remain (less than 0.01%). From the original planting in 2000 to 2014, the Eureka College Prairie has been burned and reseeded four times. In fall 2017, Environmental Studies capstone students Kim Johnson *(EVS '19)*, Colton Johnson *(EVS '18)*, and Ray Vogel *(EVS '18)* surveyed the prairie and assessed critical need for management of invasive species including *Ambrosia aremisiifolia, Melilotus albus,* and *Rumex crispus.* Over a period of 9 months, the research team periodically removed invasive species,successfully conducted a prescribed burn late spring, and drafted a 5-year management plan for the campus (administration, students, and grounds crew) to use as a guide for future care and upkeep of the prairie.

One of the primary goals for native landscapes on the Eureka College campus is the use of these outdoor areas as educational tools in and out of the classroom. The aforementioned prairie provides a valuable educational resource to the college community, yet the general public and campus visitors are not aware of its history, purpose, or current uses. To fill this knowledge gap, I created interpretive materials to be placed in newly constructed kiosks at this prairie and another natural area: the Sanders Hall Rainwater Garden, as part of an internship in environmental education during my senior year at Eureka College. Interpretation is key to informing community members of the importance of natural ecosystems in developed areas and their value to our campus community. Informational kiosk contents include historical and scientific information about the prairie, its benefits and benefactors, and what species viewers may see throughout different parts of the year.

This poster presentation will provide information on the 5-year management plan creation and content as well as the interpretive material creation and incorporation into our natural areas on the Eureka College campus.

61 2:15pm UG **Effects of Elevated Salinity on Cuban Treefrog (*Osteopilus septontrionalis*) Aldosterone Levels, Growth, and Development**

*Erin Lukens, Travis Wilcoxen [Millikin University]

Amphibian habitats are challenged with salinization due to environmental factors such as climate change, the use of road salts, and elevated sea levels. High salinity can have negative effects on the physiology and development of species living in freshwater habitats. Aldosterone is a steroid hormone that is produced by the adrenal cortex and is involved in osmotic regulation. We studied the effects of salinity on growth, development, and aldosterone levels in Cuban Treefrog tadpoles. Gosner stage, growth rates, and aldosterone levels were determined for tadpoles among three salinity treatments (150, 250, and 350 ppm) over a six-week period. Aldosterone levels were determined by an enzyme immunoassay of tadpole plasma. There was a significant effect of salinity on growth, development, and aldosterone levels. Tadpoles in the low salt group were larger, more developed, and produced the least aldosterone compared to those in the high salt group. It appears that Cuban Treefrog tadpoles have the ability to respond to high salt levels with increased aldosterone secretion; however, in order to survive high salt concentrations, trade-offs in growth and development must occur to regulate osmotic functions.

62 4:00pm UG **Implementing a Composting System on a Small College Campus**

*Kaitlyn Hild, Kathryn Everett [Eureka College]

Composting systems are slowly becoming a common addition to college and university dining halls and facilities operations across the country, yet smaller campuses with less resources face unique challenges in implementing similar programs. In the fall of 2018, I implemented a trial composting procedure at Eureka

College (in Eureka, IL) for my Environmental Science Capstone project. Eureka College is a small, liberal arts college with a population of approximately 600 students, that has never engaged in any composting of food scraps. The purpose of the 1-month trial was to determine the financial and operational feasibility of a college-supported composting operation in the campus dining hall through analysis of total waste diverted from our landfill, total cost of implementation, and feedback from primary stakeholders. The Eureka composting trial was designed using Goshen College (Goshen, IN) as a model and feedback from Goshen Director of Sustainability, who also shared compost bin design and management advice. Final results of the study will be presented to college administration to determine if Eureka College should implement a long-term composting operation at the campus dining halls.

63 2:15pm UG **Solar Energy System Site Assessment of Eureka College**

*Katy Everett, Riley Francis [Eureka College]

Eureka College is a small, liberal arts college in Central Illinois with a core value of sustainability and stewardship. Through sustainable investments, the college can make a transparent and intentional effort to support our core values and create opportunities for financial savings and marketing opportunities while lowering our environmental impact. In the fall of 2019, one of my senior advisees, Riley Francis, explored the feasibility of solar panel installation at multiple campus locations through her capstone project in Environmental Studies at Eureka College and an internship with Straight-Up Solar in Bloomington. This exploratory research and site assessment included an analysis of cost effectiveness, roof type/age, aesthetics of potential installations and acceptance by the campus population. All results were shared at the Eureka College Student Research Symposium in November 2018 and presented to the Board of Trustees in February 2019. The poster presentation will include all financial models and projected layout of solar installations recommended to the college.

64 4:00pm UG **Management and Research of *Amur* Honeysuckle Removal on Growth of Spring Ephemerals at Eureka Lake Park**

*Luke Brodahl, Cecilia Hennessy [Eureka College]

The invasive species, *Lonicera maackii*, impacts the local flora and fauna in United States Midwest. Amur honeysuckle is especially detrimental to other flora and fauna. Spring ephemerals are native flowering plants that appear very early in the spring and die back before the summer begins. These species help support bee populations, add color to early spring forests, and increase the overall biodiversity of the forest. Eureka Lake Park is a managed park in Eureka, Illinois beside a manmade lake. The forest is a part of the park with hiking trails throughout and a Frisbee golf course. Amur honeysuckle's introduction and growth into the park affects the growth and spread of spring ephemerals. By conducting population samples of spring ephemerals, the population of spring ephemerals found in areas with honeysuckle should be lower than in areas with honeysuckle removed. This experiment has found that removing honeysuckle from the area and monitoring the spring ephemeral growth in the next spring resulted in a shift of the types of spring ephemerals growing in the area. More analysis and data collection is planned in the future with a drafted management plan for Eureka College to use to continue the research and removal of Honeysuckle from Eureka Lake Park.

HEALTH SCIENCES

65 2:15pm Grad **Genotyping the Human Leukocyte Antigen *DQB1* Gene in Patients with Narcolepsy**

*Jennifer Folami, Julie Haring, Kortney Lucius, Justin Hollinshead, Dexter Kimbrough [Eastern Illinois University]

Narcolepsy is a chronic neurological disorder characterized by frequent and uncontrollable episodes of extreme daytime sleepiness, and affects approximately 1 in 2,000 people. Remarkably, little is known about the genetic and biochemical mechanisms that lead to this disorder. The goal of our current research was to attain more data about this understudied sleep disorder by examining the allelic variations associated with the human leukocyte antigen (HLA) gene *DQB1*, which has been previously associated with sleep disorders. We collected buccal (cheek cell) swabs from a group of patients that had been diagnosed with narcolepsy. We also mailed swab kits to individuals who were interested in participating in our research yet could not meet with our group in person. In addition, one patient with narcolepsy obtained samples from her extended family, which allowed a genetic pedigree map to be created. Several individuals who do not suffer from

narcolepsy also provided samples that made up the negative control set. After DNA extraction, the samples were amplified using PCR with barcoded primers specific for a variable region of the *DQB1* gene. The barcoded amplicons were pooled and sequenced using the MiSeq system at the Roy J. Carver Biotechnology Center at the University of Illinois at Urbana-Champaign. The resulting sequences were compared with known allelic variants of the *DQB1* gene to generate the genotype for each volunteer. Among the key findings was the presence of the*DQB1*0602* allele in the family pedigree study, which has been strongly correlated with narcolepsy in previous studies.

66 4:00pm UG **Isotype Switching and Spleen Development in *Rana catesbeiana***

*Raisa Zamacona Gonzalez, Laura Zimmerman, Travis Wilcoxen [Millikin University]

Compared to immunity in adult frogs, little is known about immunity in tadpoles. It has been demonstrated that *Rana catesbeiana* tadpoles can isotype switch from IgM to IgY three weeks after exposure to an antigen. However, the exact timing of this has not been determined. The time period of isotype switching in *Rana catesbeiana* was studied in 90 tadpoles, in addition to the development of their spleens. We divided the tadpoles into two different groups, the control group and the immunized group. Control tadpoles received 10 µL of a 50/50 of phosphate buffer solution (PBS) and alum. Immunized tadpoles received 10 µL of 50/50 solution of 10 µg/ µL of keyhole limpet hemocyanin in PBS and alum. Two tadpoles from the control group and four from the immunize group were selected randomly to be sampled every three days. We discovered that the immunized group had an enlarged spleen than the control group. The antibody levels to KLH will be measured using an ELISA. These results help us in determining the period of time it takes the tadpoles take to isotype switch from IgM to IgY. This information could be used in future research to investigate factors such as stress levels, change in temperature, and change in resource availability could affect the length of time that *Rana catesbeiana* takes to respond to novel antigens.

67 2:15pm Grad **Activated Zinc Mouth Rinse Reduces Inflammatory Cytokine Expression in a Gingival Epithelium Injury Model**

*Kaitlyn Stanton, Barbara McCracken [Southern Illinois University School of Dental Medicine]

Periodontitis, a polymicrobial infection and oral disease, causes oral malodor due to the periodontopathogenic bacteria producing volatile sulfur compounds including hydrogen sulfide and methyl mercaptan. Methyl mercaptan induces secretion of interleukin 1b (IL-1b), an inflammatory cytokine involved in the pathogenesis of periodontal disease. Periodontal pathogens such as *Porphroymonas gingivalis* trigger secretion of interleukin 8 (IL-8), a chemokine for phagocytic neutrophils. Toll-like receptors (TLR) are involved in the recognition of bacteria such as *P. gingivalis.* Periodontalpatients must be compliant with home care instructions after scaling and root planning treatment. Chlorhexidine mouth rinse is the leading home treatment plan for periodontal patients, however patient compliance is often reduced due to side effects such as teeth staining, unpleasant taste, and changes in taste perception. In this study we used a mouth rinse containing zinc, an important mineral for wound healing, and a possible alternative for chlorhexidine. A recent clinical study showed that patient compliance increased when using this activated zinc mouth rinse compared to chlorhexidine. We have subjected primary gingival keratinocytes (PGK) to different zinc-activating mouth rinse dilutions, and then injured them through a scratch assay. Cell media was collected and levels of IL-1b and IL-8 were determined by ELISA. The PGK cells were fixed and immunofluorescence was performed to visualize TLR-2 and TLR-4. The activated zinc mouth rinse did not slow wound healing compared to media alone. Both IL-8 and IL-1b levels were lower from wounded cells treated with the activated zinc mouth rinse compared to media alone. We hope that these studies will contribute to a better understanding of oral healing after injury, while providing in vitro research for clinicians to make an evidence-based decision on which at home mouth rinse to provide to their patients.

68 4:00pm UG **Enhanced Hematological Condition in Birds of Prey Undergoing Rehabilitation is Independent of Vitamin Supplementation Not Presented**

*[1]Anthony Bryan, [1]Travis Wilcoxen, [2]Jacques Nuzzo, [2]Jane Seitz [[1]Millikin University, [2]Illinois Raptor Center]

Antioxidants play a key role in protecting cells by inhibiting harmful oxidants, or free radicals, and are especially important in vertebrates that are ill or are overcoming injury, such as birds of prey in rehabilitation. Hematocrit and total plasma protein levels are also indicators of blood health and proper body function. In order to improve raptor health, 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 overall health in birds of prey undergoing rehabilitation. Blood samples from birds were taken at admission and release to be used in a Total Antioxidant Capacity (TAC) assay, hematocrit measurements, and refractometry. We found that antioxidant capacity increases from admission to release independent of diet, supporting that normal diet increases antioxidant capacity levels by itself. Hematocrit increases from time of admission to time of release independent of diet. We conclude that Vitahawk® is not cost or time effective to be used at the Illinois Raptor Center in the future.

MICROBIOLOGY

69 2:15pm UG **Recombinant Expression of Putative Chloramphenicol/Florfenicol Efflux Pump Proteins**

*Maya Webber, Keith Johnson [Bradley University]

Increased resistance to antibiotics is a significant health issue, having recently been identified by the WHO as a worldwide problem. A variety of contributing factors, including over prescription of antibiotics, spread of antibiotics between bacterial species, indirect selection and mutations have contributed to the rise in resistance. Relatively few new antibiotics have been developed in the past twenty years. One newer antibiotic, florfenicol, is a modified version of chloramphenicol. This antibiotic has been approved for use in agriculture and aquaculture. While florfenicol has been approved for use in aquaculture since 1995 for use in treating bacterial infections in farm-raised salmon and catfish, several different mechanisms of resistance to the antimicrobial have been identified. Mechanisms have been identified for inactivating florfenicol through hydrolysis, while a second mechanism has been identified that alters the 23S ribosomal RNA site that is involved in the interaction with the antibiotic. However, multiple putative efflux pump proteins have been identified in different pathogenic and non-pathogenic species that confers resistance to florfenicol and chloramphenicol. Previously our laboratory has identified mercury-resistant, salmonid intestinal bacteria that are resistant to multiple antibiotics, including florfenicol. These *Serratia* species were used to generate a genomic DNA library to screen for chloramphenicol resistance in *E. coli* and subsequent rescreening for resistance to florfenicol. Two putative efflux pump proteins were sequenced from the genomic DNA fragments conferring resistance. At least four other bacterial species have been identified which express efflux pump proteins that have been shown to confer resistance to florfenicol. Recombinant expression of a chloramphenicol resistance gene (not an efflux pump) and the *Aeromonas salmonicida* FloR efflux pump protein show the expected results of chloramphenicol resistance for both and florfenicol resistance only for the FloR protein. Optimization of recombinant expression of controls will be presented, comparing different induction methods as well as different *E. coli* expression strains. The goal is to optimize expression of control strains while the *Serratia* putative efflux pump coding sequences are being created for testing.

70 4:00pm UG **Investigation of the Potential Regulatory Role of the 5' Untranslated Region in Regulation of a Putative, Florfenicol-Resistance Efflux Pump Protein using a Reporter Gene Assay**

*Colleen Miller, Keith Johnson [Bradley University]

The increased occurrence of antibiotic resistance has become an important problem throughout the world. Overuse, misuse, and other issues have contributed to the rise in resistance. Bacteria demonstrate resistance to antibiotics through a variety of mechanisms, including preventing the antibiotic from entering the cell, actively removing the antibiotic from the cell, altering the target site of the antibiotic, and cleaving the antibiotic. Resistance can be the result of mutations, but resistance can also be acquired through transfer of plasmids or other DNA between bacterial species. Our research lab has identified several mercury-resistant bacteria from hatchery-reared salmon. These bacteria have been demonstrated to be resistant to multiple antibiotics, including chloramphenicol and the related florfenicol. Florfenicol was developed as an antibiotic in the 1990s and was first introduced into aquaculture in 1995. The sampled salmonids did not experience this antibiotic in the hatchery. Genomic library screening of DNA from the bacteria demonstrated two putative efflux pump proteins that confer resistance to florfenicol and chloramphenicol when expressed in *E. coli*. Studies in our lab are investigating the role of these putative efflux pumps in conferring resistance. This research focuses on the putative 5’ untranslated region (UTR) that precedes one of the coding sequences. The 5’ UTR has several features, including two upstream open reading frames (uORFs) and a stemloop structure that may contribute to regulation of expression of the downstream efflux pump RNA and/or

polypeptide. The putative 5' UTR region has been placed upstream of the reporter gene *LacZ* in pUC19 along with several directed mutations to investigate the potential roles of the two uORFs in LacZ activity. Mutations in the first uORF start codon affect overall reporter gene expression, but mutations in the nearby second uORF have minimal impact in reporter gene expression. This suggests a potential role for the first uORF start codon or the short uORF peptide (six amino acids) in regulation of the downstream reporter gene. This may contribute to further understanding the role of this 5' UTR in influencing expression of the putative efflux pump protein.

71 2:15pm Grad **Description of Novel Endophytic Taxa within the Pleosporales and Evaluation of their Role on Plant Growth**

*Xiomy-Janiria Pinchi-Davila, Maria-Jose Romero-Jimenez, Andrea Porras-Alfaro [Western Illinois University]

Grasses in desert ecosystems and stressful conditions are colonized by dark septate endophytic fungi. These fungi are found worldwide and include multiple orders of the phylum Ascomycota including the order Pleosporales likely playing critical roles on plant survival and adaptation to drought. The main objective of this project was to describe, characterize and determine the effects of a novel group of isolates on plant growth under drought stress. Fungi were isolated from roots of three native grasses distributed in 18 sampling sites across a latitudinal gradient in the US and characterized using ITS rRNA and LSU rRNA sequencing. Sequences were compared with NCBI database and phylogenetic analyses were performed using MEGA7. Cultures were also characterized using different media and growth conditions. Colonies on MEA reach more than 35 mm diameter in 14 days, present aerial very diffuse white mycelium and, white, brownish or beige in the back of the plate. Some colonies on PDA were brown, olivaceous or beige and stain the media. Isolates had dark septate melanized hyphae when mycelium was more than 14 days old, chlamydospores were found in the mycelium, terminal or intercalar, sometimes solitary; smooth cell wall and oil-droplets were found in dark hyphae. These novel isolates are likely in the Montagnulaceae family closely related to *Kalmusia* and *Didymocrea* representing a potential new species, but additional genes will be sequenced to confirm its placement with respect to known taxa. Plant bioassays to test host specificity and drought tolerance will be conducted using *Bouteloua gracilis* (blue grama), *Bouteloua eriopoda* (black grama) and *Buchloe dactyloides* (buffalograss).

72 4:00pm UG **Detecting Antibiotic Resistance Loci in Wastewater**

*Emmaline Cler, Allie Hueston, Kai Hung [Eastern Illinois University]

Antibiotic resistance is a major public health concern. The transfer of these genes is exacerbated during wastewater treatment, as the probability of lateral gene transfer between species is significantly higher when species are in the same area. Wastewater treatment plants are then ideal candidates for studying this interaction between species. Preliminary data indicates that the Charleston Wastewater Treatment Plant in Illinois contains β-lactamase genes. These genes facilitate resistance to β-lactam antibiotics, which are the most commonly prescribed in the United States. There are four β-lactamase genes present within the water: TEM, KPC, AMPC, and SHV. To further study if the treatment and processing of the water facilitates lateral gene transfer of these four genes, water samples are taken from 5 locations within the plant. The bacterial species are processed, and then run through polymerase chain reaction (PCR) to amplify the genes in question. Further inquiry into the quantity of genes present as well as the quality of the genes is required to determine if the bacterial DNA is persistent after the organism is dead, or if antibiotic-resistant organisms are persisting through the water treatment process.

73 2:15pm UG **Antibiotic Properties of Newly Synthesized δ-Lactone Derivative**

*Jennifer Houser, Ivah Fears, Naomi Stover, Brad Andersh [Bradley University]

With antibiotic resistance becoming an increasing issue, there is a constant need for new antibiotics to be synthesized. The family of antibiotics belonging to δ-lactone derivatives have been shown to inhibit bacterial growth. Our present study is focused on creating a new δ-lactone derivative compound, which we have called 625-DCP, with a dichlorophenol substituent. Following synthesis, the compound was extracted and purified with dry ether. Nuclear magnetic resonance (NMR) was run to confirm synthesis of 625-DCP. To test for toxicity, minimum inhibitory concentration (MIC) assays have been run on *Bacillus subtilis*, a gram-positive bacteria, showing inhibited growth around 26.0μg/mL. Future directions of this study investigate the mechanism of action behind the disruption of cell function induced by 625-DCP by testing for changes in

gene expression.

74 4:00pm Grad **An Amoebae-Bacteria-Phage Matryoshka Doll: Investigating Bacteria-Bacteriophage Coevolution Dynamics within a Eukaryotic Host System**

*Paige Bangle, Susanne DiSalvo [Southern Illinois University Edwardsville]

Due to the ever increasing issue of antibiotic resistance, researchers have been looking for new ways to combat infections caused by pathogenic bacteria. One avenue that has shown huge promise is phage therapy. This is the practice of using a bacteriophage whose necessary host for replication is the pathogenic bacteria causing infection to infect that bacteria and destroy the cells, effectively wiping out the infection. There have been several studies that have shown the efficacy of phage therapy in clearing an infection; however, there are still many questions that need to be answered. One area of particular interest is how to avoid the bacteria simply becoming resistant to the phage just like they have done with antibiotics. Our study begins to look at the coevolution of a bacteriophage, Bonzo8, and its host bacteria, *Burkholderia bonniea,* as Bonzo8 attempts to cure host amoeba, *Dictyostelium discoideum,* of an infection of *Burkholderia*. This is accomplished by treating the infection for two weeks and pulling samples of both bacteria and phage twice throughout the course of the treatment. Following this, the recovered organisms will be tested to see if Bonzo8 is still capable of infecting *Burkholderia* or if *Burkholderia* has grown resistant. Furthermore, we wish to test if *Burkholderia* evolves, how well can Bonzo8 evolve in return to continue infecting its host.

75 2:15pm Grad **Bacteriophage Treatment in a Social Amoebae Host Reduces *Burkholderia bonniea* Bacterial Infections**

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

Bacteriophages are viruses that infect bacteria. They are often highly selective, as they infect only a specific subset of bacterial species or a subset of strains within a bacterial species. Bacteriophages are key shapers of microbial networks in the environment, they alter bacterial strain diversity and drive bacterial evolution. Phages can also infect and kill important human pathogens and thereby have the potential to be used as natural antibiotics. Interest in using bacteriophages to eliminate bacterial infections has increased in response to the rise of antibiotic resistant infections. Bacteriophages also influence general symbiotic interactions between bacteria and host organisms. Bacteriophage infections may decrease symbiont populations in host cells or may endow new functions to the symbiont via the alteration of bacterial genomes through bacteriophage mediated transduction. Our research focuses on understanding the outcome of bacterial-eukaryotic interactions and conditional alterations on their dynamics using an amoebae-bacterial symbiotic system. The social amoebae *Dictyostelium discoideum* is a common soil inhabitant that prey on bacteria through phagocytosis. Many *D. discoideum* isolates have been shown to be stably infected with bacteria belonging to the *Burkholderia* genera. *Burkholderia* infections of amoebae can influence host fitness and alter their interactions with other bacteria. Our goal for this study is to isolate bacteriophages specific to symbiont *Burkholderia* strains, characterize them, and ultimately examine their impact on the interaction between *Burkholderia*and *Dictyostelium*.

Results: We successfully isolated *Burkholderia* specific bacteriophages. Each displayed a unique host range and plaque morphology, and all appear to be myoviridae based on TEM. Our preliminary results suggest that selected bacteriophages can impact the association and density of *Burkholderia* with host cells. We are continuing to explore the impact of co-culturing these bacteriophages with *Burkholderia* infected amoeba to better determined their effects.

76 4:00pm UG **Use of Combined Phage Exposure in Minimizing the Development of Anti-Phage Resistance in *Klebsiella pneumoniae***

*Jacob Hanes, Jeffrey Hughes [Millikin University]

This study focuses on isolating and characterizing bacteriophages that have potential for use in phage therapy with *Klebsiella pneumoniae*. Phage therapy could be advantageous as an alternative or complimentary treatment method for infections of drug resistant *K. pneumoniae*. The phages should be stable in storage, have high host specificity, lyse their hosts quickly, and yield minimal anti-phage resistance. Bacteriophage isolates collected from Decatur's waste water treatment plant effectively lysed *K. pneumoniae* in vitro. Of the eleven isolates, there appear to be at least four distinctly different phage types. Of these, two phages expressed notable stability and lytic potential. Phage resistance has been present among trials with

all phage isolates. Bacterial anti-phage resistance appears to arise mostly in a temporary manner with the phages being able to compete against the bacteria upon re-exposure. However, bacterial strains that acquired more consistent resistance levels to a single phage type, had significant detriments to growth rate. This decreased growth rate remained in cultures grown in a stress-free environment. Bacterial anti-phage resistance was also shown to be reduced with concurrent exposure to multiple phage types.

77 2:15pm Grad ***Helicobacter canadensis*** **Induces Inflammatory Response in Colonic Epithelial Cells**

*Angie Garces, Vance J. McCracken [Southern Illinois University Edwardsville]

Several *Helicobacter* species have been identified as pathogens. *Helicobacter pylori,* for example has been found to cause illness, ulcers in the stomach and is a leading cause of gastric cancer. More recently, *Helicobacter canadensis* has been discovered as a potential zoonotic pathogen but has not been very well studied. This emerging pathogen has been found in different avian species and several clinical cases involving diarrhea and gastroenteritis in infected patients. The purpose of this research is to evaluate the immunological response when *H. canadensis* comes in contact with colonic epithelial cells. In our experiment we have co-cultured the adenocarcinoma cell line HT29 with *H. canadensis* in order to measure the expression of genes encoding inflammatory cytokines and antioxidant responses. We measured expression of IL-8, glutathione peroxidase (Gpx2), TNFa, and catalase via qRT-PCR. We observed a fold change in the presence of *H. canandesnsis* of 59.85 for IL-8, 0.23 for Gpx2, 16.61 for TNFa, and 0.25 for catalase, respectively. In the presence of TNFa as positive control the fold changes were 354.10 for IL-8, 1.15 for Gpx2, 292.54 for TNFa and 0.36 for catalase. Additional experiments to ascertain the need for live, adherent organisms for induction of the immune response are underway.

78 4:00pm Grad **Comparison of Vancomycin (*vanA*)and B-lactam (^{bla}*NDM1*) Antibiotic Resistance Genes in the Charleston Water Treatment Plant**

*Androw Sawiris, Leta Chesser, Kai Hung [Eastern Illinois University]

Background: For decades, cities have been using wastewater treatment plants (WWTP) to process water and eliminate waste and dangerous pathogens. The water from homes, businesses, and agricultural areas, co-mingle at WWTP, which ends up facilitating the spread of antibiotic resistance via horizontal gene transfer events (Kiel et al). The resistance that develops in these bacterial strains are often to beta-lactam and glycopeptide antibiotics, since they are the most heavily employed. The rise of antibiotic resistance, such as methicillin-resistant Staphylococcus aureus (MRSA) and vancomycin-resistant enterococci (VRE) is of significant concern to healthcare providers because of the prevalence and severity of these two types of resistance. In this study, we examined the wastewater samples from a municipal WWTP to determine whether blaNDM1 (NDM1 form of beta-lactamase) and vanA, which disrupts beta-lactam drugs and vancomycin, respectively, are present in the samples. **Methods:** Samples were collected from the influx tank (which is the beginning of the secondary treatment process) and the efflux tank (which is the end of the tertiary treatment process). DNA extraction was conducted, followed by DNA purification. Finally, PCR with appropriate controls and gel electrophoresis were conducted to visualize the presence of the genes of interest. The first PCR conducted was with 16S rDNA, to test whether the materials and PCR protocols were correct and functioning properly. Limit of Detection serial dilutions were conducted in order to determine what the limit of detection was for blaNDM1 and vanA.

Data: The preliminary data collected showed positive results that could indicate the presence of the genes of interest in the WWTP. However, further testing is required to fully and reliably confirm the presence of the blaNDM1 and vanA in future sample collections.

79 2:15pm UG **Investigating AbrB Phosphorylation by the Kinase PrkC as a Mechanism of Regulation of *ahpA* by *Abr*B in Biofilms of *Bacillus subtilis***

*Cameron Basquez-Pfeifer, Melinda Faulkner [Bradley University]

Although many organisms rely on oxygen for aerobic cellular respiration to produce energy (ATP), toxic reactive oxygen species are made as a consequence. Reactive oxygen species can cause damage to cell membranes, DNA, enzymes, and can even result in cell death. Nine different enzymes with the ability to combat these reactive oxygen species have been identified in *Bacillus subtilis.* Previous studies in this lab show that one of these enzymes, alkylhydroperoxide reductase A (AhpA), is expressed by *B. subtilis* during biofilm formation, but not during exponential or stationary phase. We also showed that the regulatory

protein AbrB controls the expression of *ahpA.* AbrB is a transition state regulator that prevents expression of numerous target genes during vegetative growth. Interestingly, *ahpA*is not expressed in stationary phase when AbrB-regulated genes are derepressed, but there is no indication of a protein other than AbrB that may regulate *ahpA*. Therefore, there appears to be an additional signal that allows for the derepression of *ahpA* by AbrB in biofilms. Studies have shown that the phosphorylation of AbrB may affect its ability to bind to its target genes. Accordingly, the regulation of *ahpA* may be controlled by one of three kinases through phosphorylation of AbrB. The kinase PrkC is expressed in and required for biofilm conditions. It is possible that PrkC may phosphorylate AbrB during biofilm formation, resulting in the derepression of *ahpA*. This study aims to investigate the regulation of *ahpA* by AbrB through the kinase activity of PrkC.

80 4:00pm UG **Investigating the Ability of *Bacillus subtilis* Tpx and Bcp to Detoxify Peroxides and Other Oxidants**

*Maggie Rusiecka, Abbey Sells [Bradley University]

In environments that contain oxygen, O_2, can be converted into toxic molecules called reactive oxygen species (ROS). ROS include compounds such as hydrogen peroxide, which can be harmful to cells and our bodies. ROS can cause damage to cell membranes, DNA, and proteins and lead to diseases such as Alzheimer's. In *Bacillus subtilis*, there are nine different enzymes used to detoxify the toxic ROS. It is not well understood why nine enzymes are needed in a single-celled organism for a single function, to scavenge ROS. Two types of enzymes produced by bacteria to scavenge ROS are catalases and peroxidases (including peroxiredoxins). This study focuses on two peroxiredoxins: thiol peroxidase (Tpx) and bacterioferritin comigratory protein (Bcp). These two enzymes often have similar catalytic activities and appear to have redundant activities with one another. However, it is not clear if the primary function of Bcp and Tpx in the cell is to detoxify peroxides, thus these enzymes may have a different *invivo* function other than being a peroxidase. Bcp and Tpx show peroxidase activity *invitro*, but their *in vivo*function is less clear and not well defined**.** Due to our limited understanding on Bcp and Tpx and the number of peroxidases in *B. subtilis*, we are exploring other possible functions of the enzymes. This project focuses on characterizing the specific function of Tpx and Bcp in protecting *B. subtilis* against different oxidants. We will investigate if Tpx or Bcp can scavenge peroxides *invivo*by analyzing if expression of these enzymes can restore growth to a strain experiencing peroxide stress. Additionally, we will analyze the ability of Tpx and Bcp to protect cells against various oxidants including hydrogen peroxide, cumene hydroperoxide, paraquat, and diamide. These studies will explore the ability of cells both to survive in the presence of these oxidants and to grow while under oxidative stress. Since Tpx, Bcp and the other peroxidases found in *B. subtilis* are homologous to those found in humans, these studies can help us gain insight into similar cellular processes in our bodies. Understanding the functions of the numerous peroxidases found in cells can help us understand the effects of ROS on our own bodies and the resulting diseases that can affect us.

81 2:15pm **Analysis of Beneficial Bacterial Populations from Chinese Longbeans**

*Scott Holt, Alexis Zaide [Western Illinois University]

Chinese Longbean (*Vigna unguiculate* (L.) Walp. ssp. *Sesquipedalis* (L.) Verdc.) is a crop plant that originated in the southern Asia region from domestication of Cowpea. Longbeans are now grown in Asia, Europe, and North America as a food source and for ornamental applications. Longbean pods, leaves, and stems are edible and the violet-blue flowers with draping pods are a useful ornamental. Despite their popularity, little information is known about the beneficial bacteria associated with this productive alternative food crop. The objectives of this project were to detect, enumerate, and identify beneficial *Methylobacterium* spp. on the leaves and symbiotic rhizobia spp. in the root nodules. The long-term goal is to develop natural agricultural biologicals that support the growth of crop plants. For this study, longbean plants were divided into two groups and cultivated in a garden setting (summer 2018) and a greenhouse setting (fall 2018). For *Methylobacterium* detection, macerated leaves were plated on selective agar containing methanol and incubated for seven days at 25ºC. Pink colonies typical for *Methylobacterium* spp. were counted and identified using cultural, microscopic, and molecular identification. Leaf samples were also plated on Plate Count Agar to determine total bacterial count. For rhizobia detection, root nodules were surface sterilized, crushed, plated on Congo Red Yeast Extract Mannitol Agar (CRYMA), and incubated for fourteen days at 25ºC. Suspected rhizobia colonies were counted and identified using cultural, microscopic, and molecular identification. Root-nodule rhizobia were identified as *Bradyrhizobium* spp. Two types of *Bradyrhizobium* spp. were isolated from nodules but only one sp. type per nodule. The typical *Bradyrhizobium* sp. (*elkanii*) was found in a majority of nodules. The atypical *Bradyrhizobium* sp. (*japonicum*) was found in an occasional

nodule. Heterotrophic bacterial counts for greenhouse longbeans were slightly higher (43 CFU /g leaf x 10^6) versus the garden setting (36 CFU /g leaf x 10^6). The *Methylobacterium* counts for greenhouse-grown longbeans (8.7 CFU /g leaf x 10^4) were much lower versus the garden longbean plants (1230 CFU /g leaf x 10^4). The root-nodule rhizobia bacterial count for greenhouse longbeans was slightly lower (9.8 CFU / nodule x 10^6) than the garden longbeans plants (16.0 CFU/ nodule x 10^6). Although none of the bacterial count comparisons were statistically significant due to variability, there was clearly a trend that growth conditions (garden vs greenhouse) impact *Methylobacterium* counts on longbeans. This is the first report on detection and identification of beneficial *Methylobactrium* and *Bradyrhizobium* spp. associated with the productive alternative food crop Chinese Longbeans. It is also unusual to find two different rhizobia species form a symbiosis with the same crop plant. The beneficial bacterial species isolated from productive longbeans can be used to develop natural microbial inoculants that support the growth of other crop plants.

PHYSICS, MATHEMATICS, & ASTRONOMY

82 4:00pm UG **Variation of Refractive Index and the Optical Band Gap in Lead Borate Glasses**

*Sadie Nickles, Saisudha B. Mallur, P. K. Babu [Western Illinois University]

Lead borate glasses represent an interesting glass forming system which exhibit a considerable range of variation in optical properties as a function of glass composition. Refractive index and the optical band gap are two fundamental characteristics of a glass. Both quantities play a significant role in determining the optical properties of a glass matrix. The study of the variation of refractive index and the optical band gap with composition in glasses gives information about their structure and electronic properties. Refractive index can be measured by the Brewster angle method while the optical band gap can be determined from the study of optical absorption spectra. We prepared a series of lead borate glasses with varying PbO concentration and measured their refractive indices and optical absorption spectra. Glasses are prepared from the stoichiometric amounts of PbO and H_3BO_3 by melting the starting materials at 950 ^oC and then quenching the melt. These glass samples are then annealed to remove the thermal strains and then polished using a lapping machine. Refractive index is measured using a Brewster Angle set up with a diode laser operating at 650 nm. Optical absorption spectra are recorded using a Cary 5 UV-VIS absorption spectrometer. From the optical absorption edges, we determined the optical band gaps. The refractive index increases with increasing PbO concentration while the optical band gap decreases with increasing PbO concentration.

83 2:15pm UG **Compositional Dependence of Fluorescence Properties in Rare-Earth Ion-Doped Bismuth Borate Glasses**

*[1,2]Clara Barclay, [1]Saisudha B. Mallur, [1]P. K. Babu [[1]Western Illinois University, [2]Macomb High School]

Borate glasses are excellent host materials to study the fluorescence of rare earth ions. Sm^{3+} and Eu^{3+} ions show excellent fluorescence in the visible region. We prepared two series of bismuth borate glasses doped with Sm_2O_3 and Eu_2O_3 and studied the fluorescence as a function of the concentration of rare earth ions from 0.5 mol% to 2.0 mol%. The general formulas for these glasses are (30-x) Bi_2O_3-$70B_2O_3$-xSm_2O_3 and (30-x) Bi_2O_3-$70B_2O_3$-xEu_2O_3, and x is varied between 0.5mol% and 2.0mol%. The glasses are prepared using the melt-quenching method and are subsequently annealed and polished. The polishing is done using a lapping machine. Fluorescence spectra are collected using a model LEOI-101 double grating spectrometer using the excitation at 405 nm. We used the electric dipole (ED) and the magnetic dipole (MD) transitions to analyze the rare earth ion concentration effect on the fluorescence intensities. The ED transitions are greatly affected by the changes in the environment of rare earth ions whereas MD transitions are not affected. Ratio of the ED/MD peak intensity, therefore, indicates the asymmetry of the rare earth sites which in turn are related to the structural changes around the rare earth ion. ED/MD ratio increases for the Sm^{3+} doped samples with the ion concentration from 0.5 mol% to 2.0 mol% while the Eu^{3+} doped samples, it reaches a maximum at 1.5 mol% of Eu^{3+} concentration and then decreases. Our results show that the size as well as the concentration of the rare earth ions play a dominant role in affecting the fluorescence.

84 4:00pm Grad **Optical Properties of Samarium (Sm) and Europium (Eu) Co-Doped Bismuth Telluro-Borate Glasses**

*Michael Adetunji, Saisudha B. Mallur, P. K. Babu [Western Illinois University]

Bismuth Telluro-borate glasses doped with rare earth (RE) ions are important materials for optical devices. We prepared a series of bismuth telluro-borate glasses with the composition $30Bi_2O_3$: $10TeO_2$: (60-x-y) B_2O_3: xSm_2O_3: yEu_2O_3(x=0.5, y= 0.5 to 2.0) and studied the refractive index and fluorescence of these samples. These glasses are synthesized using the melt quenching method. The glass samples obtained are annealed at 350^0C for 3hrs to remove the thermal strains. Annealed glass samples are flattened and polished using a lapping machine to obtain well reflecting surfaces. In the two sets of samples prepared, in the first set we fixed the concentration of Sm as 0.5 mol% and varied the composition of Eu (0.5,1.0,1.5 and 2.0 mol%) and in the second set, we fixed the concentration of Sm as 1.0 mol% and the Eu content is varied as before. The refractive index of the glasses is measured by the Brewster angle method using a PASCO set up (OS-8170) with a diode laser operating at 650 nm as the source. The fluorescence of each sample is measured by exciting at 405nm and the light emitted by the sample is collected using a LEOI-101 Modular Multifunctional Grating Spectrometer. The fluorescence spectrum of Sm^{3+} exhibits four emission peaks at 565nm ($^4G_{5/2} \rightarrow {}^6H_{5/2}$), 598nm ($^4G_{5/2} \rightarrow {}^6H_{7/2}$), 646nm ($^4G_{5/2} \rightarrow {}^6H_{9/2}$), 707nm ($^4G_{5/2} \rightarrow {}^6H_{11/2}$) and five emission peaks for Eu^{3+} which are 580nm ($^5D_0 \rightarrow {}^7F_0$), 585nm ($^5D_0 \rightarrow {}^7F_1$), 615nm ($^5D_0 \rightarrow {}^7F_2$), 650nm ($^5D_0 \rightarrow {}^7F_3$) and 695nm ($^5D_0 \rightarrow {}^7F_4$). Among the observed bands, the 598nm ($^4G_{5/2} \rightarrow {}^6H_{7/2}$) and 615nm ($^5D_0 \rightarrow {}^7F_2$) are more intense for Sm^{3+} and Eu^{3+} ion respectively. From the fluorescence spectra, we observed that, the fluorescence intensity of Sm^{3+}changes drastically with co-doped Eu^{3+} as compared to the Sm^{3+} alone doped glasses. The enhancement of fluorescence intensities in Sm^{3+} + Eu^{3+} co-doped glasses compared to Sm^{3+} alone glasses indicates that there is an efficient energy transfer between the Sm^{3+} and Eu^{3+} ions in bismuth telluro-borate glasses.

85 2:15pm UG **Variation of the Refractive Index of Barium Bismuth Borate Glasses**

*John Turton, P. K. Babu [Western Illinois University]

Glasses play a very important role in our technological society. They are used in a wide variety of applications from windows to camera lenses, and glass containers to lasers. Refractive index is a fundamental optical property of any glass that is crucial in determining its potential for applications in optical devices. In this study, we report the variation of the refractive index of barium bismuth borate glasses with glass composition. Barium Carbonate, Bismuth Oxide, and Boric Acid are the starting materials that we used to prepare these glasses. We measured each chemical out and poured them into a crucible. We melted the samples in a furnace and the melt is then poured onto a brass plate and covered with another brass plate to bring down the temperature to form the glass. After the glass samples had cooled, we placed them in a second furnace to anneal the samples. The annealed glass samples are then polished to obtain smooth reflecting surfaces for the refractive index measurements. Refractive indices are measured using the Brewster angle method and the densities are determined using the Archimedes' principle. Our glass samples show densities in the range 5.5-5.8 g/cm^3 and the refractive indices varied from 1.801 to 1.813. The refractive index is mostly constant. The higher value of the density and the refractive index is attributed to the presence of the heavy metal bismuth oxide in the glass composition.

86 4:00pm UG **Variation of Sm^{3+}Fluorescence with Excitation Wavelength in Strontium Bismuth Borate Glasses**

*Lucas Elliot, Mark S. Boley, Saisudha B. Mallur, P. K. Babu [Western Illinois University]

Glasses doped with Samarium (Sm^{3+}) ions are interesting optical systems due to several potential applications. Strontium oxide based glasses have been found to demonstrate promising optical properties. These attributes help to make an ideal host glass for these Sm^{3+} ions. We studied the fluorescence of Sm^{3+} ions in four glass samples, with varying concentrations of strontium oxide, using 3 different excitation wavelengths. An argon ion laser is used to excite the samples at 488 nm and 457.9 nm, and a diode laser is used to excite them at 405 nm. The resulting fluorescence are collected from the sample and focused into a Triax 550/ model LEOI-100 double grating spectrometers. The resulting fluorescence spectra have peaks characteristic of Sm^{3+} emissions. Detailed analysis is carried out through Gaussian peak fittings using the Origin graphing software. Our results reveal that the peak intensities show significant variation with the host glass composition as well as the excitation wavelength.

87 2:15pm UG **Using Solar Pathfinder Technology to Quantify Solar Panels**

*Madison Peyton, Pratheesh Jakkala [Illinois College]

The experiment conducted was aimed at utilizing the data collection and analyzation capabilities of solar pathfinder technology to determine the most effective location for solar panel placement on the campus of Illinois College. With the ever-growing need for clean, renewable alternative energy sources, the study shown examines the physical concepts of solar panel technology, while breaking down the engineering required by such arrangements. To establish the ideal geographic location for the solar system, the solar pathfinder instrument was aligned throughout the upper quadrant of campus, with sunchart images capturing the hours of sunlight incident on each individual section. Using the PV2 software, specific locations were determined to receive sufficient sunlight to support the placement of a solar system with these results reflected in the study.

88 4:00pm UG **Simultaneous Morse Code Telegraphy using Arduino UNOs**

*Luigi Erba, *Vivswan Shah, Pratheesh Jakkala [Illinois College]

Morse code communication system was originally a one-way wired signaling system between two devices, that is, if one device is transmitting then the other one can only receive. In this paper, we present simultaneous Morse code telegraphy in a one-way transmission channel using a set of Arduino UNO micro controllers. Features such as multi-channel radio transmission, integrated LCD display, instantaneous code-to-letter conversion, verification of delivery, customizable Morse code characters, backspace and erase function were added to the program. The program allows the microcontrollers to communicate through the interconversion of digital signals and radio waves and the manipulation of cycle rates making use of the Half Duplex Mode, thus providing a seamless communication experience. Using an ordinary 5 cm HC-12 antenna, the devices were tested in diverse locations: a successful and seamless communication, without any dropouts was observed between the devices for a maximum distance of 92 meters in an open space with no physical barriers, and for a maximum distance of 104 m inside a closed building with no obstacles in between. Other successful measurements were observed in a crowded-closed residential building, open residential neighborhood and open college football field at different antenna orientation angles. Our study demonstrated simultaneous communication in a one-way radio transmission.

89 2:15pm UG **Analysis of a Double Pendulum through Long Exposure Photography**

*Elijah Rhoad, Ryan Bickhaus, Pratheesh Jakkala [Illinois College]

In this paper, kinetic and kinematic principles are utilized to analyze the behavior of a double pendulum in 2 dimensions and three dimensions. An LED circuit with CR2032 3-volt coin battery is used to trace the path of the double pendulum along with the technique of long exposure photography. The position of the double pendulum arms is able to be accurately mapped as it oscillates in both two-dimensional and three-dimensional space. To analyze the motion of the double pendulum in 2-D, a pair of images were taken at a 3 second exposure time then compared for likeness. The drop angles of 0°, 90°, 180°, and 270° were considered for 2D analysis and 30°, 45°, and a 60° angle respectively for 3D analysis at different shutter speeds. Although double pendulums are commonly introduced as demonstrations of chaos, through testing and analysis repeatable patterns were discovered. In 2D, LEDs trace very similar patterns for the first half period but vary significantly from the previous trial beyond the first half period. In 3D, it was discovered that the oscillations do not repeat the exact trajectories but instead tend to repeat portions of the previous trajectory.

118 4:00pm UG **Energy Requirements and Production Methods of Conventional Solar Panels**

*Juta Wowoe, Pratheesh Jakkala [Illinois College]

This paper will present the details of the energy requirements to produce a solar panel and carbon emission analysis during this production. This study considered the ready-made panels manufactured in the United States, China, and India such as SunLux, Vikram Solar, Tongwei Solar, GCL System Integration, Shunfeng, and Lumos Solar with the specifications on the open circuit voltage, short-circuit current, power efficiency, and dimensions. This study considered the energy requirements of each layer of the panel, like silicon, glass, aluminum, and the antireflective coating. Moreover, it focuses on crystalline silicon, polycrystalline and amorphous solar panels. It is estimated that a 250 W solar panel can produce approximately about 30 kWh on average per month. This research also discusses the roll to roll deposition and the Czochralski processes used in the production of solar panels.

STEM EDUCATION

90 4:00pm UG **"Green" General Chemistry Laboratory Experiment Showing the Difference between Ionic and Molecular Compounds**

*Jocelyn Lanorio [Illinois College]

Classification and investigation of properties of ionic and molecular compounds can be done in a green way with the use of household materials and sodium polyacrylate-water gel. The concept of polymer, crosslinking of monomer units, forces of attraction that exist in ionic and molecular compounds can be incorporated in an undergraduate experiment with careful selection of compounds.

Among the compounds that can be used for classification are silicon dioxide (sand), calcium chloride (roadway deicer), sucrose (table sugar), sodium chloride (table salt), magnesium sulfate (Epsom salt), sucralose (Splenda-brand sweetener), sodium carbonate (washing soda), urea, and naphthalene. After compound classification using sodium polyacrylate-water polymer, properties such as melting point, solubility, conductivity in water, and electronegativity between atoms in the substance can be further investigated using fewer selected compounds.

This hand-on experience in probing the general properties of compounds helps undergraduate students to explain their observation in the behavior of gel upon addition of different substances, and is a great introduction of Green Chemistry concepts in the General Chemistry curriculum.

ZOOLOGY

91 2:15pm UG **Comparison of Mandible Form in Swift Fox *Vulpes velox* and Gray Wolves *Canis lupus***

*Haley Gouchenour, Luci Kohn [Southern Illinois University Edwardsville]

Analysis of mandible form provides insight into evolution and functional differences between related taxa. Dietary differences are reflected in regions of the mandible, including the mandible body, alveolar region and ramus. Estimates of bite force incorporate dimensions associated with the temporalis and masseter muscles, as well as length of the mandible. Swift fox (*Vulpes velox*) and gray wolves (*Canis lupus*) are both carnivores, but differ in dietary components. This study tests for differences between swift foxes and gray wolves in mandible shape in regions of the body, alveolus and ramus, as well as testing for differences in bite force.

Mandibles from 34 *Vulpes velox* and 29 *Canis lupus* were photographed in a standardized position. Image J was used to digitize XY coordinates of 17 landmarks from the photographs, and 39 linear distances were calculated between landmarks to generate dimensions representing the mandibular body, alveolus and ramus. Bite force associated with the temporalis and masseter muscles were also estimated. Analysis of variance and principal component analysis were used to test for differences between the taxa in the mandibular body, alveolus and ramus.

While the taxa clearly differ in size, shape differences are evident throughout the mandible once the data are adjusted for the size differences. Selection forces associated dietary differences and feeding ecology are integral to these shape differences.

92 4:00pm UG **Morphological Differences between Ancient Dogs, Modern Coyotes, and Wolves: Data from Mandibles**

*Hannah Carter, Haley Gouchenour, Luci Kohn [Southern Illinois University Edwardsville]

The origins of dog (*Canis familiaris*) domestication including when, where, and the number of domestication events remains a hotly debated topic. Domestication appears to have occurred in Eurasia, approximately 16,000 bp. Wolves (*Canis lupus*) tend to be the focus of many dog domestication studies though all wild species of the genus *Canis* can interbreed. Due to interbreeding, many early dogs are likely indistinguishable from their ancestors which makes classifying the emergence of a new species, domestic dogs, difficult. Genetic studies suggest that dogs are most closely related to wolves. This study assesses mandible form differences of prehistoric dogs from the Illinois River valley with modern wolves and coyotes.

The data for this study include 62 modern coyotes (*Canis latrans*), 29 modern wolves (*Canis lupus*), and 26 prehistoric dogs (*Canis familiaris*) from 14 prehistoric sites (approximately 8800 bp, to 1000 bp), from the Illinois River Valley. The sample includes mandibles from the earliest known dog burials in North America, Koster and Stilwell. All mandibles were photographed in a standard position, and XY coordinates of 17 landmarks were digitized using Image J. Inter-landmark distances were calculated to represent morphological and functional regions of the mandible body and ramus. Data were adjusted for differences in body size using the geometric mean, and the data were tested for significant differences between taxa.

Prehistoric dog mandibles were significantly different in form compared to modern wolves and coyotes. Significant morphological changes occurred with domestication, and these are observable in these prehistoric dogs.

93 2:15pm UG **Cranial Growth in Raccoons *Procyon lotor***

*Mikaylin Bent, Lindsay Longfellow, Dennis Lawler, Luci Kohn [Southern Illinois University Edwardsville]

Studies of cranial growth provide insight into the functional development of the craniofacial complex. Many changes occur through the developmental period, including growth of the face, brain and cranial vault. Individuals increase their dietary diversity and the regions associated with food processing develop as well. Longitudinal or cross-sectional samples of growing wild-born individuals are relatively rare. This cross-sectional study assesses craniofacial growth in wild-caught raccoons (*Procyon lotor*), examining growth of the face and cranial vault through the developmental period.

The sample for this study includes immature and mature raccoons. Individual were divided into four relative age groups based on growth status of 13 postcranial epiphyses and the spheno-occipital synchondrosis. All individuals had permanent dentition. Thirty-five dimensions were recorded with digital calipers, including dimensions in the face, dental region, cranial vault and cranial base. Multivariate allometry estimates form change associated with growth across the skull. Analysis of variance estimates shape changes in each region, once data are adjusted for size differences based on the geometric mean of individual data.

Significant shape change occurs in each region through the growth period. Despite the presence of permanent dentition early in development, regions associated with food processing show shape changes throughout the growth period. The results of raccoon growth provide insights into carnivore growth.

94 4:00pm UG **Characteristics of American Crow (*Corvus brachyrhynchos*) Roosts**

*Samuel Taylor, Caitlin Mrowiec, Paul Switzer, Eric Bollinger [Eastern Illinois University]

During the winter months, American crows (*Corvus brachyrhynchos*) congregate in large communal aggregations that include preroosts that form before sunset and roosts that persist through the night until dawn. This study was designed to test characteristics of communal preroosting and overnight roosting locations of American crows in Charleston, Illinois in the 2018-2019 winter. The characteristics that I tested include tree height, light levels in the area, and height within the tree that the birds occurred. I located groups of American crows and compared characteristics of the roost trees with nearby unused trees. Light levels were recorded at three locations (at the roost site, 50 m from the roost, and at a random location within town), and I also compared both absolute and relative tree heights. The American crows tended to roost in trees which were taller than the neighboring unused trees, and in areas which had higher light levels. Taller trees and better lighting may allow the crows better vision of their surroundings. This may allow American crows to better identify potential threats and identify other crows within the roost.

95 2:15pm UG **Lateralization Tests in a Basal Anuran the Rocky Mountain Tailed Frog, *Ascaphus montanus***

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

Anurans exhibit a range of locomotor behaviors, which can be broadly grouped based upon asynchronous and synchronous limb movement patterns. 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, Leiopelmatidae 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 four behaviors: righting response, trot-swimming, Y-maze test, and jumping directionality 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.

96 4:00pm Grad **Comparing Habitat Conditions to Zebra Mussel Growth and Survivability using Field Enclosures**

*Nick Topping, Jennifer Jost [Bradley University]

Since its introduction to the Illinois watershed, the zebra mussel has been responsible for widespread economic destruction. Zebra mussels reproduce often, attain high densities, and negatively impact both the ecosystem and the infrastructure of the habitat. They are extremely costly to remove from pipes, boats, and docks. Due to this, there is great interest in understanding the factors that limit their spread to new habitats. However, while they are highly studied, the literature shows large discrepancies in the optimal conditions for this species, which is likely the result of a large geographic range and localized adaptation. However, these discrepancies make it extremely challenging to develop and run biologically relevant laboratory studies. Additionally, most studies have been examining zebra mussel physiology in response to one abiotic stressor, even though they often co-occur. For example, as water temperature increases, dissolved oxygen levels decrease. Therefore, we aim to use a series of field-deployed enclosures to track zebra mussel survival, performance, and cellular physiology in response to habitat conditions for a period of one year. Preliminary work has been done testing the enclosures both in the lab and in the field. We have determined that the enclosures themselves do not impact the mussels regular growth in the field and that they are easily deployed and retrieved at the marsh site. To date, we have data from September, October, and November 2018. Survival was high each month, suggesting that the moderate fall temperatures were not eliciting significant thermal stress. However, as water temperature cooled significantly, there was a corresponding significant decrease in mussel growth (as estimated by change in shell size). Yet, these differences were not detected for change in mussel mass (either shell or soft tissue). In similar mussel species, it is common for period of shell and tissue growth to be temporally separated. Therefore, it is possible that zebra mussels preferentially allocate energy to shell size in the fall months. We will continue to monitor this population for one year.

97 2:15pm Grad **The Effect of Age on Cold Tolerance of the Fruit Fly, *Drosophila melanogaster***

*Amber Bouren, Jason Williams [Southern Illinois University Edwardsville]

Even though senescence is inevitable, its onset and pace varies between organisms and in the metric of performance measured. An understudied area of senescence is in an animal's ability to survive extreme temperature. Most studies examining low temperature tolerance of insects typically minimize the potential confounding effect of age-related loss of cold tolerance by only using animals that have been adults for less than three days. This standard practice assumes a relatively rapid loss in cold tolerance even though the effects of age on low temperature tolerance has yet to be examined. The purpose of this study was to characterize the age-associated loss of cold tolerance in *Drosophila melanogaster* by exposing males of various ages to one hour cold treatments followed by assessing survival, or ability to right themselves 24 h after the stress. Our initial data indicate that exposure to -5°C was considerably harsh for two day old adults as only 6% survived the treatment. However, there was no reduction in survival for seven day old males which also survived at 6% rate. Comparably, a one-hour exposure to -2°C was considerably mild for two day old adults as all individuals survived the treatment (100%). There was, however, a trend of reduced survival for seven day old males exposed to -2°C, although they also survived at a high level (95%). We are currently analyzing intermediate exposure temperatures and older individuals to further characterize senescence of cold tolerance in this species.

98 4:00pm Grad **Diurnal Temperature Cycles Reduced Egg Laying and Altered Media Choice in *Drosophila melanogaster***

*Jeremy Howard, Jonah Wendling, Jason Williams [Southern Illinois University Edwardsville]

Insects enhance offspring survival through several mechanisms including choice of oviposition site. For instance, *D. melanogaster* will lay eggs in food media that contain higher carbohydrates and/or proteins to speed development and enhance fecundity. Other food constituents, such as λ-tocopherol or cholesterol enhance low temperature tolerance in *Drosophila* and certain insects increase λ-tocopherol content in the fall, indicating they may preferentially choose foods that contain this constituent. To determine if oviposition site is influenced by media containing components that enhance cold tolerance, we placed mated female *D. melanogaster* in a petri dish containing access to control food and food augmented with λ-tocopherol or cholesterol. Females raised and held at a constant 25°C throughout their life laid an average of 7.1 ± 0.7 eggs over the 24h experiment and did not demonstrate a preference in egg laying media, which averaged 2.4 ± 0.3 eggs per female in all three media. If one-day-old adult flies were placed in a thermal environment that fluctuated between 20 and 30°C every 24 h (mean of 25°C) egg laying was much reduced. Females in these conditions only laid a combined 3.4 ± 0.4 eggs per female in all three media. In addition, females subjected to diurnally variable temperature preferentially chose to lay eggs in media containing λ-tocopherol (1.5 ± 0.2 eggs per female) compared to cholesterol or controls (1.1 ± 0.3 and 0.7 ± 0.2 eggs per female respectively). These data indicate that insects may choose food containing components which increase cold tolerance if subjected to a variable thermal environment.

99 2:15pm UG **Comparison of Bone Ossification in the Forelimb and Hindlimb of *Alligator mississippiensis***

*Kylee Fall {Western Illinois University]

During embryonic development, the long bones of the *Alligator mississippiensis* skeleton are formed through endochondral ossification. In this process, bone replaces the fetal hyaline cartilage as it deteriorates, extending from the diaphysis to the epiphysis. For this research, the long bones of the fore- and hindlimb were of interest: humerus, radius, ulna, femur, tibia, and fibula, as well as digit III in each. The goal of our research was to compare the percentage of ossification in the bones of interest throughout embryonic development. This would allow us to find the rates of ossification and determine if the hindlimb develops faster than the forelimb. By clearing and staining the specimen, the area, length, and width of each bone can be measured and analyzed utilizing a program called ImageJ. Our results showed that the humerus developed faster than the femur and that the ulna developed significantly faster than the fibula. The radius and tibia developed at similar rates. Overall, we found that the stylopodial elements (femur and humerus) lagged behind their zeugopodial counterparts (radius/ulna and fibula/tibia). From the collected data, we can conclude that the hindlimb does not ossify faster than the forelimb. This research helps develop an understanding of how ossification rates change in vertebrates, especially within the reptile class. It also assists in fossilized species research when the patterns of ossification do not match morphogenesis.

100 4:00pm Grad **Haplotype Diversity of Antistrophus Gall Wasps (Cynpoidea: Cynipidae) Associated with Two Silphium Species and Implication for Host Mediated Speciation**

*[1]Jiaxin Deng , [1]Doug Ginder, [2]Yin Pang, [1]Zhiwei, [2]Dao-Hong Zhu [[1]Eastern Illinois University; [2]Central South University of Forestry and Technology, China]

Gall making insects form a special feeding guild of phytophagy, and by manipulating host plant tissue differentiation, are able to avoid plant chemical defenses and thus have no need for counter defense mechanisms. Host plant selection is crucial to the evolution of these insects because successful gall formation is largely dependent on host plant ability to respond to stimuli. In Illinois and neighboring states *Antistrophus* gall wasps associated with rosin weed (*S. integrifolium*) and cup plant (*S. perfoliatum*) are morphologically indistinguishable, but display strong host preference, suggesting the presence of cryptic species. In this study, we used tow mitochondrial genes often used in insect species identification, Cytb, and COI, to test whether exists genetic discontinuity between wasp populations defined by host plant species. Five haplotypes have been identified among our Cytb (n= 35) and COI (n= 35) sequences, respectively. Further analyses revealed a distinct host affiliation pattern in Cytb haplotypes while no such pattern for the more conservative COI gene. The results apparently do not support the cryptic species hypothesis, but may indicate an on-going process of host related speciation.

101 2:15pm Grad **Conservation Status of the State-Threatened Illinois Chorus Frog, *Pseudacris illinoensis*, in Southwestern Illinois**

*Katherine Wiesehan, Richard Essner [Southern Illinois University Edwardsville]

The Illinois Chorus Frog (*Pseudacris illinoensis*) is a state-threatened amphibian in Illinois. Populations have been extirpated throughout their range in Arkansas, Missouri, and Illinois due to human impacts. A single population remains in Madison County, Illinois near the Southern Illinois University Edwardsville (SIUE) campus. These frogs are facing habitat loss due to recent warehouse development in the I-255 corridor. In addition, they are heavily impacted by road mortality. The Illinois Chorus Frog is highly fossorial and is found exclusively in sand prairie habitat. It is unique among frogs by its reliance on forelimbs rather than hind limbs for burrowing. In addition, it is the only species of frog known to eat agricultural pests while underground. The Madison County population is found primarily in a restored sand prairie known as the Sand Road Wetland Compensation Site (SRWCS), and breeds in nearby ephemeral ponds. Their range has shrunk by around 50% since the 1990s due to the combined effects of habitat loss, road mortality, and predation. The goal of this research is to assess the conservation status of the population using a mark-recapture approach (Jolly-Seber) to estimate population size. In addition, we will identify the location of breeding and non-breeding habitat, migratory routes, estimate road mortality, and demographic features of the population. The study will be conducted from late February through April 2019 and 2020 and will involve visual encounter surveys along roads and at breeding sites. Frogs will be weighed, and their snout-vent length and sex will be recorded. In addition, we will record GPS location, movement direction, time of encounter, and weather conditions. Individuals will be uniquely identified by inserting a passive integrated transponder (PIT) tag subcutaneously into the dorsal lymphatic sac. These data will be incorporated into a GIS database, which will inform future management decisions.

102 4:00pm **Evaluating the Drivers of Bird-Window Collisions at the University of Wisconsin–Platteville**

*[1]Kelly J. McKay, [2]Ryan T. Schmitz, [2]Elizabeth E. Tanner, [2]James L. Nooyen, Jr. [[1]BioEco Research & Monitoring Center, [2]University of Wisconsin – Platteville]

Increasing urbanization throughout North America appears to be resulting in greater amounts of avian mortality due to bird-window collisions (BWCs). Current accepted estimates suggest that annually 1-10 birds die due to collisions with windows at every building throughout the U.S., which means a staggering 500 million to 1 billion birds may be perishing each year. A variety of factors may be causing or driving the BWC phenomenon. This project assessed how various factors such as building size, window area, and the amount of vegetation near buildings were influencing BWCs on the University of Wisconsin – Platteville campus during the 2013 fall migration season. Six study buildings were selected and stratified by size (small, medium, large) and the percent vegetation occurring in a 50-meter zone around the building (low green space, high green space). We examined the influence of structural variables such as total window area, number of building stories, and total building floor area, as well as the environmental variable (percent vegetation near a building) on BWC mortality. The perimeter of each building was searched daily over a 21-day study period (23 September through 13 October) for the presence of BWC victims. During this project, 7 carcasses resulting from BWC were documented among 7 species. However, no significant relationship existed between the number of carcasses and the three structural and one environmental variables analyzed ($P > 0.05$). Nevertheless, higher R^2 values for total window area and building floor area suggest that these two structural factors may be potentially driving BWCs. The lack of significant results during this investigation may be largely due to small sample sizes throughout (n = 6 buildings; n = 7 carcasses; n = 1 year), as well as relatively similar amounts of vegetation occurring near the study buildings.

103 2:15pm **Persistence of Bird Carcasses Resulting from Window Collisions in an Urban Landscape**

*[1]Kelly J. McKay, [2]Stephen B. Hager, [3]Bradley J. Cosentino [[1]BioEco Research & Monitoring Center, [2]Augustana College, [3]Hobart and Smith Colleges]

Accurately estimating the magnitude of avian mortality at windows is difficult and may be influenced by scavengers on window victims. Failure to account for removal of carcasses by scavengers has the potential to bias estimates of window mortality. We tested the hypothesis that carcass persistence depends on local habitat factors related to scavenger behavior and the timing of carcass deposition resulting from window strikes. Scavenger activity on bird carcasses was documented at 20 randomly selected buildings in an urban landscape in northwestern Illinois, USA, over the course of one year. Daily carcass persistence was greater in winter than in non-winter (spring, summer, and fall). Persistence was negatively related to canopy cover and

window area and positively related to pavement cover. Using an exponential model of persistence time, estimated mean persistence of carcasses (*t* ± 1 SE) was 82.9 ± 11.7 days for winter and 11.8 ± 7.2 days for non-winter. Motion-triggered cameras revealed that raccoons (*Procyon lotor*) scavenged more carcasses than other species and 63% of carcasses were removed at night. Feather piles remained in 53% of all scavenging events and may be used as evidence of window victims in lieu of complete bodies. Overall, our results suggest that local habitat structure creates variation in the persistence of bird victims from window collisions by mediating scavenger behavior and carcass deposition at buildings. Bias associated with carcass persistence in our study area would likely be reduced if building surveys for monitoring studies were conducted at time intervals of £ 3 days.

104 4:00pm UG **Relative Abundance and Habitat Associations of American Badgers *Taxidea taxus* and Plains Pocket Gophers *Geomys bursarius* in McLean County**

*[1]Jack McKermitt, [1]Oscar Schmidt, [1]Alexander Palacios, [1]Noah Haskin, R. [1]Given Harper, [2]Angelo Capparella [[1]Illinois Weselyan, [2]Illinois State University]

Prior to Euro-American settlement in the early 1800's, approximately 60% of Illinois consisted of prairie, but by 2006 less than 0.01% remained, most of which existed in fragments less than 4.1 ha in size. Numerous studies have indicated that the loss of prairie has brought about steep population declines of prairie-dependent species. In spite of such habitat losses, fossorial species such as the American Badger (*Taxidea taxus*) and the Plains Pocket Gopher (*Geomys bursarius*) still persist in intensive landscapes such as McLean County, Illinois. Approximately 94% of McLean County is row-crop agriculture, and much of the remaining grassland habitat consists of narrow strips of non-native grasses between roads and agriculture fields. The purpose of this study was to determine the relative abundances and habitat associations of both species via roadside automobile surveys of badger dens and pocket gopher mounds. We conducted surveys on 272.62 km of secondary roads in all 30 townships from September - November 2017 and March - November 2018. We found 88 badger dens (0.32 dens/km) mostly in central and eastern McLean County. Previous studies have documented that badgers dig multiple dens in a year. Based on home range size in areas with intensive agriculture, we estimated 5 - 9 individual badgers were present in 18 of 30 townships. Badgers apparently did no choose den locations based on the amount of grassland habitat in their home range, as there was no significant difference in the mean number of hectares of hay/pasture within 5 km around dens (339.40 $\pm$ 208.29 ha; $\bar{x}$ + SD) compared to hay/pasture within 5 km of randomly chosen locations (265.90 $\pm$ 307.20 ha; $t_{13} = 0.26$, $P = 0.64$). Likewise, we recorded 245 pocket gopher mounds in 16 mound clusters (15.31 mounds/cluster; 0.059 clusters/km) in 5 of 30 township, all of which were found in central and eastern McLean County. Future analyses will be conducted to determine factors that may have contributed to the limited pocket gopher distribution. Although the replacement of grasslands with intensive row-crop agriculture has likely reduced the original abundance and distribution of these two species, nevertheless they have been able to persist as members of our native fauna.

105 2:15pm UG **The Origin of Ants: Circumventing the Hegemony of Wings**

*Dylan Gladson, Paul Brunkow [Southern Illinois University Edwardsville]

Ants (Formicidae) are among the most dominant insects in almost all terrestrial habitats, and are characterized as universally ground-dwelling and universally social, wingless with reduced or no vision, and possessing a wide diversity of physical and behavioral castes raised through mass brooding. Ants exploit resources en masse using central place foraging relying primarily on chemical cues, from a colony with a collective phenotype tailored for defense and harvesting. Conversely, bees (Anthophila), which include the most important pollinators of angiosperms, are characterized as universally winged flyers with advanced vision, comprising social systems ranging from solitary to highly eusocial, and possessing limited physical variability with individuals serving in behavioral castes raised from individual brood cells or hosts. Bees exploit resources across a range of geographic scales using chemical cues and vision, either singly or from a colony of relatively uniform workers with flexible behaviors. Recent phylogenetic analyses place ants and bees as sister groups, raising the possibility that these sweeping differences between the taxa could be explained by relatively simple genetic changes. Models describing developmental control of caste production in ants build off of a general hymenopteran template specifying the order of reproductive organ, eye/ocelli, and wing differentiation. We propose here a modification to an ant caste production model that allows for inclusion of bees in the same developmental program. Our model proposes that a simple heterochronic shift in the relationship between relative pupal size and adult emergence in the ancestral hymenopteran

template, wherein developmental events are compressed into a relatively narrow range of allowable emergence sizes, reverse engineers the ant caste development model to include the Anthophila. Such a model has the potential to focus future discussion and research on identifying simple molecular mechanisms that might explain the origin and diversification of two of arguably the ecologically most important groups of insects.

106 4:00pm Grad **Evaluating the Use of Barnhart Silos for Reintroducing Hatchery-Reared Juvenile Mussels in Two Central Illinois Watersheds**

*[1]David Seidel, [2]Diane Shasteen, [1]Paul Brunkow [[1]Southern Illinois University Edwardsville, [2]Illinois Department of Natural Resources]

Loss of freshwater biodiversity is a global problem, and loss of freshwater mussel diversity is especially high in the midwestern US and the state of Illinois. We explored the feasibility of using Barnhart mussel silos, protective concrete mussel rearing containers, as an intermediate release device to assist reintroduction efforts of juvenile mussels into riverways in central Illinois. Juvenile *Lampsilis siliquoidea*, *Lampsilis cardium*, and *Ligumia recta* were raised in the IDNR's fish hatchery system to a size class appropriate for release into wadable river sites. We chose two sites each in the Sangamon and Iroquois River basins, deploying 15 silos per site, for a total of 60 silos placed during this study. Between five and seven individually tagged mussels of a single species were placed in each silo. To simulate contact with the site substrate, half of the silos had native river sediment added; remaining silos were kept sediment-free. Mussels were placed in silos in April 2018, and all mussels were removed from silos and measured and checked for viability once per month through October 2018. Logistic regression revealed that the addition of sediment significantly depressed mussel survivorship even only half way through the study, with only 18% of mussels surviving in sediment silos; 67% of mussels survived to the end of the study in sediment-free silos. There was also a significant difference in survivorship between species, with *L. cardium* experiencing the lowest survivorship. Substrate presence initially enhanced size-adjusted mussel growth at the second survey (June 2018), but sediment presence significantly depressed mussel growth by July 2018, the last date for which growth was analyzed due to high mortality in the presence of sediments. We suspect that sediment eventually prevented adequate water flow through the silos to maintain mussel viability. This study demonstrates the feasibility of using mussel silos as a reintroduction method for the conservation of mussel species in central Illinois for certain species. We also propose changes to mussel silo design to incorporate the use of softer, organically rich sediments in silos so as to reduce mortality while at the same time enhancing growth.

107 2:15pm Grad **Nocturnal Movement and Roost Coalescence in the American Crow**

*Caitlin Mrowiec, Samuel H. Taylor, Eric K. Bollinger, Paul V. Switzer [Eastern Illinois University]

During the winter months, American crows (*Corvus brachyrhynchos*) aggregate in large communal roosts that may include thousands of individuals. While communal roosting is fairly common in birds, there is considerable variation in behaviors between species, and the factors influencing these behaviors are not especially well understood. In American crows, these roosts are a nightly occurrence in winter, with crows dispersing in the mornings and returning to the roost site in the evenings. This study explores the roost movements that occur after sunset, because entire aggregations may sometimes shift roost sites after dark. Beginning at sunset, we collected location and activity data via four hours of continuous observation of roosts in Charleston, IL. Last known roost locations were then checked for presence-absence of crows at eight hours and twelve hours after sunset. With this, we sought to answer two major questions. The first relates to our understanding of the nightly temporal patterns for roost selection. We examined if there is a time frame at which crows will generally cease movement to new sites. The second question relates to our understanding of the nightly spatial patterns for roost formation. We investigated whether crows tend to aggregate more tightly as the night progresses.

108 4:00pm UG **Alligator Ossification Rates – Clearing and Staining**

*Kyle Mustiful-Brumfield [Western Illinois University]

Few studies have been done looking into the ossification rates in crocodylian species, more specifically the ossification rate and development of crocodilian embryos. Previous studies have looked into the ossification of the entire skeleton, but for our experiment we would be looking specifically at the long bones used for locomotion. The goal of this project is to find the ossification rates of *Alligator mississippiens* embryos at different stages of development. We will be specifically measuring the ossification rates of the long bones

(ulna, radius, humerus, tibia, femur, fibula, third metapodial) on the same side of the body. This will be measure by staining the bones at different stages of development. This process is done first by taking the embryos and soak them in distilled water, bleach solution and then place in enzyme solution. After this is done, the embryo would then be moved to the Alizarin Red solution. Once this step is finished, the specimen is moved to ethyl alcohol to remove stains. Then, the specimen is placed in a glycerin and ethyl alcohol to conclude the clearing process. Next, plain glycerin would be added to extend evaporation. Finally, the specimen is placed in a jar of plain glycerin. The goal of this process is to differentiate the developmental bones away from cartilage. After staining is done, we would measure the lengths of the long bones and compare them with bones of the same side. Once the measurements are taking at each stage, the rates would then be calculated and recorded. This data that we will record will help us determine whether the hind limbs or the fore limbs develop first. This will help us have an understanding of the development of other crocodylian species and some extinct species .

109 2:15pm UG **Sub-Lethal Effects of Lead Poisoning on Multiple Species of Raptors in Central Illinois**

*[1]Alyssa Koffman, [1]Travis Wilcoxen, [2]Jacques Nuzzo, [2]Jane Seitz [[1]Millikin University, [2]Illinois Raptor Center]

Lead toxicity in wild birds of prey has been an ongoing issue for animal conservationists both in the United States and abroad. The Illinois Raptor Center in Decatur, Illinois is just one of many rehabilitation centers throughout the world working to understand the prevalence of lead poisoning and the effects of lead toxicity in wild raptors within their specific regions. While we know that raptors can make a successful recovery from sub-lethal effects of lead poisoning, we did not yet know how much of an effect sub-lethal doses have on the birds' overall recovery as compared to birds of prey that comes in without lead poisoning. We hypothesized that calcium levels, heterophil;lymphocyte ratios, and hematocrit levels in raptors with lead poisoning would show inhibited improvement at release over raptors without lead poisoning. Blood samples were taken from the raptors upon arrival to the IRC and again at the time of release. We determined the hematocrit levels in the blood immediately after blood sampling, used a colorimetric assay to determine levels of calcium in the blood, completed counts of heterophils and lymphocytes from blood smears via microscope. We found evidence that although birds of prey with and without sub-lethal levels of lead in their blood at the time of admission to the IRC are able to be released back into the wild, the raptors without lead toxicity are show significantly greater physiological profiles than those suffering with lead toxicity at the time of arrival to the IRC.

110 4:00pm UG **The Effects of Prescribed Burns on Bat Activity and Species Composition in a Forested Landscape**

*[1]Sabrina Doyle, [1]Bryan Arnold, [2]Ray Geroff [[1]Illinois College, [2]Illinois Department of Natural Resources]

A prescribed burn is planned fire used as a forest management method to reduce the risk of wildfires and to promote ecological diversity by enhancing habitat for native species. However, while this method benefits forests in many ways, it also may lead to unintended consequences on wildlife, including bats. Given the decline of forest dwelling bat populations due to White Nose Syndrome, the impact of wind farms, and habitat degradation, the effects of prescribed fire on these species deserves more study. In this multi-year study conducted in Siloam Springs State Park, Illinois, we examined bat activity acoustically using Pettersson D500 recorders placed in forested upland and riparian habitats in areas that were burned in the calendar year of data collection or burned the previous year, and areas that have never been burned. After two weeks, recordings were collected and analyzed, and the recorders were moved to new sites in each burn category, with a total of 17 sites monitored over the course of two field seasons. Our results indicate that bat activity was highest in sites that were burned in the year of recording and overall activity was highest in the areas that were burned as opposed to the areas that were unburned. This suggests that prescribed burning may have a positive influence on bat activity with potential benefits including opened flight corridors, increased prey density, and additional tree roosting habitat. Future directions will include classifying echolocation recordings to determine if species composition is affected by prescribed burning.

111 2:15pm UG **Time Course of Immunomodulatory Effects of Stress in Northern Leopard Frog Tadpoles**

*Samuel Billig, Travis Wilcoxen [Millikin University]

Studying vertebrate immune systems allows us to better understand our own response to disease and improve our ability to treat and prevent illness. Amphibians serve an excellent medium for analysis of the

immune system due to ease of care and their susceptibility to environmental stressors and pathogens. We examined the innate and acquired ability of the Northern Leopard Tadpole (*Lithobates pipiens*) to mount an immune response to a common opportunistic amphibian pathogen, *Aeromonas hydrophila*. We hypothesized that the innate defenses against *A. hydrophila* would be higher in those not experiencing a stressor. Additionally, we hypothesized that the adaptive immune response of the tadpoles would decrease over time when continually exposed to a stressor. We tested these hypotheses using two groups of tadpoles. The experimental group was exposed to corticosterone (CORT) dissolved in ethanol added to their rearing water and the control group was exposed only to ethanol. After six weeks of exposure, we collected blood samples, extracted the plasma, and used an *in vitroA. hydrophila* killing assay to assess innate defenses against the pathogen. We then tested adaptive immune responses, with and without the stressor, by exposing tadpoles to CORT and ethanol as before, but also adding small inoculates of the pathogen. For this experiment, blood was sampled from five tadpoles from each group for six consecutive weeks. Plasma from those samples will be analyzed for antibody responses to the pathogen. From our innate immune study, we found that the experimental group demonstrated a slightly higher pathogen killing potential, which was not consistent with our predictions. Combined, our results will demonstrate the complex interactions of acute and chronic stress on innate and acquired immunity in free-living larval amphibians.

112 4:00pm UG **Seroprevalence of *Pasteurella multocida*, the Causative Agent of Avian Cholera, among Free-Living Birds in Central Illinois**

*[1]Meredith Artime, [1]Travis Wilcoxen, [2]Jacques Nuzzo, [2]Jane Seitz [[1]Millikin University, [2]Illinois Raptor Center]

Wild birds are exposed to many pathogens in their natural habitats, including the bacterium *Pasteurella multocida*. *P. multocida* is the causative agent of avian cholera. Although much research has been conducted on avian cholera in waterfowl, little to none has been conducted on other birds, such as songbirds, wading birds, and raptors. Some songbirds and wading birds share habitats with waterfowl and some raptors share habitats and feed on waterfowl, which may expose them to *P. multocida*. We hypothesized that waterfowl would have antibodies against *P. multocida* at a rate much greater than other bird species due to their frequent exposure to contaminated water. We collected blood samples from 193 birds, including birds of prey, songbirds, and waterfowl, and completed enzyme-linked immunosorbent assays to determine if IgY antibodies specific to *P. multocida* were present. Of the 193 birds, 31 birds possessed IgY specific to avian cholera. Waterfowl had a seroprevalence of 25%, and 30.5% of wading birds were seropositive. Only two songbirds (4.5%) were positive for IgY to the pathogen. Among raptors, 13.5% tested positive for the *P. multocida*. The highest prevalence was in the Columbiformes (doves and pigeons), at 31.1%. Clearly there is a risk of avian cholera across taxonomic groups; however, and while waterfowl may be the most common spreader of the pathogen via their migratory behaviors, they do not appear to be the most commonly infected.

113 2:15pm UG **Seroprevalence of *Borrelia burgdorferi* in Songbirds and Raptors in Central Illinois**

*[1]Logan Bader, [1]Travis Wilcoxen, [2]Jacques Nuzzo, [2]Jane Seitz [[1]Millikin University, [2]Illinois Raptor Center]

Many zoonotic diseases, such as Lyme disease, can be transmitted from wildlife hosts and vectors to other populations of wildlife and even human populations in some circumstances. While many studies of seroprevalence of Lyme disease in avian communities remain largely descriptive, this study aims to gain an understanding of which bird species have developed immunoglobulins to the causative agent of Lyme disease, *Borrelia burgdorferi*. The objective of this study was to analyze the seroprevalence of *B. burgdorferi* in birds that were admitted to the Illinois Raptor Center in Decatur, Illinois as well as songbirds captured from the wild. We hypothesized that birds that forage on the ground in grassy areas would possess the most elevated levels of IgY and IgM antibodies against *B. burgdorferi*. We determined from our study that our specific enzyme-linked immunosorbent assays (ELISA) and associated secondary antibodies are able to detect the presence of IgY and IgM antibodies to the causative agent of Lyme disease, *B. burgdorferi*, based on the ratio of antibodies present in assays positive for antigen versus assays negative for antigen. All but six bird species of 19 surveyed with a sample size of over five individuals had at least one individuals that possessed antibodies to *B. burgdorferi*. Overall, we found that raptor species typically had a lower percentage of individuals with seroprevalence to Lyme than songbirds, with the exception of the Red-shouldered Hawk and the Northern Harrier.

114 4:00pm UG **Effects of Cypermethrin on Neurophysiology, Development, and Behavior of Cuban Treefrog Tadpoles (*Osteopilus septentrionalis*)**

*Jacquelyn Spence, Travis Wilcoxen [Millikin University]

Cypermethrin is a pesticide designed to disrupt the nervous system of invertebrates, though vertebrates may also be affected. We exposed Cuban Treefrog (*Osteopilus septintrionalis*)tadpoles to cypermethrin at two different doses and measured neurophysiological and behavioral differences among groups. Tadpoles exposed to cypermethrin were found to be smaller, less developed, and hyperactive compared to a control group, despite showing no signs of altered acetylcholinesterase levels. Overall, our results demonstrate that cypermethrin is a stressor for these animals even though it may not have direct impacts on the nervous system.

115 2:15pm UG **Dietary Choices of Franklin's Ground Squirrels (*Poliocitellus franklinii*) in Central Illinois**

*Kaitlyn Hild, Cecilia Hennessy [Eureka College]

Franklin's ground squirrel, *Poliocitellus franklinii*, is declining in its southernmost range, including Illinois and Indiana. We examined the stomach contents of 12 Franklin's ground squirrels from Illinois and compared them to the stomach contents of specimens from a more robust population in Canada. Access to preferred diet items has been proposed to be a factor in the decline of this species. A stomach content analysis of twelve specimens showed a diet that was composed mainly of plants rather than insects. While performing the study, the authors created a specific methodology that can be used for a variety of small and medium sized mammals that can help make the process of stomach content analysis more standardized. Previous stomach content analysis studies were examined to create a universal stomach content analysis method.

116 4:00pm UG **The Effects of Artificial Breeding Pools on the Reproductive Success of Illinois Chorus Frogs (*Pseudacris streckeri illinoensis*)**

*Hana Parker, Richard Essner [Southern Illinois University Edwardsville

Illinois Chorus Frog (*Psuedacris streckeri illinoensis*) populations have been declining across their range (Southeast Missouri, Southern and Central Illinois, and Northern Arkansas) due to urban and agricultural development in those areas. Highway construction also serves as a factor in their decline. This has caused them to become a threatened species in Illinois. Though the Illinois Department of Natural Resources (IDNR) has been making efforts to restore the native sand prairie where these frogs spend most of the year burrowing in search of food and shelter, progress with restoring their ephemeral breeding ponds becomes expensive and shows little improvement in their reproduction. The Sand Road Wetland Compensation Site (SRWCS) represents the highest quality sand prairie habitat remaining for the Illinois Chorus Frogs in Madison County, IL. However, this wetland is prone to flooding and is the home to many predators such as bullfrogs and fish. This leads to decreased breeding success for the frogs in this area. It also causes increased mortality for the frogs as they are often migrating across busy roads toward unprotected agricultural land and back. In response to this, an array of artificial breeding pools were placed in both the wetland (n=20) and sand prairie (n=20) areas of the SRWCS in spring 2017. The objectives in this experiment include determining which habitat is more suitable for placement of artificial breeding ponds based upon breeding success and comparing the effectiveness of the ponds in reducing the risk of predation. Artificial pools are compared with a constructed breeding pond (Brockmeyer South). Continued surveying has shown that in comparison to the wetland pools, the sand prairie pools exhibit greater anuran diversity even though it possesses a higher quantity of bullfrog predators and macroinvertebrate species. Brockmeyer South had higher amphibian diversity and recruitment compared to artificial pond locations. Further evaluations of these sites will be done over multiple breeding seasons to assess if these artificial breeding pools will increase the reproductive success of the Illinois Chorus Frog.

ORAL PRESENTATION ABSTRACTS

9:00am-12noon, Saturday, April 6, 2019, in Olin Hall

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

AGRICULTURE

10:40am Grad Rm 024

Growth and Gene Expression of Soybean during Germination under High Salinity Stress and Salicylic Acid

*Opeyemi Oduniyi, Sue Hum-Musser, Richard Musser [Western Illinois University]

Soybean (*Glycine max*) is an important source of food, oil and protein, therefore more research studies should be promoted to increase its yield under adverse conditions such as salt stress. Soil sanity is major hindrance to legume production in all parts of the world. Salicylic acid (SA) is a phenolic phytohormone acting as a plant regulator and signaling molecule to reduce abiotic stress impact in soybean and plants generally. This experiment was conducted to screen treatments of SA to mitigate the concentration of salt (NaCl) on soybean. The soybean seeds were treated with 200 mM concentrations of NaCl and 1µm concentrations of SA. Germination was recorded when the radicle broke through the seed coat. The results showed high salt severely limited seed germination but some of was alleviated by the SA treatment. The physiological effects of the treatments were also revealed through gene expression analysis. We found differences in gene expression in treated seeds compared to the control seeds. Although SA is not necessary under normal growth conditions for germination, it plays a vital role under salinity by reducing oxidative damage in seeds thereby relieve the signs of salinity stress.

BOTANY

11:00am Rm 024

Quantile Regression: A Better Analysis of Responses to Invasion and Competition

*Kurt Schulz, Luci Kohn [Southern Illinois University Edwardsville]

Studies of community response to invasion and competition often use the same graphical representation of the data: a scatterplot with the invader/competitor on the independent axis (x) and a community response metric (e.g., H', s) or target species abundance of the dependent axis (y). These are commonly evaluated using Model I regression or Pearson correlations. This is inappropriate because both techniques assume normal distributions and uniform variances along the estimated line of response. Model I regression also assumes values for x are fixed variables, when they are usually random variables. Both approaches potentially suffer from misestimates of relationship and a loss of power. A more informative way to analyze the data is to use quantile regression, which depicts the variation in quantile boundaries along x. A typical response is that the upper quantiles (e.g., >75th percentile) widen in the absence of the invader/competitor, demonstrating a greater proportion of large values for the y-axis variate. This speaks with greater nuance to the frequency of reduced community status or species abundance within the study population—a vital insight.

11:20am Grad Rm 024

Gene Expression of Soybeans (*Glycine max*) in Response to Inoculation with *Trichoderma* Fungi

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

Soybean is a crucial staple food for human and animal consumption and therefore it is an important agricultural crop. Illinois is a main midwestern producer of soybeans that heavily contributes to the US economy. However, the yield of soybean can be drastically impacted by adverse growing conditions. Therefore, increasing plant growth and yield in response to changing weather conditions is critical in maintaining productivity in this crop. Some fungal species are known to increase plant growth. In this project, we examined the effect of a naturally occurring beneficial fungi on the growth and gene expression of soybean plants. Many species of *richoderma* fungi promote plant growth and increase plant tolerance and immunity. We determined that *Trichoderma*-inoculated soybean plants have a statistically significant increase in seed dry weights compared to control uninoculated plants. Real-time quantitative polymerase chain reaction (rt-qPCR) was used to assess gene expression of the plants. There were differences in the level of gene expression of genes in various physiological categories between the treatment groups. Since plant growth and defense pathways are complex due to numerous connections to one another, determining which pathways are affected will help elucidate the plant growth and defense mechanisms used in this beneficial plant-fungal interaction. The project will provides

information on the effectiveness of *Trichoderma* fungal colonization on soybean, growth, yield and gene expression.

CELLULAR, MOLECULAR, & DEVELOPMENTAL BIOLOGY

9:00am **UG**
Rm 164

The Characterization of Highly Adaptable Biocompatabile Nanomaterials for the Integration, Differentiation, and Transplantation of Stem Cells

*Jack Blank, Jaclyn Conway [Bradley University]

For many years, the utilization of stem cells and their excreted factors has been a topic of extensive research. The potential of these cells to differentiate and replace functional adult tissues in clinical settings is of particular significance. Due to this discovery, recent efforts are being made to fabricate biomaterials with the exact environmental, mechanical, and chemical cues that will lead to the successful integration and differentiation of stem cells. In this regard, the electrospinning of synthetic polymer scaffolds has previously been shown to mimic the extracellular environment necessary for stem cell integration and proliferation. This study utilized an FDA-approved polymer known as polycaprolactone that has ideal biocompatible properties for a wide set of applications. The inclusion of collagen, a structural protein found in the extracellular space, within this scaffold allows for the fabrication of a hybrid extracellular matrix with enhanced mechanical properties that further aid in stem cell integration and proliferation. Furthermore, these scaffolds allow for the spatiotemporal release of specific biological factors which further aid in the controlled differentiation of stem cells into functional tissues. Despite these scaffold properties, the potential usage of these biomaterials is still hindered by their ability to be precisely replicated with highly regulated control of stem cell fate. In this manner, the fabrication and prediction of the ideal mechanical characteristics associated with differing degrees of the polymer and protein concentrations in these scaffolds can allow for successful and repeatable stem cell proliferation and eventual differentiation. SEM, AFM, tensile tensile testing, and degradation testing were all done in order to characterize the varying properties of the nanofiber scaffolds. These mechanical properties were then utilized to construct a novel finite element model to predict the macroscale mechanical properties of future nanofiber matrices. As such, this study shows promise for creating highly repeatable and optimized nanofiber scaffolds for utilization in stem cell therapies and regenerative medicine.

9:20am **Grad**
Rm 164

The Optimization and Application of Behavioral Analysis on the Planarian Flatworm *Schmidtea mediterranea*

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

The planarian flatworm, *Schmidtea mediterranea*, is a structurally simple model organism; their central nervous system (CNS) comprises a bi-lobed cephalic ganglia and two ventral nerve cords. Despite their CNS being relatively primitive, planarians are morphologically complex and possess similarities to higher organisms. Planarians can sense a variety of external stimuli, such as tactile and olfactory information, and direct an appropriate behavioral response to these environmental factors. Planarians can be habituated to an environment through repeated exposure. In addition, planarians have remarkable regenerative capacity owing to a pool of stem cells they can use to regrow any body part, including the nervous system, following amputation or injury. The objective of our experiment is to design a behavioral analysis enabling us to identify planarian genes affecting memory. We cloned homologs of genes known to cause long-term associative memory effects in *C. elegans*, genes encoding neurotransmitters, genes highly expressed in the planarian CNS that do not cause an overt phenotype upon knockdown, as well as genes completely unrelated to the CNS to serve as negative controls. Planarians were habituated to a rough or smooth surface-type while undergoing RNAi knockdown of target genes. The day after the sixth RNAi feeding, worms were cut anterior to their pharynx forcing them to regenerate their cephalic ganglia. We assayed planarian memory on the tenth day of regeneration through videos taken in infrared light on a rough surface-type testing arena. We are currently optimizing the behavioral analysis testing planarian memory. For example, we overcame the organism's innate edge-seeking behavior by placing the chemoattractant in the center of the testing arena while inserting planarians along the edge of the arena. The worms' memory was assessed based on the number of times worms left and were recaptured by the edge of the testing arena. Planarians habituated to a rough surface-type leave the safety of the edge to reach the chemoattractant more readily than planarians habituated to a smooth surface-type, and our preliminary results suggest that knockdown of genes required for memory eliminates the difference between the two groups. By designing and optimizing a behavioral assay to explore the molecular basis of memory in planarians, we can lay

the foundation to investigate roles of genes involved in the memory of higher organisms.

9:40am Rm 164 **Grad**

Modification of Peptide J18 for Enhanced Ovarian Cancer Cells Targeting

*Michael Oni, Mette Soendergaard [Western Illinois University]

In 2018, 22,000 new cases and 14,000 deaths of ovarian cancer is projected to occur in the United States. The low survival rate is due to inadequate means of detection, which emphasizes the need to develop effective screening techniques.

Peptide J18 was discovered using *in vivo* bacteriophage (phage) display technology, and was found to bind specifically to ovarian cancer cells, showing moderate binding with half maximal effective concentration (EC_{50}) of 68.3 ± 15.3 µM (mean ± SEM). To improve the binding properties of the peptide, an alanine scanning experiment was carried out. Results showed that substituting serine-5 (S5) and aspartic acid-6 (D6) with alanine decreased the EC_{50} values to 22.6 ± 5.9 µM and 8.6 ± 1.9 µM (mean ± SEM), respectively. Thus, it was hypothesized that a double alanine substitution of both S5 and D6 (J18-S5A-D6A) may lead to a furtherincrease in the binding affinity. The objective of this study was to determine and compare the binding affinities of peptides J18 and J18-S5A-D6A using a modified enzyme-linked immunosorbent assay (ELISA) and fluorescent microscopy. Human ovarian carcinoma (SKOV-3) cells were maintained in McCoy's 5A cell medium supplemented with 10% fetal bovine albumin (FBS) and 50 µg/mL gentamycin at 37°C and 5% CO_2. Varying concentrations of the peptides (10 nM - 300 µM) in phosphate buffered saline (PBS) were incubated with SKOV-3 cells for 1 h at 37°C and 5% CO_2. Unbound peptides were removed by washing with 1% bovine serum albumin (BSA) in PBS. Cells were then fixed with 10% formalin and blocked with 10% FBS, 0.3 M glycine, 0.05% Tween-20 in PBS. Probing was done by incubation with horseradish peroxidase (HRP)-conjugated streptavidin. The cells were then washed with 0.05% Tween-20 in PBS and 2, azino-bis 3-ethylbenzothiazoline-6-sulphonic acid (ABTS) substrate was added and incubated at room temperature for 20 m. Cell binding was measured spectrophotometrically at 405nm. Results showed that J18 and J18-S5A-D6A exhibited EC_{50} values of 208.1 and 1.86 µM, respectively. These results indicate an approximate 100-fold increase in binding affinity of J18-S5A-D6A compared to J18. Next, peptide binding to SKOV-3 cells was further investigated by fluorescent microscopy. Cells were maintained on chamber slides as previously described and then incubated with 10 µM of J18 and J18-S5A-D6A or dimethyl sulfoxide (DMSO; control) for 1 h at 37°C and 5% CO_2. The slides were then washed (PBS) and blocked with 10% FBS, 0.3 M glycine, 0.05% Tween-20 in PBS. Bound peptides were probed with fluorescein isothiocyanate (FITC)-labeled mouse monoclonal anti-biotin antibody, and the slides were imaged using an epifluorescent EVOS FLoid cell imaging station. Results showed increased SKOV-3 binding of peptide J18-S5A-D6A compared to J18.

In conclusion, peptide J18-S5A-D6A demonstrates increased binding to SKOV-3 cells compared to peptide J18, and may therefore be useful in the detection of ovarian cancer cells, thereby improving diagnosis, treatment and significantly reducing the disease fatality.

10:20am Rm 164

A Simple and Efficient System to Study Sunflower Roots Response to Nutrient Limitations

*Yordan Yordanov, Tyler Parks [Eastern Illinois University]

Sunflower is one of the most important oilseeds crops worldwide but its production has been gradually driven to marginal areas due to the rapid change of agricultural practices. Cultivation of crops on marginal lands will entail developing varieties that can sustain high levels of productivity under a broad range of conditions. Different abiotic stresses such as mineral deficiencies, drought, cold, heat, and salinity reduce crop yields. Minerals (like nitrogen, phosphorus, and iron) and water availability are the major factors that limit productivity on marginal lands. Mechanisms of mineral use are complex and affect morphology and physiology of the entire plant. However, available information on gene expression in response to abiotic stresses in sunflower is still limited. We focus on roots as they are primarily organ involved in minerals uptake, response and adaptation. Hydroponics offers an inexpensive system to study the effects of nutrient limitation in a controlled environment. Additionally, recently developed nanopore sequencing offers simple and affordable platform for transcriptomic studies. We developed a cost-effective way to set up and run experiments to test abiotic stress effects on cultivated sunflower, using hydroponics and nanopore sequencing. This system was successfully used to study gene expression in response of nitrogen, phosphorus, and iron limitations. Identified key genes will be further verified and characterized to identify their potential for sunflower crop improvement.

10:40am **UG** **Rm 164**

Cloning of *rol* Genes Region from *Agrobacterium rhizogenes* strain K599

*Deshaun Laughlin, Yordan Yordanov [Eastern Illinois University]

Agrobacterium rhizogenes is a gram-negative soil bacterium that genetically modify plant cells and produce "hairy roots" on variety of plants. The ability to modify plants cells depends on the pRi (Root inducing) plasmid containing all necessary genes for the gene transfer and virulence. The specific T-DNA region of the pRi is stably integrated into the plant genome and the *rol* genes (root locus) are essential part for the generation of the "hairy roots" phenotype. Once the T-DNA sequence is transformed into a plant cell, the induced hairy roots can be maintained indefinitely in media with minimal requirements. The strain K599 can infect many dicot and monocot plants and have been widely used in plant research. We PCR amplified part of the T-DNA region of the plasmid pRi2659 from *A. rhizogenes* K599 containing *rol* genes A to E. The amplified sequence was then cloned in binary plasmid pART27 to produce pART-Ri plasmid. After verification by sequencing and restriction, pART-Ri was transformed into a disarmed strain of *Agrobacterium tumefaciens* GV3101/pMP90. Further, to verify functionality of the pART-Ri, we inoculated plant tissues with GV3101/pMP90/pART-Ri and observed callus and hairy root regeneration demonstrating the successful transformation and functionality of the cloned *rol* genes. The established "hairy roots" system will be further studied and redesigned to include in a wider range of T-DNA constructs that apply for gene functional discovery via hairy roots activation tagging.

11:00am **Grad** **Rm 164**

Gene Expression of Corn Earworm (*Helicoverpa zea*) when Infected with *Pseudomonas aeruginosa* Bacteria

*Bayan Aljamal [Western Illinois University]

The Corn Earworm, *Helicoverpa zea* (Boddie), is the second most serious economic pest of agricultural corps in North and South America. In order to study the immune response of *H. zea* to infection by various pathogens we infected them with Pseudomonas aeruginosa bacteria. *Pseudomoansaeruginosa* is a pathogenetic pest because of their ability to produce extracellular enzymes and toxins that destroy the physical barriers and infect host cells. This study examined *H. zea's* immune response to infection as well as provide information on how to overcome their defense system for the development of biocontrol methods. One of the main focus of this experiment is to compare the growth, survival, and gene expression of *H. zea* when it consumed a diet treated with *P. aeruginosa* or bacteria-free diet for 72 hours. Larvae that fed on the diet containing *P. aeruginosa* had a statistically significant increase in mortality compared with control. Microarray analysis was done to measure the expression level of larvae that fed on *P. aeruginosa*diet and bacteria-free diet. The expression of 3397 genes was significantly different between the two treatment groups. Out of this total, ~31% of the genes (1067 genes) have unknown functions, and ~ 69% of the genes (2290 genes) have known functions. The main categories that had significantly different gene expression were categorized according to their specific major functions including, but not limited to, encoding for metabolism, digestive, immune system, and cell growth. Caterpillars infected with *P. aeruginosa*showed a significantly different gene expression pattern compared to control. This research determined the immune reaction of *H. zea* in response to bacterial infection. This information will be useful in figuring out how to make*H. zea* more susceptible and increasing control of this pest.

11:20am **Grad** **Rm 164**

Sulfamethoxazole Retards Growth and Reproduction in *C. elegans* by Inhibiting Folate Biosynthesis

*Hashni Epa Vidana, Gopal R. Periyannan, Britto P. Nathan [Eastern Illinois University]

Glutamate carboxypeptidase II (GCPII) is a Zn-metalloprotease expressed in multiple human tissues (hGCPII) as well as in other organisms such as*Caenorhabditis elegans* (cGCPII). In the human small intestine, GCPII is predicted to facilitate folate absorption. Folates act as a cofactor in one-carbon metabolic pathways such as nucleotide synthesis and consequently involved in cell division and growth. The hGCPII ortholog is found in *C. elegans* (cGCPII) as three paralogs: *gcp-2.1*, *gcp-2.2* and *gcp-2.3*, and all share high structural similarity with hGCPII. The *C. elegans* strains; wild-type (N2), and *gcp-2* deletion mutant strains; RB1055 (*gcp-2.1*), TM6632 (*gcp-2.2*) and TM5710 (*gcp-2.3*) were used to investigate the role of *gcp-2* in folate metabolism by measuring the reproductive and physiological properties. Mutant strains showed ~15% decrease in brood size than N2. The body length increased 20%, 39% and 5% in *gcp-2.1*, *gcp-2.2*, and*gcp-2.3* mutants respectively in comparison to N2. *C. elegans* strains were maintained on *E. coli* OP50 treated with varying concentrations of sulfamethoxazole (SMX), a bacterial folate biosynthesis inhibitor to test the effect of folate level on brood size and body length. At the half maximal inhibitory concentration (IC_{50} = 1025 µg/ml) of SMX, *gcp-2.1* and *gcp-2.2* worms were infertile, whereas N2 and *gcp-2.3* strains showed 71% and 83% decline in progeny size respectively compared to non-treated controls, and twice the IC_{50} of SMX was lethal to all the strains. Additionally, all the strains showed growth retardation in a dose-dependent manner. Collectively, our study shows that the *gcp-2.1* and *gcp-*

*2.2*paralogs play a significant role in folate metabolism, reproduction, and embryonic and post-embryonic development in *C. elegans*.

COMPUTER SCIENCE

11:20am **Grad**
Rm 245

Virtualizing and Visualizing Social Interactions for Teaching Social Skills

*Justin Doty, *Justin Ehrlich [Western Illinois University]

Students with Autism typically need extra assistance on learning social skills when compared to their peers. This presentation presents the current iteration of VOISS: Virtual Reality Opportunities to Implement Social Skills, which is a virtual reality application that will allow middle school students to experience an average day at school. The students will interact with avatars in settings such as hallways, cafeterias, buses, classrooms, sporting events, etc. They will have opportunities to respond to social settings that might have them start a conversation, make eye contact, use appropriate contingent discourse, respond to bullying, and practice numerous other skills in a safe, controlled environment. The application will offer the students and caregivers feedback and visualizations on how they handled situations and how to best generalize the lessons learned to the real world. This project is a collaboration between researchers at the University of Kansas and Western Illinois University. The Office of Special Education and Programs of the U.S. Department of Education is providing funding for this project.

ENVIRONMENTAL SCIENCE

9:00am **Grad**
Rm 149

Home Range and Spatial Ecology of the Eastern Box Turtle, *Terrapene carolina*, at Southern Illinois University Edwardsville

*Erin Shamley [Southern Illinois University Edwardsville]

When human development degrades natural habitat and surrounding areas, abundant and otherwise healthy species can suffer. Eastern box turtles may seem common due to occasional sightings, but they are a species in decline. Management plans to conserve this species, derived from population monitoring, habitat assessments, and spatial ecology studies, will be necessary to prevent further decline. Box turtles are ideal candidates for a spatial ecology study because they are a long-lived, prevalent species present on campus, and they have defined home ranges that can be quantified. Accurate measurements of home range size and detailed notes of habitat preference can put facts and figures to use, arguing for box turtle preservation efforts, making sure the turtles have enough space to survive given suitable conditions. Maps made using Geographic Information Systems (GIS) can discover differences in individuals' home ranges, such as ideal elevation and soil type, furthering our understanding of habitat preference. For example, females may have larger ranges than males because they travel farther to find nesting sites, larger turtles may traverse steeper areas because they are more physically capable, or turtles with smaller ranges may find their needs are being met by abundant resources due to high quality soil. Results from this study can be relayed to wildlife managers to improve their success protecting the Eastern box turtles as well as understanding the SIUe ecosystem as a whole.

9:20am
Rm 149

Elevated Particulate Matter and Noise Exposure for Spectators at Outdoor Motorsport Events

*[1]Ben K. Greenfield, [2]Kabindra Shakya, [1]Oladoyin M. Oluaderounmu, [1]Jarrod N. Koski [[1]Southern Illinois University Edwardsville, [2]Villanova University]

Since the first recorded steam carriage race in Manchester England, in 1867, motorsport racing has been a globally popular and commercially successful leisure activity. Despite the many environmental health hazards present at racing events, there have been no published air pollution exposure assessment studies and few noise studies for event spectators. To address this knowledge gap, we conducted particulate matter and noise exposure assessment at a series of auto and motocross racing events. We sampled nine race events from May to October, 2017 in designated spectator seating areas at four racetracks. Sample sites included two dirt auto racing tracks, a paved auto racing track, and a dirt motocross track in the St. Louis metro-east region, Illinois, USA, and in Sedalia, Missouri, USA. We also conducted an intensive monitoring campaign at two tracks and three reference sites from August 7 to August 13, 2018. Overall mean fine particle number concentrations at race events were 2.1 times concentrations at reference stations. Noise levels at race events regularly exceeded 90 decibels (dB),

periodically exceeded 100 dB, and were generally 20 – 30 dB higher than same-day reference monitoring. During the intensive campaign, particle mass concentration, particle counts, and black carbon were all elevated at two late model stock car racing events but a motocross event was comparable to a reference site. At one of the stock car race events, the 1 minute peak concentration of fine particulate matter ($PM_{2.5}$) was 369 μg/m^3. This peak concentration was 29 times the average recorded concentration of 12.8 μg/m^3 at a nearby reference station over the prior day. $PM_{2.5}$, black carbon, and particle counts all tracked each other, indicating combustion sources. Our results suggest that despite the short duration of these activities, there are possible hazards from noise and airborne particulate matter exposure for spectators at stock car races.

9:40am **UG** **Rm 149**

Exposures to Perfluorooctane Sulfonate Elicit Neurotoxicity in *Drosophila melanogaster*

*[1]Carl Namini, [1]Amanda Fix, [1]Yusuf Ali, [1]Ki-Bae Hong, [2]Yooheon Park [[1]Southern Illinois University Edwardsville; [2]Dongguk University, South Korea]

Perfluoroalkyl substances (PFAS) are an emerging health concern in the United States and many developing countries as they are found in the blood samples in humans and animals on every continent. PFAS are synthetic, non-biodegradable compounds used in industry to produce fire-fighting foams, stain repellents, and surface protection products. The most prominent chemical in this family of compounds is perfluorooctane sulfonate (PFOS). Previous research has shown PFOS to be endocrine disruptive, neurotoxic, carcinogenic and bioaccumulative. PFOS affects the nervous system by altering the normal physiology of ligand and voltage gated receptors. Particularly, PFOS has been described as an agonistic modulator of glutamate gated (NMDA and AMPA) receptors, leading to increased calcium concentration in nerve cells. Still, details of toxic actions of PFOS are to be understood. Current research seeks to determine if PFOS directly or indirectly modulates type-A gamma-aminobutyric receptors (GABAARs). Pentameric, ionotropic and ligand-gated chloride channel that controls Cl^- ion flow and is known to be a target of many natural and synthetic chemicals. Based on our preliminary findings, PFOS was found to be toxic and elicit mortality response in fruit flies (LT_{50} = 19.69 hours at 20 μM concentration).

10:20am **Rm 149**

Exposure to Sublethal Ivermectin is Responsible for Increased ROS, MDA, and DNA Damage in Fruit Flies

*[1]Kyong Yoon, [1]M. Yusuf Ali, [1]Ki-Bae Hong, [2]John Clark, [3]Barry Pittendrigh, [4]Si H. Lee [[1]Southern Illinois University Edwardsville; [2]University of Massachusetts; [3]Michigan State University; [4]Seoul National University, South Korea]

Present study shows that sublethal ivermectin treatments cause behavioral, biochemical, and molecular biological changes in wild-type female fruit flies. Using the glass vial contact method, a dose dependent mortality response was established following 72 hr of ivermectin exposure. Based on the results, exposures to six different ivermectin concentrations (1 x 10^{-6} to 1 x 10^{-1}%, w/v) under specific laboratory conditions were utilized for further experiments (the short term ivermectin exposure conditions, STIECs). Adult female flies under the STIECs produced viable eggs with the mean hatchability values (78.9 to 96.1%) that were not statistically different from the control mean hatchability which was determined using eggs oviposited by the ivermectin untreated adult females ($P > 0.05$). As expected, female flies under the STIECs showed a decreasing trend of locomotor activities as ivermectin concentration increased. These flies produced significantly increased hydroxyl radicals and malondialdehyde (MDA) in their ovaries compared to ivermectin untreated flies ($P < 0.05$). Additionally, ivermectin concentration-dependent DNA damage occurred in ovaries of ivermectin-treated flies.

10:40am **Grad** **Rm 149**

The EIU Compost Project: Recycling Food Waste to Grow More Food

*Grace Wilkin, Jenny Le, Tom Canam [Eastern Illinois University]

Organic waste is the largest contributor to municipal solid waste in US landfills, including millions of tons and billions of dollars of food-waste each year. Once food-waste enters a landfill, it releases flammable greenhouse gases into the environment. At the same time, the US applies millions of tons of agricultural fertilizer, which too often runs off into waterways and causes environmental problems downstream. These linear, environmentally destructive processes have served as motivation to start the EIU Compost Project. The project aims to reduce organic waste going into the landfill from EIU's dining halls and construction waste by processing it into usable compost. The finished compost is then used as a soil amendment on campus, reducing the need for synthetic fertilizers.

The project started in October of 2017 by collecting food waste from one EIU dining hall and processing it on campus. Currently, we are collecting pre-consumer food waste from all three dining halls and processing it at the City of Charleston Wastewater Treatment Plant (WWTP). This research establishes best practices for the EIU Compost Project and tracks food waste collection—approximately 2,000 gallons in total. This study also examines the effect of various amounts of compost, by volume, mixed with peat moss and vermiculite on spinach (*Spinacia oleracea*) growth. Specifically, the study seeks to balance the high pH of the compost to find an ideal ratio of compost to use in soils on campus. This interdisciplinary project involves soil science, agriculture, renewable energy, and waste management. Future expansions include collecting post-consumer food waste on campus and using our finished compost in the proposed EIU Sustainable Garden.

11:00am Grad Rm 149

Effect of Deer Browse on Plant Communities

[1]Stephani Sather, [1]John Yunger, [2]Scott Kobal, [2]Dan Ludwig [[1]Governors State University, [2]Forest Preserve District of DuPage County]

White-tailed deer (*Odocoileus virginianus*) can decrease the diversity, frequency, and cover of preferred, nutrient-dense forbs and woody seedlings. Management involving prescribed burning, planting of native species, manual removal of invasive plant species, and deer population control is used in an attempt to restore habitats to presettlement conditions. We hypothesized that frequencies and cover of preferred species *Trillium flexipes*, *Trillium recurvatum,* and *Polygonatum canaliculatum* would be highest inside exclosures while frequencies and cover of less preferred*Rhamnus cathartica*, *Rosa multiflora*, and *Alliaria petiolate* would be highest outside exclosures. To test our hypothesis, we compared the frequencies and cover of these plants at deer exclosures in DuPage County, Illinois using repeated measures MANOVAs. Preliminary analysis suggests that there is not a significant difference between the frequencies or cover of any of the six plant species inside or outside exclosures. These results suggest that the deer population does not alter the plant communities of the natural areas surveyed. One possible explanation for these results is that the deer population is managed below the threshold of habitat alteration. Another explanation could be faulty experimental design.

11:20am Rm 149

Quantifying Effects of Biotic and Abiotic Factors on Lake Michigan Zooplankton from Field Time Series Data

*John Marino [Bradley University]

The dynamics and composition of zooplankton communities depend on a combination of abiotic and biotic factors, such as temperature, resource availability, and predator density. Field time series data contain information about the contribution of these factors and underlying mechanisms. However, complexities intrinsic to ecological systems and data (e.g., nonlinearities, stochasticity, and measurement error) pose challenges to extracting that information. A combination of statistical tools was used to address these challenges (generalized additive models, GAM, and state-space models, SSM) to understand how these factors influence common zooplankton in Lake Michigan, applied to long-term, offshore time series data (1994-2016). Results of the GAM analysis provided estimates for effects of temperature, seasonality, population density, and the invasive predatory zooplankter, *Bythotrepheslongimanus,* on estimated zooplankton population growth rates (e.g., 17-30% reductions in cladoceran and cyclopoid population growth rates by *B. longimanus*). Application of SSM analysis allowed for tests of hypothesized mechanisms underlying these effects, such as the contribution of consumptive and nonconsumptive *B. longimanus* effects. Such effects likely alter the production and composition of zooplankton, with consequences for planktivorous fish species. The results thus provide field-based evidence for ongoing impacts of these factors in Lake Michigan and have implications for ecosystem-scale processes.

HEALTH SCIENCES

10:40am Grad Rm 245

Cancer Cohort Matrix Induces Adhesion Molecule Expression Differences in Salivary Gland Cells

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

Once a primary tumor has developed in cancer patients, cells are able to individually migrate away from this primary site and travel to other areas of the body. Previous studies conducted in our laboratory have shown that salivary gland cancer cells break away from the primary tumor as individuals but travel throughout the body as groups or cohorts. Migration studies revealed these cohorts to be more aggressive than even the cancerous cells.

This increase in aggressive behavior may be linked to an increase in cancer progression and consequently a poor prognosis. Cohorts also displayed a unique expression of cell adhesion molecules where an increase in expression was seen within the center along with a decreased expression in marginal cells. We then investigated whether the extracellular matrix (ECM) played a role in cohort formation and behavior. The extracellular matrix is a network of proteins secrete by the cells to function in cell to cell communication an interaction. Our preliminary studies on the effects of a cancerous matrix on normal salivary gland cell behavior resulted in an early loss of adhesion molecules seen within the cells, suggesting they were in a transitory stage which could ultimately lead to complete loss of cell adhesion. Because these results revealed that the cancerous ECM did have influence on adhesion molecule loss, we hypothesize the testing of cohort ECM effects on normal salivary gland cells will produce a significant increase in cell adhesion proteins. To test cohort ECM effects, cancer cohort cells will be culture to 80-90% confluency and then stripped from their ECM. Normal cells will then be seeded on this cohort cancer ECM and cultured to 80-90% confluency. Immunofluorescence techniques will then be used to fluorescently stain for cell adhesion molecules. Scanning electron microscopy will also be performed to compare morphological differences between a normal salivary gland ECM, a cancerous ECM, the cohort ECM, and the normal cells grown on the cohort ECM for comparison.

11:00am Grad
Rm 245

Does Osteopontin Regulate TWIST Expression in Salivary Gland Cancer?

*[1]Hailey Freres, [2]Anita Joy, [2]Kathryn Carter [[1]Southern Illinois University Edwardsville, [2]SIU School of Dental Medicine]

Human salivary gland (SG) cancer is a rare but often life-threatening disease due to its asymptomatic nature, which frequently leads to a late stage diagnosis. Once a SG cancer diagnosis is made, patient prognosis is usually unfavorable. In an attempt to identify SG cancers at an early stage to help a more favorable prognosis, scientists have suggested targeted therapies. As a molecular target in cancer therapeutics, TWIST proteins play a key role in the progression of cancer to a metastatic stage and may serve as an independent prognostic marker for patient survival. Osteopontin (OPN) is a critical signaling molecule that regulates downstream TWIST. Another protein that plays an important role in regulating mechanisms, like cell proliferation, survival, and invasion, which can lead to salivary gland cancer cell migration and metastasis is Fos-related Antigen 1 (Fra-1). Fra-1 regulates cell morphology by driving cells through a process known as epithelial-mesenchymal transition (EMT). EMT is an important change needed during embryonic development, but is also implicated in pathological conditions. Although we have previously established the independent roles of OPN and Fra-1 in SG cancer progression, possible interconnections between OPN, Fra-1, and TWIST have not been studied. So, we examined the potential upstream regulation of Fra-1 by OPN through the mitogen activated protein kinase/extracellular signal-related kinase (MAPK/ERK) pathway. Immunofluorescence and immunoblotting studies were used to localize and quantify the components of the signaling pathway in normal and cancer salivary gland cell lines. Further modulation of the pathways in these cell lines using ERK1/2 activators and inhibitors, and OPN silencing via siRNA silencing techniques were used to evaluate the role of OPN in regulating Fra-1. Our initial data show that OPN plays a role in regulating Fra-1 and Fra-1 induces TWIST to initiate EMT. This data indicates that future molecular therapies targeting OPN could be effective in controlling downstream Fra-1 and TWIST and, thereby, limit cancer cell metastasis, migration and invasion in patients.

MICROBIOLOGY

9:20am Grad
Rm 245

Multigene Characterization of *Darksidea* Isolates and Description of a New Species

*Maria-Jose Romero-Jimenez, Andrea Porras-Alfaro [Western Illinois University]

Dark septate endophytes (DSE) include root-associated fungi known to be dominant colonizers of arid plants. They likely provide protection to their hosts against pathogens and stressful conditions such as drought and high temperatures. *Darksidea*is a DSE that has been found in semiarid plants in the United States, however its characterization and ecological role is yet to be determined. The objective of this research was to characterize a culture collection of *Darksidea* isolates using a multi-gene phylogeny. Roots of six grass species were sampled across central south states in the United States. Seventy-seven *Darksidea* isolates were identified using the ITS rDNA region and clustered in eight operational taxonomic units (OTU) based on a 97% similarity. Actin (ACT), β-tubulin (BTUB), calmodulin (CAL) and transcription elongation factor (TEF) genes were amplified and sequenced to characterize phylogenetic relationships between *Darksidea* species. Sequences were compared with curated databases; the Ribosomal Database Project and UNITE. Morphology of representative isolates of each OTU was

determined using different media. Most *Darksidea* isolates were recovered from blue grama, black grama and buffalo grass in Texas and New Mexico. Using the ITS rDNA region five potential clades were identified. These are closely related to *Darksidea* isolated from grasses in Hungary and in the USA southwest. A new species was also identified. *Darksidea* isolates produced a variety of pigments, metabolites and microscopic structures including chlamydospores, conidia and hyphal loops. *Darksidea* shows a broad distribution in arid plants and the northern hemisphere indicating a potential role supporting plants growing on arid environments.

9:40am UG
Rm 245

Detection of Antibiotic Resistance Loci in Waste Water and Fresh Water

*Audrey Rex, Kai Hung [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 (Liu & Breukink, 2016). 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 (Drawz & Bonomo, 2010). 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 (Eccles, Searle, Holt, & Dennis, 2014).

In this project, we 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. By increasing the number of sampling sites along the waste water treatment process we obtain a more refined analysis on the critical steps that facility lateral gene transfer. Further, the statistical significance of our earlier findings is more accurate with continued independent sampling repeats.

10:00am UG
Rm 245

Agglutinin-Like Sequence Genes in *Meyerozyma guilliermondii*

*[1]Allyson Isenhower, [1]Laura M. Zimmerman, [2]Soon-Hwan Oh, [2]Lois Hoyer ([1]Millikin University, [2]University of Illinois Urbana-Champaign]

ALS genes are important to understand because of their cell adhesion function. Cell adhesion plays an important role in many interactions as well as pathogenesis.*Meyerozyma (Candida) guilliermondii* is a species in the CTG clade that possesses*ALS* genes. Although *M. guilliermondii* has a variety of uses, it is clinically relevant because it is an opportunistic pathogen. Knowing the sequences of the *ALS* genes is critical to understanding how *M. guilliermondii* adheres to surfaces. DNA sequencing techniques such as Oxford Nanopore, Illumina sequencing, and Sanger sequencing were utilized in this study. Various bioinformatics websites were used to analyze the BLAST results, translate sequences, and read sequencing files. Oxford Nanopore and Illumina sequencing was used to create a genome for *M. guilliermondii*. A BLAST search yielded five results, but two "hits" were fragments of the same gene. PCR was performed to determine the size of the different gene regions (N-terminal, tandem repeats, C-terminal) and to use as a sequencing template. There were four total *ALS* genes in *M. guilliermondii*. Mg1, Mg2, and Mg3 were typical *ALS* genes. The 5' end of Mg4 fit the criteria for an *ALS* gene, but the rest of the gene more closely resembled a different unknown gene family. The tandem repeat region of the genes proved to be difficult to sequence completely. However, the combination of Oxford Nanopore and Illumina sequencing provided a more accurate assembly of the genome than what was available on NCBI. With the more accurate sequence, gene expression, gene manipulation, and drug development can be investigated.

ZOOLOGY

9:20am Rm 024 **Grad**

Movement and Microhabitat Selection in Southern Flying Squirrels (*Glaucomys volans*)

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

Flying squirrels (genus *Glaucomys*) have a direct link to forest trees for food, shelter, and travel, making them a good model to understand the effects of fragmentation on forest mammals. This study examined the southern flying squirrel (*Glaucomys volans*) in urban and rural fragments in southwestern Illinois. Squirrels were collared and tracked using radio-telemetry. Nighttime tracking established home range sizes. Daytime tracking determined nesting tree preferences. Hypotheses tested included: (1) squirrel sex affects home range size, (2) tree mast type affects nesting tree selection, (3) tree size affects nesting tree selection. 95% minimum convex polygon (MCP) and 95% kernel density estimator (KDE) determined home range sizes. No significant difference between sexes in home range size was found. MCP and KDE in this study are among the lowest observed. Squirrels selected soft mast trees for nesting significantly more than expected. Tree size preferences were significant, with medium and large trees (>40 cm diameter) being preferred over small trees (<40 cm diameter). The finding of larger tree usage was consistent with most other studies. During the course of tracking, one male squirrel was observed crossing a road, indicating gap crossing potential for flying squirrels in urban environments. Understanding the spatial behavior and habitat characteristics provides crucial insight to better understand the effect of fragmented landscapes on small mammal communities.

9:40am Rm 024 **UG**

Does Length of Stay in Rehabilitation Influence the Magnitude of the Acute Stress Response in Birds of Prey?

*[1]Naomi Klingbeil, [1]Travis Wilcoxen, [2]Jacques Nuzzo, [2]Jane Seitz [[1]Millikin University, [2]Illinois Raptor Center]

Wild animals are occasionally injured or become ill as a result of human activity. As a way to remediate the damage imposed by humans on wildlife population, wildlife rehabilitation is often an option. The Illinois Raptor Center (IRC) in Decatur, Illinois, rehabilitates native birds of prey. Federal laws for rehabilitators set limits for the length of time an animal can remain in rehabilitation prior to release or euthanasia, but little is known about the consequences of long stays in captivity for stress physiology of the animals. We hypothesized that length of stay in rehabilitation would influence the ability of raptors to handle stress upon release from the Illinois Raptor Center. Blood samples were taken from the bird upon their admission and release exams, a process by which the animals are exposed to a significant, acute stressor of capture and examination. We used a corticosterone enzyme immunoassay to determine the corticosterone levels present in the blood of the bird during both the admission and release exam and compared the admission and release corticosterone values within the context of length-of-stay at the IRC. Our findings will shed light on the potential cost of long-term rehabilitation in relation to ability to handle natural stressors in the wild upon release.

10:00am Rm 024 **UG**

Seasonal and Inter-Species Variation in Seroprevalence of West Nile Virus in Clinic-Admitted Raptors in Central Illinois

*Owen Pulver, [1]Travis Wilcoxen, [2]Jacques Nuzzo, [2]Jane Seitz [[1]Millikin University, [2]Illinois Raptor Center]

West Nile Virus (WNV) is a virus that is commonly found in avian species in the Midwestern United States. WNV commonly follows a bird-mosquito-bird transmission pattern, with birds serving as amplifying hosts, or reservoirs, for the pathogen. We analyzed plasma samples from raptor species that were admitted to a rehabilitation clinic in Central Illinois for two types of antibodies against WNV using an Enzyme-Linked Immunosorbent Assay (ELISA). In all, eight different raptor species were tested. From our survey, we found that Great-Horned Owls (*Bubo virginianus*) had the highest seroprevalence (38.6%) and Turkey Vultures (*Cathartes aura*) had the lowest seroprevalence (14.3%) for IgY antibodies. The highest seroprevalence for IgM antibodies was for American Kestrels (*Falco sparvarius*) with 27.6% and the lowest was Great-Horned Owls with 0.0%. We also saw a pattern of WNV positive cases among seasons that mirrored the pattern of mosquito activity in Central Illinois. Many of the species-specific frequencies from our data differed significantly from those reported in studies done in Wisconsin and Colorado.