TRANSACTIONS OF THE
ILLINOIS STATE ACADEMY OF SCIENCE

SUPPLEMENT TO VOLUME 115

113TH ANNUAL MEETING – VIRTUAL
APRIL 9, 2022

HOSTED VIA ZOOM

BY ILLINOIS COLLEGE

ILLINOIS STATE ACADEMY OF SCIENCE

FOUNDED 1907

AFFILIATED WITH THE ILLINOIS STATE MUSEUM
SPRINGFIELD, IL

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113TH ISAS ANNUAL MEETING – VIRTUAL

April 9, 2022
Illinois College
Host: Dr. Laura Corey

MEETING SCHEDULE

SATURDAY, APRIL 9TH

- 7:30am Check in to Zoom Sessions opens (continues throughout day)
- 8:00am – 12:00noon Oral Presentations Begin (Zoom Breakout Rooms)
- 12noon – 1:00pm Break for Lunch (on your own)
- 1:00pm – 4:20pm Poster Presentations Begin (Zoom Breakout Rooms)
- 4:20pm – 5:00pm Division Meet0ngs and Awards Determinations (Zoom Breakout Rooms)
- 5:00pm – 5:30pm Student Award Presentations (Zoom)
- 5:30pm – 6:30pm Keynote Address (Zoom)
- 7:00pm Meeting Closes

Future Meeting Sites
2023 – Bradley University
2023 – Millikin University

ABBREVIATIONS USED IN PROGRAM

Division Abbreviations

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

Participant Abbreviations

HS	High School Student
UG	Undergraduate Student
Grad	Graduate Student
None	Regular/Faculty Member

Participating School and Organization Abbreviations

AIC	School of the Art Institute of Chicago
Bradley	Bradley University
DePaul	DePaul University
EIU	Eastern Illinois University
IC	Illinois College
INHS	Illinois Natural History Survey
INPS	Illinois Native Plant Society
ISU	Illinois State University
Knox	Knox College

Lincoln	Lincoln College
Millikin	Millikin University
NDSU	North Dakota State University
SIUe	Southern Illinois University Edwardsville
UHS	University High School
UHSP	University of Health Sciences and Pharmacy in St. Louis
UIUC	University of Illinois Urbana-Champaign
UofI	University of Illinois
WIU	Western Illinois University

ORAL PRESENTATION ROOM SCHEDULE – SATURDAY, APRIL 9, 2022 – 8AM-12NOON

All Oral Presentations in Division Zoom Breakout Rooms

8:00am	**Jessi Kreder** Environmental Science			**Pradip Bhattarai** Physics, Math, & Astro
8:20am	**Zhi-Qing Lin** Environmental Science	**Jenna Thelen** Cell Biology	**Elexis Richardson** Zoology	**Alex Rahe** Physics, Math, & Astro
8:40am	**Abby Pagels** Environmental Science	**Damilola Lawore** Cell Biology	**Hailey Wimberly** Zoology	**Moreom Akter** Physics, Math, & Astro
9:00am	**Cora Wessman** Environmental Science	**Kevin Marcus** Cell Biology	**Annalee Anderson** Zoology	**Daniel Lel** Physics, Math, & Astro
9:20am	**Joseph Krischon** Environmental Science	**Nicholas Canton** Cell Biology	**Michelle Hollon** Zoology	**Md Arefur Rahman** Physics, Math, & Astro
9:40am	**Kyong Yoon** Environmental Science		**Benjamin Jellen** Zoology	**Al Masud** Physics, Math, & Astro
10:00am	***BREAK***			
10:20am	**Myles Genrich** Environmental Science	**Victoria Johnson** Cell Biology	**Dennis McMeekan** Computer Science	**Eric Ulaszek** Botany
10:40am	**Brooke Prater** Environmental Science	**Owen West** Cell Biology	**David Salazar** Computer Science	**Jacob Murphy** Botany
11:00am	**Akinloye Emmanuel Ojewole** Environmental Science	**Hannah Bowers** Cell Biology	**Yun Jia** Engineering & Tech	**Susan McIntyre** Botany
11:20am	**Lauren Sgambelluri** Environmental Science	**Jazmin Brown** Microbiology	**Mona Fazel Sarjoui** Engineering & Tech	**Abdullah Rubayyi** Chemistry
11:40am	**Manuel Gomez** Environmental Science	**Emily Baalman** Microbiology	**Hannah Warfel** Health Sciences	**Nathan Garnett** STEM Education

POSTER PRESENTATION ROOM SCHEDULE – SATURDAY, APRIL 9, 2022 – 1PM-4:20PM

All Poster Presentations in Division Zoom Breakout Rooms

1:00pm	**Gabrielle Valenzuela** Chemistry	**Shay Adio** Botany	**A. Michelle Harms** Environmental Science	
1:10pm	**Brandon Ayer** Chemistry	**Sydney Metternich** Botany	**Jayden Lawrence** Environmental Science	**Emily Hansen** Agriculture
1:20pm	**Grant Meyer** Chemistry	**Patrick Nilges** Botany	**Rylee Cook** Environmental Science	**Scott Holt** Microbiology
1:30pm	**Emmanuel Adejumo** Chemistry	**Farid Rodriguez** Botany	**Merritt Steffens** Environmental Science	**Kwame Owusu-Nyantakyi** Microbiology
1:40pm	**Zachary Dodson** Chemistry	**Stephanie Mullen** Botany		**Gia-Maria Calbaza** Microbiology
1:50pm	***BREAK***			
2:00pm	**Grace Brownlee** Chemistry	**Morgan Rockwell** Zoology	**Audrey Smith** Environmental Science	**Alex Wolfe** Health Sciences
2:10pm	**Ethan Leitschuh** Chemistry	**Sydney Kehrmann** Zoology	**Elizabeth Wolk** Environmental Science	**Md Hasibul Hasan** Physics, Math, & Astron
2:20pm	**Matthew Ward** Chemistry	**Makenzie Groenhof** Zoology	**Pamela Taylor** Environmental Science	**A K M Ashiqur Rahman** Physics, Math, & Astron
2:30pm	**Alexis Dreyer** Chemistry	**Patrick Menke** Zoology	**Rachel Papavasilopoulos** Environmental Science	
2:40pm	**Regina Scarpaci** Chemistry	**Antoine Haddad** Zoology	**Josh Gifford** Environmental Science	**Emily Bone** Anthro & Archeology
2:50pm	***BREAK***			
3:00pm	**Briar Helsabeck** Chemistry	**Emily Wymore** Zoology	**Hunter Brugler** Cell Biology	**Alexis Keegan** STEM Education
3:10pm	**Lillie Purcell** Chemistry	**Matthew Goessling** Zoology	**Victoria Stuart** Cell Biology	**Dianne Jedlicka** STEM Education
3:20pm	**Mary Pearson** Chemistry	**Sydney Tomaschke** Zoology	**Misael Villegas** Cell Biology	**Dianne Jedlicka** STEM Education
3:30pm	**Ashley Webb** Chemistry	**Alyssa Diaz** Zoology	**Alexis Pawlak** Cell Biology	**Olivia Beckwith** STEM Education
3:40pm	**Patrick Combs** Chemistry	**Katie Cutler** Zoology	**Thomas Fowler** Cell Biology	**Sirihaasa Nallamothu** Computer Science
3:50pm	**Logan Barnard** Chemistry		**Christine Gouws** Cell Biology	
4:00pm	**Mojisola Adisa** Chemistry		**Kevin Edwards** Cell Biology	
4:10pm	**Shelby Carlson** Chemistry			

ORAL PRESENTATIONS – SATURDAY, APRIL 9, 2022
DIVISION ZOOM BREAKOUT ROOMS – 8AM-12NOON

Time	Presenter	Title of Presentation
		Botany
10:20am	Eric Ulaszek (INHS)	Assessment of Illinois' North Shore Ravines Flora and Plant Communities
10:40am	Jacob Murphy (EIU, Grad)	Isolation and Functional Characterization of Novel Root-Specific Promoters in Sunflower
11:00am	Susan McIntyre (INPS)	Pink Milkwort (*Polygala incarnata*) Conservation Status and Ecological Questions
		Cell, Molecular, & Developmental Biology
8:20am	Jenna Thelen (Millikin, UG)	Associations between Interferon Gamma (IFN-γ) Levels and Ivermectin Treatment on Avian Malarial Parasite Loads
8:40am	Damilola Lawore (WIU, Grad)	Anti-Cancer Activity of Morel Mushroom (*Morchella esculenta*) Extracts in Ovarian Cancer Cells
9:00am	Kevin Marcus (IC, UG)	Disruption of an Essential Protein in *E. coli* Using Peptide Fragments
9:20am	Nicholas Canton (Millikin, UG)	Therapeutic Compound Efficacies on Cognitive Function in Transgenic *Caenorhabditis elegans*
10:20am	Victoria Johnson (Knox, UG)	Identification of the Photosensitive Protein(s) in *Stentor coeruleus*
10:40am	Owen West (EIU, Grad)	*Helianthus eggertii* Regeneration and Transformation Efficiency among 19 Lines
11:00am	Hannah Bowers (SIUe, UG)	Investigating the Function of Novel Planarian Genes
		Chemistry
11:20am	Abdullah Rubayyi (NDSU, Grad)	A Rapid Method to Measure Exogenous Gamma-Hydroxybutric Acid in Beer for Drug Facilitated Sexual Assault Investigation Using (HILIC-ESI/MS/MS)
		Computer Science
10:20am	Dennis McMeekan (WIU)	Analysis of Security Vulnerabilities of WebRTC
10:40am	David Salazar (IC, UC)	AI Mid-Air Gesture Authentication for Mobile Devices
		Engineering & Technology
11:00am	Yun Jia (ISU, Grad)	Impact of Supply Chain 4.0
11:20am	Mona Fazel Sarjoui (ISU, Grad)	Improving Project Budget Forecasting by Using Artificial Intelligence
		Environmental Science
8:00am	Jessi Kreder (Millikin, UG)	Characteristics of Microplastic Contamination Agricultural and Wetland Areas
8:20am	Zhi-Qing Lin (SIUe)	Bioaccumulation of Selenium, Cadmium, and Mercury in Chicken Eggs of Different Production Systems and Their Interactions in Toxicity
8:40am	Abby Pagels (UofI)	Evaluating Historic Records of Prairie-Dependent Insect Species of Greatest Conservation Need in Illinois
9:00am	Cora Wessman (UIUC, Grad)	Comparison of Pollinator Behaviors and Reproductive Success for *Monarda fistulosa* in Native/Restored Prairies and Urban Gardens
9:20am	Joseph Krischon (UIUC, Grad)	Effects of Mycorrhizal Inoculations on Conservative Prairie Plant Establishment
9:40am	Kyong Yoon (SIUe)	Impacts of Short-Term Ivermectin Exposures in Fruit Flies
10:20am	Myles Genrich (IC, UG)	The Effect of Prescribed Burns on Bat Activity and Species Composition in Riparian and Upland Habitats of Siloam Springs
10:40am	Brooke Prater (SIUe, UG)	Seed and Biomass Production of *Ocimum basilicum* (Basil) Grown in Horizontal and Vertical Garden Systems and the Integration of the Companion Plant *Aster novae-angliae* (Pink Chiffon Aster)
11:00am	Akinloye Emmanuel Ojewole (SIUe, Grad)	Effects of Fish Age and Growth on Accumulation and Interaction of Selenium and Toxic Metals in Asian Carps in the Lower Illinois River
11:20am	Lauren Sgambelluri (IC, UG)	The Use of Automated Passive Recorders to Examine how Abiotic Factors Including Temperature, Humidity, and Barometric Pressure Affect Bat Activity
11:40am	Manuel Gomez (SIUe)	Survival of Fishes in a Stormwater Retention Pond at the Watershed Nature Center, Edwardsville, Illinois

Time	Presenter	Title of Presentation
		Health Sciences
11:40am	Hannah Warfel (Millikin, UG)	The Effect of Vitamin B12 (Methylcobalamin) on the Innate and Adaptive immunity of Cuban Tree Frog (*Osteopilus septentrionalis*) Tadpoles
		Microbiology
11:20am	Jazmin Brown (Millikin, UG)	Prevalence of *Toxoplasma gondii* in Birds of Prey Admitted for Rehabilitation
11:40am	Emily Baalman (IC, UG)	Antibiotic Resistance in Soil of Central Illinois
		Physics, Mathematics, & Astronomy
8:00am	Pradip Bhattarai (WIU, Grad)	Simulation of Quantum Error Correction for Encoded Single Qubits
8:20am	Alex Rahe (WIU, Grad)	Physical and Optical Properties of Pr^{3+} and Dy^{3+} Doped Bismuth Boro-Tellurite Glasses
8:40am	Moreom Akter (WIU, Grad)	Investigating the Spectral Energy Distribution of Young High-Mass Stellar Objects Using VLASS
9:00am	Daniel Lel (WIU, Grad)	Computational and Visualization-Based Approaches to Study of Heterogeneous Traffic Systems
9:20am	Md Arefur Rahman (WIU, Grad)	Comparative Analysis of Search Algorithms for Automatic Gameplay of Two-Player Games
9:40am	Al Masud (WIU, Grad)	On Designing a Quantum Game: Quantum Connect 4
		STEM Education
11:40am	Nathan Garnett (IC, UG)	Special Relativity Video Game Simulator
		Zoology
8:20am	Elexis Richardson (Millikin, UG)	Effect of Exposure to Male Flies on the Lifespan of Female Adult *Drosophila melanogaster* (Diptera: Drosophilidae)
8:40am	Hailey Wimberly (Millikin, UG)	Hormonal Correlates of Brood Patch Size in Male and Female Downy Woodpeckers (*Picoides pubescens*)
9:00am	Annalee Anderson (Bradley, UG)	Can Urban Parks be the Suitable Wingmen for Protected Areas to Protect Arthropod Diversity?
9:20am	Michelle Hollon (UHSP, UG)	Additional Evidence For A Volatile Sex-Attractant Pheromone In Snakes
9:40am	Benjamin Jellen (UHSP)	Copperhead (*Agkistrodon contortrix*) Thermal Ecology

POSTER PRESENTATIONS – SATURDAY, APRIL 9, 2022
DIVISION ZOOM BREAKOUT ROOMS – 1PM-4:20PM

Time	Presenter	Title of Presentation (Posters)
		Agriculture
1:10pm	Emily Hansen (ISU, Grad)	Effects of Depth and Cover Crop on the Functioning and Diversity of Soil Microbial Communities
		Anthropology & Archeology
2:40pm	Emily Bone (IC, UG)	Correlations Between Cranial Angles and Classification of Malocclusion
		Botany
1:00pm	Shay Adio (SIUe, UG)	The Effect of Various Smokewater Concentrations on the Germination of *Bouteloua dactyloides* (Buffalo Grass)
1:10pm	Sydney Metternich (ISU, Grad)	Local vs. Novel Prairie Soil Microbes: Testing for Local Adaptation in the Response of *Lobelia spicata* from Illinois vs. Kansas
1:20pm	Patrick Nilges (SIUe, UG)	Smoke Water Concentration Effect on the Germination of *Sorghastrum nutans*, a Native Grass
1:30pm	Farid Rodriguez (SIUe, UG)	Impact of Smoke Water Concentration on the Germination of *Bouteloua curtipendula*
1:40pm	Stephanie Mullen (SIUe, UG)	Adjustment of pH and Potassium Nitrate Concentration in TAP Media Show Increased Biomass Production in *Neochloris oleabundans*, as Compared to Growth in Soil Extract Media
		Cell, Molecular, & Developmental Biology
3:00pm	Hunter Brugler (Bradley, UG)	Inducing Neuronal and Glial Characteristics in BMSC's on Polycaprolactone Nanofiber Scaffolds
3:10pm	Victoria Stuart (Millikin, UG)	Serum Amyloid A Levels Relationship to a Long-Lived Vertebrate, the Red-Eared Slider Turtle
3:20pm	Misael Villegas (DePaul, UG)	Effect of Tri-Isopropylphosphine Gold(I) Chloride ($PiPr_3AuCl$) On The Cell Proliferation and Apoptosis of MDA-MB-231 Human Breast Cancer Cells
3:30pm	Alexis Pawlak (DePaul, UG)	Effects of Tricyclohexylphosphine Gold(I) Chloride ($PC_{y3}AuCl$) on the Cell Proliferation and Apoptosis of MDA-MB-231 Breast Cancer Cells
3:40pm	Thomas Fowler (SIUe)	*Schizophyllum commune matBα9-β6* Region DNA Includes Mating Pheromone and Receptor Gene Candidates and Confers Mating Responses
3:50pm	Christine Gouws (EIU, UG)	New Constructs for Visual Identification of Transgenic Tissues in Plants
4:00pm	Kevin Edwards (ISU)	A Live-Embryo, Genome-Wide Confocal Microscopy Screen for Protein Localization Signals
		Chemistry
1:00pm	Gabrielle Valenzuela (WIU, Grad)	Quantification of Cannabinol in Hemp Oil by Ultra High Performance Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry
1:10pm	Brandon Ayer (WIU, Grad)	Quantification of Cannabinol among Sixteen Cannabinoids in Hemp Oil by Liquid Chromatography Ultraviolet Detection
1:20pm	Grant Meyer (WIU, Grad)	Quantification of Cannabigerol among Sixteen Cannabinoids in Hemp Oil by Liquid Chromatography Ultraviolet Detection
1:30pm	Emmanuel Adejumo (WIU, Grad)	Quantification of Δ9-Tetrahydrocannabinol among Sixteen Cannabinoids in Cannabis by Liquid Chromatography Ultraviolet Detection
1:40pm	Zachary Dodson (WIU, Grad)	Quantification of Cannabigerol in Hemp Oil by Ultra High Performance Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry
2:00pm	Grace Brownlee (WIU, Grad)	Quantification of Ketoprofen in Equine Plasma by Ultra-High Performance Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry (UHPLC-ESI/MS/MS)
2:10pm	Ethan Leitschuh (IC, UG)	Copper-Catalyzed Click Chemistry of Benzyl Azide and Phenylacetylene
2:20pm	Matthew Ward (WIU, Grad)	Correlation Consistent Basis Sets Designed for Density Functional Theory: 5-p Block Elements
2:30pm	Alexis Dreyer (WIU, Grad)	Analytical Techniques for Determination of Antioxidant Concentration in Soybeans

Time	Presenter	Title of Presentation (Posters)
2:40pm	Regina Scarpaci (WIU, UG)	Detection of Illicit Drugs with Fluorescent Biosensor Silica Nanoparticles
3:00pm	Briar Hilsabeck (WIU, UG)	Synthesis of Humic Acid and Humic-Like Acids and Metal Functionalization of Humic Acid
3:10pm	Lillie Purcell (WIU, UG)	Analyzing Illicit Drugs Using Copper Nanoparticles
3:20pm	Mary Pearson (WIU, UG)	Detection of Illicit Drugs using Silica Nanoparticle as Fluorescent Biosensors
3:30pm	Ashley Webb (WIU, UG)	The Detection of Illicit Drugs Using Florescent Cored Silica Nanoparticles
3:40pm	Zvi Pasman (IC)	Inhibition of Tyrosinase with 5-Hydroxyindole
3:50pm	Logan Barnard (WIU, UG)	Illicit Drug Detection Using Nanoparticles with Fluorescent Biosensors
4:00pm	Mojisola Adisa (WIU, Grad)	Quantification of Cannabidiol among Sixteen Cannabinoids in Hemp Oil by Liquid Chromatography Ultraviolet Detection
4:10pm	Shelby Carlson (WIU, Grad)	Quantification of Δ9-Tetrahydrocannabinolic Acid among Sixteen Cannabinoids in Cannabis by Liquid Chromatography Ultraviolet Detection
Computer Science		
3:40pm	Sirhaasa Nallamoutha (UHS, HS)	Supervised Binary Convolutional Neural Networks with Model Stacking for Diagnosis of Fundus and Eyelid Diseases
Environmental Science		
1:00pm	A. Michelle Harms (Lincoln, UG)	Do College Students Affect Climate Change Through Fast Fashion?
1:10pm	Jayden Lawrence (Lincoln, UG)	Planaria Regeneration in Response to Varying Nitrate Concentrations
1:20pm	Rylee Cook (Lincoln, UG)	Stream Water Quality and Macroinvertebrate Diversity in an Agricultural Watershed
1:30pm	Merritt Steffens (Lincoln, UG)	A Study of Life History in Mealworms (*Tenebrio molitor*) on Polystyrene Foam Diets
2:00pm	Audrey Smith (Lincoln, UG)	Plant-Insect Diversity Relationship in a Restored Prairie
2:10pm	Elizabeth Wolk (SIUe, Grad)	Developing and Implementing an Environmental PhotoVoice Curriculum in an After-School Program for Middle School Students
2:20pm	Pamela Taylor (Bradley, UG)	Quantifying the Relationship Between Land Use and Parasitic Trematode Infections in Larval Cricket Frogs (*Acris crepitans*)
2:30pm	Rachel Papavasilopoulos (EIU, UG)	Bibliometric Analysis: The Effects of Triclosan on Human Health
2:40pm	Josh Gifford (SIUe, Grad)	Measures of Noise and Air Pollution Throughout the St. Louis Metropolitan Region
Health Sciences		
2:00pm	Alex Wolfe (Lincoln)	Heart Rate Variability: The Rosetta Stone of Health and Wellness
Microbiology		
1:20pm	Scott Holt (WIU)	Bacterial Communities Isolated from Root Nodules and Leaves of *Vigna unguiculata* (L.) Walp. ssp. *sesquipedalis* (L.) Verdc (Yard-Long Bean)
1:30pm	Kwame Owusu-Nyantakyi (Knox, UG)	The Effects of Different Monochromatic Lights on the Photophobic Response in *Stentor coeruleus*
1:40pm	Gia-Maria Calbaza (Bradley, UG)	Implementing Transposon Mutagenesis to Investigate Proteins that Alter the Expression of Bacterioferritin Comigratory Protein in *Bacillus subtilis*
Physics, Mathematics, & Astronomy		
2:10pm	Md Hasibul Hasan Hasib (WIU, Grad)	A Brief Study of Physical and Optical Properties of Pr^{3+} and Dy^{3+} Co-Doped Bismuth Boro-Tellurite Glasses
2:20pm	A K M Ashiqur Rahman (WIU, Grad)	Study of Fluorescence Spectra of Praseodymium (Pr^{3+}) and Dysprosium (Dy^{3+}) Co-Doped Bismuth Boro-Tellurite Glasses
STEM Education		
3:00pm	Alexis Keegan (SIUe, UG)	Investigating Illinois Students' Shifts in Scientist Stereotypes with Curricular Interventions
3:10pm	Dianne Jedlicka (AIC)	Of Crows and Bagpipes: An Animal Behavior Lab Activity
3:20pm	Dianne Jedlicka (AIC)	Balancing Life as a Biologist
3:30pm	Olivia Beckwith (SIUe, UG)	Understanding Science Identity Formation: Preliminary Results from Interviews with Scientists

Time	Presenter	Title of Presentation (Posters)
	Zoology	
2:00pm	Morgan Rockwell (Millikin, UG)	Prevalence of *Francisella tularensis* in Raptors: A Role for Hawk Flies?
2:10pm	Sydney Kehrmann (Millikin, UG)	Avoidance Behavior by Wingless *Drosophila melanogaster* of a Food Source Infected with Lipopolysaccharides
2:20pm	Makenzie Groenhof (Bradley, UG)	The Influence of Microhabitat on Amphibian Survival in Larval *Lithobates catesbeianus*
2:30pm	Patrick Menke (Bradley, UG)	Measuring the Response of Red Swamp Crayfish to the Doses of Potassium Chloride Used During Zebra Mussel Eradication
2:40pm	Antoine Haddad (Bradley, UG)	Determining Impact of Aerial Exposure on Zebra Mussel Survival, Growth, and Oxidative Stress
3:00pm	Emily Wymore (Bradley, UG)	Variation in Trematode Infection in Larval Frog Hosts from Constructed Wetlands in an Agricultural Landscape
3:10pm	Matthew Goessling (SIUe, Grad)	Invasion of *Lespedeza cuneata* Negatively Impacts Plant Diversity While Enhancing Ground Beetle Diversity
3:20pm	Sydney Tomaschke (SIUe, Grad)	Repeated Exposure Enhances Honey Bee Ethanol Tolerance Independent of Age and Behavioral Group
3:30pm	Alyzza Diaz (SIUe, UG)	Cold Tolerance may be Preserved in Aged Flies Subjected to Variable Thermal Environments
3:40pm	Katie Cutler (SIUe, Grad)	Lead Contamination and Fish Deformity in the Big River

KEYNOTE ADDRESS – DR JOCELYN LANORIO – ZOOM – SATURDAY, APRIL 9, 2022 – 5:30PM

COVID: Carrying Over Valuable Instruction Developments –
Virtual Instruction and Research for Undergraduate Students in Chemistry

Dr. Jocelyn Lanorio, Illinois College

Dr. Lanorio is an organometallic chemist interested in the development and application of transition metal complexes in catalysis. The goal of her research is to address the synthesis and reactivity questions using a combination of spectroscopic techniques such as multinuclear NMR, UV-Vis, and FT-IR spectroscopy. She teaches Advanced Inorganic Chemistry, General Chemistry, CHEM Senior Seminar II, and Organic Chemistry.

Keynote Address
Dr. Lanorio will be demonstrating the chemistry activities she developed during the pandemic. Assisting Dr. Lanorio will be two of her students, Emma Green (Chemistry, '24) and Myles Genrich (Biochemistry, '22).

MESSAGE FROM THE VICE PRESIDENT

Dear colleagues,

Thank you for participating in the 2022 Virtual Annual Meeting of the Illinois State Academy of Science. It is hard to know what the early twentieth century founders of ISAS would have thought of a scientific meeting held through technologies not yet imagined, but I am confident that we are honoring their hopes for a community of scientific advancement throughout the state Illinois.

Huge thanks go to Tere North, our talented and generous Director of Communications & Program Planning and to Robyn Myers, our Executive Secretary. The hosts of the 2021 ISAS virtual meeting (Gary Bulla, Billy Hung, and Gopal Periyannan of Eastern Illinois University) and the ISAS Executive Council were enormously helpful in developing the format of the 2022 meeting.

Lastly, I would like to thank the attendees, presenters, and research mentors. Your excellent scientific achievements, and your willingness to share them here are very much appreciated. Your commitment to education and scientific exploration during a global pandemic are admirable.

We are looking forward to gathering virtually on Saturday, April 9th and we hope we will see many of you in person next spring at the 2023 ISAS Annual Meeting at Bradley University!

Sincerely yours,

Laura Corey,
Vice-President, 2022 ISAS Annual Meeting

Laura Corey
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Dean of Faculty
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ORAL PRESENTATION ABSTRACTS

8:00am – 12noon, Saturday, April 9, 2022, in Division Zoom Breakout Rooms

*presenter, [school] with differences noted by superscript

BOTANY

10:20am **Assessment of Illinois' North Shore Ravines Flora and Plant Communities**

*Eric Ulazek, Sara Johnson, Brenda Molano-Flores, Paul B. Marcum, David N. Zaya, Connie Carroll-Cunningham, Greg Spyreas, Valerie Sivicek, Andrew Olnas, Susan McIntyre, Eric Janssen, Edward Prince [Illinois Natural History Survey]

Illinois' North Shore Ravines occur throughout the entire length of Lake County and into northern Cook County. These watersheds run perpendicular to the Lake Michigan shoreline and represent the only remaining natural drainage systems into Lake Michigan in Illinois. These ravines provide important ecosystem services by assisting with water flow management as well as providing critical habitat for many rare and northern relic species, migratory and wetland bird species, and unique plant communities (e.g., eroding bluff, seeps). Ravines are a fragile ecosystem, however, and face multiple threats from erosion, invasive species, stormwater runoff, and human development. Although several studies have been conducted assessing the physical conditions of Illinois' North Shore Ravines, a comprehensive assessment of its flora has not been conducted. In 2019 and 2021, we conducted surveys at 25 ravines to document their plant diversity using a timed-meander sampling method. Around 950 unique taxa were identified, including over 500 native species and around 278 non-native species. Native species percent ranged from a low of 57% to a high of 77% and species richness was well-predicted by ravine area with our most rich ravine hosting around 400 unique taxa. Rare species such as state-listed or Plant of Concern watch list species were also documented during these surveys. This work will provide baseline data to assist with the prioritization of high-quality ravines for ecological management and the restoration needs of these important ecosystems.

10:40am **Grad** **Isolation and Functional Characterization of Novel Root-Specific Promoters in Sunflower**

*Jacob Murphy, Yordan Yordanov [Eastern Illinois University]

Sunflower (*Helianthus annuus* L.) oil is an important component of a large number of cosmetic and food products. The success of genetically modified (GM) plants is often dependent on proper temporal and spatial expression of transgenes. The incorporation of tissue-specific promoters to regulate transgene expression may reduce adverse pleiotropic effects. Identification of tissue-specific promoters in sunflower would be valuable for the genetic modification of sunflowers and other plants. RNA sequencing (RNA seq) is used to identify differential gene expression within a sample. RNA seq data can be used to identify genes with tissue-specific expression by assembling data from multiple tissues. We compiled publicly available sunflower RNA seq data from various tissues and organs to produce a dataset that is representative of the entire plant. The selected tissues include seed, cotyledon, stem, root, trichome, leaf, flower bud, bract, ray floret (RF) ovary, disc floret (DF) ovary, DF-corolla, style, RF-ligule, stamen, and pollen. These data were aligned with the *Helianthus annuus* XRQr2.0 mRNA sequence and quantified. Abundance data were analyzed using Pavlidis Template Matching (PTM) with Bonferroni corrected threshold p-value to identify 49 genes with root-specific expression. Of these 49 genes, eight showed high expression in all root samples regardless of treatment. The 2.5kbp promoters of 6 of these highly root-specific genes were successfully cloned. These promoters contain the root-specific *cis*-regulatory elements ROOTMOTIFTAPOX1 and MYBCORE. The promoters were fused with the GUSPlus reporter gene and mobilized in *Agrobacterium tumefaciens* for transformation of tobacco (*Nicotiana tabacum* L). Functional characterization of the promoters will be achieved by histochemical and fluorometric analysis of GUSPlus expression in regenerated plantlets.

11:00am **Pink Milkwort (*Polygala incarnata*) Conservation Status and Ecological Questions**

*Susan McIntyre [Illinois Native Plant Society]

Pink milkwort (*Polygala incarnata*) is a state endangered annual plant that has declined significantly over the past 150 years. It was rated as a priority species of concern by the IDNR due to a lack of recent surveys for most of the nine remaining occurrence records (EORs). In 2021, I conducted a statewide survey of the EORs as well as several historic or potential sites and found only two populations in Illinois. I also investigated sites in neighboring states. Based on these investigations, I determined that the "Endangered" status was warranted for Illinois and that reintroductions may be possible, but many ecological questions should first be addressed. I will discuss the results of my surveys and some of the questions that I hope to begin answering this year, including

insect associates (do they have pollinators?), methods of seed dispersal (are ants necessary?), seeding in restorations (can we improve germination?), and microhabitat requirements (what role does soil or microclimate play?), as well as other questions that can be future lines of research.

CELLULAR, MOLECULAR, & DEVELOPMENTAL BIOLOGY

8:20am **UG**

Associations between Interferon Gamma (IFN-y) Levels and Ivermectin Treatment on Avian Malarial Parasite Loads

*[1]Jenna Thelan, [1]Travis E. Wilcoxen, [2]Beth Chan, [2]Jacques T. Nuzzo, [2]Jane Seitz [[1]Millikin University; [2]Illinois Raptor Center]

The role of interferon gamma (IFN-y) in coordinating immune responses within avian species is not well understood. Specifically, the IFN-y contribution to the immune response to malaria, an intracellular parasitic infection, is unknown. Additionally, ivermectin is a widely accepted endectocide, but its effect on intracellular parasitism in avian species is underrepresented. Paired blood smear samples from avian raptor species located at the Illinois Raptor Center (IRC) were analyzed in addition with enzyme-linked immunosorbent assays to determine the relationship between IFN-y and avian malarial parasite load. Furthermore, ivermectin was used in a four-group blind study to observe its effect on intracellular parasite load. Contrary to what has been discovered in other mammalian species, we did not observe a significant relationship between IFN-y and avian malarial parasite load. Ivermectin, however, did significantly reduce intracellular parasite load. Furthermore, reducing parasite load did not have an effect on IFN-y levels, however, we did observe a time-dependent influence on IFN-y levels between admission and release samples that was not dependent on ivermectin; avian IFN-y levels were significantly higher at the time of release. Plasma corticosterone had a significant negative correlation with plasma IFN-y levels. Overall, our results indicate that the primary immune response towards malaria in avian species is likely not coordinated by IFN-y, but ivermectin is effective at reducing intracellular parasites, and has more potential use in a broader range of infections for various host species.

8:40am **Grad**

Anti-Cancer Activity of Morel Mushroom (*Morchella esculenta*) Extracts in Ovarian Cancer Cells

*Damilola Lawore, Mette Soendergaard [Western Illinois University]

Morel mushroom (*Morchella esculenta)* is an edible mushroom found all over the world. Studies have shown that the mycelia and fruiting bodies of *M. esculenta* exhibit anti-cancer activity in certain cell lines. Here, the anti-cancer effects of morel mushroom extracts in ovarian adenocarcinoma (SKOV-3) cells were investigated.

Wild yellow and grey *M. esculenta* fruiting bodies were harvested from Illinois in the spring of 2019, freeze-dried, and then ground into powders. Next, mushroom materials were extracted thrice using ethanol, methanol, and water for 24 h. Extracts were evaporated overnight at 50ºC and then resuspended in dimethyl sulfoxide (DMSO) to a final concentration of 20 mg/mL. Cell viability was determined using the 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay. The results indicated that all of the morel extracts significantly ($p< 0.001$) reduced the cell viability when compared to DMSO (negative control). The cytotoxic effect was determined using a propidium iodide (PI) assay. The results showed a significant ($p< 0.001$) increase in fluorescence of all the extracts when compared to DMSO indicating that the morel extracts are cytotoxic to SKOV-3 cells. Finally, to determine the potency of each extract, the half-maximal inhibitory concentration (IC_{50}) was determined using the MTT assay. The IC_{50} values were determined to be 11.78 (9.10-14.64), 6.80 (4.79-8.98), 11.73(8.98-14.65), 8.71 (6.84-10.71), 9.70 (8.43-11.07), 5.40 (4.80-6.07) mg/mL (95% confidence interval: CI) for yellow ethanol, grey ethanol, yellow methanol, grey methanol, yellow water, and grey water, respectively.

These results indicate that extracts of the *Morchella esculenta* exhibit anti-proliferative and cytotoxic effects that may be used in the treatment of ovarian cancer.

9:00am **UG**

Disruption of an Essential Protein in *E. coli* Using Peptide Fragments

*Kevin Marcus, Gwendowlyn S. Knapp [Illinois College]

The quaternary structure of proteins is essential for function of the protein and survival of an organism. We hypothesized that disruption of these interactions with protein fragments could yield new drug targets for antimicrobial therapeutics. PanB was chosen because it is a homopentameric protein and has been shown to be essential for pantothenate (vitamin B5) biosynthesis. Disruption of the *pan*B gene in both *E. coli* and *M. tuberculosis* results in bacteria that are unable to grow without pantothenate supplementation in the media. A previous study suggested a fragment containing amino acids 26-136 was sufficient for oligomerization. This fragment was called an interacting sequence tag, or IST. We hypothesized that by overexpressing the IST in a

negative-dominant assay, the native PanB structure could be poisoned, and we have tested this hypothesis using an arabinose-inducible system in *E. coli.*

9:20am UG **Therapeutic Compound Efficacies on Cognitive Function in Transgenic *Caenorhabditis elegans***

*Nicholas Canton, Anne Rodriguez [Millikin University]

Learning and memory are the result of the constant modifications of binding proteins occurring within synapses in the hippocampus. Genetics and Chemistry are being used to explain the cellular and molecular mechanisms that occur in these processes. *Caenorhabditis elegans* a simpler model of neural networks were used to study the effects of Ethanol, Dimethyl sulfoxide (DMSO), and Tryptophan peptides on mutant *C. elegans* via touch habituation. *C. elegans* strains such as N2 Wild Type, OSM, CL2355, CF2805, JPS845, and JPS809 were investigated. Mutations consisted of pan-neuronal expression of Amyloid beta peptides, removal of four different dopamine receptors, and the expression of human APP transgene, respectively. 50ul of DMSO, Ethanol, and tryptophan peptide solutions were added to each petri dish. All strains had significantly increased the number of touches when exposed to ethanol, supporting that ethanol greatly inhibits learning and memory. OSM and CL2355 showed a decrease in touch responses when exposed to DMSO, all other strains had similar results to the control. Tryptophan dipeptides (WW), tripeptides (WWW), and tetrapeptides (WWWW) showed to improve exponentially the learning ability of all *C. elegans* strains, suggesting learning improved in the presence of these peptides.

10:20am UG **Identification of the Photosensitive Protein(s) in *Stentor coeruleus***

*Victoria Johnson, Mark Slabodnick [Knox College]

As humans, we are accustomed to seeing with our eyes; however, there are a number of organisms that detect and respond to light without any organ specialized for this task. The giant, blue-green ciliate *Stentor coeruleus* has caught researchers' attention due to its size, regenerative abilities, complex behaviors, and photosensitivity. Although how *S. coeruleus* can sense and respond to light is not yet understood, the pigment responsible for the blue-green color in *S. coeruleus*, called stentorin, has been suspected to play a role in this cellular mechanism. Research has revealed that this pigment may be coupled with a protein(s), and this complex is thought to be housed in the pigment granules localized to the cellular cortex. The goal of this research project is to associate gene(s) with the protein(s) found within these pigment granules in order to better understand the phototransduction mechanism of *S. coeruleus*. Native PAGE was used to crudely isolate the pigment granules that house the unknown protein(s). Four candidate genes were identified utilizing mass spectrometry analysis. We then used RNA interference to silence the expression of these genes, and novel behavioral analyses were performed to analyze defects in *S. coeruleus*'s step-up photosensitive abilities and phototactic tendencies. Investigating the contribution of these proteins to *Stentor*'s behavior has the potential to enhance our comprehension of the various ways that organisms can detect and respond to light stimuli.

10:40pm Grad ***Helianthus eggertii* Regeneration and Transformation Efficiency among 19 Lines**

*Owen West [Eastern Illinois University]

The Sunflower (*Helianthus annuus L.*) is a commercially important oil seed crop, that is subject to biotic and abiotic stresses. Other seed oil crops such as corn, and soy use transgenics to combat and study these stresses. In contrast, sunflower to date has few gene functional studies using transgenics and no commercially available transgenic varieties. Plant regeneration is essential part for producing transgenic plants. Many wild relatives of the sunflower are easy to cultivate in tissue culture with high levels of regeneration while also being possess many genes for resistances. Previous studies indicate that the wild species *Helianthus eggertii* possesses high regeneration capacity. To study this trait, we introduced *in vitro* 19 lines from 10 different accessions of this wild species. We observed variation in the regeneration of different lines and accessions. About one third of tested lines showed good to high rates of regeneration. Transformation efficacy of these lines was tested by co-cultivating for two days on regeneration media of leaf segments with different Agrobacterium strains containing β-glucuronidase (GUS) transgene and the expression of GUS was observed. As a control tobacco and cultivated sunflower leaf segments were used together with *H. eggertii* leaf segments from one of the highly regenerative lines. All tested agrobacterium strains show efficient transformation in tobacco, most were able to transform cultivated sunflower, but only one chrysopine strain shows transformation in *H. eggertii*. Using this strain, we tested the transformation capacity of all the available *H. eggertii* lines in tissue culture and identified variation between lines uncorrelated with the regeneration capacity. Third generation sequencing will be used in a time series experiment to study differentially expressed genes during regeneration. Further direction will be to identify and clone genes involved in regeneration of the wild sunflower species *Helianthus eggerti* to better understand regeneration and transformation.

11:00am UG **Investigating the Function of Novel Planarian Genes**

*Hannah Bowers, Kailynne Cruthis, Peyton Jeckstadt, Michelle Lynch, Taylor Pierce, Amy Winn [Southern Illinois University Edwardsville]

The planarian *Schmidtea mediterranea* is a popular model species for the study of stem cells and regeneration. They owe their impressive ability to regenerate any part of the body to a pool of adult stem cells, called neoblasts, that make up roughly 20-35% of their cell number. Many of the molecular pathways and genes that regulate stem cell maintenance and differentiation in planarians are evolutionarily conserved; however, a substantial number of genes known to be expressed in the worms have no clear homology outside of closely related species, and others are homologous to genes that have not yet been characterized in any model species. Because most planarian researchers choose the genes they will study by working backwards, finding the planarian homolog of a known stem cell regulator and seeing how it works in worms, many of these gene may go overlooked. Starting from a list of all 32615 planarian genes from the *Schmidtea mediterranea* Genome Database (SmedGD, we filtered down to those that are expressed with a transcript length greater than 1000nt, based on published RNAseq data, and where the annotated function was listed as "cannot determine". We used the remaining 2789 genes as queries in the program BLAST2GO to identify their homologs in other species. We were interested in those that had no hits with an e-value cutoff of 0.001 (905 genes) and those where the top homologs were described using terms like "hypothetical", "expressed conserved protein", or "predicted uncharacterized protein" (260 genes). We are currently cloning a subset of genes from these lists to perform knockdown experiments assessing their function.

CHEMISTRY

11:20am Grad **A Rapid Method to Measure Exogenous Gamma-Hydroxybutric Acid in Beer for Drug Facilitated Sexual Assault Investigation Using (HILIC-ESI/MS/MS)**

*[1]Abdullah Rubayyi, [2]Liguo Song [[1]North Dakota State University; [2]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 (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 µg/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.

COMPUTER SCIENCE

10:20am **Analysis of Security Vulnerabilities of WebRTC**

*Dennis McMeekan, Binto George, Nilanjan Sen, Chunying Zhao [Western Illinois University]

The importance of real-time communication in the present world is irrefutable. Its usage had gradually increased in the pre-Covid era. However, the Covid-19 pandemic has impelled us to utilize this alternative way of communication more in obligatory self-isolated life due to the demanding situations such as work-from-home, online classes, telehealth, and even entertainment. Many survey results show a massive surge in the usage of online video conferencing apps such as Zoom, Google Meet, and Microsoft Teams during 2020-2021. In recent years, Web Real-Time Communication (WebRTC) based applications have gained popularity for real-time communication between two or more peers. WebRTC allows real-time video communications through a web application without extra installations. This specification provides immense advantages to web developers across the world. However, some limitations in WebRTC make such applications vulnerable to eavesdroppers. The main

focus of this work is to investigate the security vulnerabilities of WebRTC and mitigate these issues. To explore the vulnerabilities, we have conducted a study to look further into possible security flaws with WebRTC using real-life applications. Specifically, we focused on exploring confidentiality violations through covert channels and mitigating IP leaks through a distributed hash table server. We built two prototypes using open-source projects: an unsecure prototype that establishes covert channels, and a secure prototype which mitigates covert channels with a series of delays. The results showed that WebRTC API could be exploited for covert signaling between pairs without significant reduction in video quality. Two mitigation mechanisms we experimented with can effectively mitigate exfiltration through covert channels in specific circumstances.

10:40am UG **AI Mid-Air Gesture Authentication for Mobile Devices**

*David Salazar, Zheng Huang [Illinois College]

In our daily lives, many different gestures are used to help each other to understand different intentions. For example, waving/pointing in a different direction could be used to direct traffic in a busy intersection. With the rapid development of AI image recognition, more and more Gesture-based digital commands are introduced into different areas, such as mid-air gestures to help the drivers to operate without distraction. However, some gestures are only meaningful or unique to a specific group of individuals (e.g., people who have hearing impairments). Inspired by exclusive gestures, we propose a new gesture-based authentication approach to help users to authenticate efficiently and smoothly to adapt to the uniqueness of mid-air gestures. This approach aims to effectively prevent the common attacks of current authentication (i.e., Shoulder Surfing, Smudge Attacks, and Reliability on high-end authentication).

ENGINEERING & TECHNOLOGY

11:00am Grad **Impact of Supply Chain 4.0**

*Yun Jia, Jaby Mohammed [Illinois State University]

The supply chain plays a vital role in contemporary business and affects everyone's daily lives. Since the production process from planning to delivery contains many control points, making the process more efficient but the lower cost has been a hot topic in the supply chain field. With this purpose, people in the supply chain constantly optimize processes and apply advanced technologies. This presentation discusses how supply chain 4.0 would predict bottlenecks early enough to avoid shortcomings.

Traditional supply chain focuses on the global supply chain perspective from production, inventory control, transportation, tools, and resources in the real-world business by a flow chart. In contrast, supply chain 4.0 will be introduced and compared with the traditional supply chain from different angles or aspects. Currently, the global supply chain faces significant challenges because of Covid. Supplies and materials in the markets appeared to be the situation of the inventory shortage and rising prices, which means products supply problems and logistics problems. Although traditional supply chain analysis can analyze all the problems, supply chain 4.0 will provide a more efficient flow using IoT and big data. Supply chain 4.0 integrates information resources, provides high analysis efficiency and helps companies to make decisions ahead when the consuming market appears turbulent, making the decisions of expediting the production or changing production plan. With the promotion of supply chain 4.0, the evolution of the supply chain will be accelerated and deepened in decades. At the same time, the supply chain field can work together with other departments and industries to become an essential role of Industry 4.0. With the development of industry, supply chain 4.0 does have strong upward momentum in the future.

11:20am Grad **Improving Project Budget Forecasting by Using Artificial Intelligence**

*Mona Fazel Sarjoui, Jabby Mohammed [Illinois State University]

During the past decades, millions of projects have been defined in the developed and emerging economies. As a result of this high demand, project management skills, tools and techniques has been growing at a high pace in different aspects. Managing project costs is one of the most critical aspects and concerns in every project which is aimed to minimize the variance between the planned budgeted cost and the actual spent cost on project activities. Therefore, having and accurate cost planning, control and monitoring model would assist the projects with managing costs. There are several methods for planning the project costs which are mainly categorized as project budgeting methods such as parametric estimating, bottom up, top down, historical data based on at completion cost for similar projects) and three-point estimates. The above-mentioned methods include human bias as well as lacking high level of accuracy in generating results and predicting project costs, the more accurate the results are, the less our cost variance will be. As a result, it is required to utilize other tools and techniques to achieve more accurate results. Machine learning and (Artificial Intelligence) is one of the tools that enables the leveraging and

analyzing of the historical and real-time data by generally delivering faster and more accurate results. In this paper we are addressing the application of machine learning in predicting projects budget more accurately. The techniques are combined with statistical regression analysis to increase the accuracy of outcomes. Categorized historical data of previous "Forecasted Budgets" as well as "Actual spent costs" have been used as inputs to facilitate the machine learning process. AI will play a significant role in delivering accurate and in time results and could be a perfect tool for assisting the project managers in planning and monitoring the financial aspects of their projects.

ENVIRONMENTAL SCIENCE

8:00am **UG** **Characteristics of Microplastic Contamination Agricultural and Wetland Areas**

*Jessi Kreder, Laura M. Zimmerman [Millikin University]

Plastic production and consumption have become a common aspect of everyday life for many countries around the world and has led to a dramatic increase in microplastic pollution. Microplastics are small pieces of plastic, usually defined as pieces less than 1-5 mm and can be placed into three different categories: fibres, fragments, and beads. Although microplastics are a known pollutant in aquatic areas, information surrounding microplastic pollution in terrestrial areas is scarce. For the purpose of furthering knowledge on microplastic contamination in soil, during this experiment, density separation was used to extract microplastics from agriculture wetlands and floodplain wetlands and quantified. Soil samples were collected from the floodplain and three wetlands located on the Franklin Research and Demonstration Farm in Lexington, IL. After testing, it was found that larger microplastic were, in total, higher in concentration in each sample location. Additionally, the three samples from the floodplain samples contained more microplastics than the three wetland samples. By furthering research of microplastic pollution, we may one day be able to apply our knowledge to understanding microplastic pollution in affected environments and how it affects organisms and ecosystems. Due to little research involving microplastic pollution, this project can aid us in understanding microplastic contamination in various areas.

8:20am **Bioaccumulation of Selenium, Cadmium, and Mercury in Chicken Eggs of Different Production Systems and Their Interactions in Toxicity**

Zhi-Qing Lin, Ali Zeinali, Jonathon Majka, Akinloye Emmanu Ojewole [Southern Illinois University Edwardsville]

Selenium is an important nutrient for human health. Selenium deficiency has many complications. Chicken eggs are major sources of dietary selenium (Se) intake. Americans consume approximately 99 billion eggs each year. The eggs produced in North America are primarily through three ways including free-range, cage-free and conventional caged systems. This study collected eggs of different brands from supermarkets in the US Midwest. Concentrations of Se and toxic cadmium (Cd) and mercury (Hg) accumulated in egg tissues were determined and their elemental interactions for potential mitigation of toxic heavy metals have been explored. Results show that egg yolk contained significantly higher concentrations of Se (797.1±109.7 ng/g) than egg white (154.1±27.6 ng/g) or egg shell (180.7±23.0 ng/g). There was no significant difference ($p>0.05$) in Se accumulation between egg white and shell tissues. Different egg production systems do not show significant differences ($p>0.05$) in Se accumulation in egg tissues, and also no statistically significant difference ($p>0.05$) in Se concentration between brown and white eggs that were produced from the same free-range system. The majority of egg samples did not contain detectable concentrations (<0.1 ng/g) of Cd and Hg, except for few free-range eggs containing Cd of 0.17 ng/g and 1.11 ng/g in white and yolk, respectively, while 0.08 ng/g and 0.44 ng/g with Hg. High molar ratios of Se to Cd (>22) and Hg (>629) were observed in the egg tissues, suggesting that Cd and Hg contamination in free-range eggs would not result in significant toxic impacts on human health due to the formation of stable Se-metal complex.

8:40am **Evaluating Historic Records of Prairie-Dependent Insect Species of Greatest Conservation Need in Illinois**

*Abby Pagels, Valeria Trivellone, David N. Zaya, Thomas J. Benson, Christopher H. Dietrich, Brenda Molano-Flores [University of Illinois]

Insects are one of the largest components of biodiversity in the world, they are integral to all terrestrial food webs, and they perform crucial ecosystem services (e.g., pollination). Although some charismatic species, such as monarch butterflies (*Danaus plexippus*), have increased public awareness regarding the decline of insects, we lack sufficient information about most species to be able to assess their status and make meaningful conservation decisions. During a three-year project (2020-2022), we focused on a subset of 9 species, 2 leafhoppers

(Hemiptera) and 7 butterflies or moths (Lepidoptera), to provide basic information that can aid to define conservation and management strategies for conservation-priority insects in Illinois. We summarized existing collections with historic records to select sites and conduct additional surveys to update the present status and distribution of the selected species. In 2020, a total of 62 sites were inspected with 52 of them sampled to confirm the presence of the target species and habitat suitability. For the two leafhopper species (*Aflexia rubranura* and *Athysanella incongrua*) we found historic data is sparse, temporally scattered and does not allow for detailed evaluation, however we selected additional sites to inspect to gain further insight on the status of these species. For most of the Lepidopteran species (*Calephelis muticum*, *Hesperia metea*, *Hesperia ottoe*, *Lycaeides melissa samuelis*, and *Speyeria idalia*) we found a general decline of populations within the last decade or two. The data collected by this project is providing new information to land managers and policy makers in the form of updated distribution maps of historic and new localities for these species of concern. Our next steps are to use the current distribution to examine potential influences of management practices, assess restoration sites as suitable habitat and conduct conservation assessments to provide recommendations for species of greatest conservation concern in Illinois.

9:00am **Grad** **Comparison of Pollinator Behaviors and Reproductive Success for *Monarda fistulosa* in Native/Restored Prairies and Urban Gardens**

*[1]Cora Wessman, [2]Janice Coons, [3]Brenda Molano-Flores
[[1]University of Illinois Urbana-Champaign; [2]Eastern Illinois University; [3]University of Illinois]

Native prairies are an increasingly rare ecosystem, being replaced by urban development or farmland. Though prairie restorations are being developed to mitigate this habitat loss, it is unclear whether these areas have similar pollinator behavior and abundance as native prairies. In this study we investigated how pollinators may be affected by native, restored, and urban plant environments by focusing on *Monarda fistulosa* L. (Wild Bergamot, Lamiaceae) populations at each site classification. A total of 15 sites (5 per site classification) were used for the study in central Illinois. Pollinator behavior and abundance were examined through pollinator counts as well as through evaluating pollinator movement using florescent dye to track movement of pollen. Pollinators were classified into functional groups (e.g., bees, butterflies, flies, etc.). Additionally, pollen loads and seed sets were calculated to measure reproductive success at each site for *Monarda fistulosa*. A total of 139, 191, and 258 pollinators were found in native, restored, and urban site, respectively. Bees were the most abundant group of pollinators visiting *Monarda fistulosa.* Also, pollinator movement based on florescent dye ranged from 1m to 57m across the sites. Significant differences were found among the pollinator visitations and reproductive success at all site types, with urban sites having significantly more pollinator visitors as well as higher seed set than native and restored sites. These differences indicate that urban environments provide suitable habitat for pollinators. Urban landowners should be encouraged to plant native species such as *Monarda fistulosa* to support pollinator habitats and the resources they provide (i.e., pollen and nectar).

9:20am **Grad** **Effects of Mycorrhizal Inoculations on Conservative Prairie Plant Establishment**

*[1]Joseph Krischon [University of Illinois Urbana-Champaign]

Ecological restoration projects are increasingly employing the use of commercially available mycorrhizal inoculants. Commercially available mycorrhizal inoculants typically represent one or several species of well-studied associative fungi whereas naturally occurring microbial communities in prairie remnants contain more complex and less studied assemblages of microbes that may benefit long-term plant community stability. A field experiment was set up to determine if any differences could be observed in conservative prairie plant species germination and establishment between commercially inoculated plots and plots inoculated with soil from remnant prairies. One-meter squared field plots were treated with commercial inoculant or remnant prairie soil or no treatment (control). Replication occurred five times for each treatment. Each plot was seeded with a conservative prairie plant seed mix designed to germinate during the warm season without pre-stratification. Prior to plot establishment, plots were treated with non-selective herbicide in order to deplete the legacy seed bank. Every week plot surveys were conducted to detect species emergence. Additionally, for *Verbena hastata* aboveground biomass and percent cover were collected per plot to examine whether treatments increased vigor. For each plot, species richness, FQI, and mean C value were generated. Overall, no significant differences were found among treatments for species richness, FQI, and mean C value. A similar result was found for *Verbena hastata* aboveground biomass and percent cover. Although many studies indicate that mycorrhizal inoculants contribute to increased plant vigor and growth, this study did not for any inoculation type studied. It is possible that the impact of the persistent legacy seed banks within the plots may have been disruptive to the integrities of each treatment type.

9:40am **Impacts of Short-Term Ivermectin Exposures in Fruit Flies**

*[1]Kyong Yoon, [1]M. Yusuf Ali, [1]Carl K. Namini, [1]Noah Parks, [2]Yooheon Park, [3]John M. Clark, [4]Barry R. Pittendrigh, [5]Si H. Lee [[1]Southern Illinois University Edwardsville; [2]Dongguk University; [3]University of Massachusetts-Amherst; [4]Purdue University; [5]Seoul National University]

The short-term ivermectin (IVM) exposures elicited behavioral, biochemical, and molecular biological changes in wild-type female fruit flies. Exposures to the six different concentrations of IVM (1×10^{-6} to 1×10^{-1} %) for equal to or shorter than 12 hr durations were determined to be the most desired conditions for downstream investigations to assess impacts of the short-term IVM exposures in female fruit flies. Under these conditions, all female flies produced significantly higher levels of hydroxyl radicals and MDA in their ovaries when compared to those produced in ovaries obtained from the respective control females received no IVM treatments (ANOVA, $p < 0.05$). Additionally, female flies exhibited significantly increased DNA damages in their ovaries in an ivermectin concentration dependent manner (ANOVA, $p < 0.05$). Despite the negative impacts described above, the mean percent hatchability values obtained from the eggs oviposited by the IVM exposed female flies were not statistically different when compared to the respective mean value obtained from the unexposed female flies (ANOVA, $p > 0.05$). Two concentrations (1×10^{-4} and 1×10^{-3} %) of IVM were selected for the transgenerational short-term IVM exposures. F1, F2 and F8 flies transgenerationally exposed to IVM showed significantly delayed developments (2.5-3.2, 2.5-3.0, and 0.9-1.3 days delayed, respectively) when compared to that of unexposed flies (ANOVA, $p < 0.05$). Female flies from F5, F11 and F17 showed significantly delayed IVM-induced sluggish behaviors (c^2 test, $p < 0.05$).

10:20am **UG** **The Effect of Prescribed Burns on Bat Activity and Species Composition in Riparian and Upland Habitats of Siloam Springs**

*[1]Myles Genrich, [1]Lauren Sgambelluri, [1]Bryan Arnold, [2]Ray Geroff [[1]Illinois College; [2]Illinois Department of Natural Resources]

A prescribed burn is a habitat management technique where the forest understory is routinely burned. Benefits of prescribed burns include removal of invasive and weedy species to promote the growth of native species. However, while prescribed burns benefit forest habitats in many ways, they also may lead to unintended consequences on wildlife, including bats. Given the decline of forest dwelling bat populations due to White Nose Syndrome, the impact of wind farms, and habitat degradation, the effects of prescribed burns on these species deserves more study. The purpose of this ongoing research project is to track bat activity throughout different areas of Siloam Springs State Park in Clayton, Illinois. The locations studied are forested upland and riparian habitats in areas that were burned in the calendar year of data collection or burned the previous year, and areas that have never been burned. Bat activity was measured acoustically using six recorders (Wildlife Acoustics SM4) with each recorder at a unique site in each burn or no-burn habitat. Every two weeks, recordings were collected and analyzed, and the recorders were moved to new sites in each burn category. The data collected were analyzed using Kaleidoscope Pro 5 software to determine bat passes per two-week period as well as identifying the echolocation calls to species, depending on the quality of the recording. Each recording file was individually examined to ensure that all bat passes, and species identifications were recorded correctly by the automated software. Our preliminary results indicate that bat activity increases in burned areas, potentially due to the opening of flight corridors and increased prey density, although it will require further study to examine these hypotheses.

10:40am **UG** **Seed and Biomass Production of *Ocimum basilicum* (Basil) Grown in Horizontal and Vertical Garden Systems and the Integration of the Companion Plant *Aster novae-angliae* (Pink Chiffon Aster)**

*[1]Brooke Prater, [2]Mark Woolbright, [1]Bill Retzlaff [[1]Southern Illinois University Edwardsville; [2]Verdtech, Inc.]

The spread of urbanization has resulted in many environmental issues within communities. By implementing living architecture in urban communities, such as green wall and green roof systems, we may counteract the consequences of urban environmental issues (Cortês et al. 2021). In this experiment, we observed the difference in seed and biomass production of *Ocimum basilicum*, commonly known as Basil, between vertical gardening systems and horizontal gardening systems. Companion planting may be used to increase garden yields by promoting cross pollination (Griffiths-Lee et al. 2020), so we also evaluated how the seed and biomass production of *O. basilicum* in vertical and horizontal systems were affected by the integration of the pollinator attracting plant *Aster novae-angliae*, commonly known as Pink Chiffon Aster. Horizontal gardens have a greater average *O. basilicum* aboveground biomass compared to vertical gardens in integrated (4.0 grams vs. 2.2 grams) and monoculture (3.2 grams vs. 2.2 grams) systems. There was no difference between average *O. basilicum* seed count or average *O. basilicum* seed weight between horizontal and vertical systems (64.8, 0.31g vs. 56.6, 0.34g).

There was also no difference in average seed count between monoculture and integrated systems (59.2 vs. 62.2), but integrated systems do have a greater average *O. basilicum* seed mass than monoculture systems (0.62g vs. 0.03g). Vertical garden systems remain a good alternative to use in urban areas where ground space for living architecture is limited.

11:00am Grad **Effects of Fish Age and Growth on Accumulation and Interaction of Selenium and Toxic Metals in Asian Carps in the Lower Illinois River**

*Akinloye Emmanuel Ojewole, Paul Brunkow, Zhi-Qing Lin [Southern Illinois University Edwardsville]

Concentrations of As, Cd, Hg, Se, and Zn in scale, skin, gill, muscle, liver, kidney, heart, and brain tissues of silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*H. nobilis*) of different ages from the Lower Illinois River were determined. Metal concentrations (μg/g FW) in different fish tissues ranged 0.002-0.06 for As, 0.002-0.07 for Hg, 0.38-2.75 for Se, and 4.15-57.69 for Zn, but the Cd concentration varied from undetectable (<0.1 ng/g) in muscle to 0.42 μg/g in kidney. The Se and Zn concentrations in muscle were lower than in the other tissues of both species, while concentrations of toxic Hg and As in muscle were higher than their concentrations in the other tissues. The bioconcentrations of Hg in bighead carp were significantly higher than those in silver carp. Overall, concentrations of Se, As, Hg, and Zn in muscle tissues of two carp species were positively correlated with age, total length, and fresh weight. The molar ratios of Se to Hg in muscle tissues decreased with increasing age, total length, and fresh weight, but no significant changes with the Se-As molar ratio. Concentrations of As, Hg, and Zn in muscle tissues of silver and bighead carps were below the WHO-recommended accumulation limits.

11:20am UG **The Use of Automated Passive Recorders to Examine how Abiotic Factors Including Temperature, Humidity, and Barometric Pressure Affect Bat Activity**

*Lauren Sgambelluri, Bryan Arnold [Illinois College]

Many biotic and abiotic factors can influence bat activity - environmental conditions, prey activity, time of year, and time of day. Specifically, previous studies suggest that forest bat activity increases with an increase in temperature and peaks at 20-30 degrees celsius. However, high temperature fluctuations may result in decreased activity. In addition, studies show a general pattern of seasonal variation in bat activity, with the highest levels of activity in August and September, although on a nightly basis, activity can vary by species. Previous studies show inconsistent patterns, however, for the effects of humidity and barometric pressure - some suggesting a positive correlation between these factors and bat activity and others suggesting no correlation. As part of an ongoing research project investigating the effect of prescribed burns on bat activity which began in 2019, this study aims to investigate the effects of environmental conditions on forest bat activity using passive acoustic recorders placed in both upland and riparian habitats in Siloam Springs State Park in Clayton Illinois. Humidity, temperature, and barometric pressure were recorded in 10 minute intervals using a Kestrel data logger attached to each recorder (Wildlife Acoustics SM4). Recordings were analyzed using Kaleidoscope Pro 5 software to determine bat passes per two-week period as well as identifying the echolocation calls to species, depending on the quality of the recording. Preliminary results suggest a positive correlation between bat activity and temperature and bat activity and barometric pressure although these findings are influenced by recording site and will be further studied to look at species specific trends.

11:40am **Survival of Fishes in a Stormwater Retention Pond at the Watershed Nature Center, Edwardsville, Illinois**

*Manuel Gomez, Sharon Locke, Richard Brugam [Southern Illinois University Edwardsville]

A study of the Upper Pond at the Edwardsville Watershed Nature Center (WNC) was conducted to discover the potential cause of fish kills in the small stormwater retention pond and to determine how the current populations of bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), common carp (*Cyprinus carpio*) and largemouth bass (*Micropterus salmoides*) can survive in the pond based on prevailing environmental conditions. Dissolved oxygen (DO) was measured from June 19 to December 5, 2019 in the center of the open lake (4 m deep) and from a dock near the shore (1.1 m deep). Water temperature was measured intermittently at both sites from June 19 to November 4. In the open lake, oxygen levels reached a peak of 11.6 mg/L at the surface on July 2. Below 2.5 m DO remained less than 1.5 mg/L until Oct. 8 when it slowly began to rise reaching a high of 10.8 on Nov. 20. The dock station had similar oxygen levels. Temperature varied from a high of 31.2 °C on July 21 to a low of 6.5° C on November 3. The low DO in the pond results from a nearly continuous cover of duckweed (*Lemna* sps) which prevents interchange of oxygen with the atmosphere. It is likely that the low oxygen levels select for fish species that are physiologically and behaviorally capable of surviving hypoxia.

HEALTH SCIENCES

11:40am UG **The Effect of Vitamin B12 (Methylcobalamin) on the Innate and Adaptive immunity of Cuban Tree Frog (*Osteopilus septentrionalis*) Tadpoles**

*Hannah Warfel, Travis E. Wilcoxen [Millikin University]

Vitamin B12 is a micronutrient required by a variety of organisms for healthy cellular functioning. In spite of the systemic effects observed in cases of B12 deficiency, little is known about how vitamin B12 affects immune health. In this study, we tested how supplementing an algae-only diet with B12 affects the innate and adaptive immunity of Cuban tree frog (*Osteopilus septentrionalis*) tadpoles. We found that innate immunity, as measured by a bacterial killing assay, was significantly more robust in B12-fed tadpoles than control tadpoles, but no significant differences were found in natural antibody production or hematocrit between groups. Adaptive immunity, as measured by *Aeromonas hydrophila*-specific IgY antibodies, was significantly greater in tadpoles challenged with *A. hydrophila* and supplemented with B12 than in control tadpoles, those only challenged with *A. hydrophila*, and those only given B12.

MICROBIOLOGY

11:20am UG **Prevalence of *Toxoplasma gondii* in Birds of Prey Admitted for Rehabilitation**

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

Toxoplasma gondii is an obligate 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. We analyzed samples from 440 birds of 8 species, with an overall prevalence of 20.2%. There is much variation in prevalence among species, with species for which rodents are the primary food source having the greatest prevalence.

11:40am UG **Antibiotic Resistance in Soil of Central Illinois**

*Emily Baalman, Mikaela Kalaskie, Gwendowlyn S. Knapp [Illinois College]

The misuse of antibiotics in both clinical and agricultural settings has contributed to the global spread of multidrug-resistant (MDR) bacteria. MDR bacteria are wide-spread and identifying specifically where MDR bacteria live in the environment, as well as developing new treatments are both important to tackling the MDR problem. We have been working to survey the local environment for antibiotic resistance, as well as identifying microbes that can produce potentially new antimicrobials.

Soil samples were collected over time from the Meredosia National Wildlife Refuge and various local agriculture sites and the level of resistance to medically relevant antibiotics was determined. It was concluded that antibiotic resistance is present at each site, whether or not there is direct human contact. Kirby-Bauer assays suggest that a subset are MDR-bacteria.

Antibiotics come from many sources such as soil bacteria and fungi. To identify potential new sources of antibiotics, unknown strains of bacteria isolated from environmental samples were tested for the ability to inhibit growth against the ESKAPE pathogens and several antimicrobial producing strains isolated. We are currently working to identify the strains using classical microbiological techniques, as well as 16s rRNA sequencing.

PHYSICS, MATHEMATICS, & ASTRONOMY

8:00am Grad **Simulation of Quantum Error Correction for Encoded Single Qubits**

*Pradip Bhattarai, Kishor Kapale [Western Illinois University]

Quantum error correction (QEC) will be a vital element of quantum information processing systems of the future. The current quantum hardware does not contain enough qubits to implement full-fledge QEC. Quantum computation and communication require detection and correction of errors and to protect information against

unavoidable noise. Furthermore, direct measurement of quantum systems to detect errors is not possible as measurement causes irreversible change to the quantum system. Therefore, QEC protects information stored in qubits (two-level quantum systems) in a three-step process: (i) clever encoding of single logical qubit into multiple physical qubits, (ii) controlled operations on the ancilla qubits to detect errors in the main qubits, (iii) rectifying errors with operations conditioned on the outcome of measurements performed on the ancilla. For widespread applicability, it is important to eliminate the measurement and measurement-based error-correction logic. We developed error-correction logic using controlled operations on the main qubits based on the state of the ancilla without resorting to measurements. Thus, the circuit essentially offers automated error correction protocols. We tested the idea for a 7, and 9-qubit encoded circuit using IBM's quantum circuit development platform called qiskit. We used the simulator to test these error correction protocols. I will share the results of our findings and further outlook on tests on actual quantum hardware.

8:20am **Grad** **Physical and Optical Properties of Pr^{3+} and Dy^{3+} Doped Bismuth Boro-Tellurite Glasses**

*Alex Rahe, Saisudha B. Mallur, P.K. Babu [Western Illinois University]

We studied the effects of composition on various physical and optical properties of rare earth ion doped metal oxide glasses. Our glasses are made from a mixture of bismuth oxide [Bi_2O_3], boric oxide [B_2O_3], and oxides of tellurium [TeO_2], praseodymium [Pr_2O_3], and dysprosium [Dy_2O_3]. We varied the content of Dy_2O_3 as 0.5, 1.0, and 1.5 mol%. Samples are made by a process of melting, quenching, annealing, smoothing, and polishing. The sample densities are measured using a simple set up for Archimedes' principle. Refractive indices are measured using Brewster's Angle method. For samples containing 10% TeO_2, densities are in the range of 5.45-5.67 g/cm^3 while samples containing 20% TeO_2 are in the range of 5.75-5.86 g/cm^3. The refractive index varies from 2.06-2.36 for the 10% TeO_2 samples while the 20% samples show lower values in the range of 2.06-2.13. Finally, the fluorescence spectra were obtained using a Lambda Scientific (LEOI-101) modular muti-functional spectrometer by exciting the Pr^{3+} ions at 445nm. Some of the most interesting data comes from the excitation of Pr^{3+}. We observed fluorescence from Dy^{3+} ions at 576 nm caused by cross excitation from Pr^{3+} ion as the incident 445nm laser cannot excite Dy^{3+} ions directly. An increase in relative intensity of fluorescence of Dy^{3+} ions is observed with increase in the Dy^{3+}content. This observation clearly supports the idea of energy transfer from Pr^{3+} ions to Dy^{3+} ions.

8:40am **Grad** **Investigating the Spectral Energy Distribution of Young High-Mass Stellar Objects Using VLASS**

*Moreom Akter, E.D. Araya [Western Illinois University]

Spectral energy distribution (SED) is a plot of flux density (amount of radiation we get from a source) versus frequency, and it is a well-known tool to investigate the nature of astronomical sources, for instance, to determine whether they emit thermal or non-thermal radiation. Rosero et al. (2016) published a large survey for continuum radiation toward regions of high-mass star formation, including SED plots between 4.7 and 25 GHz. The objective of this project is to extend the SED plots of the Rosero et al. (2016) detections to lower frequencies (3 GHz) using data from VLASS, which is an all-sky survey being conducted with the Very Large Array (VLA) telescope in New Mexico. The method had two main components: 1) download the images of the different sources from the VLASS archive and use the Common Astronomy Software Application (CASA) package to measure flux densities or obtain upper limits; 2) develop Python code to generate and analyze SEDs of the sources. Images from 72 sources were downloaded, including sources from Rosero et al. (2016) and also from Purser et al. (2021), which is another radio continuum survey of high-mass star-forming regions. This presentation will summarize the current results of the project, including detections of sources not reported in Rosero et al. (2016) and changes in the SED trends at 3 GHz with respect to published results, which could be indicative of opacity effects and/or variability in the sources.

9:00am **Grad** **Computational and Visualization-Based Approaches to Study of Heterogeneous Traffic Systems**

Daniel Lel, Kishor T. Kapale, Michael Nsor [Western Illinois University]

The world population is growing every day, and the land mass remains constant. As a result of the popularity of private cars the urban traffic situation is getting more and more dire due to overcrowding of the existing roads. Traffic congestion and accidents are becoming increasingly serious problems in big cities all over the world.

The goal of this research is to assess the effects of self-driving vehicles on traffic conditions using agent-based modeling using the Net Logo system. Net Logo is a multi-agent programming language and cross platforms modelling environment for simulation of complex phenomena and is designed for both research and education. We built Net Logo models to allow us to vary parameters such as number of lanes, cars, and trucks. We use the

models to calculate mean speed, breaking and change of lane in the highways. We are working on adapting the computational model to allow for self-driving vehicles to attain increased speed in various conditions.

The merits of our models are the agent base aspect which allows us to observe the system behavior. The model is also flexible to poll data for different traffic condition in any part of the world.

9:20am Grad **Comparative Analysis of Search Algorithms for Automatic Gameplay of Two-Player Games**

*Md Arefur Rahman, Kishor T Kapale [Western Illinois University]

We are interested in the performance of search algorithms as AI gameplay agents for two-player quantum games, especially Quantum Chess. Before applying the search algorithms in the quantum domain, we wanted to study their advantages and disadvantages in the context of a simple classical game. Tic-tac-toe is a ubiquitous game that can be played on a piece of paper or in electronic formats. We have adapted two search algorithms for the game of tic-tac-toe: Minimax and Monte Carlo Tree Search (MCTS). We have verified that Minimax is a more effective algorithm than MCTS for a game with small search depth like tic-tac-toe. The MCTS algorithm has many knobs to turn to tune its effectiveness. To determine the optimized parameter range for the MCTS such that it compares well with the Minimax algorithm we carried out an extensive comparative analysis between Minimax and MCTS algorithm. We will describe our investigations and further applications to quantum games.

9:40am Grad **On Designing a Quantum Game: Quantum Connect 4**

*Al Masud, Kishor T Kapale, Antonio Cardenas-Haro [Western Illinois University]

Over the past decade, the quantum mechanical concepts have been applied to board games like Chess and Tic Tac Toe to produce more strategic games that offer more features than their classical counterparts. The quantum games also allow development of quantum strategies for educational purposes and to stimulate algorithmic development for quantum information. We have created a new quantum game, Quantum Connect 4, by incorporating the fundamental principle of quantum mechanics called superposition. Quantum superposition allows a physical system (say, an electron) to exist partially in all its, theoretically possible, states simultaneously. Nevertheless, when measured, the result obtained corresponds to only one of the possible configurations. To add quantumness to the game, players have the option to insert quantum discs to the board by dragging the mouse between two specific columns. Quantum discs have a 50% chance of being in two places at once. To determine the position of the quantum disks with certainty quantum measurement becomes essential. We allow the measurement of the quantum disks by clicking the collapse button (C on keyboard). Internally, the quantum states of the game are simulated to be truly quantum with the help of classical simulators. We further make use of IBM's quantum programming platform qiskit to perform the quantum measurement. Quantum players have an added advantage during game play compared to the classical players since players with quantumness can drop both classical and quantum pieces and they can strategically place their quantum pieces to stake a claim to two winning positions at once. Quantum Connect 4 utilizes quantum principles and enriches the game play through a larger number of possibilities and the inherent randomness they bring to the game. Moreover, the game offers a nice visual platform to illustrate principles of Quantum Mechanics.

STEM EDUCATION

11:40am UG **Special Relativity Video Game Simulator**

*Nathan Garnett, Josiah D. Kunz [Illinois College]

Special relativity is a topic that, while not mathematically difficult, can be difficult for students to grasp. One reason is that there are no perfect analogies and very few ways to convey the topic in a laboratory setting. This project overcomes the experiential problem with special relativity by playing a video game using a special relativity simulation. The simulation utilizes simple video game "fetch" quests along with basic relativistic equations. Student success was quantified via 10 point pre- and post-lab questionnaires. The project's results indicate the project was a success. The scores between the pre-test and post-test increased on average, with the average score increasing by 1.486 from 3.6 to 5.086 out of 10. The lowest score on the pre-test was 1, while on the post-test it was 3. The highest score on the two tests was 7 and 9 for the pre-test and post-test respectively. From this, future work on this project includes adding more entertaining aspects without needing to add much more educational content.

ZOOLOGY

8:20am **UG**

Effect of Exposure to Male Flies on the Lifespan of Female Adult *Drosophila melanogaster* (Diptera: Drosophilidae)

*Elexis Richardson, Marianne Robertson [Millikin University]

Energy is a limited resource that is used in reproduction, growth, and maintenance. For organisms to reproduce, energy may be transferred from maintenance to reproduction. We studied the effect of a single mating period on adult lifespan in *Drosophila melanogaster* to examine whether exposing female *D. melanogaster* to 0, 1, 2, or 6 male(s) for a 48-hour time interval would impact lifespan while also examining how the male competition would impact lifespan. We assigned females (n=20) to one of four above treatments and exposed them to the designated number of males for a 48-hr time period, and we then isolated both males and females and monitored them daily for survival. There were no significant differences in the number of days survived between treatments. These results suggest that lifespan is not affected by the number of mates a female is exposed to or the number of competitors a male is exposed to.

8:40am **UG**

Hormonal Correlates of Brood Patch Size in Male and Female Downy Woodpeckers (*Picoides pubescens*)

*Haley Wimberly, Travis E. Wilcoxen [Millikin University]

Brood patch formation is an incubation trait that has an association with prolactin hormone in many avian species. For those species that have a parental care system that is bi-parental, males and females may form brood patches. Prolactin may also vary in avian species based on timing of breeding, environmental conditions, and behavior. We studied brood patch area in male and female, adult and hatch year, Downy Woodpeckers, *Picoides pubescens* to determine if differences in brood patch size was related to prolactin levels. We used an enzyme-linked immunosorbent assay (ELISA) to measure prolactin in plasma samples. We found that adult females had significantly larger brood patches and higher levels of prolactin compared to adult males, while the relationship between brood patch and prolactin was significantly stronger in males. Hatch year birds showed no relationship between prolactin and featherless abdominal area, demonstrating that the feather loss in breading birds is at least partially prolactin dependent. Overall, our findings suggest that in this is bi-parental care system, prolactin likely serves a role in brood patch formation, but there are differences between males and females, perhaps because females may provide more care.

9:00am **UG**

Can Urban Parks be the Suitable Wingmen for Protected Areas to Protect Arthropod Diversity?

*Annalee Anderson, Anant Deshwal, Abbey McComb, Olivia Smith [Bradley University]

Despite urbanization being one of the major causes for the decline in arthropod diversity, urban parks have attracted the attention of conservation biologists. However, there are no studies comparing arthropod diversity in urban parks vs protected areas. To address this knowledge gap, we compared the arthropod community in urban parks to nature preserves by measuring 1) alpha diversity, 2) beta diversity, 3) family richness, 4) effect of park size on family richness, and 5) the preference of arthropods for urban parks or nature preserves using association tests. We used Pileou's evenness index and Shannon-Weiner's H index for estimating alpha diversity. We used Betapart function to measure beta diversity across urban parks and nature preserves. Our results indicate that urban parks are equally critical in conservation of arthropod biodiversity as the protected areas in terms of family diversity, evenness, and richness. Within beta diversity: low value of family nestedness and high value for spatial turnover suggest that urban parks are not biodiversity sinks and they play an important role in maintaining insect biodiversity for both common and uncommon families. Our data indicate that medium-sized parks are effective in maintaining high arthropod richness, which may be critical in urban design and planning, especially in an era of rapid urbanization and limited space availability. We used association tests along with Chi-square analysis to establish that some arthropod taxa can be used as indicator families for urbanization.

9:20am **UG**

Additional Evidence For A Volatile Sex-Attractant Pheromone In Snakes

*Michelle Hollon, Benjamin Jellen [University of Health Sciences and Pharmacy in St. Louis]

Snakes rely on chemosensation to locate one another during the mating period. The only reported sex-attractant pheromone in snakes is believed to be terrestrial. However, some species inhabit multi-modal environments (e.g., semi-aquatic, arboreal) which would not allow for the deposition of a continuous terrestrial pheromone trail. Therefore, a volatile, and/or a multimodal, pheromone trail is hypothesized to exist for species inhabiting these environments. We constructed two y-mazes to determine whether male Northern Watersnakes (*Nerodia sipedon*), a semi-aquatic species, relied on terrestrial and/or volatile trails to locate estrous females. Our results indicate that the males were able to successfully follow both the terrestrial and volatile cues of females through the y-mazes.

Males showed no interest in the trails of other males and of non-estrous females. Despite the prevailing thought that snakes produce terrestrial sex-attractant pheromones, our results indicate the existence of volatile sex-attractant pheromones at least in some species. This new development may explain some inconsistencies reported in the literature regarding anecdotal reports of mate location in the field and results of laboratory investigations. Further research is needed on additional species which occupy various habitats.

9:40am **Copperhead (*Agkistrodon contortrix*) Thermal Ecology**

*Benjamin Jellen, Brittany Neier [University of Health Sciences and Pharmacy in St. Louis]

Poikilothermic animals generate a negligible amount of metabolic heat and must use the specifics of their microhabitat to regulate their body temperature. Maintaining an internal body temperature within a preferred thermal gradient is essential for avoiding hyper- and hypothermia, maintaining homeostasis, and greatly influences physiological processes such as locomotor ability, digestive efficiency, and embryogenesis. Thermal preferences vary according with age and reproductive state (*i.e.*, gravid females) and therefore influence habitat selection and preference. We examined the thermal ecology of a population of eastern copperheads (*Agkistrodon contortrix*) in St. Louis County, Missouri throughout the active and overwintering periods as part of a larger ecological investigation. Here, we present thermal data related to emergence, egress, ingress, and overwintering in this population.

POSTER PRESENTATION ABSTRACTS

1:00pm – 4:20pm, Saturday, April 9, 2022, in Division Zoom Breakout Rooms

*presenter, [school] with differences noted by superscript

AGRICULTURE

1:10pm Grad **Effects of Depth and Cover Crop on the Functioning and Diversity of Soil Microbial Communities**

*Emily Hansen [Illinois State University]

Global agriculture is strained by the unpredictable effects of climate change, as well as flooding, drought, erosion, and decreases in soil fertility. To meet these challenges, global agricultural systems must develop new techniques while promoting sustainable intensification practices. Cover crops can provide farmers with an off-season cash crop, while also positively impacting the soil and reducing reliance on less sustainable conventional farming practices. The objective of this research is to evaluate the impact of different cover crops on soil microbial communities at varying depths. Soils were sampled in October from plots that had pennycress; cereal rye; pea, clover, radish, oat mix; or fallow soil the previous winter. EcoPlates were used to conduct community-level physiological profiling and test the hypothesis that cover crop type and soil depth are strong determinants of microbial community diversity and functioning in an agricultural field. I predict: (a) that the physiological profile of the microbial community, as measured by the rate and ability to metabolize a variety of carbon sources, will change across depths and differ among cover crop types, and (b) that the overall functional diversity of the microbial community will be greater under cover crop treatment than without. Initial findings indicate that depth significantly affects soil microbial community diversity. However, cover crops, which were terminated in the spring before my fall sampling, did not produce significant effects. This spring I will re-sample these fields to determine whether cover crops have affected the soil microbial community by the time the next cash crop is planted

ANTHROPOLOGY & ARCHEOLOGY

2:40pm UG **Correlations Between Cranial Angles and Classification of Malocclusion**

*Emily Bone, Miranda Karban [Illinois College]

Dental malocclusion is caused by disproportionate growth of the mandible and/or maxilla during fetal development, caused by both genetic and developmental factors, leading to the misalignment of the jaws and teeth. Previous studies have come to conflicting conclusions whether a link between dental malocclusion class and other aspects of cranio-facial anatomy, such as cranial base and facial angles, exists. Measurements of cranial base angle and facial protrusion (SNA and SNB) angles were taken from a longitudinal sample of lateral human cephalograms. A sample of 30 subjects, 15 male and 15 female, with 10 from each of Angle's classes of malocclusion, were measured at 5.0-6.3, 11.0-12.1, and 15.0-16.2 years of age. T-tests were performed to test for sexual dimorphism, as well as to test for significant changes in angle measurements over time and between classes. Few significant sexual dimorphism or developmental patterns were found for the angle measurements. The only significant sexual dimorphism was found in the SNA angle at the youngest age group. The only significant developmental angle change was the SNB angle, which differed significantly between the youngest and oldest age groups. There were significant differences in the cranial base angle between individuals classified as having Class III malocclusion compared to those having both Class I and Class II. Additionally, a significant difference was found in the SNA angle between individuals in Class I versus Class II and in Class II versus Class III. Finally there was a significant difference found in the SNB angle measurement between each of the classes. The significant sexual dimorphism in SNA angle found in the youngest age group is likely due to the difference in incisor eruption timelines between the sexes. This study informs on developmental interactions between facial projection and dental malocclusion.

BOTANY

1:00pm UG **The Effect of Various Smokewater Concentrations on the Germination of *Bouteloua dactyloides* (Buffalo Grass)**

Shay Adio, Kelly Barry [Southern Illinois University Edwardsville]

Plenty of research investigates the regrowth of plants after wildfires in the western United States region. Water remaining from wildfires are rich in karrikins, a group of compounds that help induce seed germination. Wildfires are especially frequent due to the dry climate characteristic of the western region. However, the restorative effects of wildfires on the growth of midwestern plants such as *Bouteloua dactyloides* (Buffalo Grass) have not been investigated as thoroughly even though wildfires occur (although less frequently) in the region. Therefore, we investigated the effect of different smokewater concentrations on the germination rate of a midwestern plant species: Buffalo Grass. Specifically, we used various concentrations of *Wright's Hickory Liquid Smoke* solutions (0.01%, 0.05%, and 0.10%) to mimic natural smokewater. After applying these conditions, along with a control of deionized water, we observed the seed germination over a 7-day period.

1:10pm Grad **Local vs. Novel Prairie Soil Microbes: Testing for Local Adaptation in the Response of *Lobelia spicata* from Illinois vs. Kansas**

*Sydney Metternich, Diane Byers [Illinois State University]

Plant-soil feedbacks have been well described as interactions between plants and soil microbes; soil microbes associated with plant roots, acquire nutrients for plants that are otherwise unavailable. Plants quickly differentiate a soil microbial community by attracting additional conspecific microbes, and while these microbes are often mutualistic, species-specific microbial pathogens can accumulate in the soil as well, generating negative plant soil-feedbacks. Biotic factors, such as soil history, in combination with abiotic factors, such as rainfall, determine the diversity of the soil microbial community. The North American Tallgrass Prairie ecosystem has been subjected to severe habitat fragmentation. The rainfall gradient (increasing eastward) which crosses where native prairie plant populations are found, provides a unique opportunity to study the effects of varying rainfall on soil microbial communities and how these communities subsequently influence the fitness of geographically constrained plant populations. To test for plant-soil feedbacks we performed a greenhouse study that subjected *Lobelia spicata*, a perennial prairie forb, sampled from populations in Illinois and Kansas to local and novel conspecific soil microbes. Additionally, they were treated with heterospecific soil microbes differentiated by native Illinois and Kansas *Andropogon gerardii* and *Lespedeza capitata,* grown in both states. Rosette diameter and biomass are used as estimates of plant fitness. We are currently analyzing the results of this study but expect local adaptation of *L. spicata* fitness to be positively correlated with the locality of soil microbes; this would provide support for positive plant-soil feedback. Negative plant-soil feedback is suspected if *L. spicata* incurs a fitness advantage when freed from conspecific pathogens. Our research has the capacity to improve restoration efforts by informing land managers of the sensitivity of plant fitness to changes in the soil. This work also has the potential to describe the soil microbial community and its influence as it varies with rainfall.

1:20pm UG **Smoke Water Concentration Effect on the Germination of *Sorghastrum nutans*, a Native Grass**

*Patrick Nilges, Kelly Barry [Southern Illinois University Edwardsville]

While much research has previously observed the ability of plants to regrow following wildfires in dry, fire-prone regions, the same cannot be said for those in areas like the midwest that see few modern wildfires. To explore this, we chose the midwestern grass species *Sorghastrum nutans* (Indiangrass) which sees few modern wildfires to see if there was a change in their germination in response to elements of a fire. Specifically, we looked at the smoke aspect of fire by using smoke-infused water solutions similar to runoff that plants might experience from a fire. Previous experiments indicated that common liquid smoke has a similar composition to water infused with the smoke of native plant species, so varying concentrations of diluted Wright's Hickory liquid smoke solutions were used. Solutions varied from a control of 0% liquid smoke up to 0.1% liquid smoke for seven days. All smoke-water concentrations saw some increase in germination, with 0.05% liquid smoke concentration overall leading to both the fastest and most consistent germination of seeds within a seven-day period.

1:30pm UG **Impact of Smoke Water Concentration on the Germination of *Bouteloua curtipendula***

*Farid Rodriguez, Kelly Barry [Southern Illinois University Edwardsville]

Wildfires have become a more prevalent problem throughout the last decades due to the increasing threat of global warming. Most of the research previously done to study the effects of wildfires on remaining plant

species has been carried out in dry regions that are particularly vulnerable to this problem. This research aims to explore the potential effects of wildfires on Midwestern grass species, which belong to a region that does not experience wildfires on a common basis. The research focused on sideoats grama (*Bouteloua curtipendula*), a species used for prairie restorations that is becoming common in the state of Illinois and generally present in areas along the Illinois and Mississippi Rivers. The experiment focuses on the smoke generated during the wildfire, simulated using varying smoke-water solutions that would resemble the runoff obtained after a fire. These solutions were made using Wright's Hickory liquid smoke diluted at different levels. The smoke-water solutions consisted of 0% (control group), 0.01%, 0.05%, and 0.1%. The 0.05% smoke-water solution lead to a faster germination rate during the seven-day period following smoke treatment.

1:40pm **UG**

Adjustment of pH and Potassium Nitrate Concentration in TAP Media Show Increased Biomass Production in *Neochloris oleabundans*, as Compared to Growth in Soil Extract Media

*Stephanie Mullen, Kelly Barry [Southern Illinois University Edwardsville]

Neochloris oleabundans is a species of microalgae used in biofuel production due to its quick growth rate, ability to withstand harsh conditions, and its' high production of fatty acids that can be converted into a sustainable fuel source. In this experiment we recognized that the greatest biomass production is seen using Soil Extract media, as opposed to TAP media which is more affordable, and easier to produce. Our goal is to adjust certain properties of TAP media, namely the pH and concentration of Potassium Nitrate to increase biomass production to be equal to or greater than the production observed using Soil Extract media.

The methods used entailed the use of four, 10 membered groups of 125mL Erlenmeyer flasks. Each group had a different type of media, Soil Extract, TAP at pH 7.25, TAP at 7.5, and unadjusted TAP. All flasks were inoculated with 1 mL of *N. oleabundans* and then measured every other day for 14 days by light absorbable using a spectrophotometer at 600 nm. This trial we hypothesized based on previous results of pH adjustment done by Dr. Kelly Barry and that slightly basic TAP will experience more algal growth than unadjusted TAP and SE.

In further experiments we will be compounding this slightly basic pH adjustment with an elevated concentration of potassium nitrate, which we hypothesize based on previous repetitions will increase biomass production even further. With these findings biofuel production could be made more affordable and efficient.

CELLULAR, MOLECULAR, & DEVELOPMENTAL BIOLOGY

3:00pm **UG**

Inducing Neuronal and Glial Characteristics in BMSC's on Polycaprolactone Nanofiber Scaffolds

*Hunter Brugler, Craig Cady [Bradley University]

Stem cell therapies have the potential to improve the outcome of Parkinson's disease (PD), which occurs when dopaminergic neurons in the substantia nigra die inducing tremors and impaired balance. Drug therapy only improves some symptoms but is unable to halt the disease. Stem cell therapy has the potential to end these symptoms by restoring dopaminergic neurons. Many groups are currently investigating the use of induced pluripotent stem cells (iPSCs) as a source of autologous dopamine producing neurons due to their ability to differentiate into mature cells and self-renew. However, iPSCs have oncogenic risks and are genetically engineered, which is expensive and time-consuming. Our lab is investigating bone marrow mesenchymal stem cells (BMSCs) as an alternative source of neurons that can be differentiated on polycaprolactone (PCL) nanofiber. PCL is an FDA approved, biocompatible nanofiber, that can enhance BMSC proliferation when coated with a concentrated exosome extract (CEE), developed in our laboratory. Our lab plans to plate BMSCs onto PCL coated with differentiation factors that have previously induced glial and neuronal morphology in BMSCs on culture dishes. Immunocytochemistry will then be used to screen for glial and neuronal specific proteins. ***We hypothesize that BMSCs plated on PCL fibers coated with differentiation factors will be induced to express glial and neuronal specific characteristics.*** BMSCs cultured on PCL coated with differentiation factors expressed glial fibrillary acidic protein, a glial specific protein, and nestin, a neuronal specific protein. Stem cell derived dopamine neurons on a PCL substrate present a great promise for PD treatments.

3:10pm UG **Serum Amyloid A Levels Relationship to a Long-Lived Vertebrate, the Red-Eared Slider Turtle**

*Victoria Stuart, Laura M. Zimmerman [Millikin University]

Inflamm-aging is the dysregulation of immune response that occurs as organisms age. In a healthy individual a pathogen triggers inflammation, but with inflamm-aging this inflammation occurs chronically and worsens the individual's ability to maintain homeostasis. For humans, chronic inflammation causes increased risk for many diseases. Turtles, like humans, are long-lived and thus make them an interesting model system for aging of the immune system. However, few immune assays are available for use in turtles. Serum amyloid A (SAA) is a protein involved in the inflammation response of organisms' innate immune response and is highly conserved in vertebrates. SAA has been found to be upregulated in inflammatory conditions and in early bacterial infection stages. We collected blood samples from red-eared slider turtles to measure levels of serum amyloid A (SAA) using a chicken SAA assay. Plastron length was measured as a proxy for age. We were able to measure the SAA levels in the red-eared slider turtles using the chicken SAA ELISA and we did find variation in the amounts present. A significant relationship between high levels of serum amyloid A in older individuals would have indicated inflamm-aging. However, we did not find any significant relationship between serum amyloid A and plastron length. Thus, we did not find any evidence of inflamm-aging in red eared slider turtles. This evidence points to a lack of immunosenescence in red-eared slider turtles as a previous study found no immunosenescence in the adaptive system and our SAA results do not indicate immunosenescence in the innate system. In order to further understand the role of SAA in turtles, future studies will be conducted studying SAA levels in red-eared sliders with known infections.

3:20pm UG **Effect of Tri-Isopropylphosphine Gold(I) Chloride ($PiPr_3AuCl$) On The Cell Proliferation and Apoptosis of MDA-MB-231 Human Breast Cancer Cells**

*Misael Villegas, Alexis Pawlak, Robin Redline, Kyle Grice, Talitha Rajah [DePaul University]

Some breast cancers can develop resistance to existing chemotherapeutic agents, requiring research into new treatment options. Previous research has shown that gold(I) compounds such as Auranofin, an FDA approved drug for rheumatoid arthritis, has antiproliferative effects on MDA-MB-231 cancer cells at low concentrations. Auranofin might function in cancer cells by inhibiting thioredoxin reductase leading to an imbalance in reactive oxidative species, thereby promoting cell death. In addition to inducing oxidative damage, gold(I) compounds may lend themselves as potential chemotherapeutic agents due to soft metal centers enabling the formation of stable complexes and are large cations that can cross membranes easily. Hence the objective of this study was to analyze cell proliferation and apoptosis in MDA-MB-231 breast cancer cells exposed to $PiPr_3AuCl$ (a branched compound with three isopropyl groups attached to a phosphate center).

MTT assay was used to measure the cell proliferation of MDA-MB-231 cells after exposure to $PiPr_3AuCl$ at various concentration (0.1 to 7.5 μM) for 24 hours and 48 hours. Apoptosis assay was determined by acridine orange and propidium iodide staining after exposure to $PiPr_3AuCl$ for 48 hours.

Our results show that $PiPr_3AuCl$ caused a statistically significant decrease in cell proliferation in a dose dependent manner: 62.1% (1 μM), 26.4% (2.5 μM), 8.8% (5 μM) and 9.2% (7.5 μM) for 24 hours; and 41.9% (1 μM), 2.7% (2.5 μM), 0.6% (5 μM) and 0.6% (7.5 μM) for 48 hours. IC_{50} values determined by Probit analysis were found to be 1.34 μM (24 hours) and 0.84 μM (48 hours). $PiPr_3AuCl$ did not show a significant change in apoptosis.

Our preliminary studies suggest that $PiPr_3AuCl$ could be an effective chemotherapeutic agent. Further research to determine its potential mechanisms of action by examining signaling proteins involved in cell proliferation might shed light on its efficacy as a potential chemotherapeutic agent.

3:30pm UG **Effects of Tricyclohexylphosphine Gold(I) Chloride (PCy_3AuCl) on the Cell Proliferation and Apoptosis of MDA-MB-231 Breast Cancer Cells**

*Alexis Pawlak, Misael Villegas, Robin Redline, Kyle Grice, Talitha Rajah [DePaul University]

Triple negative breast cancer is the most aggressive type of breast cancer with minimal treatment options available. Gold compounds have been shown to induce apoptosis via the mitochondrial thioredoxin system revealing a potential as a chemotherapeutic agent. In this study, we examined the efficacy of a novel gold(I) compound, Tricyclohexylphosphine gold(I) chloride (PCy_3AuCl), on cell proliferation and apoptosis in triple negative MDA-MB-231 human breast cancer cells. PCy_3AuCl contains three stable cyclohexyl groups, which could enable it to easily cross the cell membrane barrier. This is the first study to examine the effects of PCy_3AuCl on cell proliferation and apoptosis in human breast cancer cells. Cell proliferation was determined by an MTT assay. Cells were exposed to PCy_3AuCl at concentrations ranging from 0.1 μM-7.5 μM for 24 and

48 hours. Cell proliferation was calculated as a percent of the control and IC_{50} values were determined via Probit analysis. Acridine orange and propidium iodide staining was used to examine apoptosis after exposure to PCy_3AuCl for 48 hours. Our results indicate PCy_3AuCl inhibits cell proliferation at concentrations of 0.1 mM (65%), 0.5 mM (47%), 1 mM (25%), 2.5 mM (7%), 5 mM (3%), and 7.5 mM (1%) for 24 hours, and 0.1 mM (79%), 0.5 mM (47%), 1 mM (18%), 2.5 mM (2%), 5 mM (1%), and 7.5 mM (1%) for 48 hours. The IC_{50} values were found to be 0.43 ± 0.07 μM and 0.37 ± 0.29 μM for 24 and 48 hours, respectively. A significant change in apoptosis was not observed when compared to the control. Our results suggest PCy_3AuCl may be acting by inhibiting cell proliferation. Future studies aimed at analyzing relevant proteins involved in cell proliferation (Ras, ERK 1/2) and apoptosis (Bax, Bcl2, Caspase3, 8, 9) may elucidate the mechanistic pathway by which PCy_3AuCl inhibits cell proliferation.

3:40pm ***Schizophyllum commune matBα9-β6*** **Region DNA Includes Mating Pheromone and Receptor Gene Candidates and Confers Mating Responses**

*Thomas Fowler, Sierra Cheney, Laura Sorbel [Southern Illinois University Edwardsville]

Schizophyllum commune is a wood-rotting, mushroom-forming heterothallic basidiomycete with thousands of mating types. Signaling of an individual's mating type is, in part, through the actions of many small lipopeptide pheromones and an estimated eighteen different heterotrimeric G protein-coupled receptors specified in multiple versions of the complex *matB* locus. A fraction of the projected pheromone and receptor genes have been isolated to date and characterized to provide an outline of their relationships for receptor-ligand signaling. As part of an ongoing investigation of a developmental mutant with *matB*version *matBα9-β6*, we identified two overlapping fosmid clones with a PCR-based screen to find a pheromone receptor-like DNA sequence. Both of these fosmid clones have been partially sequenced and strong candidates for one pheromone receptor gene and three pheromone genes were identified. Additional pheromone gene candidates are also noted in the DNA sequence. Each of the fosmids, with ~30-40 kb of *S. commune* DNA, was integrated into a sterile deletion mutant strain of *S. commune* ("*B*-null") that has no mating pheromone or receptor activity. Independent transformants of each fosmid sent pheromone signals and responded to pheromones in mating tests with a battery of strains that represent the breadth of *S. commune matB* versions. These results indicate that the clones include much or all of the *matBα9-β6* locus, which has not been previously characterized. The candidate genes within these clones will be separated from each other to define their signaling abilities, and additional *matBα9-b6* genes will be sought from within the unsequenced portions of the clones. *matBa9-β6* is of special interest as a *matB* version that rarely recombines between the *matBα* and *matBb* regions for reasons that are currently not understood. Most other *matB* versions recombine regularly between the *α* and *β*.

3:50pm UG **New Constructs for Visual Identification of Transgenic Tissues in Plants**

*Christine Gouws, Yordan S. Yordanov [Eastern Illinois University]

A marker gene is used to easily identify transgenes in organisms through use of colour. There are several types of marker genes used in transgene identification. The most abundant marker gene in plants, beta-glucuronidase (GUS), is destructive, meaning that to be able to stain the plants, the plant must be destroyed. In some cases, the plant can still grow after staining, but growth will be severely limited. To identify transgenic material without tissue destruction, fluorescent proteins can be used. These markers will then be visible under specific light, enabling identification and study of the transgenic elements. However, plant tissue destruction is wasteful, and being able to study the transgenes in roots and other areas without destroying the tissue would be very useful. On the other hand, for the fluorescent marker genes to work, one needs special equipment like UV/blacklights and filters, which makes the process expensive. The third type of marker gene produces pigments in transgenic plants that allow the observer to see transgenic material without tissue destruction or expensive equipment. The aim of this study is to produce vectors for each of these types of markers that can be used for future studies in plant functional genetics. For the tissue destructive vector, the GusPlus gene was combined with a tCUP promotor and Nos terminator in a pMDC32 plasmid to produce pGMDC32 binary vector. Additionally, the GusPlus gene uses the signal peptide excreted from the cells naturally, so that tissue death may not occur. This pGMDC32 vector was used to study sunflower root genes. For the fluorescent protein marker, we intend to use smGFP and combine a tCUP promotor and Nos terminator in a pMDC32 plasmid, producing pFMDC32. We will also use the pMDC32 plasmid for the RUBY gene, creating pRMDC32, able to stain plants red without tissue destruction.

4:00pm **UG**

A Live-Embryo, Genome-Wide Confocal Microscopy Screen for Protein Localization Signal

*Kevin Edwards, Ben Lundy, Andrew Melaga, Shaniya Barrett, Brandon Bernicky [Illinois State University

The intracellular environment is highly structured, with myriad protein-protein interactions controlling the subcellular location of each protein. These localization signals in turn control the protein's local concentration, interaction network, access to substrates, etc. To identify novel protein localization signals in an unbiased manner, we tested the effectiveness of screening protein traps (fluorescent protein fusions to endogenous coding regions) in live Drosophila embryos with laser scanning confocal microscopy. The protein traps were generated with the Hostile takeover (Hto) transposon system, in which the protein trap fusion is expressed under GAL4 transcriptional control to provide tissue specificity, and the fusion may contain either the full-length target protein or a C-terminal fragment. In a pilot screen, we recovered any embryo with a fusion protein showing a pattern distinct from that of the Starter transposon. Of 79 selected and hatched embryos, 66 eclosed as adults, 56 were crossed, 55 transmitted the fluorescent tag to offspring, and 46 yielded stocks with new stable protein trap insertions. A majority of those fusions are concentrated in the nucleus, with several subtypes (nucleolar, non-nucleolar, and patterned), and there are several lines with distinct non-nuclear patterns (junctions, vesicles, and plasma membrane). A secondary transposition in one of the selected animals yielded an additional line with an apparent microtubule-binding fusion. Thus, live embryo Hto screening provides an efficient means of harvesting protein fragments with diverse and useful subcellular localization signals. The ISU Confocal Microscopy Facility is funded by NSF-MRI.

CHEMISTRY

1:00pm **Grad**

Quantification of Cannabinol in Hemp Oil by Ultra High Performance Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry

*Gabrielle Valenzuela, Shelby Carlson, Liguo Song [Western Illinois University]

An ultra high performance liquid chromatography electrospray ionization tandem mass spectrometry (UHPLC-ESI/MS/MS) method was developed for quantification of cannabinol (CBN) among twelve cannabinoids in hemp oil. The quantification was achieved using internal standard calibration between 0.01 and 12.5 mg/mL with CBN-d3 as internal standard. The limits of quantitation (LOQ) was determined to be 0.008% CBN in hemp oil. To recover CBN, hemp oil was combined with methanol to prepare a 25 mg/mL mixture. After ultrasonication, centrifugation and filtration, the extract was serially diluted to 125 mg/mL containing 0.5 mg/mL CBN-d3. The measurement precision in triplicate was 4.1%. The method is not interfered by other cannabinoids present in hemp oil.

1:10pm **Grad**

Quantification of Cannabinol among Sixteen Cannabinoids in Hemp Oil by Liquid Chromatography Ultraviolet Detection

*Brandon Ayer, Emily Jovanovich, Liguo Song [Western Illinois University]

A liquid chromatography ultraviolet detection (LC-UV) method was developed for quantification of cannabinol (CBN) among sixteen cannabinoids in hemp oil. The quantification was achieved using external standard calibration between 0.02 and 25 mg/mL. The limits of quantitation (LOQ) was determined to be 0.008% CBN in hemp oil. To recover CBN, hemp oil was combined with methanol to prepare a 25 mg/mL mixture. After ultrasonication, centrifugation and filtration, the extract was serially diluted to 250 mg/mL and analyzed by LC-UV. The measurement precision in triplicate was 2.5%. The method is not interfered by other cannabinoids present in hemp oil.

1:20pm **Grad**

Quantification of Cannabigerol among Sixteen Cannabinoids in Hemp Oil by Liquid Chromatography Ultraviolet Detection

*Grant Meyer, Liguo Song, Jack Whyte [Western Illinois University]

A liquid chromatography ultraviolet detection (LC-UV) method was developed for quantification of cannabigerol (CBG) among sixteen cannabinoids in hemp oil. The quantification was achieved using external standard calibration between 0.02 and 25 µg/mL. The limits of quantitation (LOQ) was determined to be -.008% CBG in hemp oil. To recover CBG, ultrasonication, centrifugation and filtration, the extract was serially diluted to 250 µg/mL and analyzed by LC-UV. The measurement precision in triplicate was 5.8%. The method is not interfered by other cannabinoids present in hemp oil.

1:30pm Grad **Quantification of Δ9-Tetrahydrocannabinol among Sixteen Cannabinoids in Cannabis by Liquid Chromatography Ultraviolet Detection**

*Emmanuel Adejumo, Shelby Carlson, Liguo Song [Western Illinois University]

A liquid chromatography ultraviolet detection (LC-UV) method was developed for quantification of Δ9-tetrahydrocannabinol (Δ9-THC) among sixteen cannabinoids in *Cannabis*. The quantification was achieved using external standard calibration between 0.02 and 25 mg/mL. The limits of quantitation (LOQ) were determined to be 0.04% Δ9-THC in *Cannabis*. To recover Δ9-THC, *Cannabis* was combined with methanol to prepare a 25 mg/mL mixture. After ultrasonication, centrifugation and filtration, the extract was serially diluted to 50 mg/mL and analyzed by LC-UV. The measurement precision in triplicate was 5.6%. The method is not interfered by other cannabinoids present in cannabis.

1:40pm Grad **Quantification of Cannabigerol in Hemp Oil by Ultra High Performance Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry**

*Zachary Dodson, Gabrielle Valenzuela, Liguo Song [Western Illinois University]

An ultra high performance liquid chromatography electrospray ionization tandem mass spectrometry (UHPLC-ESI/MS/MS) method was developed for quantification of cannabigerol (CBG) among twelve cannabinoids in hemp oil. The quantification was achieved using internal standard calibration between 0.01 and 12.5 mg/mL with CBG-d9 as internal standard. The limit of quantitation (LOQ) was determined to be 0.008% CBG in hemp oil. To recover CBG, hemp oil was combined with methanol to prepare a 25 mg/mL mixture. After ultrasonication, centrifugation and filtration, the extract was serially diluted to 125 mg/mL containing 0.5 mg/mL CBG-d9. The measurement precision in triplicate was 9.2%. The method is not interfered by other cannabinoids present in hemp oil.

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

Grace Brownlee, Madison Chao, Mojisola Adisa [Western Illinois University]

An UHPLC-ESI/MS/MS method was developed for simultaneous quantification and confirmation of ketoprofen in equine plasma. Ketoprofen was recovered from equine plasma by strong anion exchange solid phase extraction (SAX-SPE). The concentration of ketoprofen was determined between 5 and 250 ng/mL by internal standard calibration using naproxen-d3 as the internal standard. The limits of detection (LOD) were determined to be 1 ng/mL. The measurement precision and accuracy were 4.5% and 102.7%, 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.

2:10pm UG **Copper-Catalyzed Click Chemistry of Benzyl Azide and Phenylacetylene**

*Ethan Leitschuh, Jocelyn Lanorio [Illinois College]

Cycloaddition reactions, also known as Click Chemistry reactions, are attractive for their high, easily purifiable yields and atom economic properties. These reactions have a wide range of real-world applications and are utilized in various fields such as drug discovery, polymer chemistry, biochemistry, material science, and nanomaterials. Experimentally accessing various copper-catalyst capabilities, benzyl azide and phenylacetylene were thought to yield 1,5-benzyl-5-phenyl-1H-1,2,3-triazole in solvent or neat reactions at room temperature and applied heat. The products were characterized and confirmed pure by infrared spectroscopy, gas chromatography-mass spectrometry, Thin Layer Chromatography, among other techniques.

Neat reactions proved to be more efficient, green, reproducible, and provided products of higher purity and yields compared to solvent reactions. In the homogeneous reactions, copper sulfate with sodium ascorbate, and copper iodide exhibited the same results. Of the complexes tested, it is suggested that steric strain of the ligands attached to copper play a role in the catalysis of cycloaddition reaction of benzyl azide and phenylacetylene.

2:20pm Grad **Correlation Consistent Basis Sets Designed for Density Functional Theory: 5-p Block Elements**

*[1]Matthew Ward, [1]John Determan, [2]Angela Wilson
[[1]Western Illinois University; [2]Michigan State University]

Compact all-electron correlation consistent basis sets (cc-pVNZ and related) were previously designed by Mahler and Wilson for use with ab initio computational methods. Previous studies by Mahler, Determan and Wilson, show while these basis sets show smooth monotonic convergence when used in conjunction with ab initio methods, the same is not always true for Density Functional Approximations (DFAs). Because of their pan-periodic versatility, it is desirable to 'fit' the correlation consistent basis sets to an efficient alternative to ab initio methods: Instead of approximating the Schrodinger equation, DFT instead relies on the electron density thus

making it more efficient for larger systems. The purpose of this research was to recontract and reoptimize all-electron Dunning basis sets for the 5p elements (In-Xe) to be used with various density functional approximations (DFAs). The DFAs selected are PBE, BLYP, TPSS and their hybrid counterparts, PBE0, B3LYP, TPSSh, respectively. These have been tested for accuracy for bond lengths and dissociation energies of diatomics with one or both atoms coming from the 5p block. Furthermore, these have been tested on a molecular data set composed of thermochemical properties of organometallics where the metal is a 5p element.

2:30pm Grad **Analytical Techniques for Determination of Antioxidant Concentration in Soybeans**

*Alexis Dreyer, Brian Bellott [Western Illinois University]

Antioxidants are a biochemical compound which inhibit the oxidation of species. Antioxidants are important because oxidation can cause damage to vital molecules in cells. Free radicals are one electron species which are highly reactive. Antioxidants prevent damage to living systems by reacting with the free radical and stabilizing the one electron species, preventing it from damaging other species present in the system. Antioxidants are abundant in vegetables, nuts, whole grains and fruits among other foods. One example of where many different antioxidants are found is in soybeans. Soybeans (Glycine mas L. Merr) are a class of edible legume which originated from east Asia, but are now mostly grown in North and South America. Soybeans have a multitude of different uses, ranging from biofuels, to cosmetic products to human and animal consumption. Some compounds which have antioxidant properties found in soybeans includes chlorogenic acid isomers, ferulic acid, caffeic acid, and isoflavones. There are a multitude of ways and analytical methods to determine the concentration of antioxidants in soybeans. These methods include high-performance liquid chromatography (HPLC), thin-layer chromatography (TLC), capillary tube electrophoresis. and spectrophotometry. These methods all work by isolating the components which have antioxidant properties based upon their chemical characteristics. Before the methods for quantification of antioxidants can be performed, the antioxidant must be extracted with the use of solvent extraction, distillation, or sublimation. The most common method of extraction is the use of solvents and centrifuge to separate the flavonoids from the solid compounds and then the solutions are used to measure the antioxidant activity and concentration within the solution. This works examines the concentration of antioxidants present in soybeans.

2:40pm UG **Detection of Illicit Drugs with Fluorescent Biosensor Silica Nanoparticles**

*Regina Scarpaci, John Determan, Harley Davidson [Western Illinois University]

Drugs pose a great threat to society. Drugs are widely abused by people of all classes. An efficient test that can be used on-site is crucial for countering this problem. Common techniques for detecting drugs like gas chromatography-mass spectrometry, high-performance liquid chromatography, and enzyme-linked immunosorbent assay are time-consuming, difficult to understand without proper education and training, and are not cost-efficient. The detection of illicit drugs has been done using coinage metal nanoparticles. Silica nanoparticles are an economical and widely available choice when compared to coinage metals. This makes it ideal for the detection of illicit drugs. A fluorescent core is introduced to the nanoparticles for observing drug and nanoparticle interactions. DNA aptamers, biologically specific molecules, are attached to the fluorescent-cored nanoparticles. The aptamer allows the nanoparticles to only interact with one target drug. This is helpful so that any legal analogs do not cause false positives. Fluorescent spectroscopy and infrared spectroscopy are used to monitor the progress of nanoparticle synthesis, core and aptamer integrations, and drug interactions. A change in fluorescence can determine if a drug is present or not.

3:00pm UG **Synthesis of Humic Acid and Humic-Like Acids and Metal Functionalization of Humic Acid**

*Briar Hilsabeck, Amanda LaPage, John Determan [Western Illinois University]

Biochar is a useful way to store carbon that cannot be easily released back into the atmosphere. When burned at low temperatures, they can be highly functionalized to bond to lighter metals. At higher burning temperatures, they are porous and aromatic and bind to heavier metals. This type could be functionalized to bind to both light and heavy metals. Humic-like acids (HLA) that can be extracted from biochar give it these properties and are used in a similar manner to humic acid (HA). HA is commercially available and can be prepared from soil samples and our procedure for doing so is from the International Humic Substances Society recommendations in addition to excerpts from Science of Total Environment. The commercially available HA is compared to the soil samples produced from the soil samples. The HA will be used in conjunction with magnetic nanoparticles. The properties of nanoparticles can allow for a wide variety of applications and altered properties. This includes binding properties. Our production and procedure of metal binding nanoparticles is guided by articles in American Chemical Society and an additional article from Bioresource Technology. Magnetic nanoparticles will be attached to HA to functionalize it to better bind with metals. This can be used to bind to and remove harmful substances (like metals) from the environment.

3:10pm UG **Analyzing Illicit Drugs Using Copper Nanoparticles**

*Lillie Purcell, John J. Determan, Harley N. Davidson [Western Illinois University]

This research project seeks to use nanoparticles to detect the presence of illicit drugs such as a methamphetamine analog. Nanoparticles have a diameter of less than 100 nanometers. Coinage metal like copper, silver, and gold nanoparticles are relatively stable with high refractive indices. These characteristics allow for a visual color change to detect the drug. The detection of illicit drugs is helpful in the forensic field and can further aid law enforcement in identifying unknown substances in an efficient manner. Gold nanoparticles have been shown to be able to detect drugs in previous studies but are costly. Alternatively, using a different metal such as copper with similar chemical and optical properties to gold, can allow for the detection of amethamphetamine analog while also reducing the cost.

The detection of methamphetamine is performed using the colorimetric test. Metal nanoparticles have vivid visible colors due to their high refractive indices. This makes them susceptible to change due to interaction with other chemicals, such as illicit drugs. Aptamers are oligonucleotides or peptide molecules that selectively interact with a drug of interest. The aptamer will be used to enhance the interaction of the nanoparticles with a methamphetamine analog. Interaction with the drug of choice causes a change in the surface structure of the nanoparticles. As a result, the change in structure will cause a visible change in the color of the aptamer coated nanoparticles.

Past research includes interacting the gold nanoparticles with a with a phosphate buffer saline solution (PBS) in which we saw a visual color change from red to purple. Furthermore, an aptamer will be added to protect the gold nanoparticles in the absence of the illicit drug, and finally a colorimetric detection in the presence of a methamphetamine analog.

3:20pm UG **Detection of Illicit Drugs using Silica Nanoparticle as Fluorescent Biosensors**

*Mary Pearson, John Determan, Harley Davidson [Western Illinois University]

Drug trafficking has become one of the most problematic illegal businesses in the world. Many illicit drugs are metabolized quickly and cause critical damage to a person's neurological and cardiovascular systems. This makes a rapid, cost effective, and analytical technique for detecting illicit drugs for law enforcement, forensic science authorities, and medical diagnostics to use in their work necessary.

Gold nanoparticles have been used in previous research in the detection of illicit drugs, due to their sensitivity to interactions with drugs. However, gold nanoparticles are not the ideal due to a high associated production cost and the rarity of the materials used. Silica nanoparticles are a more cost effective and abundant option then coinage metals. The procedure of the production of silica nanoparticles is based on the procedures of Zhixue Zhou, Yan Du, and Shaojun Dong. The nanoparticles have a hollow core with biological fluorescent dye, which is Fluorescein Isothiocyanate Isomer I.

In this research, illicit drugs are detected using aptamers attached to the surface of silica nanoparticles. An aptamer is a synthetic single-stranded DNA or RNA molecule that is used to interact with a target molecule. The fluorescence is blocked during the interaction with drug molecules and the change in fluorescence is measured using fluorescence spectroscopy. The change of fluorescence is used to indicate if there are illicit drugs present.

3:30pm UG **The Detection of Illicit Drugs Using Florescent Cored Silica Nanoparticles**

*Ashley Webb, Harley Davidson, John Determan [Western Illinois University]

A global crisis is the use and addiction to illicit drugs. The different types of illicit drugs have their own side effects, and some illicit drugs are quickly metabolized by the body causing them to be undetectable after only a couple hours. To help counteract this issue, effective and reliable onsite testing can be utilized by police officers. The common testing techniques, like gas chromatography-mass spectrometry and Raman instruments, that are used to detect the illicit drugs are complex and not easily portable.

In previous studies, metal nanoparticles capped with DNA aptamers have shown to have visible colorimetric changes in the presence of illicit drugs. Instead of using metals, silica nanoparticles will be studied because they are inexpensive and more abundant. To produce silica nanoparticles, the procedure described by Zhixue Zhou, Yan Du, and Shaojun Dong will be used. The silica nanoparticles will be filled with a biological fluorescent dye, Fluorescein Isothiocyanate Isomer I. DNA aptamers will be attached to the filled silica nanoparticles. DNA aptamers are a biologically specific molecule that will interact with only the target drug. The DNA aptamer will not interact with antilogs (often legal drugs) of the target drug. When the filled and aptamer complexed silica nanoparticles are in the presence of the target drug, the fluorescent dye will be either quenched or enhanced. Other techniques, such as infrared and NMR spectroscopy will also be presented to confirm the synthesized structure.

3:40pm UG **Inhibition of Tyrosinase with 5-Hydroxyindole**

*Patrick Combs, Zvi Pasman, Suzanne Green, Scott Huckabay, Kevin Marcus [Illinois College]

Tyrosinase is the catalyst in the first step of melanin biosynthesis. Studying inhibition of tyrosinase is important because the activity of tyrosinase is thought to not only be associated with melanoma and other skin diseases but also is thought to be a factor in the nutritional value of food. Because tyrosinase is involved in the browning of fruits and vegetables, as well as the hyperpigmentation of skin, it produces undesirable effects that an inhibitor of tyrosinase may be able to reverse or completely prevent. Here, we tested the effect of 5-hydroxyindole, a candidate tyrosinase inhibitor, on the tyrosinase-catalyzed conversion of DOPA to dopachrome. Tyrosinase steady state kinetics experiments yielded a catalytic rate constant (k_{cat}) of 8.0 s^{-1} and an apparent K_m of 0.49±0.10 mM in the absence of added inhibitor. In the presence of 5-hydroxyindole, k_{cat} was not affected significantly, whereas K_m was increased, arguing that 5-hydroxyindole acts as a competitive inhibitor of tyrosinase. The K_i calculated for 5-hydroxyindole was 0.13±0.02 μM, whereas the K_i of kojic acid, a known mixed inhibitor of tyrosinase, was 36±8 μM. Thus we show that 5-hydroxyindole is a significantly stronger inhibitor of tyrosinase than kojic acid.

3:50pm UG **Illicit Drug Detection Using Nanoparticles with Fluorescent Biosensors**

*Logan Barnard, John Determan, Harley Davidson [Western Illinois University]

The use of illicit drugs around the globe has become an ever-rising crisis. The techniques and methods used for the detection of illicit drugs take time and are unlikely to detect any drugs that get metabolized quickly in the body. Some of these techniques include Raman instruments, gas chromatography, and mass spectrometry. These techniques are complex, require training to operate, and are not portable in an easy manner.

Coinage metals nanoparticles have been used in the detection of drugs, but are expensive and less abundant compared to silica nanoparticles. The silica nanoparticles have a hollow core that is filled with the biological fluorescent dye, Fluorescein Isothiocyanate Isomer I. This dye, when in the presence of a target drug, will either be quenched or enhanced. A DNA aptamer is attached to the surface of the nanoparticle. DNA aptamers are biologically specific molecules that react solely with the targeted drug and not with its analogs. When the nanoparticles are introduced to the drug, a change in its fluorescence can be observed. Other spectroscopic techniques, such as infrared and NMR spectroscopy also will be done to validate the structure of these nanoparticles.

4:00 Grad **Quantification of Cannabidiol among Sixteen Cannabinoids in Hemp Oil by Liquid Chromatography Ultraviolet Detection**

*Mojisola Adisa, Savannah Cooper, Liguo Song [Western Illinois University]

Botanically, "hemp" is called *Cannabis sativa*, one of the two primary Cannabis species. The other primary Cannabis species is called *Cannabis indica*, which is generally known as "marijuana." Both hemp and marijuana are well known for their characteristic to produce a unique class of compounds named cannabinoids.
The percentage of Δ9-tetrahydrocannabinol (Δ9-THC), a cannabinoid present in marijuana makes it a psychotropic drug. In contrast, hemp is characterized by low levels of Δ9-THC and high levels of cannabidiol (CBD). Due to these properties, hemp impeded the regulation of marijuana as a controlled substance in the US.

A liquid chromatography ultraviolet detection (LC-UV) method was developed for the quantification of CBD among sixteen cannabinoids in hemp oil. The quantification was achieved using external standard calibration between 0.02 and 25μg/mL.

The quantification of cannabinoids in hemp products is important for both legal and medicinally regulatory requirements. Here, we report the quantitation of CBD in hemp oil which we project to assist the United States Department of Agriculture (USDA) to regulate hemp oil products.

4:10 Grad **Quantification of Δ9-Tetrahydrocannabinolic Acid among Sixteen Cannabinoids in Cannabis by Liquid Chromatography Ultraviolet Detection**

*Shelby Carlson, Liguo Song [Western Illinois University]

A liquid chromatography ultraviolet detection (LC-UV) method was developed for quantification of Δ^9-tetrahydrocannabinolic acid (Δ^9-THCA) among sixteen cannabinoids in *Cannabis*. The quantification was achieved using external standard calibration between 0.02 to 25 μg/mL. The limits of quantitation (LOQ) were determined to be 0.04% Δ^9-THCA in *Cannabis*. To recover Δ^9-THCA, *Cannabis* was combined with methanol to prepare a 25 mg/mL mixture. After ultrasonication, centrifugation and filtration, the extract was serially diluted to 50 μg/mL

and analyzed by LC-UV. The measurement precision in triplicate was 5.1%. The method is not interfered by other cannabinoids present in cannabis.

COMPUTER SCIENCE

3:40pm HS **Supervised Binary Convolutional Neural Networks with Model Stacking for Diagnosis of Fundus and Eyelid Diseases**

*[1]Sirhaasa Nallamoutha, [2]Cory Culbertson, [3]Sateesh Nallamothu [[1]University High School; [2]Illinois State University; [3]Independent]

Retinal and ocular health is often overlooked and seen as a privilege not a necessity. Although there are a variety of machine learning based solutions and retinal specialists to diagnose these ailments, they require expensive equipment and resources, and often times overlook specific retinal diseases. This comprehensive research posters details the creation of six binary convolutional neural networks to diagnose Diabetic Retinopathy, Age-Related Macular Degeneration, Myopia, Glaucoma, Ocular Hypertension, and Cataracts with fundus images, along with Trachoma through inner under eye lid images. In order to produce a conclusive diagnosis model stacking was implemented, and the diagnosis results were compared to a trial multiclassification neural network. Analysis was also completed on the visualizations of the convolutions to identify which features of the image the model was detecting, using a 'green-blue feature map', and compared to traditional classification.

The neural networks produced promising results for both training and testing data accuracies along with model classification and show promise for implementation and for further research to be completed. These models have the ability to identify new features or aspects of a fundus image.

Traditionally, specialists focus on abnormalities in the arteries. However, after analyzing the convolutions it seems that the models were focusing in on the optic disc and fovea region of the fundus along with pigmentation and fundus spots, often overlooked with traditional diagnosis.

Additionally, the Trachoma convolutional neural network may be able to provide further insights into what specific features of the inner eye lid to focus on when diagnosing this ailment. Traditionally, inner eye lid scarring and magnitude of the puss are used. However, the feature maps depict that pigmentation of eyelid scarring along with puss, eyelash rheum, trichiasis [abnormal unhealthy eyelash placement] in the inner eyelid were fixated on.

ENVIRONMENTAL SCIENCE

1:00pm UG **Do College Students Affect Climate Change Through Fast Fashion?**

A. Michelle Harms [Lincoln College]

Climate change, in large part, is driven by emissions of greenhouse gases associated with industry. Mass production of clothing is no exception. However, when it comes to name brand companies some are more sustainable than the others. With the fashion industries that are contributing more to climate change they are doing this through fast fashion. Fast fashion is replicating recent high-fashion designs and mass producing them at a lower cost to get them into stores while the demand is high. This causes clothing plants to produce more clothes which increases the emissions produced by the plant. While focusing on a certain group of people, fast fashion targets individuals usually in their teens and twenties. To find out how much impact college students have on climate change through fast fashion, we conduct surveys targeted towards students at Lincoln College in Logan County, IL. We will find out if students use fast fashion or upcycling fashion, the recycling clothing to get similar fashion trends. Measuring college student choices, attitudes, and perceptions of the fashion industry will enable us to determine if their clothing choices have an indirect effect on climate change.

1:10pm UG **Planaria Regeneration in Response to Varying Nitrate Concentrations**

Jayden Lawrence, Ryan Sherman [Lincoln College]

Planaria have been used as model organisms in a variety of studies. Recently, it has been noted that they are particularly susceptible to toxins in their environment, as such they can be used as an indicator species for water quality and toxicity. Specifically, planarian regeneration rates specifically, have been shown to reflect the nutrients in their environment. There has been an increase in studies on the effects of pollutants on freshwater invertebrates, but not specifically the components of fertilizers. In this study, I tested the effects of sodium nitrate on planarian regeneration. Nitrate is a component of fertilizers used in the Midwest. Runoff from agricultural

watersheds increase nutrients in freshwater systems, having an adverse effect on water quality and lead to eutrophication. In this study, a variety of concentrations of sodium nitrate were chosen based on average levels of nitrate in freshwater lakes around the Midwest to replicate conditions of a natural setting. In a controlled lab setting I measured planarian regeneration rate in response to four nitrate concentrations ranging from 0mg to 100mg. Initial measurements were taken after post-auricle amputation over a period of 21 days. I expect that high concentrations of sodium nitrate will result in slower regeneration rates. Planarians are considered an indicator species of water quality, therefore this project could provide valuable insights about freshwater habitats experiencing variable nutrient concentrations from fertilizer runoff.

1:20pm UG **Stream Water Quality and Macroinvertebrate Diversity in an Agricultural Watershed**

*Rylee Cook, Ryan Sherman [Lincoln College]

Macroinvertebrates are one of many indicators of stream health as they are sensitive to changes in water quality. This study was carried out in Sugar Creek stream located in Lincoln, Illinois that receives runoff from surrounding agriculture. This study investigated the indirect effects of agricultural runoff by testing the stream water quality and macroinvertebrate species diversity at various sampling sites in the stream. Water and macroinvertebrate samples collected from sampling sites using standard procedures. Water quality metrics quantified include dissolved nitrate, dissolved phosphate, pH, and odor. The macroinvertebrate diversity was calculated using the Shannon-Wiener diversity index. This study can provide more information about the effects water quality has on stream biodiversity and the indirect effects of agricultural runoff on stream health.

1:30pm UG **A Study of Life History in Mealworms (*Tenebrio molitor*) on Polystyrene Foam Diets**

*Merritt Steffens [Lincoln College]

Mealworms from the species *Tenebrio molitor* have been found to be able to breakdown polystyrene. Polystyrene is a durable material that can last anywhere from a few years to hundreds of years depending on the environment in which it is disposed. Previous research has shown through chemical analysis of fecula extract, that after polystyrene is incorporated into fecula that the molecular weight decreases, which suggests that cleavage occurs during the digestion process. This cleavage is found to be done by two bacterial strains found in the guts of the mealworm. Over the course of 6 weeks, 10 populations of mealworms were examined to see how Styrofoam affects their mortality, how fast they mature, when they begin reproduction, and the total biomass of each population. The sample populations will receive diets consisting of either 100% bran meal, 25% polystyrene and 75% bran meal, 50% polystyrene and 50% bran meal, 75% polystyrene and 25% bran meal, or 100% polystyrene. Examining the effect that the polystyrene foam diets have on mealworm life history could provide insights for large scale biodegradation/recycling applications.

2:00pm UG **Plant-Insect Diversity Relationship in a Restored Prairie**

*Audrey Smith, Ryan E. Sherman [Lincoln College]

Throughout the Midwest native prairies have been destroyed due to increasing agriculture and settlement practices. Prairies absorb a lot of rain, decreasing erosion and runoff, and increase ecological diversity. Little is known about the diversity of restored habitats, which is important since restoration promotes biodiversity and mitigates climate change. It is known however that new restored habitats do not hold as much biodiversity as native older habitats. Previous studies have shown that higher plant diversity often shows higher insect diversity, but some have argued there is no cause-and-effect diversity relationship between the two. Although plant diversity and insect diversity often follow the same patterns, abiotic variables have been demonstrated to be the driving factor. However, these studies on plant-insect diversity relationships are often in tropical regions of the world, which will not apply to restored prairies in Central Illinois. This project is set up to identify the plant-insect relationship in a restored Central Illinois prairie. Random quadrat samples, as well as the use of pitfall traps, will be used to quantify species diversity with the Shannon-Wiener diversity index. Correlation between plant and insect diversity will be determined, on small sample scales and whole plot scales. The results can help in the successful restoration and conservation of prairies.

2:10pm Grad **Developing and Implementing an Environmental PhotoVoice Curriculum in an After-School Program for Middle School Students**

*Elizabeth Wolk , Sharon M. Locke, Carol E. Colaninno, Jennifer Zuercher, Georgia Bracey, Maggie Dust, Candi Johnson [Southern Illinois University Edwardsville]

PhotoVoice is an educational method that helps students voice their interests and concerns through the use of photography and structured reflective writing. The Southern Illinois University Edwardsville STEM Center, in partnership with the university's Environmental Sciences and Applied Health Departments, along with local schools, has developed a modification to the PhotoVoice method referred to as Environmental PhotoVoice.

Through Environmental PhotoVoice, students explore the environment where they live. They then document the environmental assets and challenges they see in their own environment using photography and then reflect on these assets and challenges using their own voice. We report on an after-school program where we implemented an Environmental PhotoVoice curriculum with students in middle school. Our Environmental PhotoVoice curriculum draws on the SHOWeD method established by Wand and Burris (1997) and incorporates science content based on the Next Generation Science Standards at the middle school grade band. We developed this curriculum with the goal that students will discover a newfound interest in environmental health sciences that will encourage them to become changemakers for their community and potentially pursue careers in the health sciences. Given the context of after-school learning, coupled with the uncertainties of the COVID-19 pandemic, our current implementation includes modifications that provide greater flexibility for the PhotoVoice teacher. We also discovered that with Environmental PhotoVoice, students tend to focus their interests and concerns on pre-established familiarity rather than exploring new environmental concepts unprompted. Through scaffolding and an intentional learning progression, we try to introduce new environmental concepts to students to support their discovery of a greater awareness of their environments. This process helps these students consider new ways they can take positive steps to improve the environment of their community.

2:20pm UG **Quantifying the Relationship Between Land Use and Parasitic Trematode Infections in Larval Cricket Frogs (*Acris crepitans*)**

*Pamela Taylor, Steven Blake, John Marino [Bradley University]

Parasites can have large impacts on wildlife populations, and human activities are influencing the magnitude of these impacts. However, the relative importance of different human activities for changes in parasitism levels is largely unknown for many ecological systems. In this project, we investigated how different human activities corresponded with variation in parasitism in a wildlife host. We focused on the effects of land use in central Illinois on parasitic trematode infections in amphibians; trematodes can cause mortality and other negative effects in larval frogs, and the large impacts of humans on wetlands in central Illinois likely influence the magnitude of parasite effects. We examined such effects through a survey of trematode infection levels in northern cricket frog (*Acris crepitans*) tadpoles from 14 ponds surrounded by differing land use (agricultural, suburban, or natural areas) from 2019-2021. We predicted that higher infection levels would occur in tadpoles from ponds with higher proximity to human activity, due to potential impacts of chemical pollution (e.g., fertilizer from farm fields or lawns) that can influence the risk of tadpoles getting infected. Overall, we found high variability in infection loads over time and space, but we did not find a consistent pattern in infection levels associated with land use. Infection in tadpoles from different ponds varied from 0.2-127 mean trematode cysts per host. Infection levels also varied across years; for example, one site changed from a mean of 127 to <1 cysts per host from one year to the next. Our findings suggest that land use +was not a strong predictor of infection levels and that other factors likely lead to high variation in infection levels. Nevertheless, the relatively high infection levels we observed in some individuals suggest that these parasites may be having important impacts on these populations.

2:30pm UG **Bibliometric Analysis: The Effects of Triclosan on Human Health**

*Rachel Papavasilopoulos, Sanghoon Kang [Eastern Illinois University]

Triclosan (TCS) is a widely used chemical whose effects on human health remain elusive. TCS may play a role in a variety of health issues including endocrine dysfunction, irregular embryonic development, and immune suppression. It is possible that TCS's penetrative abilities across all body barriers, including the blood-brain-barrier, may make bioaccumulation the primary driver of these issues. In addition, chronic overuse of this chemical in everyday life may further contribute to the already increasing problem of antibiotic resistance. TCS research has steadily increased since its transition from medical to common, commercial use over the last 50 years. However, there are some clear gaps in the depth of this research as the safety of this agent is not fully agreed upon. The FDA recently issued regulatory rules on TCS in some commercial products, however TCS can still be found in almost anything marketed "antimicrobial" or "antibacterial". The purpose of this bibliometric study is to analyze research trends in this field and determine the amount of global attention TCS has received regarding its harmful effects. Documenting and determining research concentration trends related to this field will outline where additional research is most necessary, as well as demonstrate the most valuable research produced and its relation to the advancement of our understanding of TCS. We found that China has become an increasingly important player in recent years, leading the shift from research directed towards TCS on human health to research based on the indirect effects of TCS through environmental contaminations such as propagation of antibiotic resistance. Although TCS has received notice, the simple fact of its continued use in so many common products, reinforces the need for additional and more conclusive research before it has possible irreversible effects on our environment and health.

2:40pm **Grad** **Measures of Noise and Air Pollution Throughout the St. Louis Metropolitan Region**

*Josh Gifford [Southern Illinois University Edwardsville]

Southern Illinois University Edwardsville's STEM Center and Department of Environmental Sciences developed an environmental monitoring network for air quality and noise levels in the St. Louis metropolitan region, including southwestern Illinois. Extech SDL600 sound level meters and PurpleAir-II-SD air quality sensors were deployed at varying dates to capture levels of noise and air pollution, respectively. Our team strategically and opportunistically selected monitoring locations in a variety of communities to provide a range of Neighborhood Socioeconomic Status (NSES) levels throughout the network. Comparing decibel and PM2.5 levels to the NSES allowed me to find how differing socioeconomic levels experience multiple forms of pollution throughout the Metro East. We also placed monitors in urban, suburban, and rural areas to understand exposure levels as a factor of distance to a dense urban area. Using this network, we have collected over 1 million decibel readings and over 2 million PM2.5 readings across all 9 sites. I use the data from this network to address many environmental topics surrounding environmental exposures. Using the statistical package R and tests of linear regression, I found a relationship between decibel and PM2.5 levels with both distance from the St. Louis City Center and NSES. This suggests that communities in lower socioeconomic classes could be experiencing heightened levels of noise and air pollution compared to communities in higher socioeconomic classes. In addition, communities closer in proximity to the St. Louis City Center could be exposed to higher levels of pollution compared to communities living further from the city. Exposure to high levels of noise and PM2.5 may increase the risk of high stress, heart disease, high blood pressure, hearing loss, respiratory disease, and cancer. Additional research and monitoring is needed to further understand how these pollutants impact those residing in communities throughout the Metro East.

HEALTH SCIENCES

2:00pm **Heart Rate Variability: The Rosetta Stone of Health and Wellness**

*[1]Alex Wolfe, [1]Maggie Werts, [2]Allena Kraft, [2]Karen Dennis [[1]Lincoln College; [2]Illinois State University]

An experimental design investigating the effects of physical activity and stress management education on heart rate variability. Over the course of 16-weeks, subjects completed a physical fitness and health management course. Subjects completed physical activity requirements and stress management education seminars. It was hypothesized within this study, that this would result in an improvement in HRV and overall health. Paired samples T-tests were utilized to assessment the differences between pre- and post-assessments. The results of this study found no statistically significant differences between measures of HRV ($t_{(46)}$=-.191, p=.849). Although there was no statistically significant difference in our results, it is important to consider external factors. These factors include, but are not limited to, cooler temperatures and the coronavirus pandemic which may have limited our subjects access to physical activities, provided an additional source of stress and therefore minimized changes in HRV measures. Previous studies have shown a correlation between increased heart rate variability intervals when physical activity and stress management education seminars are utilized. These studies also occurred before the COVID-19 pandemic. Consequently, physical activity involvement improved cardiorespiratory fitness within the current study, which is a leading risk factor in CVD morbidities. However, further research is needed in order to assess the magnitude of the relationship between HRV, physical activity and stress management. Although causation cannot be determined from these results, further investigations are needed to assess the effect of this current pandemic on stress levels, physical activity involvement and HRV.

MICROBIOLOGY

1:20pm **Bacterial Communities Isolated from Root Nodules and Leaves of *Vigna unguiculata* (L.) Walp. ssp. *sesquipedalis* (L.) Verdc (Yard-Long Bean)**

*Scott Holt, Kylee Hill [Western Illinois University]

Long bean (*Vigna unguiculat*e (L.) Walp. Ssp. *Sesquipedalis* (L.) Verdc.) is a crop plant that originated from Cowpea and is grown in many countries as a food source. Despite its popularity, little information is known about the beneficial bacteria associated with this productive food crop. The objectives of this project were to enumerate and identify beneficial methylotrophs on leaves and symbiotic rhizobia in root nodules. For methylotrophs, macerated leaves were plated on selective agar containing methanol and incubated for seven days at 25°C. Pink colonies typical for *Methylobacterium* spp. were counted and identified using cultural, microscopic, and molecular identification. Leaf samples were also plated on Plate Count Agar to determine non-selective bacterial

count. For rhizobia, root nodules were surface sterilized, crushed, plated on Congo Red Yeast Extract Mannitol Agar, and incubated for 14 days at 25°C. Suspected rhizobia colonies were counted and identified using cultural, microscopic, and molecular identification. The rhizobia count was 2.1 x 109 ± 2.0 x 109 CFU/nodule. Rhizobia isolates were identified as *Bradyrhizobium* species based on characteristic cultural, microscopic, biochemical, and 16S rDNA sequencing. For methylobacteria, the count was 3.6 x 105 ± 1.9 x 105 CFU / g leaf tissue. The methylobacteria isolates were identified as *Methylobacterium* or *Methylorubrum* species based on characteristic cultural, microscopic, biochemical, and 16S rDNA sequencing. For the non-selective aerobic bacteria, the mean CFU count / g leaf tissue was 3.7 x 105 ± 2.2 x 105. Heterotroph isolates were identified as *Microbacterium*, *Brachybacterium*, *Brevibacterium*, *Sphingomonas*, and *Bacillu*s species. Overall, this is the first report of beneficial bacterial populations associated with the leaf tissues and root nodules of long bean crop. The beneficial bacterial species isolated from productive long beans can be used to develop natural microbial inoculants/fertilizers that support the growth of other important crop plants.

1:30pm UG **The Effects of Different Monochromatic Lights on the Photophobic Response in *Stentor coeruleus***

*Kwame Owusu-Nyantakyi [Knox College]

Many living organisms have evolved ways to sense and respond to the rather harsh environment that nature has to offer us. Cells developed ways to detect light in order to locate food or to find protection. Photosensation is well conserved in many organisms and even in humans. *Stentor coeruleus* are a species of microorganisms in the phylum Ciliophora and inhabit freshwater environments where they swim around using cilia. The way in which *Stentors* sense light is similar to the human eye as they are both mediated via G-coupled proteins. *Stentors* exhibit a photophobic response when suddenly exposed to bright light. This photophobic response is characterized by a halt in forward motion, a short period of backward swimming followed by a restoration of forward movement in a new direction and when exposed to light *stentors* respond by reversing their ciliary beat. In this experiment, I developed a behavioral assay to study the effects different monochromatic lights will have on the photophobic response in *Stentors* by imaging cells under different controlled light conditions and operationalizing the observed characteristic of the photophobic response. Cells were found to exhibit the most photophobic response under red light conditions. Interestingly, these data are consistent with the absorption spectra of a blue-green pigment called stentorin and may indicate that this pigment is involved with the response to light. Future experiments into the mechanics involved in photosensation in *Stentors* can possibly shed light on a novel way biological systems can sense light.

1:40pm UG **Implementing Transposon Mutagenesis to Investigate Proteins that Alter the Expression of Bacterioferritin Comigratory Protein in *Bacillus subtilis***

*Gia-Maria Calbaza, Melinda Faulkner [Bradley University]

All organisms that rely on oxygen for survival produce reactive oxygen species (ROS). Living organisms must maintain moderate levels of ROS, otherwise they may undergo oxidative stress. Oxidative stress has the ability to damage the structures of proteins, lipids, and deoxyribonucleic acids of cells. It can intervene in a lot of the cellular processes that are important for life, and may even cause cell death. Bacteria use peroxide-scavenging enzymes to attack ROS and maintain them at low and tolerable levels. In *Bacillus subtilis*, there are nine different enzymes that have been identified to play a role in removing ROS, including bacterioferritin comigratory protein (Bcp). However, little is known about Bcp, including its regulatory proteins. Regulatory proteins control the replication of genetic material and the synthesis of proteins in cells. The goal of this study is to investigate the regulatory proteins of *bcp*, and how they function in terms of influencing Bcp to defend against ROS. In this project, strains containing a *bcp'-lacZ* fusion have been created to measure expression of the *bcp* gene. These strains have undergone transposon mutagenesis and screening processes to analyze possible mutations that may increase expression of the *bcp* gene.

PHYSICS, MATHEMATICS, & ASTRONOMY

2:10pm Grad **A Brief Study of Physical and Optical Properties of Pr^{3+} and Dy^{3+} Co-Doped Bismuth Boro-Tellurite Glasses**

*Md Hasibul Hasan Hasib, AKM. A. Rahman, P. K. Babu, Saisudha B. Mallur [Western Illinois University]

Density and refractive index are important physical properties relevant for the analysis of optical absorption and fluorescence of rare-earth-doped glasses. In this work, we have prepared a series of Pr^{3+} and Dy^{3+} co-doped bismuth-boro-tellurite glasses by varying Bi_2O_3-B_2O_3-TeO_2 content and measured these properties as a function of the glass composition. The raw materials of the glasses are homogenously mixed to make a 20g batch for each

sample and melted in the temperature range of 800-1000 ºC by using appropriate amounts of Bi_2O_3, H_3BO_3, TeO_2, Pr_2O_3, and Dy_2O_3 of high purity (99.9%). The melted samples are air quenched and annealed at 350ºC for 2-3 hours to remove the thermal strains and then polished to obtain well-reflecting surfaces. We used the Archimedes' method with xylene to measure the density. The refractive index was measured using a Brewster angle set up (PASCO set up OS-8170) with a 650 nm diode laser as the source. Sample density is found to increase with increase in Bi_2O_3 content from 5.6 to 6.5 g/cm^3 in the 10 mol % TeO_2 glass composition. This is due the presence of heavier bismuth ions. For 20 mol% TeO_2 glass, the density showed less variation with bismuth content. The refractive index increased from 2.03 – 2.21 with Bi_2O_3 content in both 10 mol % TeO_2 and 20 mol% TeO_2 glasses. This increase in refractive index is attributed to the presence of highly polarizable bismuth and Tellurium ions. These prepared samples can be used for further investigation of optical absorption, fluorescence spectra, and electronic oxide polarizability.

2:20pm **Grad** **Study of Fluorescence Spectra of Praseodymium (Pr^{3+}) and Dysprosium (Dy^{3+}) Co-Doped Bismuth Boro-Tellurite Glasses**

*A K M Ashiqur Rahman, M. H. H. Hasib, P. K. Babu, Saisudha B. Mallur [Western Illinois University]

Dy^{3+} ions doped glasses are excellent optical systems used for color displays, fluorescent lamps, white light source, and LEDs. In this study, we analyzed Dy^{3+} fluorescence by co-doping with Pr^{3+} and varying the content of bismuth oxide in the base glass (Bi_2O_3:B_2O_3:TeO_2). The glasses are prepared using the melt-quench method, then fluorescence spectra are recorded using the LEOI-101 Modular Multifunctional Grating spectrometer with 445nm laser source. Dy^{3+} ions can be excited only in the UV region, whereas Pr^{3+} ions can be excited in the visible region at 445 nm. In this study we excited Dy^{3+} ions indirectly by exciting Pr^{3+} ions. Because of energy transfer from Pr^{3+} ions to Dy^{3+} ions, we observed the fluorescence from Dy^{3+} ions and it exhibited noticeable changes in its intensity with change in the bismuth oxide content as well as changes in TeO_2 content in both 10 mol% and 20 mol% TeO_2 glasses.

STEM EDUCATION

3:00pm **UG** **Investigating Illinois Students' Shifts in Scientist Stereotypes with Curricular Interventions**

*Alexis Keegan, Fabiola Perez, Maurina Aranda [Southern Illinois University Edwardsville]

Students in biology courses are often not exposed to diverse representations of scientists, especially in course curricula. This may promote stereotypical scientist perceptions and have major implications for students trying to view their possible selves as scientists. To address this, Scientist Spotlights – brief curricular assignments that highlight scientists from diverse backgrounds and course content (Schinske et. al, 2016) – have been shown to shift students' views away from scientist stereotypes. However, none of these studies have been done at a primary-white Illinois institution (e.g., Aranda et. al, 2021). We expand these data in the present study, by investigating the impact of Scientist Spotlights on students in a suburban Illinois university to determine whether these curricular interventions will also impact students at a predominantly white institution. The following research question guided our study: To what extent do Scientist Spotlights shift student' perceptions of scientists in an introductory and upper-division biology course? To address this, four Scientist Spotlights were implemented during the Spring 2021 semester in both a lower-level introductory biology course (n=88) and an upper-division biology course (n=65). As a pre-post measure, students were asked to "describe the types of people that do science" both before and after implementation of the Spotlights. Responses were qualitatively coded to consensus with a previously established rubric (Schinske et. al, 2015). Our results indicate that implementing Scientist Spotlights in both biology courses resulted in major shifts in students' perceptions of scientists. In both courses there was a 30% reduction in the stereotypical scientists mentioned and approximately 20% of students reported more inclusive non-stereotypical descriptions of scientists. Therefore, this study highlights the effectiveness of Scientist Spotlights as a valuable curricular intervention in shifting Illinois students' perceptions of scientists across a variety of biology courses.

3:10pm **Of Crows and Bagpipes: An Animal Behavior Lab Activity**

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

Teaching Biology Classes in an urban area such as Chicago is full of unconventional ecological experiences. This Lab activity was designed in conjunction with the City of Chicago's annual St. Patrick's Day parade (spring) and can also be used during the fall's Scottish Festival and Highland Games. The warm up area for the parade is in the Grant Park region which is an open grassland habitat with trees rows of mature oaks which are where the resident crow (*Corvus brachyrhychos*) population lives. Bagpipe sounds have been known to make pet dogs

(*Canis familiaris*) howl. Observations on crow reactions to bagpipes have also been observed such as increased "chatter" and wing flutter. Students use the parade day to record their observations and design hypothesis which might be tested by the next semester's students. Practice of data recording, hypothesis building, and understanding cultural upbringing influences in data collection are some of the intentions of this lab.

3:20pm **Balancing Life as a Biologist**

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

Balancing Life, as a Biologist who is married to an Economist, can be recognized as a "tradeoff". During our covid times, when most universities and colleges turned to online teaching and safe at home placements, the talkative and bright, enthusiastic college professors may have felt that they have lost their audience and reason for being in this occupation. No! The students are present, in a different way, and still want and need to follow their dreams of education to fulfill their goals. The students are stressing, as are the professors. Those of us who now have "extra" time once used for traveling to our universities, can use that time for a new hobby or taking a class themselves (after all backlisted home projects are completed, of course). We, the professors, are in this occupation for a reason: we love to learn and to pass that information on. Let us embrace the time given and allow ourselves to "listen" to our own advice and follow our new or old dreams, too! A goal setting activity is presented including personal goals as well as professional goals.

3:30pm **UG** **Understanding Science Identity Formation: Preliminary Results from Interviews with Scientists**

*[1]Olivia Beckwith, [2]Samantha A. Murphy, [1]Carol E. Colaninno, [1]Georgia Bracey, [3]Clark H. Sturdavent [[1]Southern Illinois University Edwardsville; [2]Washington University; [3]Environmental Research Center, LLC]

Science identity–the degree to which one feels like or identifies as a scientist–plays a critical role in the success of one's science education and career trajectory. Carlone and Johnson (2007) proposed a model of science identity formation centered on three constructs: scientific performance, competence, and recognition. Within this model, performance is the social performance of relevant scientific tasks, competence is the knowledge and understanding of science content, and recognition is recognizing oneself and getting recognized by others as a science person. Although this model appears in the literature, it rarely has been studied with a focus on those who identify as scientists. We interviewed 17 scientists at varying stages in their scientific career–from graduate students to established career professionals–to understand how scientists view their own science identity in relation to the three constructs. After we completed the interviews, we transcribed them. Then two to three independent researchers coded each transcript using an *a priori* coding frame based on the three-part conceptual model of science identity. We suggest that there is alignment between how scientists view their science identity formation and the three-part conceptual model. Scientists frequently noted that experiences related to performing scientific tasks generated a sense of feeling like they were a scientist, and their ability to do these tasks created a sense that they were a scientist. For recognition, scientists commented that they often do not get recognized as a scientist in their day-to-day lives, but being recognized for scientific accomplishments by other scholars helped support their identity as a scientist. Although we see alignment with the three-part science identity conceptual model, we also identified aspects of the model that can be refined. These refinements may help support a greater understanding of how people begin to see themselves as scientists and find success in scientific endeavors.

ZOOLOGY

2:00pm **UG** **Prevalence of *Francisella tularensis* in Raptors: A Role for Hawk Flies?**

*[1]Morgan Rockwell, [1]Travis E. Wilcoxen, [2]Beth Chan, [2]Jacques T. Nuzzo, [2]Jane Seitz [[1]Millikin University; [2]Illinois Raptor Center]

North American raptors can be infected by a gram-negative coccobacillus, *Francisella tularensis*, or tularemia. *F. tularensis* can be transferred to a host via direct contact with another host, including ingestion or inhalation, and contamination of water. Raptors can be parasitized by *Hippoboscidae* flies (louse flies), but it is unknown if they can transmit tularemia. In this study, we explored potential modes of transmission of tularemia within raptors and Hippoboscid flies by determining the prevalence of the pathogen in hosts with direct ELISA and indirect IgM ELISA. A direct ELISA was used to detect the presence of the pathogen in flies and in the plasma of birds hosting flies An indirect ELISA for IgM against *F. tularensis* LPS was used for birds to detect the prevalence of antibodies in the plasma. The highest prevalence of *F. tularensis* was in larger predators (GHOW, RTHA, & TUVU). The higher prevalence may occur because these raptors have a diet high in rabbits – or other mammals, putting them at a higher risk. Most of the birds that had tested positive for tularemia in the direct and IgM indirect

ELISA had shown that they had illness and symptoms when submitted to the rehabilitation center. The symptoms corresponded to the birds that had tested positive. Birds that were sprayed by skunks had a high probability of testing positive for tularemia. Further studies could also test raptors caught in the wild, rather than birds admitted into the rehabilitation center, and we could use IgY ELISA to test for antibodies signaling a history of exposure to tularemia.

2:10pm UG **Avoidance Behavior by Wingless *Drosophila melanogaster* of a Food Source Infected with Lipopolysaccharides**

*Sydney Kehrmann, Marianne Robertson [Millikin University]

Information on how pathogens are controlled once entering a population is abundant, but little is known about how hosts avoid initial infection by pathogens. Individuals conserve energy through pathogen avoidance by preventing a costly immune response. Lipopolysaccharides (LPS) are gram-negative bacterial endotoxins that institute an immune response without causing infection. We tested male and female wingless *Drosophila melanogaster* using an LPS concentration of 1.0 mg/ml. We did not pre-expose the control group to any LPS, and only pre-exposed flies to a food source containing LPS in the experimental group. We then placed an individual fly into an arena that contained a healthy food source and an infected food source. For each control (n=30) and experimental (n=30) fly, we recorded how many times the fly landed on each food source, as well as the duration of time spent on the food source. There were no significant differences in number of visits or time spent on the infected food source of control flies. Male flies pre-exposed to LPS spent significantly less time on the infected food source and had significantly less visits to any food source. Female flies pre-exposed to LPS had no significant differences in time spent on the infected food source but had significantly more visits to the infected food source. These data support the hypothesis that male *D. melanogaster* will show avoidance of a food source infected with LPS, but do not support this hypothesis for females. These differential results between male and female flies demonstrate sex-specific behaviors following exposure of an endotoxin.

2:20pm UG **The Influence of Microhabitat on Amphibian Survival in Larval *Lithobates catesbeianus***

*Makenzie Groenhof, Brittney Hengst, John Marino [Bradley University]

Most organisms occupy habitats that can be subdivided into microhabitats. Variation among microhabitats in environmental factors, such as location, temperature, predator-prey interactions, nutrient availability, and water chemistry, can have important consequences for organism fitness. However, the consequences of small-scale spatial variation in environmental factors are often ignored in ecological studies. In this study, we assessed the influence of microhabitat on growth and survival of an important group of wildlife, amphibians. We used bullfrogs (*Lithobates catesbeianus*) as a model to explore microhabitat effects. We hypothesized that tadpoles in a wetland occupying shallow depths near the shore would experience greater survival due to greater food availability and warmer water temperatures compared to tadpoles in deeper water or farther from shore. We performed a field experiment in a wetland using enclosures that were placed in shallow water near the shore, near the surface farther from shore, or near the bottom farther from shore. Tadpoles remained in enclosures for 14 days before being collected, weighed, euthanized, and preserved. Our results suggest that survival differed between habitats ($p < 0.001$), while final mass did not depend on habitat ($p < 0.1$). A substantially higher percentage of tadpoles survived in the offshore deep microhabitat (60.8%) compared to the offshore near-surface microhabitat (31.0%) or the nearshore microhabitat (37.5%) . Based on these results, our hypothesis was not supported. A possible reason for increased survival in the offshore deep habitat compared to the other microhabitats could be because of increased nutrient availability near the wetland bottom or reduced exposure to predator chemical cues in the deeper water. Subsequent research should examine such mechanisms underlying observed differences in survival among microhabitats and potential consequences for amphibian populations.

2:30pm UG **Measuring the Response of Red Swamp Crayfish to the Doses of Potassium Chloride Used During Zebra Mussel Eradication**

*Patrick Menke, Sarah Nacos, Jen Jost [Bradley University]

Zebra mussels, *Dreissena polymorpha*, are an invasive bivalve mollusc that pose a threat environmentally to native species due to competition for resources and space, and economically due to their ability to attach to hard substrates via byssal threads. There is great interest in the ability to limit their spread and remove existing populations. However, the most successful methods are costly and damaging to the environment. Prior experiments have looked at using potassium chloride (KCl) to eradicate zebra mussels, but there have been discrepancies regarding the lethal dosage, and the possible effects on the native species in these habitats is unknown. In order to address these concerns, mussels were exposed to varying concentrations of KCl for 72 hours, and survival was checked every 12 hours. Results confirmed that KCl is an effective means of underwater mussel control with high mortality even at low doses. To investigate the effects on native species, red swamp

crayfish, *Procambarus clarkii*, were exposed to the lowest dose of KCl that caused >50% mortality in zebra mussels (125 mg/L) and held at either 15 or 25°C. Crayfish survival and righting response were checked every 24 hours for 72 hours, and hepatopancreas tissue was collected to measure lactate concentration. There was no significant difference between control and KCl-exposed crayfish for any of the measured parameters, regardless of water temperature. These data suggest that the lethal dose for mussels has little to no negative impact on the crayfish.

2:40pm UG **Determining Impact of Aerial Exposure on Zebra Mussel Survival, Growth, and Oxidative Stress**

*Antoine Haddad, Jen Jost, Zalan Shah [Bradley University]

Invasive zebra mussels (*Dreissena polymorpha*) were introduced to Northern America in the 1980s and have spread throughout waterways where they cause ecological and economic damage. Given that they can attach to surfaces, such as boats, and survive air exposure, it is possible for mussels to be introduced to new areas through infested and trailered boats. While it is known that mussels survive aerial exposure when conditions are cool and damp, little is known regarding their physiology post-exposure or their cellular physiology during exposure. Preliminary experiments to determine the optimal aerial conditions showed that mussels experienced high mortality with high air temperatures and low relative humidities, but the majority of mussels could survive 72hrs at 15°C and 75% relative humidity. While greatly reduced, some survival was seen at 20°C and 75% relative humidity. During aerial exposure, mussels lost significantly more mass than control mussels, but upon re-immersion, these effects were lost, regardless of the water temperature to which they were re-introduced. When mussels were exposed to either 15 or 20°C and 75% relative humidity for 48hrs, re-immersed, and tracked for four weeks, there was no significant difference in mussels size, as measured by change in shell size, change in shell mass, and change in tissue mass, between either set of exposed mussels and control mussels that remained underwater for the experiment. Oxidative stress during aerial exposure was determined by developing protocols to measure the activity of superoxide dismutase and the total levels of glutathione in zebra mussels. Preliminary results show no significant changes in antioxidant activity or levels, however, this may be the result of the relatively low sample sizes. These findings suggest aerially exposed mussels have no disadvantage relative to non-aerially exposed mussels post reimmersion, highlighting the ability of zebra mussels to thrive after being introduced to a new environment.

3:00pm UG **Variation in Trematode Infection in Larval Frog Hosts from Constructed Wetlands in an Agricultural Landscape**

*Emily Wymore, John Marino [Bradley University]

Nutrient pollution has been a major topic of ecological concern for decades. In heavily cultivated areas like the midwestern United States, aquatic nutrient concentrations in tile-drained fields can be especially high. Constructed wetlands are an effective tool for minimizing nutrient concentrations in agricultural runoff prior to reaching major waterways. Constructed wetlands can also provide habitat for wildlife populations, but these populations may be impacted by high nutrient levels in such wetlands. Amphibians, for example, can experience negative effects of high aquatic nitrogen and phosphorus concentrations, including increased susceptibility to parasites and increased mortality. In the present study, we examined trematode parasitism of larval northern cricket frogs (*Acris crepitans*) collected from constructed wetlands across a nutrient gradient in agricultural central Illinois. We expected to find a positive relationship between frogs experiencing greater infection load and exposure to higher wetland nutrient concentration. However, our initial findings indicate no or even the opposite relationship, whereby the tadpoles from wetlands with less extreme nutrient concentrations experienced greater infection load. Other environmental factors (e.g., hydrology) may covary with nutrient levels at our site, which may have overwhelmed an effect of nutrients. These findings indicate that further research of amphibian health across various nutrient gradients is necessary to better understand such interactions. Continuing to expand our knowledge of the functionality of constructed wetlands may guide amphibian conservation efforts in agricultural settings.

3:10pm Grad **Invasion of *Lespedeza cuneata* Negatively Impacts Plant Diversity While Enhancing Ground Beetle Diversity**

*Matthew Goessling, Kurt Schulz, Jason Williams [Southern Illinois University Edwardsville]

The effects of *Lespedeza cuneata* invasion on plant and insect communities were examined between 3 September to 27 September 2020 in a grassland on the Southern Illinois University Edwardsville campus. We utilized sixteen, 20x10m plots at a single site and collected ground beetles from pitfall traps each week. Half of the plots were dominated by *L. cuneata* (present at 97.9% of points sampled), while the other eight plots were nearly free of *L. cuneata* (present at 2.1% of points sampled). Plots containing *L. cuneata* had reduced plant diversity

(Shannon's diversity index = 11.5±1. 8) compared to *L. cuneata*-free plots (17±2.6), although evenness was similar between plots (0.86±0.02, 0.87±0.02). Total ground beetle collections different between plots as 497 ground beetles were from *L. cuneata*-rich plots and 909 ground beetles from *L. cuneata*-free plots. This difference is likely due, in part, to animal interference. In contrast to plant communities, ground beetles, determined to subgenera, were more diverse and more even (1.54±0.23, 0.78±0.06) in *L. cuneata*-rich plots compared to plots that lacked the invasive plant (0.10±0.22, 0.56±0.13). It is unknown how the presence of *L. cuneata* may influence ground beetle communities throughout the year or how it may affect other invertebrate communities.

3:20pm Grad **Repeated Exposure Enhances Honey Bee Ethanol Tolerance Independent of Age and Behavioral Group**

*Sydney Tomaschke, Jason Williams [Southern Illinois University Edwardsville]

Alcohol misuse is a common issue among humans and requires the use of animal models to ethically examine the underpinning of abuse. Honeybees encounter ethanol in nature and have distinct behavioral groups in a single hive that may vary in their exposure to ethanol. However, only a few studies have examined ethanol exposure using honey bees and fewer yet have controlled for level of ethanol exposure, behavioral group, and adult age. To study this, we exposed in-colony workers (nurse bees), which rarely experience ethanol in nature, and out-of-colony workers (foragers), which may routinely encounter ethanol as they gather nectar to repeated bouts of 0, 25, or 50% ethanol vapor for five consecutive days. Time until loss of posture while being exposed to 70% ethanol vapor or preference for sugar water containing ethanol was determined on the sixth day. The above exposures and measures were determined on bees that were either 14 or 24 days of adult age. Time until loss of posture was similar between bees of different age and behavioral group. However, all bees repeatedly exposed to 50% ethanol vapor maintained posture considerably longer (677 ± 55 sec) when challenged with 70% ethanol vapor compared those in the 25% or 0% treatments (513 ± 40 sec and 378 ± 40 sec respectively). We are currently examining data for preference of ethanol in sugar water.

3:30pm UG **Cold Tolerance may be Preserved in Aged Flies Subjected to Variable Thermal Environments**

*Alyzza Diaz, Evan Fox, Payton Kinder, Jason Williams [Southern Illinois University Edwardsville]

Enduring temperature stress is a critical component of terrestrial ectotherm survival, however, the pace at which thermotolerance senesces in aged individuals is understudied. Recent work suggests the ability of adult fruit flies (*Drosophila melanogaster*) to survive an extreme subzero exposure diminishes within one to two weeks of adult life, especially if held in a stable thermal environment. Yet, the ability to mitigate sublethal effects after exposure to a moderate, low temperature exposure in aged animals is unknown. The purpose of this study was to further characterize the age-associated loss of cold tolerance in *D. melanogaster* by assessing time until recovery from chill coma (i.e. resumption of righting response) and post-exposure vertical walking performance after exposing males of various age to a six-hour moderate cold stress (0°C). These assessments were done on flies held in incubators maintained at a either a constant 20°C or diurnal fluctuating environment (15-25°C) during adulthood to determine if a variable thermal environment preserve cold tolerance. Two-day-old adult flies maintained at 20°C recovered from chill coma faster (10.6 ± 0.3 min) than 12- or 20-day old flies, which averaged 14.3 ± 0.3 and 13.1 ± 0.1 min. Flies from a variable thermal environment recovered faster in two-day-adult flies (8.8 ± 0.5 min) compared to age-matched flies held at a constant 20°C, however, 12- and 20-day old flies had similar recovery periods regardless of thermal regimes. Young flies successfully walked 150mm vertically within 20 sec at a higher rate after cold stress (50.3 ± 4.6%) compared to 12- and 20-day old flies which averaged on 14.8 ± 2.6 and 17.5.1 ± 4.8%. Variable thermal regimes did appear to maintain post-cold performance in 12-day old flies as 29.9 ± 4.1% of these animals successfully passed the performance test.

3:40pm Grad **Lead Contamination and Fish Deformity in the Big River**

*Katie Cutler, Paul Brunkow [Southern Illinois University Edwardsville]

Eastern Missouri has been subject to varied levels of lead contamination due to lead mining operations existing since colonial times. Lead contamination, in the form of imported lead-containing sediment, can subject aquatic organisms to high levels of toxic stress, often resulting in altered developmental trajectories and morphological deformities. We examined this manifestation of metal toxicity in juvenile stonerollers (*Campostoma anomalum*) collected from the Big River in east-central Missouri. Two sites were sampled: Irondale, a site free of historical lead mining activities and impacts, and Leadwood, a site subject to very high levels of lead contamination over many decades. Stonerollers were examined for external morphological deformities. Scales, fins, opercula, and gill filaments were examined, and we observed no significant level of deformity from either site. We also report on the incidence of skeletal deformities, using clearing and staining techniques to visualize the axial skeleton. The absence of deformities even in a site of historical and currently high levels of lead contamination suggests

that either selection has operated so as to produce populations of fish that are tolerant of high lead levels, or that mortality due to lead contamination occurs at an even earlier stage of development in the Leadwood population.