TRANSACTIONS OF THE ILLINOIS STATE ACADEMY OF SCIENCE

Supplement to Volume 114



112th Annual Meeting – Virtual April 9 – 10, 2021

Hosted via Zoom by Eastern Illinois University

Illinois State Academy of Science

Founded 1907

Affiliated with the Illinois State Museum Springfield, IL

Table of Contents

MEETING SCHEDULE	2
Poster Presentation Schedule – Friday, April 9, 2021	3
ORAL PRESENTATION ROOM SCHEDULE – SATURDAY, APRIL 10, 2021	4
ABBREVIATIONS USED IN PROGRAM	4
Poster Presentations – Friday, April 9, 2021 – Zoom Breakout Rooms	5
ORAL PRESENTATIONS – SATURDAY, APRIL 10, 2021 – ZOOM BREAKOUT ROOMS	8
Keynote Address – Thomas Gaj, Ph.D. – Zoom – Friday, April 9, 2021 – 7pm	
Message from the Vice Presidents	11
Poster Presentation Abstracts	
Βοτανγ	
Cellular, Molecular, & Developmental Biology	14
CHEMISTRY	16
Engineering & Technology	
Environmental Science	
MICROBIOLOGY	21
Physics, Mathematics, & Astronomy	22
STEM EDUCATION	23
ZOOLOGY	27
ORAL PRESENTATION ABSTRACTS	
ANTHROPOLOGY & ARCHEOLOGY	
ΒΟΤΑΝΥ	
Cellular, Molecular, & Developmental Biology	
CHEMISTRY	
Engineering & Technology	
Environmental Science	41
Health Sciences	43
Physics, Mathematics, & Astronomy	44
STEM EDUCATION	44
Zoology	45

112th ISAS Annual Meeting – Virtual

April 9 – 10, 2021 Eastern Illinois University Host: Dr. Gary Bulla

MEETING SCHEDULE

Friday, April 9th

- 12noon 2:00pm ISAS Council Meeting (Zoom)
- 1:00pm 4:30pm Check in to Zoom Sessions
- 2:00pm 3:00pm Poster Session A (Zoom Breakout Rooms)
- 3:30pm 4:30pm Poster Session B (Zoom Breakout Rooms)
- 7:00pm 8:30pm Welcome Travis Wilcoxen (Zoom)
 - Keynote Address Thomas Gaj, PhD (Zoom)
 - *Gene-Editing Technologies and their Application for the Treatment of Neurodegenerative Diseases*

Saturday, April 10th

- 7:30am 11:40am
 - am Check in to Zoom Sessions
- 8:00am 11:40am
 Oral Presentations Begin (Zoom Breakout Rooms)
- 11:40am 12:00noon Divisions Meetings and Judging Results (Zoom Breakout Rooms)
- 12:15pm 1:00pm Awards Presentations (Zoom)

POSTER PRESENTATION SCHEDULE – FRIDAY, APRIL 9, 2021

All Poster Presentations in Zoom Breakout Rooms

	Session A: 2 – 3pm – Odd Numbers			Session B: 3:30 – 4:30pm – Even Numbers		
#	Division Last Name			Division	Last Name	
1	Botany	Hubert	2			
3	Botany	Nilges	4	Botany	Herdman	
5	Botany	Kelleher	6	Botany	Pyszka	
7	Botany	Phillips	8	Botany	Deterding	
9			10	Cell Biology	Gamsby	
11	Cell Biology	Niebrugge	12	Cell Biology	Zanker	
13	Cell Biology	Munoz Ruiz	14	Cell Biology	Edwards	
15			16	Chemistry	Valenzuela	
17	Chemistry	Chao	18	Chemistry	Ayer	
19	Chemistry	Paskach	20	Chemistry	Carlson	
21			22	Chemistry	Bobori	
23			24			
25	Chemistry	Alshehri	26	Chemistry	Nagaretnam	
27			28	Environmental Science	Lin	
29	Environmental Science	Lin	30	Environmental Science	Jackson	
31	Environmental Science	Rosales	32	Environmental Science	Gifford	
33	Microbiology	Christnacht	34	Microbiology	Aydt	
35	Microbiology	Smidt	36	Microbiology	Goodbrake	
37	Microbiology	Beanblossom	38			
39	Physics, Math, & Astronomy	Aladhyani	40	STEM Education	Karban	
41	STEM Education	Beardslee	42	STEM Education	Jackson	
43	STEM Education	Sturdevant	44	STEM Education	Wonnacott-Stanley	
45	STEM Education	Drennen	46	STEM Education	Okonya	
47	STEM Education	do Valle Santos	48	STEM Education	do Valle Santos	
49	STEM Education	Banks	50	STEM Education	Locke	
51	Zoology	Weers	52	Zoology	Vignos	
53	Zoology	Castanon	54	Zoology	Brown	
55	Zoology	Artime	56	Zoology	Gladson	
57	Zoology	Carter	58	Zoology	Mummel	
59	Zoology	Jedlicka	60	Zoology	Jedlicka	
61	Zoology	Wyco	62	Zoology	Holm	
63	Zoology	Shah	64	Zoology	Tomaschke	
65	Zoology	Goessling	66	Zoology	Patel	

ORAL PRESENTATION ROOM SCHEDULE – SATURDAY, APRIL 10, 2021

	Room 1	Room 2	Room 3	Room 4
8.00am	Botany	Environmental Science	Chemistry	Cell Biology
0.00am	Gearin	Killday	Rubayyi	Singh
8.20am	Botany	Environmental Science	Chemistry	Cell Biology
0.20dm	Renken	Truhtcheva Owikoti	Davidson	Morrone
8.40 am	Botany	Environmental Science	Chemistry	Cell Biology
8:40am	Veith	Namini	Purcell	Dahal
9:00am	BREAK	BREAK	BREAK	BREAK
0.20.00	Botany	Environmental Science	Chemistry	Engineering & Technology
9:20am	Stumbo	Brashears	Dodson	Villegas
0.40 am	Botany	Environmental Science	Chemistry	Engineering & Technology
9:40am	Minchin	Wang	Morrone	Baker
10.00 am	Botany	Environmental Science	Chemistry	Engineering & Technology
10.00am	Schulz	Robinson	Fuller-Svarz	Islam
10:20am	BREAK	BREAK	BREAK	BREAK
10.40 am	Anthropology	Health Sciences	Zoology	Physics, Math, & Astronomy
10:40am	Price	Wright	Brunkow	Anderson
11.00 am	STEM Education	Health Sciences	Chemistry	Physics, Math, & Astronomy
11:00am	Morrone	Ruiz	Fayissa	Nsor
11.20am	Botany		Chemistry	Physics, Math, & Astronomy
11:20am	Schennum		Lippincott	Gautam
11:40am	Division Meeting	Division Meeting	Division Meeting	Division Meeting

All Oral Presentations in Zoom Breakout Rooms

ABBREVIATIONS USED IN PROGRAM

Division Abbreviations

Anthropology	Anthropology & Archeology
Cell Biology	Cell, Molecular, & Developmental Biology
Physics, Math, & Astronomy	Physics, Mathematics, & Astronomy

Participant Abbreviations

UG	Undergraduate Student
Grad	Graduate Student
None	Regular/Faculty Member

School and Organization Abbreviations

AIC	School of the Art Institute of Chicago
Augustana	Augustana College
Bradley	Bradley University
CMU	Central Michigan University
EIU	Eastern Illinois University
GSU	Governors State University

IC	Illinois College
ISU	Illinois State University
Millikin	Millikin University
SIUe	Southern Illinois University Edwardsville
UHSP	University of Health Sciences and Pharmacy in St. Louis
WIU	Western Illinois University

POSTER PRESENTATIONS – FRIDAY, APRIL 9, 2021 – ZOOM BREAKOUT ROOMS

Time	#	Presenter	Title of Presentation (Posters)
			Botany
2:00PM	1	Averi Hubert (UHSP, UG)	Genomic Mining for Cloning and Expression of Putative Plant NADPH-P450 Reductases
3:30PM	2		
2:00PM	3	Patrick Nilges (SIUe, UG)	Smoke Water Concentration Effect on the Germination of Midwestern Plant Seeds
3:30PM	4	Adam Herdman (SIUe, Grad)	Conservation of the Ribbon Orchid: Habitat Distribution and Mycorrhizal Identification
2:00PM	5	Micah Kelleher (SIUe, UG)	The Efficacy of Three Pollination Methods on Seed Set of <i>Spiranthes magnicamporum</i>
3:30PM	6	Andrew Pyszka (SIUe, Grad)	Changes in Species Composition and Diversity of Loess Hill Prairies in SW Illinois
2:00PM	7	Logan Phillips (SIUe, Grad)	Changes in Species Composition and Diversity of Remnant Illinois Wetlands
3:30PM	8	Deanna Deterding (SIUe, Grad)	Does Moth Community Composition Parallel Plant Community Restoration?
2:00PM	9		
		Cell, N	Aolecular, & Developmental Biology
3:30PM	10	Aaron Gamsby (Millikin, UG)	Trained Innate Immunity Against Bacteria, Staphylococcus aureus and Aeromonas hydrophila, in Cuban Tree Frog Tadpoles, Osteopilus septentrionalis
2:00PM	11	Brianna Niebrugge (Millikin, UG)	Changes in Natural Antibody Activity in Two Species of Birds During an Acute Stressor
3:30PM	12	Tammy Zanker (SIUe, Grad)	Identifying Molecular Markers for Mapping of the <i>mnd</i> Gene Mutation in the Basidiomycete Fungus <i>Schizophyllum commune</i>
2:00PM	13	Eva Munoz Ruiz (EIU)	Reprogramming of Mouse Neuronal Cells with Transcription Factor Snai2
3:30PM	14	Kevin Edwards (ISU)	Packed Pixels: A Central Illinois Confocal Microscopy Core Facility for FLIM, Spectral Mapping, and Adaptive Deconvolution
			Chemistry
2:00PM	15		
3:30PM	16	Gabrielle Valenzuela (WIU, Grad)	Quantification of PBZ in Equine Plasma by UHPLC-ESI/MS/MS
2:00PM	17	Madison Chao (WIU, Grad)	Quantification of Flunixin in Equine Plasma by Ultra-High Performance Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry (UHPLC- ESI/MS/MS)
3:30PM	18	Brandon Ayer (WIU, Grad)	Quantification of the Date Rape Drug Gamma-Hydroxybutyric Acid in Drinking Water by Hydrophilic Interaction Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry
2:00PM	19	Alexis Paskach (IC, UG)	Understanding Suzuki-Miyaura (SM) Reaction via WebMO Calculations
3:30PM	20	Shelby Carlson (WIU, Grad)	Quantification of Meclofenamic Acid in Equine Plasma by Ultra-High Performance Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry (UHPLC-ESI/MS/MS)
2:00PM	21		
3:30PM	22	Sunday Bobori (IC, UG)	Synthesis and Application of Nickel-Phosphorus Complexes
2:00PM	23		
3:30PM	24		
2:00PM	25	Suha Alshehri (EIU, Grad)	BODIPY-Ni(II) Complexes for Photocatalytic C-N Coupling

Time	#	Presenter	Title of Presentation (Posters)
3:30PM	26	Prahadeesh Nagaretnam (EIU, Grad)	A Novel Palladium BODPIY Photocatalyst for Carbon-Carbon Coupling
			Engineering & Technology
2:00PM	27		
			Environmental Science
3:30PM	28	ZQ Lin (SIUe)	Remediation of Selenium-Contaminated Wastewater Using Drinking Water Treatment Residuals, Biosolids and Wheat Straw
2:00PM	29	ZQ Lin (SIUe)	Microbial Enhancement of Selenium Volatilization in Soil-Plant Systems
3:30PM	30	Miranda Jackson (SIUe, UG)	Mortality Bioassay Toxicity and Sublethal Concentration Effects of Glyphosate in Schmidtea mediterranea
2:00PM	31	Alayna Rosales (Bradley, UG)	Impacts of Acidification on <i>Rana catesbeiana</i> Tadpole Interactions with Trematode Parasites
3:30PM	32	Josh Gifford (SIUe, Grad)	Establishing an Air Quality and Noise Pollution Monitoring Network in the St. Louis Metropolitan Region
		T	Microbiology
2:00PM	33	Kimmy Christnacht (Millikin, UG)	Seroprevalence of Plasmodium in Birds of Prey in Central Illinois Determined by Microscopic Examination and ELISA
3:30PM	34	Jack Aydt (SIUe, UG)	Varying Concentration of MgSO₄ Effect on <i>Neochloris oleoabundans</i> Biomass Production
2:00PM	35	Jaren Smidt (SIUe, UG)	Slightly Alkaline pH levels Enhances Neochloris oleoabundans Biomass Production
3:30PM	36	Kaitlin Goodbrake (SIUe, UG)	Testing Z-cypermethrin Cross-Tolerance in Imidacloprid Tolerant <i>Reticulitermes flavipes</i> Symbionts
2:00PM	37	Alex Beenblossom (Bradley, UG)	Spatiotemporal Patterns in Freshwater Bacterial Communities Across Hydrologically Variable Sites in a Major River Watershed
3:30PM	38	,	
		Phy	sics, Mathematics, & Astronomy
2:00PM	39	Ibrahim Aladhyani (WIU, Grad)	Group Velocity of Light in Uniaxial Crystals
			STEM Education
3:30PM	40	Miranda Karban (IC)	Teaching Evolutionary Mechanisms through Games
2:00PM	41	Jacob Beardslee (SIUe, Grad)	The Effects of Course-based Undergraduate Research Experiences on STEM Retention Rates
3:30PM	42	Jordan Jackson (SIUe, Grad)	Identifying Factors Influencing Student Perceptions of Stress in Biology Courses
2:00PM	43	Clark Sturdevant (SIUe, Grad)	Field-Related Career Interest Survey
3:30PM	44	Emily Wonnacott-Stanley (SIUe)	Developing a Virtual Badge Series for Middle Schoolers Interested in Environmental Science Careers
2:00PM	45	Lisa Drennen (SIUe, Grad)	Environmental Citizen Science: Exploring Youth Understanding of Data and the Scientific Process
3:30PM	46	Juliana Okonya (SIUe, Grad)	Comparison of the Environmental Photovoice Instructional Method among Youth from Brazil, Kenya, and USA
2:00PM	47	Waleska Carolina do Valle Santos (SIUe, Grad)	Measuring Emotions in an Environmental Health Sciences Program in Brazil and the USA
3:30PM	48	Waleska Carolina do Valle Santos (SIUe, Grad)	Partnership between Brazil and the USA (Illinois) in an Environmental Photovoice Project
2:00PM	49	Carolyne Banks (SIUe, Grad)	Environmental PhotoVoice
3:30PM	50	Sharon Locke (SIUe)	Geoscience Identity and Self-Efficacy among First and Second-Year Undergraduates

Time	#	Presenter	Title of Presentation (Posters)		
	Zoology				
2:00PM	51	Clare Weers (Millikin, UG)	The Effects of Elevated Corticosterone and Food Availability on Bacterial Killing Ability and Development in Pickerel Frog Tadpoles (<i>Lithobates palustris</i>)		
3:30PM	52				
2:00PM	53	Erica Castanon (Millikin, UG)	Stress During Development Indicated by Fluctuating Asymmetry and High Feather Corticosterone in Four Song Bird Species		
3:30PM	54	Jazmin Brown (Millikin, UG)	Seroprevalence of Toxoplasma gondii in Birds of Prey in Central Illinois		
2:00PM	55	Lauren Artime (Millikin, UG)	Association of Plumage Color, Cap Size, and Physiological Traits in White-breasted Nuthatches		
3:30PM	56	Dylan Gladson (SIUe, Grad)	Discover, Cover, Flee: The Competitive Value of Aphaenogaster Tool-Use		
2:00PM	57	Amanda Carter (SIUe, Grad)	Environmental Pool Management and Long-Term Fish Community Structure in Pool 26 of the Upper Mississippi River		
3:30PM	58	Sara Mummel (EIU, UG)	Evaluating the Role of Temperature on Feeding Performance and Righting Response of the Northern Leopard Frog, <i>Lithobates pipiens</i>		
2:00PM	59	Dianne Jedlicka (AIC)	Grey Squirrel (Sciurus carolinensis) Tree Bud Foraging Behavior During Winter		
3:30PM	60	Dianne Jedlicka (AIC)	Striped Skunk (Mephitis mephitis) Nocturnal Winter Foraging Patterns		
2:00PM	61	Jacob Wyco (Augustana, UC)	Tracking Residual-Yolk Triglycerides in Hatchling Painted Turtles		
3:30PM	62	Chloee Holm (Bradley, UG)	Evaluating the Effect of Food Quantity and Collection Site on the Growth and Survival of the Invasive Zebra Mussel, <i>Dreissena polymorpha</i>		
2:00PM	63	Zalan Shah (Bradley, UG)	The Combined Effects of Low Food Quality and High Temperature on the Growth and Survival of the Invasive Zebra Mussel, <i>Dreissena polymorpha</i>		
3:30PM	64	Sydney Tomaschke (SIUe, Grad)	Collection Rates of Arthropods Were Similar Between Grasslands with Negligible and Moderate <i>Lespedeza cuneata</i> Content		
2:00PM	65	Matthew Goessling (SIUe, Grad)	Moderate Lespedeza cuneata Invasion Does Not Alter Beetle Collection Rates and Diversity		
3:30PM	66	Raj Patel (SIUe, UG)	Diurnal Temperature Cycles and Daylength Alter Egg Laying and Media Choice in Drosophila melanogaster		

ORAL PRESENTATIONS – SATURDAY, APRIL 10, 2021 – ZOOM BREAKOUT ROOMS

Time	Room	Presenter	Title of Presentation
			Anthropology & Archeology
10:40AM	1	Megan Price (IC, UG)	Investigating Sexual Dimorphism and Development in <i>Homo sapiens</i> Nasal Aperture Shape
			Botany
8:00AM	1	Molly Gearin (IC, UG)	An update on the Seed Germination of Two Hawaiian Endemic Orchids (<i>Liparis hawaiensis, Peristylus holochila</i>)
8:20AM	1	Savannah Renken (IC, UG)	Isolation and Provisional Identification of Potential Mycorrhizal Fungi from Three Midwestern Terrestrial Orchids
8:40AM	1	Charles Veith (IC, UG)	Seed Germination of Orchids Native to Republic of Palau (W Pacific): An Update
9:20AM	1	Joe Stumbo (SIUe, Grad)	Conservation of Spiranthes Orchids
9:40AM	1	Peter Minchin (SIUe)	Effects of Climate Change on the Alpine and Subalpine Vegetation of the Mt. Field, Australia
10:00AM	1	Kurt Schulz (SIUe)	Opinions on the State of Research Pertaining to Amur Honeysuckle (<i>Lonicera maackii,</i> Caprifoliaceae)
11:20AM	1	Wayne Schennum (Nature Conservancy)	Restoring the Prairie –Savanna – Woodland Continuum
		Cell, I	Molecular, & Developmental Biology
8:00AM	4	Anchal Singh (EIU, Grad)	Evaluation of Fluorescein-Based Fluorescent Probe for Monitoring of Carboxylesterase 1 (CES1) Activity in Living Cells
8:20AM	4	Dana Morrone (UHSP)	Reduced Alphabet Proteins: Generation, Biochemical Characterization, and Evolutionary Implications
8:40AM	4	Anuja Dahal (CMU, Grad)	Domain Structure and Gene Number Evolution in Fungal Dicers: A Review
Chemistry			
8:00AM	3	Abdullah Rubayyi (WIU, Grad)	A Rapid Method to Measure Exogenous Gamma-Hydroxybutric Acid in Beer for Drug Facilitated Sexual Assault Investigation Using HILIC Electrospray Ionization Tandem Mass Spectrometry
8:20AM	3	Harley Davidson (WIU, Grad)	Gold Nanoparticle in the Detection of Methamphetamine
8:40AM	3	Lillie Purcell (WIU, UG)	Analyzing Illicit Drugs Using Copper Nanoparticles
9:20AM	3	Zachary Dodson (WIU, UG)	Spectroscopic Identification of Illicit Drugs Employing DNA Aptamer Capped Silver Nanoparticles
9:40AM	3	Dana Morrone (UHSP)	Horseradish Peroxidase Isoforms are Biochemically Equivalent for Colorimetric Probes
10:00AM	3	Katelynn Fuller-Svarz (EIU, Grad)	Development and Evaluation of a Fluorescent Probe to Detect the Expression of Glutamate Carboxypeptidase II
11:00AM	3	Senaf Fayissa (IC, UG)	Sterics and Electronic Effects of Various Phosphine Ligands via WebMO Program
11:20AM	3	Kayla Lippincott (Bradley, UG)	Copper-Catalyzed Alkyne-Azide Cycloaddition Reactions Utilizing Copper Oxides Trapped Within a Polydimethylsiloxane Matrix
			Engineering & Technology
9:20AM	4	Justin Hope Villegas (UG, ISU)	Total Impact of Electric Vehicle Fleet Adoption in the Logistics Industry of Illinois
9:40AM	4	Magalie Baker (Grad, ISU)	Application of Lean Six Sigma to Artificial Intelligence and Machine Learning
10:00AM	4	Montasir Islam (ISU, Grad)	Servitization – An Upcoming Innovative Industrial Business Model

Time	Room	Presenter	Title of Presentation	
			Environmental Science	
8:00AM	2	Sam Killday (IC, UG)	A Survey of Spontaneous Tree Diversity at Starhill Forest Arboretum and its Significance	
8:20AM	2	Reni Truhtcheva Owikoti (GSU, Grad)	Transcriptome Analysis of Odonata (Anisoptera) Nymph upon Exposure to Pesticides	
8:40AM	2	Carl Namini (SIUe, Grad)	Behavioral and Biochemical Characterization of PFOS Neurotoxicity in <i>Drosophila</i> melanogaster	
9:20AM	2	Haley Brashears (SIUe, UG)	Effects of Microplastic Exposure to Schmidtea mediterranea	
9:40AM	2	Albert Wang (SIUe, Grad)	Assessing the Effects of Decreasing Particulate Matter Concentrations Over Time on Population Health in an Industrial Midwest City	
10:00AM	2	Kiernan Robinson (Bradley, Grad)	Influence of Food Resource Quality on Trematode Parasitism in Larval Frogs	
			Health Sciences	
10:40AM	2	Mallory Wright (SIUe, Grad)	Direct Smoke Exposure Influences Stem Cell Proliferation and Regulates Squamous Cell Carcinoma of the Tongue	
11:00AM	2	Gianna Ruiz (Bradley, UG)	Successful Recovery of Cryopreserved Adult Neurons Utilizing a Novel Stem-Cell Extract	
		Ph	ysics, Mathematics, & Astronomy	
10:40AM	4	Wylie Anderson (EIU, UG)	Automation for Telescopic Control and Imaging Potential Supernovae	
11:00AM	4	Michael Nsor (WIU, Grad)	Simulation and Visualization of Traffic Flow	
11:20AM	4	Suman Gautman (WIU, Grad)	Stimulated Emission Cross-Section of Praseodymium (Pr ³⁺) Ions Doped in Lead Boro- Germanate Glasses	
STEM Education				
11:00AM	1	Dana Morrone (UHSP)	Student Design and Testing of Fluorescent-DHFR Fusion Enzymes as a Visual Learning Tool in Biochemistry Labs	
	Zoology			
10:40AM	3	Paul Brunkow (SIUe)	Manifestation of the Competitive Value of Tool-Use in Aphaenogaster rudis	

KEYNOTE ADDRESS – THOMAS GAJ, PH.D. – ZOOM – FRIDAY, APRIL 9, 2021 – 7PM

Gene-Editing Technologies and their Application for the Treatment of Neurodegenerative Diseases

Thomas Gaj, Ph.D., Associate Professor Department of Bioengineering University of Illinois



Thomas Gaj is an assistant professor of bioengineering at the University of Illinois Urbana-Champaign. His research lies at the intersection of neuroscience and engineering and is focused on the development of new technologies to facilitate the correction and treatment of various neurodegenerative diseases, including ALS and Huntington's disease. Dr. Gaj received his Ph.D. in chemistry from the Scripps Research Institute in La Jolla, CA, and completed his postdoctoral research at the University of California, Berkeley, where his work focused on the application of CRISPR-Cas9 technology for gene therapy.

Recent Publications

- <u>Next-generation CRISPR technologies and their applications in gene and cell therapy</u> Zeballos C MA and Gaj T *Trends in Biotechnology* (2020) doi: doi.org/10.1016/j.tibtech.2020.10.010
- <u>Treatment of a mouse model of ALS by in vivo base editing</u> Lim CKW*, Gapinske M*, Brooks AK*, Woods WS, Powell JE, Zeballos C MA, Winter J, Perez-Pinera P* and Gaj T* (*equal contribution) *Molecular Therapy* 28, 1177-1189 (2020)
- <u>CRISPR-Cas9-mediated genome editing increases lifespan and improves motor deficits in a</u> <u>Huntington's disease mouse model</u> Ekman FK, Ojala DS, Adil MM, Lopez PA, Schaffer DV* and Gaj T* (*equal contribution)*Molecular Therapy – Nucleic Acids* 17, 829-839 (2019)
- <u>Innovations in CRISPR technology</u> Brooks AK and Gaj, *Current Opinion in Biotechnology* 52, 95–101 (2018)

MESSAGE FROM THE VICE PRESIDENTS

Although we have been pushed into our first year of a virtual conference at ISAS, we have also witnessed the power of science and technology to taking what has traditionally been a decade-long or yet unresolved quest of infectious agent isolation/characterization followed by vaccine development/distribution and replacing it with the truly landmark achievement of reducing the timeline of this process to a little over a year with COVID-19.

ISAS remains committed to the dissemination of science on Illinois. We thank the ISAS Council for providing support and guidance to this end, especially with their support for this virtual conference. We also offer a special thank you to Tere North, our 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.

Thank you for participating in the ISAS 2021 conference and we hope to see you next year at Illinois College!

Gary Bulla, Billy Hung, and Gopal Periyannin

Vice Presidents of the Annual Meeting

POSTER PRESENTATION ABSTRACTS

2:00-3:00pm or 3:30-4:30pm, Friday, April 9, 2021, in Zoom Breakout Rooms *presenter, [school] with differences noted by superscript, UG = undergraduate, Grad = graduate student, others are faculty/regular

BOTANY

1 2:00pm UG Genomic Mining for Cloning and Expression of Putative Plant NADPH-P450 Reductases

*Avery Huburt, Dana Morrone [University of Health Sciences and Pharmacy in St. Louis NADPH-P450 reductases (CPRS) are oxidoreductase enzymes that supply two electrons from NADPH to the catalytic cycle of P450s. P450s in turn catalyze complex oxidation reactions using O2 and have generated wide interest in chemistry for their ability to catalyze complex reactions. CPRs are essential for the function of P450s, yet CPRs are not as widely studied as their more prominent partner. Plants serve as a chemical reservoir due to their abundance in natural products and P450-CPR pairs are often critical in the biosynthesis of these small molecules. Biotechnology or chemical applications using plant P450s often turn to one of the three CPR genes found in *Arabidopsis* for in vitro or synthetic biology applications. However, it is unknown if there may be plant CPR enzymes that could serve as better P450 partners as relatively few plant CPR genes have been characterized. Taking advantage of the wide genomic data now available for a variety of plants, we have identified a collection of plant CPR genes which we will clone and characterize. Here we outline our work in identifying these CPR genes from a variety of plant species and look at their evolutionary relationships. This library of CPR genes is the subject of our current work to express and biochemically characterize novel plant CPR genes to expand the biochemical toolbox of P450-CPR pairs.

2 3:30pm

3 2:00pm UG

Smoke Water Concentration Effect on the Germination of Midwestern Plant Seeds

*Patrick Nilges, Farid Rivera-Rodriguez, Ashton Walden, Kelly Barry [Southern Illinois University Edwardsville]

While it has been observed that vegetation tends to rapidly regrow following widespread fires, much of the prior research has focused on only the plants native to these fire-prone regions. For this experiment, we identified multiple grass types native to the Midwest that had, for much of their existence, been exposed to such fires but are now experiencing fewer due to human intervention. Previous experiments indicated that water infused with the smoke of native plant fires had a similar composition to common liquid smoke, so varying concentrations of diluted Wright's Hickory liquid smoke solutions were used. Seeds were exposed to smoke-water solutions varying between 0.001% liquid smoke to 10% liquid smoke. Seed germination was adversely impacted by exposure to amounts in excess of 0.1% and concentrations less than 0.01% tended to have a negligible impact compared to water. While the concentration varied somewhat between species, generally the 0.05% liquid smoke concentration seems to lead to the fastest and most consistent germination, leading to about 20% more germination in some plants by the end of a seven day period.

4 3:30pm Grad Conservation of the Ribbon Orchid: Habitat Distribution and Mycorrhizal Identification

*Adam Herdman [Southern Illinois University Edwardsville]

Of the 200 species of orchids that inhabit North America, only 3 of these are examples of leafless epiphytes. These orchids are at particular risk to habitat loss and climate change because of their reliance on a host tree and mycorrhizal fungi. The obligate relationships that these orchids form restrict the populations to Southwestern Florida. The known species of leafless epiphytes are all found in this region and consist of the Ghost Orchid (*Dendrophylax lindenii*), The Ribbon Orchid (*Campylocentrum pachyrrhizum*), and the Jingle Bell Orchid (*Dendrophylax porrectus*). The Ghost Orchid and the Ribbon Orchid occupy the same habitat and have similar growth patterns and therefore can be monitored using similar techniques. Population surveys of the Ribbon Orchid in the FPNWR were completed in 2016 through 2020. The purpose of this study was to describe the habitat requirements of the ribbon orchids. This comparison features the first DNA sequencing of fungal samples isolated from the roots of this taxa. The surveys suggest that the ribbon orchid may exhibit a high habitat specificity in the FPNWR. This study

represents the first steps in the conservation of the Ribbon Orchid in Florida by describing the current state of the populations and identifying the mycorrhizal associate.

5 2:00pm UG The Efficacy of Three Pollination Methods on Seed Set of Spiranthes magnicamporum

*Micah Kelleher, Joseph Stumbo, Elizabeth Esselman [Southern Illinois University Edwardsville] Spiranthes magnicamporum is an orchid species that is native to North America. It is primarily found in the Midwestern and Southern United States. Due to habitat loss and fragmentation, it is a species of concern. The purpose of this study is to examine the efficacy of three pollination treatments on seed set of *S. magnicamporum*. The three treatments of pollination were cross-pollination, open-pollination, and storedpollination. The stored pollen was desiccated and stored at -4°C for one year before use. Capsules were collected two weeks after pollination and dissected for seeds. The seed viability was confirmed by germination. To germinate, these seeds must establish a relationship with a mycorrhizal symbiont. Our seeds were surface sterilized and placed in an oatmeal agar containing *Tulasnella*, a known *Spiranthes* fungal symbiont, then examined for eight weeks. Seed counts and germination rates were compared between the pollination treatments.

6 3:30pm Grad Changes in Species Composition and Diversity of Loess Hill Prairies in SW Illinois *Andrew Pyszka [Southern Illinois University Edwardsville]

Since European settlement, Illinois has lost 99% of its original prairie cover, mostly due to conversion of prairies to agriculture. A subset of prairies largely spared from this decline was loess hill prairies. Loess hill prairies are grassland ecosystems surrounded by forests and seen on south or south-west facing slopes, isolating them from other prairie habitats. Because of this isolation, loess hill prairies can be subject to woody species encroachment. The objective of this research is to investigate changes in plant species composition and diversity in remnant loess hill prairies and test if declines in diversity are negatively correlated with the area of the remnant and positively correlated with woody species invasion. I predict that woody species have increased in abundance, while the diversity of native herbaceous species has declined. I will resurvey 10-12 high quality loess hill prairies from the Illinois Natural Areas Inventory (INAI), while replicating their original methods used in the 1970s. Twenty to thirty 0.25m² quadrats will be surveyed along a transect, as close as can be determined to the original INAI transects. All vascular plant species within each quadrat will be identified and assigned a percentage cover score (species presence and Braun-Blanquet cover class). The data collected will be combined with data from the original INAI survey to examine changes in diversity and species composition. This data will also be used to test for relationships between changes in diversity and prairie area and will also be used to test for associations between changes in woody species and invasive species abundance, and predictor variables (area of remnant, proximity to roads). This research is important because hill prairies are among the best remaining examples of the prairie biome that historically covered more than 50% of Illinois. This research is expected to provide valuable information for conservation managers.

7 2:00pm Grad Changes in Species Composition and Diversity of Remnant Illinois Wetlands

*Logan Phillips [Southern Illinois University Edwardsville]

Illinois has lost 90% of its wetland habitat since European settlement and these ecological communities continue to experience a variety of disturbances that impact their health, with the most recent of these disturbances being the invasion of non-native species. To better understand how non-native plant species are impacting native plant species diversity and composition in Illinois wetlands, this study seeks to resample thirteen wetland preserves originally sampled by the Illinois Natural Areas Inventory (INAI) in 1976. This research will investigate how remnant scrub-swamp and natural permanent pond communities in the central, southwest, and southern regions of Illinois are being influenced by non-native plant species. Resampling these preserves and combining the collected data with the original INAI surveys will help quantify whether remnant wetlands underwent changes in the diversity and composition of their vegetation communities over the past 40 years. Analysis of the results will seek to show a correlation between these changes and invasion of non-native species. Species diversity and community composition will be used as metrics to analyze the health of these remnant wetlands, along with testing for associations between area of the remnant and proximity to roads. This research is important because wetlands are one of the rarest natural ecosystems in Illinois, and very few high-quality examples were found in the INAI. It is therefore important to monitor these remnants and determine the degree to which they have been

degraded. This investigation will complement similar work performed in the Chicago region, providing a more thorough overview of wetland health throughout Illinois. This study is expected to produce applicable information to inform conservation management decisions pertaining to non-native plants and their influence on wetland ecosystems.

8 3:30pm Grad Does Moth Community Composition Parallel Plant Community Restoration?

*Deanna Deterding, Kurt Schulz [Southern Illinois University Edwardsville] Prairie ecosystems provide important ecological services that are essential to humans as well as other organisms. Sadly, remnant prairie is scarce within the US. Even within the Prairie State, Illinois, only about 0.1% of prairie remains. In most prairie restorations, plant species richness begins to decline after a few decades instead of steadily increasing. This suggests important flaws in establishment and management techniques. Given that many restorations currently exist, we focus on how the presence and dominance of prairie plant species impact moth community composition. We evaluate this by examining plant species composition and moth species composition in a single, large prairie restoration site. We hypothesized that as plant species composition changes so will moth communities. This may be in-part due to the use of different management strategies such as burning, mosaic burns, brush hogging, and no management throughout the site. Overall, we think that restoring prairie as a mosaic of vegetation determined by a variety of management strategies could benefit moth communities and other higher taxa creating a more holistic prairie ecosystem.

9 2:00pm

CELLULAR, MOLECULAR, & DEVELOPMENTAL BIOLOGY

10 3:30pm UG Trained Innate Immunity Against Bacteria, Staphylococcus aureus and Aeromonas hydrophila, in Cuban Tree Frog Tadpoles, Osteopilus septentrionalis

*Aaron Gamsby, Travis E. Wilcoxen [Millikin University]

"Trained innate immunity" is a relatively young concept in comparison to the traditional understanding of the innate immune system. The innate immune response lacks specificity towards pathogens; however, recent research on plants, invertebrates, and mammals have provided evidence of innate immune memory which provides an increased reaction towards repeat exposure. We examined whether Cuban Tree Frog tadpoles (Osteopilus septentrionalis) possess trained innate immunity, by variably exposing the tadpoles to Staphylococcus aureus (Sa) and Aeromonas hydrophila (Ah) over five weeks. We housed the tadpoles in pairs. We took baseline samples (n = 30) in the lab acclimation period. We maintained a control group (n =57), two experimental groups (n = 29, n = 29) that were exposed to Sa once (Sa1) and five times (Sa5, once per week), respectively, and two experimental groups (n = 30, n = 30) that were exposed to Ah once (Ah1) and five times (Ah5, once per week), respectively. After the treatments, we analyzed blood samples with bacterial killing assays. Control tadpoles killed significantly more Ah and Sa than baseline tadpoles. Ah1 tadpoles killed significantly more Ah and Sa than baseline, control, and Ah5 tadpoles. Ah1 tadpoles killed significantly more Ah than Sa1 and Sa5 tadpoles but had no significant difference (NSD) in Sa killing ability. Sa1 and Sa5 tadpoles showed NSD of Sa and Ah killed. Sa1 and Sa5 killed significantly more Sa than Ah5, control, and baseline tadpoles. Sa1 and Sa5 showed NSD in Ah killing between Ah5 and control tadpoles. The general innate immune response in Cuban Tree Frog tadpoles increased with exposure; however, there is specificity as there was differential investment between pathogens and exposure.

11 2:00pm UG

Changes in Natural Antibody Activity in Two Species of Birds During an Acute Stressor *Brianna Niebrugge, Travis E. Wilcoxen [Millikin University]

Corticosterone (CORT), a glucocorticoid, is elevated when birds face internal or external stressors and is part of the overall physiological response aimed at returning to homeostasis. Chronic CORT release suppresses the effectiveness of an immune response by decreasing the number of lymphocytes produced. However, CORT can stimulate innate defenses during acute elevations. One innate line of defense comes from natural antibodies (NAb), which are antibodies that are continuously released by plasma cells and have general pathogen targets. We tested whether an acute stressor had an effect on the amount of circulating NAb in two species of birds; Downy Woodpecker (*Dryobates pubescens*) and House Finch (Haemorhous mexicanus). We took an initial blood sample from one wing, placed the bird in a cotton bag for 30 minutes to create a stressor, then took two more blood samples, one from each wing. We tested these blood samples for CORT and NAb levels. We found that both species elevated CORT and NAb over a 30-minute stressor and that there was no difference in the amount of CORT in blood samples from different wings at 30 minutes for either species. However, we found that NAb are elevated from both wings, but significantly more elevated in blood samples taken from the original wound site following the stressor. These results suggest localization of NAb at the initial wound site during a timed stressor.

12 3:30pm Grad Identifying Molecular Markers for Mapping of the *mnd* Gene Mutation in the Basidiomycete Fungus *Schizophyllum commune*

*Tammy Zanker, Thomas Fowler [Southern Illinois University Edwardsville]

The recessive gene mutation, mnd, causes unusual spherical mounds of sterile hyphae to form on colonies of Schizophyllum commune (Leonard, 1975). When mnd⁻ and wild-type strains are mated, their dikaryotic colonies often display both mounds and fruiting bodies. These mosaic colonies are genetically heteroallelic (mnd⁺ + mnd⁺) with heteroallelic fruiting bodies. However, mounds on these colonies were shown to be homoallelic (*mnd⁻* + *mnd⁻*)(Gaber and Leonard, 1981). In mound hyphae, the *mnd⁻* genetic information replaces the original mnd⁺ genetic information (Leonard et al., 1978). This replacement of genetic information occurs through a mechanism that does not appear to correspond with classical mechanisms of heritable change (Leonard and Dick, 1994). Molecular characterization of the mechanism underlying the mnd allele transformation can begin by defining a physical map position for the mnd gene. The genomic region containing mnd was narrowed down to scaffold 1 of a genome sequence (Schco H4-8 V 3.0, JGI-DOE) that includes ade2, a distantly linked genetic marker (Gula, 2019; Gaber and Leonard, 1981). We used chromosome "landing" (Tanksley, 1995) to find additional linked polymorphic molecular markers along scaffold 1. We used these polymorphic positions to recognize crossover events within populations from wild-type x mound crosses. We identified a polymorphic glucosyltransferase (GTF) gene region with a linkage distance of 46.94 cM from mnd and a peptidase gene region with a linkage distance estimate of only 10.53 cM from mnd. We are searching for additional polymorphic markers on Scaffold 1 using fosmid clones screened from a mnd mutant genomic DNA library (Gula, 2019). These additional molecular markers will assist our efforts to refine the Scaffold 1 map and identify the locus of the mnd gene with its unusual allele transformation properties.

13 2:00pm Reprogramming of Mouse Neuronal Cells with Transcription Factor Snai2

*Eva Munoz Ruiz, Mingze Gao, Abdul Alanazi, Gary A. Bulla [Eastern Illinois University] Mammalian development involves a complex system of regulatory signals and reactions, leading to the creation of distinct tissues with specific structures and functions controlled by various gene expression profiles. Tissue-specific gene expression is controlled by specific combinations of transcription factors and cofactors that dictate cell differentiation via activation and repression of genes in mammalian cells. Whole genome microarray analysis of fibroblasts has revealed candidate genes such as Prrx1 and Snai2 that may serve as master regulators of fibroblast identity Previous results showed that Prrx1 and Snai2 can both activating expression fibroblast identity in and repress liver identity in hepatoma cells. Based on these results, we sought to determine if Snai2 overexpression could partially reprogram neurons using mouse neuronal cells as a model system.

An expression plasmid containing a Snai2 expression cassette was transfected into mouse Neuro2A cells using a standard transfection technique, then G418-resistant clones were selected (pooled and individually) and monitored for over-expression of Snai2. RNA was extracted and used to synthesize cDNA. Quantitative real-time polymerase chain reaction (qPCR) was carried out using specific primer pairs and signals normalized to GAPDH mRNA levels. qPCR analysis revealed that both Snai2 were successfully overexpressed. Expression of several neuron-specific genes were strongly repressed, suggesting a partial reprograming of the Neuro2A cells away from a neural phenotype, although little activation of fibroblast genes was observed. To determine whether the neuronal phenotype was affected, we monitored neurite outgrowth. Results show a reduction in the frequency of neurite outgrowth in the Snai2 overexpressing Neuro2A cells. These results suggest that fibroblast-specific transcription factor Snai2 can partially reprogram mouse neuronal cells.

14 4:00pm

Packed Pixels: A Central Illinois Confocal Microscopy Core Facility for FLIM, Spectral Mapping, and Adaptive Deconvolution

*Kevin Edwards, Isolde McKiernan [Illinois State University]

The Illinois State University confocal core facility (illinoisstate.edu/confocal) provides Illinois researchers with an integrated set of advanced imaging options in addition to standard confocal microscopy. This Leica SP8/White Light Laser system can perform full spectral mapping of samples to generate 2D excitation/emission plots. This is a powerful approach for defining the behavior of dyes in an experiment or the autofluorescence characteristics of a sample. For improved resolution, adaptive deconvolution can be performed on a series of consecutive focal planes; this requires minimal setup and works with any dye combination. Effectiveness of this technique will be shown using fine structure of endosomes in Drosophila epithelia. The system also provides fully integrated fluorescence lifetime imaging (FLIM) with FLIM-FRET capability. This imaging mode is capable of distinguishing fluorochromes with similar emission spectra, yields chemical information about the fluorochrome, and identifies previously unseen variation in biological structures, here exemplified by specialized cuticle in a dipteran antenna.

CHEMISTRY

15 2:00pm

16 3:30pm Grad Quantification of PBZ in Equine Plasma by UHPLC-ESI/MS/MS

*Gabrielle Valenzuela, Liguo Song [Western Illinois University]

An UHPLC-ESI/MS/MS method was developed for simultaneous quantification and confirmation of phenylbutazone (PBZ) in equine plasma. PBZ was recovered from equine plasma by strong anion exchange solid phase extraction (SAX-SPE). The concentration of PBZ was determined between 25 and 1250 ng/mL by internal standard calibration using $PBZ^{-13}C_{12}$ as the internal standard. The limits of detection (LOD) were determined to be 1 ng/mL. The measurement precision and accuracy were 3.2% and 97.7%, respectively. The method is not interfered by any other NSAIDs that are regulated by the United State Equestrian Federation (USEF). The method can assist USEF to control doping in horse racing.

17 2:00pm Grad Quantification of Flunixin in Equine Plasma by Ultra-High Performance Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry (UHPLC-ESI/MS/MS)

*Madison Chao, Jasmin Duncan [Western Illinois University]

An UHPLC-ESI/MS/MS method was developed for simultaneous quantification and confirmation of flunixin in equine plasma. Flunixin was recovered from equine plasma by strong anion exchange solid phase extraction (SAX-SPE). The concentration of flunixin was determined between 5 and 250 ng/mL by internal standard calibration using flunixin-d₃ as the internal standard. The limits of detection (LOD) were determined to be 1 ng/mL. The measurement precision and accuracy were 4.8% and 101.9%, respectively. The method is not interfered by any other NSAIDs that are regulated by the United State Equestrian Federation (USEF). The method can assist USEF to control doping in horse racing.

18 3:30pm Grad Quantification of the Date Rape Drug Gamma-Hydroxybutyric Acid in Drinking Water by Hydrophilic Interaction Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry

> *Brandon Ayer, Alexandra Brisbin, Zachary Dodson, Liguo Song [Western Illinois University] Gamma-hydroxybutyric acid (GHB) is a Schedule I controlled substance that is frequently used by predators for the purpose of drug facilitated sexual assault (DFSA), and it is commonly found in drinks served at social gatherings. In this study, a hydrophilic interaction liquid chromatography electrospray ionization tandem mass spectrometry (HILIC-ESI/MS/MS) method for the analysis of GHB in drinking water was developed. The method eliminated the derivation step which is required by traditional gas chromatography mass spectrometry (GC-MS) methods. It also achieved baseline resolution of GHB with its structural isomers, i.e. alpha-hydroxybutyric acid (AHB) and beta-hydroxybutyric acid (BHB), and allowed the use a neutral mobile phase, resulting in the use of negative-ion ESI to achieve a lower LOD and LOQ, 0.0198 and 0.0660 µg/mL, respectively. In comparison, it is unusual for negative ESI to be used by reverse phase liquid

chromatography (RPLC). Furthermore, the method used isocratic elution with 84% acetonitrile in the mobile phase, resulting in a rapid analysis within 2.5 minutes.

19 2:00pm UG Understanding Suzuki-Miyaura (SM) Reaction via WebMO Calculations

*Alexis Paskach, Jocelyn Lanorio [llinois College]

Suzuki-Miyaura (SM) coupling is a metal-catalyzed carbon-carbon bond reaction between organoboron and organohalide under basic conditions. Cross-coupling reactions are typically catalyzed by the expensive palladium (Pd) catalyst. This reaction is commonly used in the synthesis of pharmaceuticals, polymers, and agrochemicals. Current studies have focused on using different reactants, catalysts, and sets of conditions for this type of coupling reaction, but limited research on mechanisms have been reported. Our objectives include investigation of the chemical properties of the reactants and product involved in a chosen SM reaction (Scheme 1) as well as determination of the factor affecting the 1st step in the mechanism of SM reaction. We used a web-based interface program called WebMO to obtain properties such as heat of reactions, bond association energy, and do molecular energy calculations.

Our calculations indicate that SM reaction is an endothermic reaction, conforming to the well-known fact that connecting two sp² -hybridized carbons is a challenging task. The BDE data reveal that the strength of the C-X bond in the series of halobenzenes decreases with increasing size of the halogen. The C-X bond distances mirror this trend, with the longest bond (C-Br) also being the weakest. In the context of the oxidative addition step of a typical catalytic cycle for a Pd-catalyzed coupling reaction, It can be concluded that the C-Br bond is the most susceptible to oxidative addition. In the broader sense, the BDE data illustrate why aryl bromides are common starting materials for Pd-catalyzed couplings rather than the less expensive and environmentally more favorable aryl chlorides.



Scheme 1. Suzuki-Miyaura Coupling of 5-bromopyrimidine and furan-3-boronic acid.

20 3:30pm Grad Tying Together Genetic and Physical Maps of Schizophyllum commune to Locate the mnd Gene *Shelby Carlson, Madison Chao, Liguo Song [Western Illinois University] An UHPLC-ESI/MS/MS method was developed for simultaneous quantification and confirmation of meclofenamic acid (MFA) in equine plasma. MFA was recovered from equine plasma by strong anion exchange solid phase extraction (SAX-SPE). The concentration of MFA was determined between 5 and 250 ng/mL by internal standard calibration using flunixin-d₃ as the internal standard. The limits of detection (LOD) were determined to be 1 ng/mL. The measurement precision and accuracy were 4.7% and 92.9%, respectively. The method is not interfered by any other NSAIDs that are regulated by the United State

Equestrian Federation (USEF). The method can assist USEF to control doping in horse racing.

21 2:00pm

22 3:30pm UG Synthesis and Application of Nickel-Phosphorus Complexes

*Sunday Ndoma Bobori, Jocelyn Pineda Lanorio [Illinois College]

Suzuki-Miyaura coupling is a metal-catalyzed carbon-carbon bond reaction between organoboron and halide under basic conditions. Cross-coupling reactions are typically catalyzed by expensive palladium (Pd) catalyst. Thus, complementary approaches to achieve such coupling are highly sought after. One attractive alternative involves the use of nickel catalysts due to nickel being readily available, less toxic, and cheaper compared to Pd. Nickel catalysis can also be used to form linkages between two heterocyclic fragments producing important classes of compounds that serve as building blocks of pharmaceutical drugs such as antipsychotics, among others.

A series of Ni-phosphorus complexes, NiCl₂(DPPE), NiCl₂(PPH₃)₂, NiCl₂(BINAP), NiCl₂(P(OPH₃)₂) and NiCl₂(P(OEt₃)₂), were successfully synthesized and characterized. Most of the prepared nickel complexes showed 100% efficiency as catalysts in the chosen Suzuki-Miyaura cross-coupling reaction. However, the Ni-phosphites did not show a complete conversion of the cross-coupling reactants. It is recommended that investigation of the retrievability of the catalysts and determination of the exact action (e.g. % conversion & TOF calculation) of Ni-phosphite complexes in Suzuki-Miyaura reactions be done as future work.

23 2:00pm

24 3:30pm

25 2:00pm Grad BODIPY-Ni(II) Complexes for Photocatalytic C-N Coupling

*Suha Alshehri, Tiffany Pellizzeri, Hongshan He [Eastern Illinois University] The formation of a C-N bond is important for the synthesis of many functionals that are industrially relevant. We recently questioned whether the combination of inexpensive nickel with a photoactive BODIPY ligand might be capable of delivering C-N formation reactions between iodobenzene and amines. Different types of BODIPY ligands were synthesized and purified using column chromatography. The products were characterized using UV-Vis spectroscopy, 1H NMR, and fluorescence spectroscopy. A Ni catalyst was synthesized and characterized using X-ray crystal diffraction analysis. The aim of the work is to study the influence of nickel catalysts on the C-N formation between iodobenzene and aniline derivatives.

26 3:00pm Grad A Novel Palladium BODPIY Photocatalyst for Carbon-Carbon Coupling

*Prahadeesh Nagaretnam, Hongshan He [Eastern Illinois University]

Sonogashira C-C cross-coupling reaction has become a popular reaction in organic synthesis because of its versatility, efficacy, and simplicity. The conventional Sonogashira cross-coupling reaction involves Pd catalyst with phosphine ligand, Cul as a co-catalyst, and an amine to form the C-C bond between vinyl or aryl halide and terminal alkyne that yields the product which can be used as a building block to synthesize many different compounds. In this study, we synthesized a Pd- BODIPY catalyst and hypothesized the BODIPY moiety will absorb the light energy to Pd to ease the reductive elimination step which is a crucial step in Sonogashira C-C coupling reaction. Thus, it would increase the yield of the product even at room temperature. The effectiveness of this copper-free, light-assisted Sonogashira coupling reaction was studied on the cross-coupling reaction between phenylacetylene and iodobenzene under visible light with different conditions. Further, the influence of electron- withdrawing (CN, CHO, COOEt, COOMe, COOH, and NO₂) and electron-donating groups (NH₂, N(Me)₂, CH₃, and OCH₃) was also studied by finding their isolated yield via column chromatography. The synthesized catalyst was characterized via X-ray crystallographic study and spectroscopic studies. The para-substituted electron-withdrawing group on iodobenzene provided a higher yield whereas the electron-donating group gave a lower yield.

ENGINEERING & TECHNOLOGY

27 2:00pm

ENVIRONMENTAL SCIENCE

28 3:30pm Remediation of Selenium-Contaminated Wastewater Using Drinking Water Treatment Residuals, Biosolids and Wheat Straw

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

Selenium (Se) is a naturally occurring trace element that is nutritionally essential for humans and animals but toxic at high concentrations. This laboratory study explored the feasibility of developing a treatment column containing drinking water treatment residuals, municipal wastewater treatment sludge (biosolids),

and agricultural solid waste wheat straw to clean up Se-contaminated industrial wastewater. We hypothesized that high microbial activity in biosolids and wheat straw could reduce selenate (SeO₄²⁻) and selenite (SeO₃²⁻) to water-insoluble elemental Se, and the abundance of aluminum (AI), iron (Fe), and calcium (Ca) hydroxides in WTRs could effectively sorb SeO₃²⁻ from wastewater through the formation of inner-sphere complexation. A series of logically connected laboratory experiments have been conducted to test this novel concept and explore potential controlling mechanisms. Results show that the biosolid-WTRwheat straw-sand treatment column reduced selenite-Se concentrations by 95% over a 3-day experimental period, changing from 1 mg/L in influent to 0.04 mg/L in effluent. Longer column retention time of wastewater generally increased the Se removal rate. Selenium speciation significantly affected Se removal efficiency, higher with selenite than with selenate. Wastewater pH also influenced selenite-Se removal from wastewater, showing a descending order of acidic (pH 6.5) > neutral (pH 7) > basic (pH 8.5) wastewater treated with 1 mg/L. Five bacterial strains were isolated from wheat straw and the biosolid-WTR-Sand treatment column substrate and all showed good biotransformation ability to reduce SeO₃²⁻ to Se⁰, One bacterial strain, Asc5, isolated from the column substrate showed the most significant methylation ability of converting SeO_3^{2-} to volatile Se organic compounds. Overall, this study has successfully proved the novel research concept and demonstrated the feasibility of developing an environmentally sound and sustainable remediation technology that uses municipal and agricultural solid waste materials to clean up Se-contaminated industrial wastewater. The post treatment Se-laden column substrate could also be used as Se fertilizer for biofortification to produce Se-enriched agricultural products.

29 2:00pm Microbial Enhancement of Selenium Volatilization in Soil-Plant Systems

*Zhi-Qing Lin, Olusegun Akindeju, Tochukwu Ekwonna [Southern Illinois University Edwardsville] Selenium (Se) is a naturally occurring micronutrient that plays vital roles in human and animal health. However, Se becomes a toxicant to aquatic wildlife at high concentrations in the environment. Phytoremediation technology using plants and associated microbes has been demonstrated as a costcompetitive, sustainable and environmentally sound remediation practice for cleaning up Se-contaminated water, sediment and soil. Soil microbes and plants are capable of bio-transforming inorganic selenate or selenite to volatile organic Se compounds, which removes Se from soil and water to the atmosphere. In this study we hypothesized that inoculation of soil-plant systems with a good Se volatilization bacterial strain would significantly enhance biogenic Se volatilization from the soil-plant systems. The laboratory studies showed that inoculation of Pseudomonas fuscovaginae in the soil-Indian mustard (Brassica juncea) system significantly (p<0.05) increased Se volatilization by 30.5% compared to the control. The soil-root compartment volatilized approximately 70% of the total Se mass volatilized in the soil-plant system (1.52) µg/pot) during a 7-day experimental period. However, in the soil-rabbitfoot grass (Polypogon monspeliensis) system, the bacterial inoculation treatment did not significantly (p>0.05) affect the level of Se volatilization. The bacterial inoculation treatment significantly (p<0.05) increased Se accumulation in rabbitfoot grass tissues from $27.91\pm3.49 \,\mu\text{g/g}$ in the control to $36.46\pm3.03 \,\mu\text{g/g}$ in the bacterial inoculation treatment, while there was no significant (p>0.05) effect on Se accumulation in Indian mustard tissues. This study also indicated that the soil bacterial inoculation significantly increased rates of Se volatilization in the soil-Indian mustard system that naturally has low levels of Se volatilization, but had no significant impacts on the soil-rabbitfoot grass system that already has high levels of Se volatilization.

30 3:30pm UG Mortality Bioassay Toxicity and Sublethal Concentration Effects of Glyphosate in *Schmidtea mediterranea*

*Miranda Jackson, Amy Hubert, Kyong Sup Yoon [Southern Illinois University Edwardsville] Glyphosate is widely used in the United States as the active ingredient in the herbicide Roundup. Glyphosate has been found in many surface waters and groundwaters in the Midwest, suggesting unavoidable exposure to aquatic organisms and humas. Glyphosate is well-known to be low in toxicity to non-target species, but recent studies have shown glyphosate may cause adverse health effects, such as cancer. To determine sublethal concentrations of glyphosate in *Schmidtea mediterranea*, acute mortality bioassays were performed with various serially diluted concentrations. Planarian expressed mortality in concentrations ranging from 0.242mg/mL to 0.400mg/mL glyphosate. We found a very steep dosedependent mortality response under our experimental conditions between 0.242mg/mL and 0.400 mg/mL glyphosate. Planarian were treated with sublethal concentrations of glyphosate and ROS content was measured in Relative Fluorescence Units (RFU) using a microplate reader. ROS in RFU was compared to protein content using a BSA assay with bovine serum albumin as the standard. RFU for concentrations of glyphosate 0.200mg/mL, 0.100mg/mL, and 0.050mg/mL was quantified as 17.04, 15.21, and 14.45, respectively. Planarian expressed increased ROS levels in sublethal concentrations compared to a control group – 13.37 RFU, and overall showed significantly increased production of ROS in a dose-dependent manner determined by an F-test with df=14 and p<0.001.

31 2:00pm UG Impacts of Acidification on *Rana catesbeiana* Tadpole Interactions with Trematode Parasites *Alayna Rosales, John A. Marino [Bradley University]

Due to pollution, aquatic habitats experience changes in pH which may negatively affect aquatic animals in combination with other stressors in their habitats, like parasites. However, the effects of parasites in conjunction with pH are not well understood in many systems. In this study, we assessed whether parasitehost interactions are influenced by acidic conditions in an amphibian-trematode parasite system. We hypothesized that reductions in pH may compromise host health (e.g., immune function), which results in increased susceptibility to parasitism. We exposed bullfrog (Rana catesbeiana) tadpoles to a range of pH conditions and the presence or absence of trematode (Plagiorchis) parasites. We followed a 3 x 2 factorial design in which tadpoles were exposed to 3 pH treatments (pH =5, 6, or 7) and 2 parasite treatments (0 or 25 cercariae added) to individual tadpoles. For each treatment combination there were a total of 10 replicates. At the end of the experiment (14 days after parasite exposure), all tadpoles were weighed, euthanized, preserved, and dissections were performed to assess infection. Our findings support our hypothesis that lower pH inhibits amphibian host defenses against parasites. Tadpoles exposed to a pH of 5 had a mean cyst (metacercariae) count that was 3.6 times higher than that of the tadpoles maintained at a pH of 7 and 2.9 times higher than tadpoles maintained at a pH of 6. This trend indicates that pH may influence parasite susceptibility, with implications for the joint impacts of pollutants and parasitism in aquatic communities. In a follow up experiment, we are exploring effects of carbon dioxide, which affects pH and is expected to continue to change under continued emissions projections. Our results could be useful to wildlife managers in planning for impacts from multiple potential stressors simultaneously, including acidification and disease.

32 3:30pm Grad Establishing an Air Quality and Noise Pollution Monitoring Network in the St. Louis Metropolitan Region

*Joshua L. Gifford, Christine Favilla, Lisa Drennen, Alexander Kalna, Ben K. Greenfield, Carol E. Colaninno, Georgia Bracey, Sharon M. Locke [Southern Illinois University Edwardsville] Southern Illinois University Edwardsville's STEM Center and Department of Environmental Sciences have developed an environmental monitoring network for air quality and noise levels in the St. Louis metropolitan region, including southwestern Illinois. We identified monitoring sites using a survey designed to gauge citizen interest in hosting monitors and capacity to host (e.g., access to power and wifi). Respondents primarily included owners of residential properties. We selected deployment locations based on multiple criteria, including the physical locations of the sites and the need to have coverage throughout the area. Monitor security and weather proofing were addressed prior to deployment and iteratively readdressed as problems arose. Using comparative calibration, monitors were co-located for several weeks prior to deployment to ensure accuracy of readings between all monitors. PurpleAir monitors and Extech sound level meters were installed together to collect air quality data and noise levels at the same location, allowing for a more comprehensive understanding of environmental exposure in the region. Data collection for air and noise pollution began at the earliest sites in June of 2020. In addition to a more thorough understanding of environmental exposure, these data are also being used for K-12 education as a component of a National Institutes of Health Science Education Partnership Award, "Environmental Health Investigators." Through this award, middle school students are taught key science and engineering practices as outlined in the Illinois State Science Standards (ILS-S). Program staff have developed a curriculum using these data to introduce students to scientific questions that can be investigated using authentic data. Students will also have the opportunity to learn how to operate and extract data from these monitors for their own research project in the summer of 2021.

MICROBIOLOGY

33 2:00pm UG Seroprevalence of Plasmodium in Birds of Prey in Central Illinois Determined by Microscopic Examination and ELISA

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

Avian malaria poses a threat to birds all over the world and has threatened the extinction of birds in New Zealand and Hawaii. One of the most common ways for identifying the parasite is through microscopic observation of blood smears to detect mature parasites. While this method is valuable for determining infections in large quantities, it is limited by parasite concentration and visibility at different life stages. Enzyme-linked immunosorbent assays (ELISA) have been used to detect *Plasmodium* infections in humans and can often detect the parasite throughout a longer window of infection and in lower concentrations than in the traditional microscopic method. This technique has not been commonly applied to detecting avian malaria. Our experiment explored the detection of Plasmodium parasites in several different species of raptors in Illinois by comparing the results of microscopic examinations of blood smears and a newly developed ELISA that utilized Recombinant Plasmodium Falciparum Circumsporozoite (PfCSP) Protein as the antigen. While there were samples that displayed a positive result for Plasmodium in the ELISA and a negative result in the blood smear, there were more samples that displayed a positive result for the blood smear and a negative result in the ELISA. These trends were dose dependent in terms of parasite density because samples that showed a greater number of parasites in the smears were more likely to be detected by the ELISA. These trends did not vary significantly between species of raptors. Overall, this experiment supported microscopic examination and ELISA as viable methods to detect avian malaria.

34 3:30pm UG

UG Varying Concentration of MgSO₄ Effect on *Neochloris oleoabundans* Biomass Production

*Jack Aydt, My Tran, Jaren Smidt, Kelly Barry [Southern Illinois University Edwardsville] Fossil fuels, while useful, are limited and non-renewable, and they have a harmful impact on the environment. Because of their unsustainability, many have turned to biofuels as a new, renewable fuel source. Our study examines the microalgae, *Neochloris oleoabundans*, and its potential as a biofuel. *N. oleoabundans* is known for its high lipid content, which makes it a promising fuel source. However, for it to be an efficient source of energy, *N. oleoabundans* growth must be optimized. This can be achieved by altering the media in which it is grown. Our study explored the effects of varying levels of the nutrient $MgSO_4 \cdot 7H_2O$ in TAP media on *N. oleoabundans* growth. The levels of $MgSO_4 \cdot 7H_2O$ in the TAP media were as follows: 0.40 mM, 1.09 mM, 1.19 mM, and 1.29 mM, based on previous studies. Over a period of 13 days, the light absorbance of the algae was measured every two days via spectrophotometer at 750 nm. The results did not support our hypothesis that growth increases with $MgSO_4 \cdot 7H_2O$ concentration.

35 2:00pm UG

m UG Slightly Alkaline pH levels Enhances *Neochloris oleoabundans* Biomass Production

*Jaren Smidt, My Tran, Jack Aydt, Kelly Barry [Southern Illinois University Edwardsville] Fossil fuels are unsustainable energy sources that leave a carbon foot-print on the environment. With the depleting supply of traditional fuel sources, biofuels provide an environment-friendly alternative. *Neochloris oleoabundans* is a microalgae known for its high lipid content, which has made it a favorable model organism for the sustainable energy production of biomass fuels. Therefore, finding the optimal growing conditions to maximize *N. oleoabundans* production is a key step to a renewable and eco-friendly fuel source. Ideal media formulations must be explored to progress towards this objective. Our research examined algal growth over time in TAP media with varying pH levels. The tested pH's were 7.00, 7.25, and 7.5; these pH measurements were taken before autoclaving. To track algal growth, light absorbance was measured with a spectrophotometer at optical density 750 nm. Measurements were taken every two days for a total of two weeks. The data collected from this trial indicate that the most alkaline media yielded the most rapid and highest total growth over two weeks, in agreement with our hypothesis based on previously published literature. The slightly alkaline media is an ideal environment to maximize the *Neochloris oleoabundan*'s growth for biofuel usage.

36 3:30pm UG Testing Z-cypermethrin Cross-Tolerance in Imidacloprid Tolerant *Reticulitermes flavipes* Symbionts

*Kaitlin Goodbrake, Allison Blanton, Brittany F. Peterson [Southern Illinois University Edwardsville]

Pesticides are valuable tools that we use to regulate pest insects, however, pesticide residues are an increasing environmental problem. This widespread of chemical pollution could be reduced or reversed through bioremediation techniques; bioaugmentation processes use microorganisms to breakdown pesticide contaminants. The microorganisms in question can be brought from many different environments, but a potential source of such organisms are the bacterial gut symbionts of the common insect pests that are targeted by pesticides. Our lab has isolated several bacteria from the guts of *Reticulitermes flavipes* that tolerate a commonly used neonicotinoid pesticide, imidacloprid. As many pesticide-degrading bacteria utilize similar mechanisms to degrade multiple pesticide classes, we hypothesize that imidacloprid-tolerant bacteria present in the gut of *Reticulitermes flavipes* workers will be tolerant to the pesticide Z-cypermethrin. To test this idea, we subjected the imidacloprid-tolerant termite gut bacteria to Z-cypermethrin enriched media for tolerance growth assays. Bacteria which grew better than expected in media containing Z-cypermethrin were said to be cross-tolerant, based on an X² test compared with bacteria grown without pesticide. These observations support the idea that there are individual bacteria tolerant to multiple pesticides. Cross-tolerant bacteria may be candidates for bioremediation operations to detoxify the environment with efficiency and improving agricultural soils.

372:00pm UGSpatiotemporal Patterns in Freshwater Bacterial Communities Across Hydrologically Variable
Sites in a Major River Watershed

*Alex Beenblossom, John Marino [Bradley University]

River hydrology plays a crucial role in water chemistry and species composition in and around rivers. The Illinois River is home to a wide variety of species, so understanding how the composition of these species is affected by the changing Illinois river hydrology is important. Bacterial communities are key components of river biota because they have important functions, such as breaking down organic matter and influencing algal productivity. In this study, water samples were collected from four sites in the Illinois River watershed that had varying hydrology. Biomass in water samples was separated into 3 different size fractions; DNA extractions and sequencing were performed on these samples.

The data from this experiment showed that there were differences in the number and type of species of bacteria observed across sites (p < 0.05) and fractions (p < .001). Differences across sites may be consistent with effects of hydrology on the composition of the bacterial community. Understanding what types of bacteria are present and in what abundances is important because this information can be used to better understand important ecological processes influenced by these communities, as well as potential pathogenic bacteria in the water.

38 3:30pm

PHYSICS, MATHEMATICS, & ASTRONOMY

39 2:00pm Grad Group Velocity of Light in Uniaxial Crystals

*Ibrahim Aladhyani, Penggian Wang [Western Illinois University]

Using the wave vector surface, we have derived the analytical expressions for the group velocities of the extraordinary light and the ordinary light travelling in an optically uniaxial crystal. Our formulas are in terms of either the wave vector direction or the ray direction, and use only the principal refractive indices and their frequency dispersions. The algebraic equation for the group velocity surface of the crystal is also derived. While the group velocity is in the same direction as the ray velocity, numerical calculation shows that in the visible region the group velocity is slower than the ray velocity, and the difference between them becomes significant at short wavelengths.

STEM EDUCATION

40 3:30pm Teaching Evolutionary Mechanisms through Games

*Miranda Karban [Illinois College]

Games have been shown to be a useful pedagogical tool in teaching difficult concepts. Evolution, a fundamental concept in the field of biology, is particularly challenging to teach due to the abstract and complex nature of evolutionary mechanisms. In this presentation, I describe a card game that can be used to illustrate evolutionary mechanisms in an introductory college biology course. The objective of this game is to obtain beneficial adaptation cards in order to escape predators, survive a changing climate, and ultimately have the highest reproductive success. This game demonstrates evolutionary and genetic concepts such as natural selection, sexual selection, founder effect, gene flow, mutation, mutualism, parasitism, allelic dominance, zygosity, and sexual vs. asexual reproduction. Games like this one allow students to interact more directly with these concepts, seeing how they operate in a simulated scenario.

41 2:00pm Grad The Effects of Course-based Undergraduate Research Experiences on STEM Retention Rates

*Jacob Beardslee, Kelly Barry [Southern Illinois University Edwardsville] As America seeks to fill a growing number of STEM careers, the nation turns to educators to reform the existing STEM curriculum to increase the number of STEM graduates. This reform has brought about the development of Course-based Undergraduate Research Experiences (CUREs), a lab format that allows students to form their own hypotheses and participate in novel research rather than following step-bystep instructions of traditional "cookbook labs." Research shows that CUREs can improve short-term outcomes like project ownership and self-efficacy more than traditional labs, but little research is available on the long-term outcomes. This study seeks to evaluate the long-term outcomes of an introductory level CURE lab, specifically retention rates and participation in research programs. Using a logistic regression model, we will be present the various effects of the CURE lab on women in STEM, underrepresented minority students, and at-risk students to determine if CUREs affect retention rates and student participation in future undergraduate research positions.

42 3:30pm Grad Identifying Factors Influencing Student Perceptions of Stress in Biology Courses

*Jordan Jackson, Hannah Almos, Osaguona Idemudia, Lauryn Leonard, Connor Lieb, Natalie Karibian, Carrie Butts-Wilsmeyer, Maurina Aranda [Southern Illinois University Edwardsville] Students in higher education encounter many factors – both inside and outside the classroom – that can influence stress while enrolled in biology courses. Academic factors that influence a students' stress levels can include course modality, workloads, and grades (Ramli et al., 2018), whereas nonacademic factors can include time management, students' personal and social obligations, and employment status (Pitt et al., 2018). Previous research has identified several of these factors in students enrolled in professional programs, health fields, and post baccalaureate programs (e.g., Hish et al., 2019), but it is currently unknown what stressors are perceived by students enrolled in a wide array of biology courses - especially given the current COVID-19 pandemic and hybrid online learning modalities. Our mixed-method study aims to address the following research questions 1) what academic factors are influencing student perceptions of stress, 2) what non-academic factors are influencing student perceptions of stress, and 3) to what extent does course modality influence students' perception of stress. Student data was collected four-year institution that held many courses online as a result of the COVID-19 pandemic in Fall 2020. Students (n=240) voluntarily completed an online survey (modified from Bedewy and Gabriel, 2015), with both Likert-scale and open-ended responses. Preliminary gualitative analysis indicates a relationship between time constraints and students perceived stress in their coursework. Many students perceived course loads and competition for grades with peers to be intense. Students also indicated unrealistic family and professor expectations during this time. We are currently working to finish the logistical regression model to analyze student Likert responses and complete the qualitative analysis to identify factors that influence students' stress in online modalities. Our goal for this analysis is to identify factors that inform could pedagogy, curriculum, and policies to mitigate students' stress during this unprecedented time of teaching.

43 2:00pm Grad Field-Related Career Interest Survey

*Clark Sturdevant [Southern Illinois University Edwardsville]

he lack of diversity in STEM careers has received significant attention in recent years, but few studies have focused on when students career goals are directed to or away from STEM fields in the education process. My research looks at the career interests of undergraduate students taking introductory courses in STEM disciplines with a field work component, specifically archaeology and physical geography. This study involves three stages of data collection, the first of which is complete and reported here. I modified a survey based on an instrument developed by Keir and colleagues (2014) which was administered at the beginning of several introductory courses at a regional comprehensive institution in the Midwest. I administered this survey to students, both majors and non-majors, taking courses offered by the departments of Anthropology and Geography and Geographic Information Sciences. A post-course survey will be administered to these same students toward the end of the course. The final stage of data collection will include interviews with select students after finishing their introductory courses. Once the data are collected and analyzed, I will examine these data for evidence of changes in career interests during this time, demographic factors that may be associated with changes, and why these changes occur if documented in the data. Initial results for the pre-course survey indicate that undergraduate students in the introductory classes are largely non-majors (93%), self-identify as White/Caucasian (70%), freshmen and sophomores (73%) and a majority (57%) identify as female. The few majors in these courses mostly identify as White/Caucasian (86%), freshmen and sophomores (57%), and female (57%). The initial data also reveal that two-thirds of the students taking these classes are not interested in careers in these core fields.

44 3:30pm Developing a Virtual Badge Series for Middle Schoolers Interested in Environmental Science Careers

*Emily Wonnacott-Stanley, Carolyne Banks [Southern Illinois University Edwardsville] Digital badges are one way learners can demonstrate knowledge and proficiency in science subjects. Students in an underserved community in southwestern Illinois are participating in a virtual after school program funded by the National Institute of Health Science and Education Partnership Award. This program, Environmental Health Investigators, is centered on learning about issues of environmental health in the students' community. These activities culminate in students designing a research project that will result in a presentation to a community group with recommendations for environmental remediation and improvement. While engaged in this program, students will be achieving a series of Digital Badges, created by STEM Center at SIUE and administered by an online badging agency. This poster presentation will be an overview of the steps in developing the digital badges from curriculum to badging requirements and assessment tools. The badges are created to excite students about careers in Environmental Health Science and also inspire adult learners to become more involved in their community. Badges include identifying pollution sources and environmental impact, calibrating and using environmental sensory equipment, data analysis, and sharing findings with stakeholders. Learners are able to chose a badge track that aligns with their interest, and will be encouraged to try each of the tracks to expand their knowledge about environmental issues.

45 2:00pm Grad Environmental Citizen Science: Exploring Youth Understanding of Data and the Scientific Process

*Lisa Drennen, Georgia Bracey [Southern Illinois University Edwardsville]

Scholars are more frequently using citizen science as the context for research, community engagement, and the development of environmental policy. Citizen science projects often involve volunteer-collected data, producing large datasets over broad geographic ranges. These large datasets, collected in various formats, need to be analyzed and interpreted to be useful. Research indicates that project participants can collect quality data, but there is limited evidence to support whether participants develop an increased understanding about the data and the scientific process from participating in citizen science programs. It is necessary to determine the public's understanding of the data process for future policy making, valid data collection and analysis, and to create more knowledgeable volunteers. In Y-CITYSCI, an NSF-funded after school program designed to help youth in underserved communities in southwestern Illinois collect, analyze, and interpret local environmental data, we are using a case study approach to examine how participation in citizen science impacts the students' scientific literacy. We hypothesize that the

participants will develop an increased understanding of data and the scientific process from participating in this after school environmental citizen science program. Using a mixed-methods design, we are collecting and analyzing quantitative and qualitative data. Pre/post surveys are being given at the beginning and end of each semester and short surveys at the end of each program session and will be analyzed using descriptive statistics. Semi-structured interviews are being conducted periodically, and we will use a basic thematic analysis to find patterns and relationships. Quantitative and qualitative data and findings will inform and support each other. We will share preliminary findings from surveys and interviews, outline plans for future research, and make recommendations for educators in the community.

46 3:30pm Grad

n Grad Comparison of the Environmental Photovoice Instructional Method among Youth from Brazil, Kenya, and USA

*Juliana Okonya, Waleska do Valle Santos, Sharon M. Locke [Southern Illinois University Edwardsville]

Photovoice is a community-based participatory action research method that allows members of communities to represent themselves through photographs. The photographs are then used to generate dialogues that can bring about positive social change in communities. This research aims to compare the Environmental Photovoice method in the United States, Brazil, and Kenya. The STEM Center at Southern Illinois University Edwardsville, through a project called "Environmental Health Investigators" funded by the National Institutes of Health Science Education Partnership Award (SEPA) program, developed an Environmental Photovoice curriculum. The curriculum was used to educate 6th, 7th, and 8th graders from schools located in underserved communities in Brazil, Kenya, and USA (Illinois), about air, soil, and noise pollution. Students from each country participated in discussions about pollution and learned how they can be agents of change through Photovoice. Students took photographs of their polluted surroundings and wrote narratives using the SHOWeD method (Wang & Burris, 1997). The curriculum was adapted to fit each country's cultural and educational context. Special attention was paid to the availability of resources, as the three countries differ in educational infrastructure. Most students from Brazil and the USA had access to cameras and were able to take photographs while students from Kenya could not take pictures because of a lack of cameras. Students from Kenya were given two photographs taken by the instructor that portrayed two different environmental issues and they were asked to write narratives about the photo that they chose. In Brazil, the curriculum was adapted to align to the national science standards. Also, the Geography, Art, and Portuguese teachers contributed to the adaptations of the curriculum, considering the context of the city of São Paulo and supporting the Photovoice narrative writing process. Our research suggests that Photovoice is most effective when adapted for each unique educational context.

47 2:00pm Grad Mea

Measuring Emotions in an Environmental Health Sciences Program in Brazil and the USA

*Waleska Carolina do Valle Santos, Sharon M. Locke [Southern Illinois University Edwardsville] This research project investigated the validity of a survey that was developed to measure emotions in informal science education programs. The program uses an Environmental Photovoice curriculum, which is likely to generate strong emotions in science learning because it focuses on local community pollution. The survey includes two sections: the first section investigates how school adolescents are feeling during the day of the educational experience and the second section considers how they are feeling during the session. Emoticons were used in the survey to increase youths' motivation to complete the survey. The global self-esteem assessment for the first section of this instrument was adapted from Hunter and Csikszentmihalyi (2003) and Rosenberg (1979). This section included 4-point Likert scale items ranging from 1 (strongly disagree) to 4 (strongly agree), represented with thumbs up and thumbs down emoticons. The emoticons have two different sizes to represent strongly agree and agree, and strongly disagree and disagree. The second part of the survey is based on the affective model of interaction between emotions and learning (Kort et al., 2001), which includes an emotion set that is relevant to learning. Emoticons for this part of the survey have a range of sizes from small to large and represent each one of the following emotions: confidence, interest, excitement, surprise, and enthusiasm. This survey has been administered in Brazil and the United States in an environmental health sciences education program to explore the validity of this instrument in different cultures. Follow-up interviews with students were used to determine if the survey was a valid measurement of student emotions.

48 3:30pm Grad Partnership between Brazil and the USA (Illinois) in an Environmental Photovoice Project

*1Waleska Carolina do Valle Santos, ²Hermom Silva, ¹Sharon M. Locke, ³Rosely Imbernon ^{[1}Southern Illinois University Edwardsville; ²Unicamp, Brazil; ³University of São Paulo, Brazil] The STEM Center of Southern Illinois University Edwardsville (SIUE) has been developing curriculum for environmental health sciences education for low-income urban communities in a project named Environmental Health Investigators funded by the National Institutes of Health. The material developed from the STEM Center at SIUE was implemented and adapted in an out-of-school program of a public school in São Paulo, Brazil. The 22 students from 8th grade involved in this program were already part of a project on the responsible use of land that started in October 2020. These students already had previous knowledge about soil pollution and soil conservation before the implementation of the Environmental Health Investigators project. The partnership between the United States and Brazil provided more resources to empower the students to take positive actions towards the pollution that they identified in their community. The students were introduced to the Environmental Photovoice method which allows members of communities to represent themselves through photographs, focusing on air, noise, soil and water pollution. This youth group developed autonomy to reflect about environmental problems that they face in their community. Most of the concerns identified in their community are garbage disposal and urban flooding. The 22 students in the project expressed sadness when they reflected about the photographs but they are motivated and interested to find solutions to their community; they created a social media page to share their photographs and educate their parents, families, and the community. The project did not only positively impact the students but also their parents and other teachers from the school. The geography, art and Portuguese teachers volunteered to assist in the project; in addition, other students from the school also want to be part of the project.

49 2:00pm Grad Environmental PhotoVoice

*Carolyne Banks, Waleska do Valle Santos, Olivia Middendorf, Jennifer Zuercher [Southern Illinois University Edwardsville]

Individuals' perspectives of their environment, taken together, can be a powerful tool for effecting change. Using photographs to reflect those perspectives provides an opportunity for community members to share what they perceive as representative of their surroundings. Environmental PhotoVoice is a qualitative research method in which community members use photographs and narratives to document observations of the concerns and strengths found in their living environment. In this presentation, we will provide an overview of an environmental photovoice curriculum implemented with middle school students in Madison, Illinois, intended to pique student interest in environmental health and create student stories about their environment. The implemented Environmental PhotoVoice curriculum uses PhotoVoice to gain students' perspectives while familiarizing them with noise, soil, and air pollution. Perspectives gained by students and researchers, and lessons learned from this semester-long project will be discussed.

50 3:30pm

m Geoscience Identity and Self-Efficacy among First and Second-Year Undergraduates

*Sharon Locke, Eloho Unufe, Cristal Campocasso, Alexander Kalna [Southern Illinois University Edwardsville]

We are studying a geoscience pathways program for undergraduates grounded in research-based design principles for broadening participation in science, with the goal of increasing the number of students from underrepresented groups who graduate with geoscience-related degrees. Based at a regional Midwestern public university, the extracurricular program includes student research experiences, career conversations, professional and technical skills development, and field excursions. At the start of the program, we administered three surveys to assess scientific values, geoscience identity, and science self-efficacy for a cohort of nine students. The results showed that the majority of students were certain that they have scientific values, and most were somewhat confident in their scientific skills, ability, and knowledge. In contrast, the majority of students surveyed chose a neutral response for geoscience identity, and one student strongly disagreed that they identified as a geoscientist. These responses are consistent with previous research suggesting that students have limited exposure to geosciences prior to entering university, even if they have an interest in science. We are administering the survey periodically until students' graduation to examine geoscience identity changes with time and to identify which components

of the program students perceive to be important for supporting their identity, values, and self-efficacy development.

ZOOLOGY

51 2:00pm UG The Effects of Elevated Corticosterone and Food Availability on Bacterial Killing Ability and Development in Pickerel Frog Tadpoles (*Lithobates palustris*)

*Clare Weers, Travis E. Wilcoxen [Millikin University]

Amphibian larvae develop among many pathogens in their environment, which is why tadpoles must be equipped with sufficient immune defenses at early stages of development. Many studies have investigated the immune responses in adult amphibians, but comparatively fewer studies have explored immunity in larval amphibians. We completed this study to better understand how corticosterone (CORT) affects innate immunity at the larval stage. We tested innate immunity using a bacterial killing assay and observed development after both a short-term and a long-term elevated CORT exposure in addition to limited food availability in pickerel frog tadpoles (*Lithobates palustris*). We found that tadpoles given *ad libitum* food and elevated CORT had a significantly greater bacterial killing ability and invested more in their development. Our data align with findings from other recent studies that CORT is not only a stress hormone, but is a hormone functioning to regulate metabolism above all else. Access to *ad libitum* food and the up-regulated metabolism associated with elevated CORT likely allows tadpoles to take better advantage of their resources and invest in more inexpensive immunity and development.

52 3:30pm

53 2:00pm UG Stress During Development Indicated by Fluctuating Asymmetry and High Feather Corticosterone in Four Song Bird Species

*Erica Castanon, Travis E. Wilcoxen [Millikin University]

Fluctuating asymmetry (FA) refers to small, random deviations from perfect symmetry in bilaterally paired traits, such as limbs. These deviations can be found in some individuals among all populations of animals. Fluctuating asymmetry can be particularly costly to birds because it can negatively impact their locomotion during liftoff, flight, and landing. Fluctuating asymmetry is often linked to each genetic inheritance and environmental stressors; birds can be susceptible to different environmental changes and other stressors in their natural environments, particularly during early development. Corticosterone is deposited into feathers when the feather is growing, and the quantity of corticosterone in feather tissue has been linked to stress experienced during the time when feathers were developed. The purpose of this study was to determine if fluctuating asymmetry in birds, a proxy for stress during development, would correlate with feather corticosterone levels. Because chronically elevated corticosterone can also suppress the immune system which leaves vertebrates more susceptible to parasitism, we also surveyed blood smears for parasites. We captured 70 songbirds from four species, assessed symmetry of paired wings and tarsi, and created a blood smear for each bird. We found a positive, linear relationship between asymmetry and feather corticosterone, with a stronger relationship in hatch year birds compared to adult birds. We did not find any relationship between either feather corticosterone or fluctuating asymmetry and parasite loads. Our findings demonstrate that stress during development can be inferred from fluctuating asymmetry, as corticosterone deposited into feathers during development are strongly related to asymmetry.

54 3:30pm UG

UG Seroprevalence of *Toxoplasma gondii* in Birds of Prey in Central Illinois

*¹Jazmin Brown, ¹Travis E. Wilcoxen, ²Jacques T. Nuzzo, ²Jane Seitz [¹Millikin University, ²Illinois Raptor Center]

Toxoplasma gondii is a zoonotic intracellular protozoan parasite. It can affect most species of warm blooded animals, including birds. Toxoplasmosis can be clinically severe for avian species, but because common prey species for raptorial birds, such as white-footed mice, are known reservoirs of *T. gondii*, the parasite may be particularly important in disease ecology of birds of prey. We used a direct enzyme-linked immunosorbent assay (ELISA) procedure with plasma samples from birds admitted to the Illinois Raptor

Center to determine the prevalence of *T. gondii* in a community of raptors. To date, we have analyzed samples from 254 birds of 6 species, with an overall prevalence of 14.9%. There is much variation in prevalence among species, with species for which rodents are the primary food source having the greatest prevalence.

55 2:00pm UG

Association of Plumage Color, Cap Size, and Physiological Traits in White-breasted Nuthatches

*Lauren Artime, Travis E. Wilcoxen [Millikin University] Carotenoid- and melanin-based coloration have been indicated as biomarkers of individual quality and as traits associated with sexual selection in many bird species. Instead of serving exclusive roles as sexuallyselected traits, the coloration of birds may contribute to camouflage, signaling of species identity or social membership, temperature regulation, or in anti-predator defense. Within these different aspects of avian coloration, there is often significant variation among members of the same species; thus, the coloration of a bird may be an honest indicator of physiological condition. We used the white-breasted nuthatch (Sitta carolinensis) as a study species to assess relationships between melanin-based plumage coloration and physiological profiles. Throughout most of the species' range, male white-breasted nuthatches have dark black caps, while females and recently-fledged hatch year birds have lighter gray caps. We captured whitebreasted nuthatches from June to September 2020, guantified cap color, cap size relative to head size, and analyzed blood samples for leukocyte counts, parasite loads, testosterone levels, and antioxidant capacity. While the diversity in cap color and size differs between sexes, there is also considerable variation in cap color and size within groups of male and female nuthatches. Our findings may reveal underlying mechanisms in expression of the melanin-based cap coloration in this species.

3:30pm Grad 56 Discover, Cover, Flee: The Competitive Value of Aphaenogaster Tool-Use

*Dylan Gladson, Paul Brunkow [Southern Illinois University Edwardsville] Competition is a force that has helped shape diversity of morphology and behavior observed in animal species, and understanding mechanisms of competitive interactions can help clarify how subordinate species can coexist with competitive dominants. Aphaenogaster rudis is a forestdwelling subordinate ant species frequently displaced at food sources by more aggressive ant species. A. rudis may alleviate this competition through use of a unique foraging behavior: at sites containing liquid food, A. rudis uses nearby debris, such as soil or leaf litter, to absorb and transport food back to the nest, a behavior widely accepted as an example of tool-use. Several authors propose that this makes liquid food less available to competitors. In addition, A. rudis exhibits extremely high food discovery ability. However, how A. rudis tool-use, discovery ability, and lack of food defense are intertwined has not been investigated. We observed foraging characteristics of A. rudis lab and field colonies when presented liquid food. In field trials, A. rudis workers discovered liquid bait stations 25% faster than did three other competing species. In lab trials, workers quickly dropped soil into liquid food, but average number of individuals decreased once harvesting of saturated soil began; harvest time also significantly decreased with increasing initial concentration of soil in the liquid food. Tool-use permits turning "immovable" food into movable food often before competing ants find it but also may function to make liquid food inaccessible to competing ants. This strategy may allow *Aphaenogaster* to devote workers toward continued searching and to reduce direct interaction with more aggressive competitors.

2:00pm Grad 57 Environmental Pool Management and Long-Term Fish Community Structure in Pool 26 of the Upper Mississippi River

*Amanda Carter, Paul Brunkow [Southern Illinois University Edwardsville] Monitoring and restoration of biological diversity in the Upper Mississippi River has been a focus of the US Army Corps of Engineers' Environmental Pool Management (EPM) program. We analyzed a 25-year fish species abundance dataset maintained by the Illinois Natural History Survey to examine trends in fish community structure in backwaters of Pool 26. We focused on potential effects of invasive silver carp (Hypothalmichthys molitrix) and on application of EPM. Data were selected from four backwaters differing in distance from Melvin Price Lock and Dam, which forms Pool 26. Fish abundance data, comprising over 80 species, were standardized to prevent taxa with high catches from dominating the data set, and silver carp abundance was separated out as a potentially covarying environmental variable. EPM was quantified as the number of days that pool elevation could be maintained at or below a target value. Ordination

analysis utilizing permutation tests of independent variables detected no systematic effect of silver carp abundance on fish community structure in these backwaters when considered separately or when considered as one community. However, EPM showed a significant effect on fish community structure within the two middle backwaters treated separately and when all backwaters were treated as one community. In particular, the number of days that pool level was maintained 0.5 foot or more below standard pool elevation between March 1 and September 30 of each year had the strongest effect on community structure. This study suggests that EPM can be a viable management strategy for mitigating the effect of navigation dams on upstream fish communities, in line with predicted effects of EPM on backwater vegetation structure and fish reproduction refuges.

58 3:30pm UG Evaluating the Role of Temperature on Feeding Performance and Righting Response of the Northern Leopard Frog, *Lithobates pipiens*

*Sara Mummel, Eloy Martinez [Eastern Illinois University]

When observing a feeding frog, the best advice is not to blink. A northern leopard frog, Lithobates pipiens, can catch a cricket in less than 70 ms—five times faster than the human eye blinks. Parallel in relevance to feeding, the speed of the individual's righting response is paramount, particularly if predators are present. These mechanisms rest upon fast, accurate muscle contractions and coordination, which rely on environmental parameters to an extent. Previous studies have tested the hypothesis that frogs utilize the same elastic recoil independent of temperature as observed in common toads (Bufo). They found that ballistic mouth opening exhibited high instantaneous power and its mechanism had a low thermal dependence. The objectives of this study were to compare the ballistic tongue prehension speed of L. pipiens and to assess the thermal performance of the righting response at various acclimation temperatures. Tongue prehension speeds were recorded at 1,000 fps after grouped specimens underwent a seven-hour acclimation period of 10°C, 20°C, and 30°C respective to each trial group. The righting responses of frogs acclimated to 5°C, 20°C and 30°C were assayed at 5°C, 15°C, 25°C, 30°C, and 35°C. The righting response performance was calculated as the reciprocal of the time spent by the frog righting itself after being place ventral side up on a glass surface. Results obtained for each acclimation group showed significant differences between acclimation and trial temperatures, where peak performance during trials corresponded to the acclimation temperatures (Two-way ANOVA; p < 0.05). Both lower and higher temperatures led to righting response performance reduction in the 20°C and 30°C acclimation groups. These results suggest that environmental temperatures, particularly seasonal extremes, could pose challenges to the physiology of L. pipiens, thus playing a significant role in ecologically relevant processes such as escape mechanisms and prey capture.

59 2:00pm

*Dianne Jedlicka [School of the Art Institute of Chicago]

Grey Squirrel (Sciurus carolinensis) Tree Bud Foraging Behavior During Winter

The Grey squirrel (*Sciurus carolinensis*) is a non-hibernating diurnal forager. This sciurid species uses trees as its preferred escape behavior (climb trees and use tree branches as escape routes). During the winter months of January and February, 2021, one individual within a known group of approximately 10 grey squirrels was observed foraging primarily on the terminal buds of a mature (22 year old) Slippery Elm (*Ulmus rubra*). This foraging occurred daily even though free choice husked black oiler sunflower seeds were available. This foraging occurred daily whether there were other squirrels present or not. Due to the late fall warm temperatures, this tree started to bud out in late fall 2020. Other mature tree species (*Catalpa speciosa, Juglans nigra, Tilia americana, Acer saccharum, Acer saccharinum, Quercus alba, Cercis canadensis, Morus rubra, Tilia cordata, Platanus occidentalis*) in the proximity did not bud out to this degree. Possible influences of this bud foraging (squirrel "pruning") on the Slippery Elm tree might be 1) to hinder this elm tree's growth in summer 2021 or 2) protect this tree's energy reserves if a late frost occurs.

60 3:30pm Striped Skunk (Mephitis mephitis) Nocturnal Winter Foraging Patterns

*Dianne Jedlicka [School of the Art Institute of Chicago]

During the winter of 2021 (January and February), nocturnal observations of foraging were collected on at least three skunks (*Mephitis mephitis*) in rural Will County, IL. Of note was the high snow deposition (highest snowfall in years) and the extreme cold (down to -7 degrees Fahrenheit at night). Skunks preferred to use a trail to navigate to their preferred feeding areas, a Foraging Pathway, rather than cross fresh snow. There were two feeding areas (free choice husked oiler sunflower seeds) within 9 meters of

the shared den. Each snowfall added to the height of the trail's "walls". As snow increased and temperatures dropped, only one Foraging Pathway trail was used. This Foraging Pathway led to the feeding area that was 6.5 meters from the den. Once temperatures increased to over 20 degrees Fahrenheit at night and snow started melting, the other food area (9 meters from the den) was again foraged using the longer Foraging Pathway. These skunks foraged both as a group and individually. When in a group, the leader was the largest skunk and all followed where that one foraged.

61 2:00pm UG Tracking Residual-Yolk Triglycerides in Hatchling Painted Turtles

*Jacob Wyco, Tim Muir [Augustana College]

Hatchling painted turtles (Chrysemys picta) spend their first winter inside their natal nests and must survive on maternally derived energy in the form of residual yolk for up to nine months. In this study, we investigated the mobilization and usage of residual-yolk energy during the first 33 weeks after hatching by measuring changes in the mass and the triglyceride content of the yolk, liver, and carcass throughout that period. We aimed to vary residual yolk mass at hatching in two groups of hatchlings by incubating one group in relatively dry conditions and the other in relatively wet conditions. Our data show that yolk mass significantly decreased over time, but did not differ between incubation conditions. The dry masses of carcass and liver significantly increased in the first two weeks, and gradually decreased thereafter and were also unaffected by incubation conditions. Triglyceride content of carcass and yolk significantly decreased over time and significantly differed between the two incubation conditions. Yolk triglyceride content fell by 70% in the first two weeks, whereas that of the carcass remained constant until week ten for the dry group and week 33 for the wet group. Liver triglyceride content for the dry group did not change, whereas for the wet group it significantly increased during the first two weeks and gradually returned to initial levels by week 33. Dry incubation conditions, when compared to wet incubation conditions, resulted in lower liver triglycerides soon after hatching, and lower carcass triglycerides at hatching, indicating that incubation conditions may influence post-hatching triglyceride storage. Our data suggest that triglycerides are mobilized from the yolk very quickly after hatching and are subsequently stored in the liver and other somatic stores for use until hatchlings emerge from the nest in the spring.

62 3:30pm UG Evaluating the Effect of Food Quantity and Collection Site on the Growth and Survival of the Invasive Zebra Mussel, *Dreissena polymorpha*

*Chloee Holm, Jennifer Jost [Bradley University]

The invasive zebra mussel first entered North America in 1988 and spread to the Illinois River by 1991. Since their introduction, zebra mussels have caused ecological and economic damage due by attaching to hard surfaces and altering water conditions. Our objective was to evaluate the growth and survival of zebra mussels from two distinct sites, Bell's Landing and Wheel Lake, which are both located at Banner Marsh State Fish and Wildlife Area in Illinois. Mussels were reared at room temperature for four weeks and either fed a high or low ration. Survival was measured weekly, and shell size and both shell and tissue mass were measured after four weeks. Survival was high for all mussels. Shell size increased more at Wheel Lake than Bell's Landing and for mussels fed a low ration. Since initial shell size was greater at Bell's Landing than Wheel Lake and larger mussels are predicted to grow slower, this may explain the differences in growth. The finding that mussels grew less under high ration is surprising, but may be explained by the relatively poor water quality that was detected and likely occurred due to excess food. On average, mussels increased shell mass, but there was no effect of site or ration. Mussels lost tissue mass, and while there was no difference by ration, mussels from Wheel Lake lost more mass. One possible explanation is the mussels were spawning gametes. However, it is also possible that the relatively higher temperatures used in this experiment were too stressful for growth to occur. While the underlying factors need further investigation, mussels from distinct sites within a few miles of each other showed very different patterns of growth in this experiment, suggesting that the collection site may be a large factor in determining mussel physiology.

63 2:00pm UG The Combined Effects of Low Food Quality and High Temperature on the Growth and Survival of the Invasive Zebra Mussel, *Dreissena polymorpha*

*Zalan Shah, Sarah Nacos, Jennifer Jost [Bradley University] Zebra mussels (*Dreissena polymorpha*) are a highly invasive species of bivalve mollusks that have managed to spread across the entire continent of North America in a matter of decades. Their high filtration rates

paired with their ability to reproduce rapidly cause large reductions of edible particles in the water for native populations which has significant negative consequences on all levels of the ecosystem. To fight the invasion, many studies have been conducted to determine the optimal conditions for zebra mussels. While previous studies have found mussel survival and growth are affected by water temperature, calcium concentration, and food availability, few have looked into the interactive effect of multiple simultaneous stressors on zebra mussels, which is more representative of field conditions. This experiment will determine how different calcium concentrations, water temperatures, and food rations will affect zebra mussel survival rates, growth, and stress (as indicated by cellular markers). The zebra mussels will be collected from Banner Marsh Fish State and Wildlife Area and brought to the lab at Bradley University where they will be housed in 37L aquaria containing water from the collection site. Mussels will be reared for a period of four weeks under either high or low food quality and high or low water temperature. Mussel survival will be checked weekly, and change in shell size, shell mass, and tissue mass will be determined after 4 weeks. It is anticipated that mussels will grow more slowly (or even decrease in size) at low food quality and high water temperature. It is also expected that mussels exposed to multiple simultaneous stressors will experience a synergistic effect, with the overall consequence being greater than the sum of each stressor in isolation.

64 3:30pm Grad Collection Rates of Arthropods Were Similar Between Grasslands with Negligible and Moderate Lespedeza cuneata Content

*Sydney Tomaschke, Matthew Goessling, Kurt Shulz, Jason Williams [Southern Illinois University Edwardsville]

Lespedeza cuneata in considered an invasive plant in much of the mid-west and southeast United States. We assessed non-beetle arthropods from 1 July to 1 October 2019 in grasslands on the Southern Illinois University Edwardsville campus to determine if moderate levels of invasion altered their communities. We collected arthropods weekly using pitfall traps in six, 20x40m plots. Three plots were relatively free of *L. cuneata* (less than 4% of the 60 random point assessments contacted the plant), while the remaining plots contained a moderate amount of *L. cuneata* (~25% of the 60 random point assessments contacted the plant), while the remaining plots contained a moderate amount of *L. cuneata* (~25% of the 60 random point assessments contacted the plant). We collected 3363 identifiable arthropods with insects being the most numerous (60% of the total), followed by arachnids (13.2%) and isopods (11.6%). There were no differences in collection rates of arthropods between plots absent or rich with *L. cuneate* with 2.2 ± 0.6 and 2.3 ± 0.5 arthropods collected per trap night, respectively. We are conducting finer scale taxonomic analysis to determine if estimates of arthropod diversity and species richness differ between plots based on *L. cuneata* content.

65 2:00pm Grad Moderate Lespedeza cuneata Invasion Does Not Alter Beetle Collection Rates and Diversity

*Matthew Goessling, Kurt Shulz, Jason Williams [Southern Illinois University Edwardsville] The effects *Lespedeza cuneata* invasion on coleopteran communities were investigated between 1 July and 1 October 2019 in grasslands on the Southern Illinois University Edwardsville campus. We collected beetles using pitfall traps weekly from six, 20x40m plots. Three plots were relatively free of *L. cuneata* (less than 4% of the 60 random point assessments contacted the plant), while the remaining plots contained a moderate amount of *L. cuneata* (~25% of the 60 random point assessments contacted the plant). We collected 987 beetles from 12 different families, with the majority (~65%) being ground beetles in the order carabidae. There were no differences in total collected beetles from *L. cuneata* free plots, which averaged 173 ± 63 beetles per plot, and *L. cuneata* rich plots that averaged 153 ± 70 beetles. Collection rate was also similar; as all plots averaged 0.4 ± 0.1 beetles collected per trap night. Lastly, diversity and evenness of beetle orders as measured by Shannon diversity index and Pielou index was similar between *L. cuneata* free plots (1.1 ± 0.1; 0.41 ± 0.2) and *L. cuneata* rich plots (1.2 ± 0.1; 0.49 ± 0.2) respectively. Further taxonomic analysis may reveal differences in diversity and species-specific differences between plots based on *L. cuneata* content.

66 3:30pm UG Diurnal Temperature Cycles and Daylength Alter Egg Laying and Media Choice in Drosophila melanogaster

*Raj Patel, Olivia Mathews, 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 their 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 in response to fall-like conditions, 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 and 12 h of light 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. Exposure to short day lengths (25°C and 8 h of light) increased eggs laid per day to 9.5 ± 0.6 and reduced the preference of ovipoistion in cholesterol containing food. If adult flies were placed in a thermal environment that fluctuated between 20 and 30°C every 24 h (mean of 25°C) and 12 h of light, egg laying was much reduced as females laid an average of 3.4 ± 0.4 eggs in all three media. However, 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.

ORAL PRESENTATION ABSTRACTS

8:00am-12noon, Saturday, April 10, 2021, in Breakout Rooms

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

ANTHROPOLOGY & ARCHEOLOGY

10:40am UG Investigating Sexual Dimorphism and Development in Homo sapiens Nasal Aperture Shape

 Rm 1
 * Megan Price, Miranda Karban [Illinois College]

 Though the nasal aperture is useful for studying ancestry, it is not commonly cited as a sexually dimorphic trait.

 SNR angle (the angle between sella, nasion, and rhinion) has been studied as an age-related trait, but not a sexually dimorphic trait. This study aims to investigate the differences in male and female nasal aperture shape and SNR angle, as well as shape covariation between these two traits, in a normal growth sample of European

derived extant human cephalograms.

A sample of 30 individuals (15 males, 15 females) from the Burlington Growth Study were measured at 2 age groups, ranging from 6.5-7.1 years and 18.0-18.25 years. A subset of 21 individuals was available to measure at a younger age, ranging from 2.1-3.6 years. Nasal aperture shape of each subject was digitized in frontal cephalograms using 3 landmarks and 15 sliding semilandmarks. Lateral cephalograms were used to measure the SNR angle. Generalized Procrustes analysis and relative warp analysis were used to investigate nasal aperture shape variation within the sample. T-tests and Shapiro-Wilk normality tests were used to assess the significance of SNR angle variation between males and females. Two-block partial least squares analysis was conducted to observe the relationship between nasal aperture shape and SNR angle. Procrustes ANOVA was used to analyze age-related differences in nasal aperture shape.

No statistically significant sexual dimorphism was found in either nasal aperture shape or SNR angle at any of the sampled age groups. No significant covariation was found between nasal aperture shape and SNR angle. However, there were significant findings in relation to the variation between the three age groups, showing that as children age, the nasal aperture elongates. These findings inform on normal nasal development and shape variation throughout childhood.

BOTANY

8:00am UG An update on the Seed Germination of Two Hawaiian Endemic Orchids (*Liparis hawaiensis, Peristylus* Rm 1 holochila)

*¹Molly Gearin, ¹Jiaqi Lu, ²Henry Oppenheimer, ¹Lawrence W. Zettler [¹Illinois College, ²University of Hawai'I at Mãnoa]

A lingering misconception is that many orchid species are native to the Hawaiian archipelago when, in fact, there are only three such species: *Anoectochilus sandvicensis*, *Liparis hawaiensis*, and *Peristylus holochila*. While all three orchids are vulnerable to extinction, *P. holochila* is currently listed as a U.S. Federally endangered species with less than three dozen individual plants known to occur on the islands of Kauai, Maui, and Molokai. The habitats of all three orchids are restricted in area and distribution, and are vulnerable to invasive pests (*e.g.*, wild pigs, slugs) and poachers that pose an omni-present threat. A decade ago at Illinois College, *P. holochila* was successfully propagated from seed *in vitro* on asymbiotic media that led to the reintroduction of seedlings 3.1 years after sowing. Several of the orchids initiated anthesis, but most did not survive. An initial effort to germinate seeds of *L. hawaiensis* was also attempted, but seeds failed to germinate possibly because capsules were not mature at the time of collection. In 2020, we began a new series of experiments aimed at germinating these two orchids from seed using the same protocols, with the goal of improving seedling survival *ex vitro*. We provide an update on our seed germination experiments, including the development of >50 *P. holochila* protocorms after 6 months incubation. Additionally, we report seed germination of *L. hawaiensis* using mature seeds.

8:20am UG Isolation and Provisional Identification of Potential Mycorrhizal Fungi from Three Midwestern Rm 1 Terrestrial Orchids

*Savannah Renken, Lawrence W. Zettler [Illinois College]

In the U.S. and Canada, half of the 250+ orchid species are vulnerable to extinction. Part of this vulnerability stems from the orchid's susceptibility to acute environmental changes exacerbated by climate change, as well as their extreme dependence on key biotic agents (pollinators, mycorrhizal fungi) to complete their life cycles. To effectively conserve orchids, their biotic agents must also be conserved. Mycorrhizal fungi are needed as a carbon source to initiate germination of their dust-like seeds, but little is known about the identity and whereabouts of these fungi on the North American continent, including the Midwest. During the summer of 2020, an attempt was made to isolate and provisionally identify potential mycorrhizal fungi from three orchids native to Illinois and the surrounding region, funded through the American Orchid Society. These included the rare Oklahoma grass pink (Calopogon oklahomensis), green fringed orchid (Platanthera lacera), and orange fringed orchid (P. ciliaris). Fungi from C. oklahomensis and P. lacera were isolated from pelotons in roots acquired from Goose Lake Prairie (Grundy Co., IL), whereas those from P. ciliaris were obtained from Kankakee Sands Preserve (IL) and Indiana Dunes National Park (IN). While P. lacera yielded fungi assignable to Ceratobasidium the genus most frequently isolated from tallgrass prairies - C. oklahomensis harbored Sebacina (Serendipita) – an important but rarely isolated genus from orchids. Fungi from P. ciliaris consisted of Ceratobasisium and Tulasnella – the most common mycorrhizal associates of orchids worldwide. Experiments that utilize these fungi to germinate seeds in vitro are currently underway.

8:40am UG Seed Germination of Orchids Native to Republic of Palau (W Pacific): An Update

Rm 1

*¹Charles R. Veith, ¹Imiezye Fegor, ²Benjamin J. Crain, ²Melissa Mccormick, ¹Lawrence W. Zettler, ²Dennis F. Whigham [¹Illinois College, ²Smithsonian Environmental Research Center] Despite its small land area (535 km²), the Republic of Palau in the Western Pacific harbors an unusually large number of native orchid species (> 90) of which 30 are endemic. In 2017, the Palau Orchid Conservation Initiative, spearheaded by the North American Orchid Conservation Center (NAOCC), was established to study the mechanisms behind orchid diversity in this forested archipelago, and to develop protocols for conservation. Among the project collaborators include the U.S. Forest Service, Palau Division of Forestry, and Ngardok Nature Reserve. Illinois College's role in this collaboration consisted of the isolation, molecular identification, and storage (cryopreservation) of potential mycorrhizal fungi, and use of select isolates to facilitate seed germination in vitro. Another goal is to cultivate the orchids from seed using conventional (asymbiotic) techniques followed by reintroduction in Palau, with some given to the U.S. Botanic Garden for public (educational) display. Roots and mature capsules of orchids were collected during three trips as a source of fungi and seeds, respectively. To date, 63 fungal endophytes have been isolated in pure culture, and many have been deposited into Canada (UAMH) for safekeeping including several assignable to the genus Tulasnella J. Schröt. Using asymbiotic media (P723, PhytoTechnology Labs), several species have been cultivated from seed in vitro to the leaf-bearing stage including Bulbophyllum membranaceum, Dendrobium brachyanthum (endemic), D. kraemeri, D. mirbelianum, Robiquetia palawensis (endemic), and Spathoglottis micronesiaca. Thus far, none of the fungal isolates have facilitated symbiotic germination.

9:20am Grad Conservation of Spiranthes Orchids

Rm 1

*Joe Stumbo, Elizabeth Esselman [Southern Illinois University Edwardsville]

Understanding the reproductive biology of species is critical when developing conservation strategies. In this study we examined the breeding systems of *Spiranthes vernalis*, near the SIUE campus and *Spiranthes magnicamporum* located at Shaw Nature Reserve, MO using hand pollination treatments. Four types of hand pollination treatments were employed including, Open, Cross, Importation, and Stored. In addition, to determine if pollen can be stored and used for successful future pollinations *S. vernalis* pollen was collected and stored in desiccant at -4 °C for two weeks, while the *S. magnicamporum* pollen was stored in desiccant at -4 °C for one year. Capsules were collected after two weeks from all treatments and seeds were extracted and counted using a microscope. Lateral roots were collected from both populations to isolate mycorrhizal fungus for use in germination assays. All *S. vernalis* treatments yielded similar viability percentages indicating that *S. vernalis* is not currently pollen limited and pollen remained viable after two weeks of cold dry storage. The *S. magnicamporum* pollen did produce viable seeds but with reduced viability percentage after one year of cold dry storage. The methods developed in this study could contribute to conservation efforts of terrestrial orchids.

9:40am

Rm 1

Rm 1

Effects of Climate Change on the Alpine and Subalpine Vegetation of the Mt. Field, Australia

*¹Peter R. Minchin, ²John B. Davies [¹Southern Illinois University Edwardsville, ²Tasmanian Herbarium] Climate change is predicted to impact mountain vegetation, causing upward shifts in the altitudinal distributions of plant species and communities. Though the effects of climate change have been studied on mountains in Europe and North America, there has been little research in the southern hemisphere. This research examines changes in the vegetation of the Mt. Field Plateau, Tasmania, an ideal location for this study because there have been minimal impacts from changes in land use, invasive plant species or air pollution and no major disturbance events within the area over the past 40 years. A network of 234 vegetation plots (100-m²) initially surveyed in the summers of 1980-1982 were resampled in February-May 2019. The plots span an altitudinal range of 900 to 1370 m. Ordination of the combined data found two major dimensions of community variation, correlated with altitude (r=0.88, P<0.0001) and drainage (r=0.84, P<0.0001). A fitted vector for year within plot (r=0.39, P<0.0001) was at an angle of 175° to the altitude vector, indicating that, on average, changes in community composition have been towards lower altitude ("warmer") communities. The mean altitude shift was -14.1 m, with a 95% confidence interval of -18.6 m to -9.5 m. The combined data were classified into 21 vegetation communities by kmeans clustering and the mean altitude of 1980-1982 and 2019 plots within each group was calculated. The mean upward shift in altitude was 11.8 m, with a 95% confidence interval of 4.3 to 19.4 m. Bayesian models of probability of occurrence of species, with altitude, drainage, and year as predictors, found strong support for shifts in species' altitudinal distributions, with a mean upward shift of 20 m (range 3.9 to 85.7 m). These results are consistent with community response to a warming climate.

10:00am Opinions on the State of Research Pertaining to Amur Honeysuckle (Lonicera maackii, Caprifoliaceae)

*Kurt Schulz [Southern Illinois University Edwardsville]

Amur honeysuckle has been recognized as a harmful forest invader since well before the 1970's. However, intensive research on the species only began in earnest ca. 1990, primarily with the work of James Luken in KY and an number of ecologists centered in OH. Initial work surmised that honeysuckles damage forest understories through light competition, and sought means for exterminating honeysuckle. Most ecologists share the opinion that honeysuckle is certain to be a forest community member well into the future and we have neglected to study it from a community point of view—not just as a singular pest. In this talk I raise the following points: 1) We have an incomplete view of how honeysuckle excludes other species. Notably, allelopathic mechanisms have been suggested, but not proved; 2) We have little sense of how well honeysuckle performs as a shade plant. The importance of early and late leaf display is constantly mentioned, but is probably exaggerated; 3) We do not understand how well Amur honeysuckle can tolerate drought, despite evidence that late summer drought is a regularity, and drought events will increase; 4) The role of birds and deer as dispersers is largely anecdotal and not well understood; and 5) We do not recognize honeysuckle for what it is, a long-lived disturbance fugitive, rather than a persistent forest resident.

11:20am **Restoring the Prairie – Savanna – Woodland Continuum** Rm 1

*Wayne E. Schennum [The Nature Conservancy]

Highly dissected topography in parts of the Midwest create ideal locations for a continuum of a prairie-savannawoodland ecosystem. Yet few examples of them remain. Most have been lost to livestock grazing, ecological succession, lack of fire, invasion by native and exotic shrubs, clear-cutting, and loss of native grazers such as elk. Small dry prairies persist on steep south- and west-facing slopes. However, plants found primarily in savannas and woodlands, which do tolerate light shade, are "homeless," usually surviving only on forest edges, small sunlit clearings, areas lacking dense shrub layers, and thin woods with some oak reproduction. Intensive management by prescribed burning, brush removal, and exotics control are necessary but often insufficient for restoring the "continuum." Introduction of dry prairie plants by harvesting and planting seeds collected from large remnants and railroad right-of-ways can be done, using the remnants as models. But without any minimally disturbed extant savannas and woodlands, models must be constructed from those bits and pieces described above. Frequent forays over the past 40 years have searched timbered areas for plant species that can live in partial shade or are often prairie associates. Examples are Yellow False Foxglove, New Jersey Tea, Shooting Star, Wood Sandwort, Starry Campion, Yellow Pimpernel, and Wood Vetch. Approximately 40 such species have been found, often in clusters. Seeds from them can be gathered in small amounts, grown under nursery conditions, and then introduced.

CELLULAR, MOLECULAR, & DEVELOPMENTAL BIOLOGY

8:00am Grad Evaluation of Fluorescein-Based Fluorescent Probe for Monitoring of Carboxylesterase 1 (CES1) Rm 4 Activity in Living Cells

*Anchal Singh, Michael W. Beck [Eastern Illinois University] Human Carboxylesterase 1 (CES1) is an enzyme that plays a key role in ester-containing drug metabolism. CES1 is known to have a high degree of genetic variation through single nucleotide polymorphisms (SNPs) producing CES1 forms that have reduced metabolism of ester-containing drugs, such as methylphenidate (Ritalin; treats ADD), oseltamivir (Tamiflu; treats the flu), and trandolapril (Mavik; treats high blood pressure). Thus, depending on a patient's genetics they may produce a form of CES1 that metabolizes a drug at a different rate than somebody who has another genetic form of CES1. This has led to different clinical outcomes for patients, highlighting the importance of developing methods to study CES1 activity. Current methods for studying CES1 typically require relatively large sample sizes and purification steps to isolate CES1 metabolites before analysis. Fluorescence cellular imaging techniques can selectively and sensitively visualize the activity of enzymes at the resolution of a single living cell. In the work presented here, we develop Fluorescein-based CES1 Probe 1 (FCP-1) and evaluate its ability to monitor CES1 activity in living cells using epifluorescence microscopy. Our results indicate that this probe can be used to measure CES1 activity in human cell lines. This suggests that FCP-1 could be used as a chemical tool to study CES1 pharmacogenetics in live cells.

8:20am Reduced Alphabet Proteins: Generation, Biochemical Characterization, and Evolutionary Implications

Rm 4

Rm 4

*Dana Morrone [University of Health Sciences and Pharmacy in St. Louis] The genetic code has an evolutionary history building up to today's commonly utilized 20 amino acids found in most proteins. Several lines of evidence indicate that the evolutionary ancestors of today's proteins likely contained fewer than 20 different amino acids. Further, the various amino acids were likely added into the genetic code in a general order. Several approaches are available for making reduced alphabet libraries which contain fewer than 20 different amino acids and represent various stages of ancestral proteins along the evolutionary path of the genetic code. This talk will present the findings of the generation and biochemical characterization of reduced alphabet proteins composed strictly of 5, 9, and 16 different amino acids assembled into reading frames with residues arranged in a random order. It was found these proteins can be solubly expressed, to varying degrees, in *E. coli*. Expressed proteins were purified and subject to biochemical characterization for secondary structure content. These experiments demonstrate that ancient evolutionary proteins of fewer than 20 amino acids are plausible, and perhaps could hold potential biological function.

8:40am Grad Domain Structure and Gene Number Evolution in Fungal Dicers: A Review

*¹Anuja Dahal, ²Thomas J Fowler [¹Central Michigan University, ²Southern Illinois University Edwardsville]

Diversity among RNA Interference (RNAi) mechanisms in eukaryotes provides an interesting case study of evolutionary divergence. Emerged as a defense system, this pathway at present shows numerous important functions besides its canonical role, such as developmental gene regulation. It is thought that core components of RNAi were present in the last common ancestor of eukaryotes. Variation in the components in extant RNAi pathways and the role of RNAi have now been demonstrated in many studies. Central to RNAi are three enzymatic components called Dicer (or Dicer-like), Argonaute, and RNA-dependent RNA Polymerase. Dicer and Argonaute process double-stranded RNAs into functional small RNAs, including microRNAs and small interfering RNAs (siRNA). Dicer proteins are retained in most fungal lineages; however, this protein family shows extensive variation in the number of family members and their domain structures. Two RNAse III domains of Dicer are typically necessary for dicing activity, whereas other typical domains are more variable among fungal Dicers. One striking variation of Dicer protein structures is the uneven distribution of the PAZ domain among species, as PAZ binds the dsRNAs for their specific positioning relative to the nuclease domains in the typical Dicer mechanism. An RNAse III study in budding yeast Kluyveromyces polysporus suggests a mechanism for processing dsRNAs without a PAZ domain and with a single RNAse III domain. There are several fungi lacking RNAi such as Saccharomyces cerevisiae and Ustilago maydis, whereas ascomycete Neurospora crassa has different types of RNAi mechanisms. Many fungi including Schizophyllum commune yet wait for an RNAi study. Fungi show evolutionary divergence in the RNAi components that shows variation when compared to plants and animals.

This range makes the fungi a good group to explore the evolutionary forces that led to the variation that is seen and to ponder what changes might affect RNAi in the future.

CHEMISTRY

8:00am Grad A Rapid Method to Measure Exogenous Gamma-Hydroxybutric Acid in Beer for Drug Facilitated Rm 3 Sexual Assault Investigation Using HILIC Electrospray Ionization Tandem Mass Spectrometry *Abdullah Rubayyi, Liguo Song, Gabrielle Valenzuela, Joe Deverich [Western Illinois University] Gamma-hydroxybutyric acid (GHB) is a drug of abuse with depressant effects that has been implicated in many cases of suspected surreptitious administration with purpose of increasing victim vulnerability to sexual assault because of its sedative and amnesic effects. Therefore, analytical methods for the identification and quantification of GHB are needed in forensic laboratories. In the current study, a novel rapid analytical method using hydrophilic interaction liquid chromatography electrospray ionization tandem mass spectrometry (HILIC-ESI/MS/MS) for the identification and quantification of the exogenous GHB in beer as one of the most available specimens encountered in forensic settings has been developed. The quantification of GHB in a beer sample was achieved using a SeQuant® ZIC®-HILIC analytical column (150 mm × 2.1 mm i.d., particle size 3.5µm). Under isocratic eluting conditions with a mobile phase consisting of 20% A (water/acetonitrile 80/20 + 1 mM ammonium formate) and 80% B (acetonitrile) at a flow rate of 0.30 mL/min, the analysis of each sample only took 2.5 min. The quantification of GHB was successfully achieved without interference from its structural isomers, i.e. alpha- hydroxybutyric acid (AHB) and beta-hydroxybutyric acid (BHB), due to baseline separation. The criteria for confirmation of identity set by the FDA for both high-resolution mass spectrometry (HRMS) and low-resolution mass spectrometry (LRMS) were successfully met. The method validation has met the ISO 17025 requirements with linear range from 1 to 50 μ g/mL, precision of 8.64% relative standard deviation (RSD) or less, accuracy of 91.42 to 107.87%, limit of detection (LOD) of 0.01468 µg/mL, limit of quantitation (LOQ) of 0.0489 µg/mL, matrix effect with an average of 82.15%, and recovery of liquid-liquid extraction (LLE) with an average of 16.12%. Therefore, the developed analytical method was found to be rapid, sensitive, and accurate for the quantification of GHB in beer for drug facilitated sexual assault (DFSA) investigations.

8:20am Grad Gold Nanoparticle in the Detection of Methamphetamine

*Harley Davidson [Western Illinois University]

Methamphetamine is a highly addictive and abused drug in the United States, and simplistic, portable analyses are needed. Usually, the detection of drugs such as methamphetamine require difficult analytical processes and complex instruments. Previous methods of detection include gas chromatography and mass spectrometry. Simple (easy enough for law enforcement without extensive scientific background to use) analysis of methamphetamine substances can performed using gold nanoparticles with diameter of 100 nm or less.

The nanoparticles are capped with an aptamer which interacts specifically with methamphetamine. An aptamer is an oligonucleotide or peptide molecule that binds to a specific target molecule (in this case methamphetamine). The aptamers change their tertiary structure in the presence of methamphetamine, which results in a visible color change. The nanoparticle color will change to red indicating changes in the tertiary structure and it will remain purple if no changes are detected. Ultraviolet-visible absorbance spectrophotometry (UV/Vis) will be used to monitor drug interactions and changes in the light absorbed by the sample.

8:40am UG Analyzing Illicit Drugs Using Copper Nanoparticles

Rm 3

Rm 3

*Lillie Purcell, John Determan [Western Illinois University]

This research project seeks to use nanoparticles to detect illicit drugs, in particular methamphetamine. Nanoparticles are small particles with a diameter of less than 100 nanometers. Coinage metal (copper, silver, and gold) nanoparticles are stable and have high refractive indices, which allows us to see a visual color change to detect cocaine. The detection of drugs can be helpful in the forensic field, and further help law enforcement identify unknown substances efficiently. Research has been done using gold nanoparticles, however, gold can be costly. By using copper, a metal with similar chemical and optical properties as gold, we can detect methamphetamine efficiently while also saving money. The detection of methamphetamine is found using the colorimetric test. Metal nanoparticles have vivid visible colors, due to their high refractive indices, that are very susceptible to change due to interaction with other chemicals, such as methamphetamine. Throughout the process, aptamers (oligonucleotide or peptide molecules which selectively interact with the drug of interest) will be used to enhance the interaction of the nanoparticles with methamphetamine. Interaction with methamphetamine will cause a change in the surface structure of the nanoparticles and will thus cause a visible change in the color of the aptamer coated nanoparticles. The change in color will be quantified using a UV-Vis detector, and shape and size of particles will be imaged using Scanning Electron Microscopy (SEM).

Throughout our research, the goal is to study the copper nanoparticles to detect methamphetamine through the colorimetric test. Through experimentation and observation, we hope to be able to efficiently detect methamphetamine, which will aid law enforcement in the future with detecting substances.

9:20am UG Spectroscopic Identification of Illicit Drugs Employing DNA Aptamer Capped Silver Nanoparticles Rm 3 *Zachary Dodson, John Determan [Western Illinois University]

In previous studies by Yarbakt and Nikkah, it was found that DNA aptamer capped gold nanoparticles, will show visible color shifts in the presence of illicit drugs. This on-site test, while simple in application to the layman, can provide an issue for police departments that do not have the fiscal flexibility to afford gold nanoparticles. (Starting materials of HAuCl₄ costing around \$44.30 per gram via Sigma-Aldrich.) In the interest of cost, metal salts such as silver nitrate is a superior starting materials, with costs of only \$5.44 per gram. Research in synthesizing nanoparticles for silver and copper salts for use in narcotic detection can prove helpful for police department's budgets and giving more people in the force access to potentially on-site drug detection methods. Methods of synthesizing silver nanoparticles (AgNPs) capped with glucose⁴ and citrate² utilized silver nitrate as a starting material, UV-Vis electronic absorbance spectra, fluorescence, and scanning electron microscopy (SEM) analyses will be used to determine the viability of these metal nanoparticles for detecting illicit drugs.

9:40am Rm 3

^m Horseradish Peroxidase Isoforms are Biochemically Equivalent for Colorimetric Probes

*Dana Morrone, Jeri Obeng, Junyun Park, Peter Spezia, Jonathan Huang [University of Health Sciences and Pharmacy in St. Louis]

Horseradish Peroxidase (HRP) is a commonly used enzyme in many applications of medicine, biotechnology, and industrial chemistry. HRP is used in conjunction with various colorimetric or fluorometric probes to detect H_2O_2 . In these applications, H_2O_2 is usually generated as the primary signal, which then becomes the substrate used by HRP to oxidize an organic probe. Probe oxidation by HRP can often be detected colorimetrically. However, there are numerous isoforms of HRP and numerous probes to select from. A systematic investigation of these isoforms and probes would be beneficial to those using and designing HRP assays. The biochemical activity of HRP isoforms I, II, ViA, X, and XII was each measured against the most common colorimetric probes: Amplex Red, ABTS, TMB, OPD, and DAB. Kinetic parameters of each HRP isoform for both H₂O₂ and probe were determined. Further, each probe was characterized with respect to temperature optimum, pH optimum, metal ion reactivity, oxygen sensitivity, and reducing agent inhibition. Our results show that all HRP isoforms exhibit the same biochemical properties with each other for a given probe. However, probes differ in pH optimums, metal tolerance, reducing agent tolerance, and have different sensitivity and dynamic range capabilities. Amplex Red showed the greatest sensitivity with detection limits for H_2O_2 in the low μM concentration range. Interestingly, we found that that certain divalent metal cations have an inhibitory effect with some probes. While there is a wide range in price and availability for the various HRP isoforms, we recommend researchers choose based on factors other than catalytic performance as we see little biochemical difference between isoforms. Probes, however, should be carefully chosen by researchers to suit the application needs and environment in which they will be used as failure to account for conditions may yield misleading results.

10:00amGradDevelopment and Evaluation of a Fluorescent Probe to Detect the Expression of GlutamateRm 3Carboxypeptidase II

*¹Katelynn Fuller-Svarz, ²Koshala Olupothage, ¹Michael Beck, ²Ajith Karunarathne, ¹Gopal Periyannan [¹Eastern Illinois University, ²University of Toledo]

Glutamate Carboxypeptidase II (GCPII) is a transmembrane zinc metallopeptidase that is expressed in various human tissues. Within the human nervous system GCPII hydrolyzes *N*-acetylaspartylglutamate, one of the most common neurotransmitters in the mammalian nervous system, and in the intestine GCPII facilitates the

absorption of dietary folate. GCPII can also be found in other human tissues including the kidneys and the prostate; however, little is known about the protein's function in these tissues. Here we have designed and synthesized a GCPII-specific, fluorescent molecular probe for the in vivo detection of GCPII in tissues of model organisms. The GCPII active site binding probe moiety was based on a known GCPII inhibitor and tethered to a Coumarin 343 fluorescent dye. Currently, purification and characterization of the probe is underway. To obtain a GCPII overexpression system, we have cloned the human GCPII (hGCPII) gene into the pCMV vector with an Nterminal mCherry tag and transiently transfected this plasmid into HEK293T and HeLa human cell lines. Both cell lines reveal GCPII expression after transfection; however, the results suggest mCherry-hGCPII may be localized in the cytosol instead of translocating to the plasma membrane. Cell lines that naturally express hGCPII will be tested to determine the best hGCPII target for the probe. This will begin with determination of hGCPII expression in human cell lines beginning with LNCaP cells, a line of human prostate adenocarcinoma cells. Future experimentation will include the determination of tissue-specific GCPII expression in C. elegans using our fluorescent probe.

11:00am UG Sterics and Electronic Effects of Various Phosphine Ligands via WebMO Program

Rm 3

*Senaf Fayissa, Clayton Spencer, Jocelyn Lanorio [Illinois College]

Ligands are ions or molecules with at least one donatable electron pair that can bind with a central metal atom to regulate solubility and minimize their surface energy of compounds in their syntheses. These properties of ligands are usually caused by two characteristics, cone angle and electron-donating ability. The cone angle of ligands affects their steric ability and their bulkiness which is crucial in determining the catalytic ability of the ligand. In this study, our main focus includes examining the sterics and electronics of different ligands by performing WebMO calculations. Bond angle/cone angle, heat of formation (stability), HOMO energy, LUMO energy, dipole moment, and partial charges data were successfully obtained. Electron donating ability was studied by calculating the dipole moments and partial charges of the atoms involved in binding. Our calculations indicate the cone angle to be increasing in the order of (smallest to the biggest). Partial charges of the phosphorus atom of a series of the phosphines were also obtained and will be reported.

A ligand's ability to donate a pair of electrons can be calculated using IR spectroscopy of the complex formed upon bonding of the ligand to the metal. The common complexes used for determining the electron-donating ability of ligands are Ni(CO)₃(PR₃) and RhCl(CO)(PR₃)₂ where PR₃ is the phosphine. Future work will be done on calculations of the CO vibrational frequency of such complexes.

11:00am UG Copper-Catalyzed Alkyne-Azide Cycloaddition Reactions Utilizing Copper Oxides Trapped Within a Rm 3 **Polydimethylsiloxane Matrix**

*Kayla Lippincott , Emily Rosengarten, Cassidy Kraft, Zaman Shah, Dean Campbell, Arijit Sengupta [Bradley University]

Copper-catalyzed azide-alkyne cycloaddition (CuAAC) or simply Cu(I) catalyzed azide-alkyne "click reaction" has proven to be a powerful synthetic tool over the past decade as it offers increased accessibility to a broad spectrum of reactions. In a conventional click reaction, several labor-intensive purification steps are required to isolate the products. The catalytic Cu(I) species removed during purification are discarded most of the time. This study explored how copper oxides trapped within polydimethylsiloxane (PDMS) can also be used to catalyze these CuAAC reactions. The catalyst is produced by the thermal decomposition of copper(II) acetylacetonate that has been deposited within a PDMS matrix using chloroform. The catalysts were used to successfully produce eight different triazole compounds. This study explored which combinations of solvent, temperature, and substrates produced the best yields. At the end of the click reaction, the PDMS containing catalytically active copper oxide can be recovered and used for multiple reaction cycles.

ENGINEERING & TECHNOLOGY

9:20am UG Total Impact of Electric Vehicle Fleet Adoption in the Logistics Industry of Illinois Rm 4

*Justin Hope Villegas, Jaby Mohammed [Illinois State University]

The continental United States has 3.8 million square miles of land and over 4 million miles of road; therefore, the United States is a land logistics-heavy country. Illinois is known to be one of the most prominent multi-modal logistics hubs in the nation. When it comes to trucking, Illinois is the most sought-after location for distribution

centers and freight forwarders—located at the heart of the country's interstate highway system, which consists of coast-to-coast interstates I-80 and I-90. Also, I-70 extends from the east coast to Utah. These major corridors join multiple north to south corridors. There is an estimated 2,185 interstate miles that serve the state, third among all the U.S. There are over 16,000 miles of state highways and 7,847 bridges, making the interstate routes accessible across the entire state. So it naturally attracts more than 7,000 trucking establishments within Illinois.

The United States also has views of a future that joins the global movement to achieve the Net- Zero Emissions Target by 2050 – this includes the over 15 million varying units used in the nation's trucking industry. Of those units, Cyber Drive Illinois identifies over 1.8 million trucks registered in Illinois – all of which are traditional petroleum-based diesel trucks.

Electric trucks produce 19% to 43% less greenhouse gas (GHG) emissions than diesel trucks, more so when used on highways. Assuming there is a cost of \$100 per metric ton of CO_2 emissions, the carbon tax savings to the nation's truckers of an all-electric fleet would be \$8.3 billion to \$18.8 billion, an annual return of 1.5% to 3.3% on the total cost of a Class 8 vehicle replacement.

This paper explores the benefits and risks of operating electric vehicles (EVs), specifically trucks when integrated into the existing logistics industry based in Illinois.

9:40am Grad Application of Lean Six Sigma to Artificial Intelligence and Machine Learning

Rm 4

*Magalie Baker, Jaby Mohammed [Illinois State University]

With an ever-growing technological world, it is no surprise that an industry's common practices would mix with new developments. Six Sigma is used in the industry as an organizational philosophy to improve performance and reduce variation, and it is often seen as an iterative and streamlined way to succeed at a project or process. The scope of success in the field has broadened to improve decision making processes such as artificial intelligence and machine learning. Artificial intelligence is defined as a theory of intelligence created by machines. It is unlike human decision making because it does not decision make with emotion, and it can be used for tasks other than decision making, such as speech recognition and language translations. Machine learning differs from artificial intelligence because it is the development of computer algorithms that learn and improve as they experience. With the emergence of these two technological developments, processes like Six Sigma that aim to simplify organizational practices could benefit greatly from them. The question comes into view: would the implementation of artificial intelligence and machine learning have a productive place in the Six Sigma world, and if so, how would this impact the day-to-day life of a company and its workforce. Six Sigma's also complements on the process also, how we can have data that are free from errors. As both artificial intelligence and machine learning are related, yet not mutually exclusive to Six Sigma, collaboration could be the way of the technological future. This presentation would reflect on how both these concepts would complement each other with in the science of improving organizational efficiency.

10:00am Grad Servitization – An Upcoming Innovative Industrial Business Model

Rm 4

*Montasir Islam, Klaus Schmidt, Jaby Mohammed [Illinois State University]

Industrial businesses are continuously exploring innovations and strategies to survive in the competitive landscape where every entity is vying to increase respective market shares. Manufacturing industry is one such area which is in necessary circumstances to take incremental initiatives and make it more commercially viable, environmentally relevant and monetarily profitable. The research paper tries to explore a relatively new method called "servitization" which is being applied at manufacturing companies for minimizing costs, maximizing revenues and participating in the circular economy -- all by not only selling customers merely the products but also long-term service contracts and subscriptions. Advanced servitization provides highly customized maintenance support and repair services with the help of Artificial Intelligence (AI) and Internet of Things (IoT) capabilities. In the process it promotes a sustainable business ecosystem that is technologically intelligent, socially responsible and intuitively predictive. Servitization enables manufacturers to quickly detect, analyze and assess equipment malfunctions and promptly offer troubleshooting, parts and replacements saving the customers from extra costs, resources and time. Additionally, with innate incorporation of AI and IoT it excels at helping manufacture data-driven smarter products to bring risk-free operations with seamless user experiences. Established manufacturing companies Rolls Royce, General Electric, Ericsson, Tesla and Castrol are renowned for actively using servitization methodologies for their select business offerings. Illinois based heavy manufacturing

company Caterpillar widely exercises servitization with successful applications and customer rapports. Servitization further provides ample opportunities to innovate in industries for the future of marketing goods and services. It immensely assists the services portfolio of manufacturing companies while letting them reduce wastes, energy consumptions and production redundancies. Servitization massively opens up new avenues for diverse opportunities, strategies and growth scopes that are substantially eco-friendly, resourceful and convenient for the manufacturer, consumers and society at large.

ENVIRONMENTAL SCIENCE

8:00am UG A Survey of Spontaneous Tree Diversity at Starhill Forest Arboretum and its Significance

Rm 2 *1Sam Killday, ^{1,2}Guy Sternberg, ¹Lawrence W. Zettler [¹Illinois College, ²Starhill Forest Arboretum] Established in 1976, Starhill Forest Arboretum, located on 19+ hectares in Menard Co. Illinois, contains a significant living collection of oaks (quercetum) serving as a reference component of the APGA Plant Collections Network. In addition to oaks, 2,000 other woody plant species in 180 genera are found on the site in a natural setting that serves to promote an understanding of trees and nature. To establish a foundation for future biological, dendrological, dendrochronological, and ecological studies, this study attempted to document all of the spontaneous trees that were assumed to have existed prior to 1976. Data collected for each tree included taxonomic identification, current CBH, GPS location, and a photograph to facilitate its location in future years. These data will serve as a benchmark for future surveys to provide a window into the growth, maturation, and/or decline of each of the species, as well as the possible recruitment of additional spontaneous species since 1976. The most surprising aspect of this study was the high level of tree diversity found in this relatively small area that was farmed and grazed dating back to the 1850s. Tree ages, based on estimates from sizes encountered augmented by old photographs and Pressler cores, revealed several even-aged cohorts present in 1976. These cohorts reflect the changes in land use since the early 1800s. The documentation of these changes through time should provide more clarity into forest synecology and facilitate a greater understanding of species-dependent fauna and associated mycorrhizal fungi.

8:20am Grad Transcriptome Analysis of Odonata (Anisoptera) Nymph upon Exposure to Pesticides

Rm 2 *¹Reni Truhtcheva Owikoti, ²Erin Grey [¹Governors State University, ²University of Maine] The role of agricultural pesticides in the decline of Anisoptera (dragonflies) is documented, but we lack detailed knowledge on the non-lethal effects of different types of pesticides on different dragonfly life stages. Previous research suggests that glyphosate-based herbicides have no immediate effect on Anisoptera or their aquatic ecosystems, but other types of pesticides and the interaction between pesticides have not been explored. Given the importance of Anisoptera predation in aquatic food webs, both as aquatic nymphs and water-associated adults, further research is needed to determine the effects of different pesticides on different aspects of Anisoptera biology and ecology. This study used mesocosm experiments to test the effects of three common agriculture chemicals, individually and combined, on gene expression in Anisoptera nymphs. Anisoptera individuals were housed in aquaria and exposed to untreated pond water, glyphosate (herbicide), bifenthrin (insecticide), chlorothalonil (fungicide), and a mixture of the three chemicals in concentrations that are typically observed in the environment. After 24 hours, nymph tissue was obtained from each sample for RNA extraction, purification, measurement, and RNA sequencing on an Illumina NovaSeq platform. Reads were trimmed and assembled into mRNA contigs using the Trinity program, and differentially expressed mRNAs were identified using the DeSeq2 package in R. We will discuss the results of this experiment, including upregulated and downregulated mRNAs across treatments, as well as implications for aquatic ecosystems in agricultural settings.

8:40am Rm 2 Grad

Behavioral and Biochemical Characterization of PFOS Neurotoxicity in Drosophila melanogaster

*Carl Namini, Emily Petruccelli, Kyong Sup Yoon [Southern Illinois University Edwardsville] Perfluorooctane sulfonate (PFOS), classified as a perfluoroalkyl acid (PFAA), is an anthropogenic pollutant widely distributed in the environment. It is currently estimated that currently 99% of the current United States population has some amount of PFOS and other PFAAs in their body. Previous studies have revealed that PFOS stimulates voltage-gated calcium channels (VGCCs) and glutamate receptors (GluR) causing calcium influx into nerve cells and leading to neurotoxicity in affected organisms. Although classified as a neurotoxicant, detailed biochemical and molecular actions of PFOS are yet to be well understood. In the present study we validated neurotoxic effects of PFOS in fruit flies. From exposing three to five-day old male fruit flies to 20 μ M PFOS via feeding, estimated LT₁₀, LT₅₀, LT₉₀ were 10.1, 19.7, and 40.5 hours respectively. Flies exposed to PFOS (20 μ M) and a sublethal concentration of an ion channel modifier displayed a wide range of altered mortality responses, offering future research opportunities to validate previously suggested targets and to also find novel binding receptors. Flies treated with PFOS (2 μ M – 100 μ M) were video recorded and analyzed for altered behaviors (wing movements, velocity and angular velocity) using the Flytracker (Caltech) program then statistical processing using R studio. Average max wing angle, amount of time with wing spent out, average wing out duration and angular velocity was significantly greater in males treated with 20 μ M PFOS for 4 hours when compared to females and male controls.

9:20am UG Effects of Microplastic Exposure to Schmidtea mediterranea

Rm 2*Haley Brashears, Kyong Sup Yoon, Amy Hubert [Southern Illinois University Edwardsville]
In the 1950s, 1.5 million tonnes of plastics were produced, by 2011, this number augmented to 280 million
tonnes. As microplastics increasingly accumulate in the aquatic environment, understanding impacts of
microplastics in aquatic organisms becomes more important. However, there has been few model organisms
used thus far, and many aspects involving the toxicity of microplastics need to be further studied. This study
utilizes the planarian species, Schmidtea mediterranea which are useful to study various aspects of ecotoxicology.
The goal of this research was to determine if exposure to microplastics are accumulating in their gut. Throughout
the investigation a dose dependent relationship between microplastic concentration and ROS production has
been detected. The highest dose of microplastics significantly increased the production of ROS (ANOVA, tukey
post hoc P < 0.05). Immunohistochemistry is being utilized, to determine if microplastics plastics are
endocytosing or if they are being distributed in the gut.

9:40am Grad Assessing the Effects of Decreasing Particulate Matter Concentrations Over Time on Population Rm 2 Health in an Industrial Midwest City

*Albert Wang, Nicholas Guehlstorf [Southern Illinois University Edwardsville] St. Louis was designated as in attainment with PM2.5 standards in 2018, a vast improvement from its nonattainment status given in 2004. This study investigates whether hospitalization rates and mortality rates due to air pollution-induced cardiovascular and pulmonary illnesses in the St. Louis metropolitan area decreased alongside fine particulate matters from 2004-2015 in St. Louis. This case study also evaluates if there is a relationship between air pollution-induced cardiovascular and pulmonary illnesses and socioeconomic factors; specifically, income and race. Health and census tract population data were taken MOPHIMS, while socioeconomic data was taken from American Factfinder. PM2.5 data was retrieved from the EPA's AirData Map App. Basic line plots were first created to visualize PM2.5 trends, mortality rates, and emergency room visits. Choropleth maps were then generated in ArcGIS Pro to evaluate patterns in hospitalization and mortality rates and PM2.5 counts. ARFIMA-MLM statistical analyses were then performed on hospitalization and mortality counts, to account for the repeated cross-sectional data in the form of census tracts and to compensate for temporal autocorrelation. The ARFIMA analyses were unable to find a statistically significant relationship for annual PM2.5 concentrations, hospitalization rates, and income, but did find a significant nonzero relationship between hospitalizations for cardiovascular and respiratory illnesses and race.

10:00am Grad Influence of Food Resource Quality on Trematode Parasitism in Larval Frogs

*Kiernan Robinson, John A. Marino [Bradley University]

Rm 2

Diet has been linked to parasitism, as low quality diets can cause hosts to be more susceptible to parasitic infection, possibly causing synergistic effects on host fitness and consequences for host populations. Food resource quality can influence larval amphibian growth, development, and survival and likely affects parasite susceptibility, which is concerning given recent amphibian declines. We hypothesized that higher food resource quality would increase tadpole growth, that parasite infection would decrease growth and survival, and that tadpoles fed higher quality food would experience higher infection levels. To examine the combined effects of parasite exposure and food resource quality, we performed two laboratory experiments using *Rana clamitans* tadpoles. In the first experiment, tadpoles were fed diets differing in protein content and were continually exposed to either the absence or presence of trematode (plagiorchid) parasite cercariae by including either an uninfected or infected snail, comparable to exposure experienced in ponds. In the second experiment, tadpoles were fed the same three diets, but were exposed to a one-time, controlled number of parasites. We measured

tadpole growth and survival in the first experiment, and tadpoles from both experiments were dissected to measure infection loads. In the first experiment, we found a significant interactive effect of diet and parasite presence on final mass. Diet did not significantly affect tadpole survival or infection level. The presence of parasites did significantly decrease tadpole growth and survival. In the second experiment, tadpoles fed the low protein diet had more than six-fold higher infection levels than tadpoles fed the high protein diet. Overall, our findings suggest that diet can affect an organism's defenses against parasitic infections, and tradeoffs may exist between allocating resources to growth or to parasite defense. Understanding such tradeoffs has implications for conserving amphibians in the face of disease and changing nutrient regimes in their habitats.

HEALTH SCIENCES

10:40amGradDirect Smoke Exposure Influences Stem Cell Proliferation and Regulates Squamous Cell Carcinoma ofRm 2the Tongue

*Mallory Wright, Barb McCracken [Southern Illinois University Edwardsville] Oral cancer is a rare disease developed in the tissues of the mouth, tongue, or throat. The oral cancer squamous

cell carcinoma of the tongue often goes undiagnosed and quickly becomes aggressive. The tongue is problematic because it has a lymphatic network that drains into the neck. Oral cancer treatments currently involve removal surgery or chemotherapy, but cancer reforming after these treatments is likely. According to the stem cell cancer model, the stem cells are rapidly reproducing themselves and sustaining cancer instead of the tumor cells as a whole. Stem cells survive longer than the typical body cells making them more likely to accumulate genetic mutations. In addition, Oral cancer development is associated with the nicotine in smoking products. Nicotine is the addictive component of smoking and promotes proliferation, invasion, and may regulate stem cell dysfunction (Ji et al., 2016). However, because of limited data, the relationship between stem cells and nicotine in cancer is still unknown. The purpose of this study is to evaluate SOX2s involvement in oral cancer and to evaluate nicotine exposure as a precursor in SOX2s dysfunction. I used a combination of immunofluorescence techniques, migration assays, and smoke exposure techniques; and showed that under the influence of stem cells and nicotine, cells proliferated more aggressively. I concluded that nicotine is influencing the stem cells in oral cancer and causing cancer cell proliferation. However, I also concluded that silencing SOX2 can decrease cancer cell progression even after exposure to nicotine, and therefore be a more effective way to treat cancer.

11:00am UG Successful Recovery of Cryopreserved Adult Neurons Utilizing a Novel Stem-Cell Extract

*Gianna Ruiz, Anne Marie Fauser, Craig Cady [Bradley University]

Rm 2

In vitro culture of neurons is an excellent tool for investigating the effects disease and stress on the nervous system. Improved methods allow adult neurons to remain viable in culture for weeks but the process remains highly technical and time-consuming requiring coordination with experiment setup (Brewer, 1998). Alternatives to culturing adult neurons include using embryonic neurons, genetically engineered neurons, and neoplastic neurons. These cells do not provide a means of assessing stress and disease in the normal adult brain. Most studies utilize embryonic neurons, but have atypical metabolic and growth characteristics making them an inaccurate in vitro model for normal adult neuronal function. Having a ready source of "off the shelf" adult neurons would be beneficial to in vitro research in neurophysiology. We're investigating a new approach to cryopreserving adult neurons. Initially, we had limited success using a new cryopreservative (CS10) and program rate freezing. In this effort, we developed a novel stem cell extract (SCE) that enhances cell proliferation of cultured cells with the potential to improve recovery of adult neurons from cryopreservation. We hypothesize cryopreserved neurons will successfully recover when cultured with SCE. Neurons from adult mice were isolated, placed in CS10 and program rate frozen. Recovered neurons were then cultured in media with or without SCE. We found increased cell numbers based on general cell counts and a proliferation assay, as well as larger and more abundant neuronal processes in cells recovered with SCE. Our results provide a new method for adult neuron recovery from cryopreservation. Allowing for cryo-banking and recovery of adult neurons, a major step in providing a new tool for research in neurophysiology.

PHYSICS, MATHEMATICS, & ASTRONOMY

10:40am UG Automation for Telescopic Control and Imaging Potential Supernovae

*Wylie Anderson, Lucas Hutton [Eastern Illinois University]

Supernovae are some of the most violent events to take place in our universe and are very rare to observe due to the low frequency of them occurring. The frequency of a star going supernova in a galaxy is once every hundred years. To increase the odds of discovering a supernova one must be able to observe a larger number of galaxies. In order to accomplish this, we wrote a program which automates the operation of any ASCOM controlled telescope and CCD camera. The system reads a list of user provided targets, optimizes the order, and executes all commands required from telescope slewing to image acquisition for each provided target.

A status report of the software development with initial results will be presented as well as next steps to automate the detection of supernova.

11:00am Grad Simulation and Visualization of Traffic Flow

Rm 4

Rm 4

*Michael Nsor, Kishor T. Kapale [Western Illinois University] We are interested in simulating and visualizing different scenarios that cause traffic jams and develop strategies to avoid them for the benefit of traffic engineers and policy makers. We use a software suite called NetLogo and control it from Mathematica for this purpose. NetLogo provides a powerful platform for studying, interpreting, visualizing and replicating complex systems in many fields by using agent-based models. This project focuses on analyzing traffic systems by changing parameters such as number of cars in the traffic lane, acceleration and deceleration We linked NetLogo with Mathematica for data visualization in order to study the effect of these parameters in the traffic system. This will help to better understand current traffic management strategies and aid us to contribute towards a future intelligent transport system

11:20amGradStimulated Emission Cross-Section of Praseodymium (Pr3+) Ions Doped in Lead Boro-GermanateRm 4Glasses

*Suman Gautman, PK Babu, Saisudha B. Mallur [Western Illinois University] Bare earth ions doped glasses have drawn abundant interest for their use in various ontic:

Rare earth ions doped glasses have drawn abundant interest for their use in various optical and optoelectronic devices. In this present work, lead boro-germanate glasses doped with Pr^{3+} ions [x PbO-10 GeO₂-(70-x) B₂O₃-0.5 Pr_2O_3 [x = 19.5, 29.5, 39.5, 49.5, 59.5 mol %] are prepared by the conventional melt quenching technique. To see the effect of glass compositions on the optical properties of Pr3+ ions, optical absorption and fluorescence measurements are carried out. Optical absorption is recorded by a Varian CARY 5G UV-VIS spectrometer. From the absorption spectra, oscillator strengths, intensity parameters and radiative transition probabilities of Pr^{3+} ions are calculated. The Pr^{3+} fluorescence spectrum is obtained by exciting the glass sample at 445 nm wavelength and examining the light emitted by the excited atoms with a LEOI-101 modular multifunctional grating spectrometer. Stimulated emission cross section (σ P) is one of the most important optical parameters and large values of that can improve the efficiency of energy conversion process in a photovoltaic cell operation. We obtained the stimulated emission cross section for Pr^{3+} fluorescing transitions using the optical absorption parameters. σ P values are found to be large for these glasses and it shows compositional dependence.

STEM EDUCATION

11:00amStudent Design and Testing of Fluorescent-DHFR Fusion Enzymes as a Visual Learning Tool inRm 1Biochemistry Labs

*Dana Morrone, Junyun Park, Jeri Obeng, Peter Spezia, Jonathan Huang [University of Health Sciences and Pharmacy in St. Louis]

Biochemistry lab experiments may often seem to students like abstract exercises in mixing clear solutions of small volumes. The fact that most enzymes and proteins in solution are colorless contributes the lack of intuitive understanding and visual cues in some biochemistry experiments. However, many studies have shown that adding a visual component to the learning process improves understanding and comprehension of the material.

As a result, we had students engage in a guided-inquiry exercise whereby they were challenged to make visually detectable fusion enzymes for a biochemistry lab. Visually detectable enzymes allow students to monitor the expression, cell lysis, and chromatographic purification of their target protein. In essence, students would now have a visual tag to see where their protein is located in test tubes or on chromatography columns. Students undertook an exercise to design various fluorescent protein fusions with dihydrofolate reductase, an enzyme found in all studied organisms that supports nucleic acid synthesis. These engineered DHFR fusion enzymes exhibit very high expression, remain soluble and stable for many weeks, are visible in ambient light and are not biochemically compromised in their activity. Further, these colored fusion enzymes can be used for inhibition studies to investigate molecules for antimicrobial or therapeutic potential. Students who use these visually traceable enzymes demonstrate learning gains on assessments as well. We report on the development, characterization, and usage of these novel visible enzyme fusions that make excellent learning tools in biochemistry labs.

ZOOLOGY

10:40am Manifestation of the Competitive Value of Tool-Use in Aphaenogaster rudis

Rm 3

*Paul Brunkow, Isabell Walker, Dylan Gladson [Southern Illinois University Edwardsville] *Aphaenogaster rudis* is a widespread, subordinate ant species found in NA eastern hardwood forests which is easily displaced from food sources by aggressively dominant ant species. *A. rudis* is commonly observed to drop soil and leaf litter into liquid food sources and then to harvest the saturated material for return to the nest. This behavior, widely accepted as an example of tool-use, has been proposed as a mechanism by which *A. rudis* can ameliorate the negative effects of aggressively dominant competitors. However, the potential competitive value of such tool-use has not been well studied. We presented liquid food baits to colonies of three ant species known to coexist with *A. rudis* in forest habitats but that were located in areas where *A. rudis* does not occur. Baits differed in the quantity of fine soil suspended in the liquid, so as to simulate encounter with liquid food at differing stages of *A. rudis* manipulation. While all three species showed some liquid harvesting from all six soil concentrations in all trials, in no trial did we observe any harvesting of liquid-saturated soil. Once excess liquid was harvested, all liquid- saturated soil was left behind, soil which *A. rudis* workers would readily harvest. This study thus provides evidence that tool-use by *A. rudis* may reflect a competitive strategy whereby liquid food can be protected against harvest by aggressively competitive dominants.