TRANSACTIONS OF THE ILLINOIS STATE ACADEMY OF SCIENCE

SUPPLEMENT TO VOLUME 116

116TH ANNUAL MEETING
APRIL 13, 2024

WITH ILLINOIS JUNIOR ACADEMY OF SCIENCE REGIONAL WINNERS

IN PERSON ALL-DAY EVENT HOSTED BY

MILLIKIN UNIVERSITY®

ILLINOIS STATE ACADEMY OF SCIENCE

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AFFILIATED WITH THE ILLINOIS STATE MUSEUM
SPRINGFIELD, IL

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116TH ISAS ANNUAL MEETING

April 13, 2024
Millikin University
Host: Dr. Travis Wilcoxen

MEETING SCHEDULE

SATURDAY, APRIL 13TH

MORNING EVENTS ARE IN LEIGHTY-TABOR SCIENCE CENTER

- 8:00am – 12:00noon First Floor Lobby – Check-in, On-Site Registration if Needed, Break Room
- 8:00am – 9:00am First Floor Lobby – Continental Breakfast
- 9:00am – 12:00noon Oral Presentations, Rms 001, 115, 208, 209

EARLY AFTERNOON EVENTS ARE IN GRISWOLD GYMNASIUM

- 12:30pm – 3:45pm Main Entry – Check-in, On-Site Registration if Needed, Break Room
- 1:00pm – 2:15pm Group A Poster Presentations (odd numbers)
- 2:30pm – 3:45pm Group B Poster Presentations (even numbers)

MEALS, KEYNOTE, & AWARDS ARE IN UNIVERSITY COMMONS BALLROOMS

- 12:00noon – 1:00pm Lunch (tickets required)
- 4:00pm – 4:45pm KeyNote Address
- 5:00pm – 5:45pm Dinner (tickets required)
- 5:45pm – 6:15pmpm Award Presentations

Future Meeting Sites
2025 – TBA

ABBREVIATIONS USED IN PROGRAM

Division Abbreviations

Cell Biology	Cell, Molecular, & Developmental Biology
Engineering & Tech	Engineering & Technology
Physics, Math, & Astron	Physics, Mathematics, & Astronomy

Participant Abbreviations

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

Participating School and Organization Abbreviations

Adlai	Adlai Stevenson High School
Bradley	Bradley University
Dunlap	Dunlap High School
EIU	Eastern Illinois University
IC	Illinois College
IMSA	Illinois Math and Science Academy
ISU	Illinois State University
Knox	Knox College
Lewis	Lewis University
Millikin	Millikin University
Nnamdi	Nnamdi Azikiwe University, Nigeria.
Oak Park	Oak Park and River Forest High School
Sacrament	Blessed Sacrament School
SIUE	Southern Illinois University Edwardsville
St. Louis	University of Health Sciences and Pharmacy in St. Louis
Warrensburg	Warrensburg-Latham High School
Washington	Washington Junior High and Academy Program
Webster	City of Webster Groves
WIU	Western Illinois University

— *Millikin University*

Campus Map

millikin.edu/tour

Academic / Administration

- 1 ADM-Scovill Hall — *Tabor School of Business, Center for Entrepreneurship, SCORE*
- 2 Alumni/Development Center
- 11 Center for Theatre & Dance
- 6 Dolson Hall — *Office of Residence Life*
- 3 Gorin Hall — *Admission Office, Registrar, Marketing*
- 4 Griswold Physical Education Center
- 24 Health Sciences Center
- 10 Health Sciences Center West
- 5 Leighty-Tabor Science Center
- 13 Millikin Health Clinic
- 8 Perkinson Music Center
- 7 Pilling Chapel
- 9 Shilling Hall
- 12 University Commons & Staley Library

Athletics

- 14 Athletic Department
- 16 Bartlett Tennis Courts
- 17 Decatur Indoor Sports Center (DISC)
- 4 Griswold Physical Education Center
- 25 Rathje Athletic Center — *Coming soon!*
- 18 Frank M. Lindsay Track & Field
- 20 Workman Family Baseball Field
- 19 Workman Family Softball Field

Dining

- 12 Dining Hall, Common Grounds — *University Commons*
- 10 Domino's, University Dogs
- 9 Einstein Bros. Bagels — *Shilling Hall (North Entrance)*

Housing

- 29 Alpha Chi Omega
- 31 Aston Hall
- 32 Blackburn Hall
- 6 Dolson Hall
- 36 Huss House
- 41 New Hall 4
- 42 Pi Beta Phi
- 43 Sigma Alpha Epsilon
- 44 Tau Kappa Epsilon
- 45 Walker Hall
- 46 Weck Hall
- 47 The Woods at Millikin Apartments

Fine & Performing Arts

- 22 3D Arts & Theatre Center
- 9 Albert Taylor Theatre
- 23 Kirkland Fine Arts Center
- 40 Percussion House
- 8 Perkinson Music Center
- 7 Pilling Chapel
- 24 Pipe Dreams Studio Theatre

Handicapped parking available in all lots.

S Public Safety

Emergency

Dining

MILLIKIN UNIVERSITY

ORAL PRESENTATIONS OVERVIEW

LEIGHTY-TABOR SCIENCE CENTER

	Rm 001	Rm 115	Rm 208	Rm 209
9:00 – 9:15	**Dana Morrone** STEM Education	**Melina Hall** Cell Biology	**Anne Claud** Engineering & Technology	**Kushal Dahal** Physics, Math, & Astronomy
9:15 – 9:30	**Noah Campbell** Microbiology	**Maede Shahin** Cell Biology	**Dolly Gupta** Engineering & Technology	**Gabriel Sojka** Physics, Math, & Astronomy
9:30 – 9:45	**Rachael Rosenstenger** Microbiology	**Jason Miller** Cell Biology	**Sakila Akter Jahan** Engineering & Technology	**Chelsie Hadley** Physics, Math, & Astronomy
9:45 – 10:00	BREAK	BREAK	**Jessica Li** Engineering & Technology	BREAK
10:00 – 10:15	**Sophi Dorgan** Zoology	BREAK	BREAK	**Kenneth VanZuiden** Physics, Math, & Astronomy
10:15 – 10:30	**Lanie Chizmard** Zoology	**Sara Kilar** Plant Biology	**Tyler McMahon** Environmental Sci	**Md Nazmul Haque** Physics, Math, & Astronomy
10:30 – 10:45	**Chris Theodorakis** Zoology	**Kurt Schulz** Plant Biology	**Brianna Cook** Environmental Sci	BREAK
10:45 – 11:00	BREAK	BREAK	**Ashley De Anda** Environmental Sci	**Dana Morrone** Chem & BioChem
11:00 – 11:15	**Jordan Morgan** Zoology	**Brailey Coulter** Health Sciences	**Emily Beiler** Environmental Sci	**Seth Eridanus** Chem & BioChem
11:15 – 11:30	**Patrick Menke** Zoology	**Camille Herdklotz** Health Sciences	Divisional Meetings – after session or Rm 224	
11:30 – 11:45	**John Marino** Zoology	**Abby Falkoff** Health Sciences		
11:45 – 12:00	Divisional Meetings – after session or Rm 224			

POSTER PRESENTATIONS OVERVIEW

GRISWOLD GYMNASIUM

Group A [1:00pm – 2:15pm] – Odd Numbers				Group A [2:30pm – 3:45pm] – Even Numbers			
1	**Mary Odubote** Cell Biology	43	**Pragya Sharma** Environmental Science	2	**Nathan Balvanz** Cell Biology	44	**Nyah Biegler** Environmental Science
3	**Lucia Thompson** Cell Biology	45	**Emily Everett** Environmental Science	4	**Zackary Woodall** Cell Biology	46	**Hannah Kolker** Environmental Science
5	**Jaelyn Boone** Cell Biology	47	**Annaliese Oldenburg** Environmental Science	6	**Gillian Monroe** Cell Biology	48	**Alexa Howard** Environmental Science
7	**Jacob Weinberg** Cell Biology	49	**Elizabeth Pippins** Health Sciences	8	**Ashton Gray** Cell Biology	50	**Madison Webb** Health Sciences
9	**Lauren Lucykow** Cell Biology	51	**Rebecca Hudson** Health Sciences	10	**Sarah Hoffmann-Weitsman** Cell Biology	52	**Cyrus Darki** Health Sciences
11	**Aminah Haynes** Cell Biology	53	**Ashley Miller** Microbiology	12	**Thomas Fowler** Cell Biology	54	**Chiemeka Emeribe** Microbiology
13	**Seth Stidham** Cell Biology	55	**Ashleigh Stults** Microbiology	14	**Lyric Johnson** Cell Biology	56	**Oluwaseyi Omodiminiyi** Microbiology
15	**Kennedy Spears** Cell Biology	57	**Mary Olorunkosebi** Microbiology	16	**Victoria Anselm** Cell Biology	58	**Danielle Ashton** Microbiology
17	**Michael Combs & Lillie Purcell** Chemistry & BioChem	59	**Diana Guzman** Microbiology	18	**Briar Hilsabeck** Chemistry & BioChem	60	**Mainprice Essuman** Microbiology
19	**Olivia Brinker** Chemistry & BioChem	61	**Harmin Patel** Microbiology	20	**Ty Ojanovac** Chemistry & BioChem	62	**Mark Naom & Caden Matthews** Microbiology
21	**Rocco Jones** Chemistry & BioChem	63	**Mehbuba Rashid Mouri** Physics, Math, & Astronomy	22	**Sam Hannig** Chemistry & BioChem	64	**Amy Aung** Physics, Math, & Astronomy
23	**Sam Hannig** Chemistry & BioChem	65	**Md Khokon Miah** Physics, Math, & Astronomy	24	**Foster Amoah** Chemistry & BioChem	66	**Garima Ranabhat** Plant Biology
25	**Shay Adio** Chemistry & BioChem	67	**Sharon Locke** STEM Education	26	**Anthony Aya** Chemistry & BioChem	68	**Pratigyan Bhusal** STEM Education
27	**Emily Jovanovich** Chemistry & BioChem	69	**Mariam Sani** STEM Education	28	**Jake Provis** Chemistry & BioChem	70	**Hunter Hansen** STEM Education
29	**Lindsey LeBlanc** Chemistry & Bio Chem	71	**Farzana Elaf** STEM Education	30	**Keszia Fabien** Chemistry & BioChem	72	**Andreia Dexheimer** STEM Education
31	**Olalekan Ogunsola** Chemistry & Bio Chem	73	**Yusra Amena** STEM Education	32	**Ammar Al-Bataineh** Chemistry & BioChem	74	**Marianne Maghamez** STEM Education
33	**Ayowole Owolabi** Chemistry & Bio Chem	75	**Dylan Krohe** Zoology	34	**Egzona Tahiri** Chemistry & BioChem	76	**Sofiane Aiche** Zoology
35	**Marlena Gabriel** Chemistry & Bio Chem	77	**Felicity Hunt** Zoology	36	**Chinedu Okoro** Chemistry & BioChem	78	**Jessica Kuca** Zoology
37	**Austin Long** Chemistry & Bio Chem	79	**Faith Nuss** Zoology	38	**Amritha Praveen** Computer Science	80	**Amelia Ayotte** Zoology
39	**Autumn Belt** Environmental Science	81	**Tomi Sewell** Zoology	40	**Alex Krupa** Environmental Science	82	**Emily Hernandez** Zoology
41	**Harriet Barker** Environmental Science	83	**Ava Maria Mendoza** Zoology	42	**Thane Woods** Environmental Science	84	**Zachary Renken** Zoology
85	**Shannon Legge** Chemistry & Bio Chem						

ILLINOIS JUNIOR ACADEMY OF SCIENCE POSTER PRESENTATIONS OVERVIEW

GRISWOLD GYMNASIUM

Group A [1:00pm – 2:15pm] – Odd Numbers				Group A [2:30pm – 3:45pm] – Even Numbers			
101	**Anda Wattanakit**	9th	Richwoods High School	102	**Emily Bah**	10th	Lane Tech College Prep118
103	**Hannamaria Ulanbek**	7th	Science Academy of Chicago	104	**Hayley Perry**	8th	Albion Grade School
105	**Ashlynn Pontious & Isabella Rhodes**	7th	Ramsey Junior High	106	**Zoya Chowdhury**	8th	Carbondale Community High School
107	**Isabelle Hou**	10th	Carbondale Community High School	108	**Julian Grisius**	10th	Illinois STEM Society
109	**Aditya Prashanth**	12th	Illinois STEM Society	110	**Savannah Ramsey**	11th	Southeastern High School
111	**Elizabeth Hubbard**	9th	Southeastern High School	112	**Quinn Melendez**	8th	Holy Family School - Oglesby
113	**Olivia DiGriorgio**	7th	St. Scholastica School	114	**Marcus King**	11th	Governor French Academy
115	**Saisrivarsha Venigalla & Ameenah Abdul-Rasheed**	12th	Edwardsville High School	116	**Loyal Flanders**	11th	Althoff Catholic High School
117	**Agrini Heekhra**	9th	Dunlap High School	118	**Anna Tataryn**	10th	Lane Tech College Prep118
119	**Olivia Jones**	10th	Lane Tech College Prep118	120	**Yairely Marchan**	10th	Lane Tech College Prep118
121	**Leah Wu**	10th	Walter Payton College Preparatory High School	122	**Michael Xi, Pranav Dharmappa, & Benjamin Brown**	11th	University High School - ISU
123	**Vignesh Tiruvannamalai & Josephine Kim**	11&12th	Illinois Mathematics and Science Academy	124	**Chloe Zu**	12th	Adlai E. Stevenson High School
125	**Isaiah Yang**	11th	Glenbrook South High School				

ORAL PRESENTATIONS SCHEDULE – 9AM-12NOON
LEIGHTY-TABOR SCIENCE CENTER

Time	Presenter	Title of Presentation
Cell, Molecular, & Developmental Biology – Rm 115		
9:00am	Melina Hall (Millikin, UG)	Characterizing the Influence of T3 and T4 on the Efficacy of Two Pro-Apoptotic Cytotoxins
9:15am	Maede Shahin (SIUE, Grad)	SLC12 Family Transporters in Schmidtea mediterranea
9:30am	Jason Miller (EIU, UG)	Developing of Gene Over-Expression Plasmid Vectors for Plant Functional Studies
Chemistry & Biochemistry – Rm 209		
10:45am	Dana Morrone (St. Louis)	Catalytic Enhancement of an Artificial RNA Ligase through Engineered Domain Addition
11:00am	Seth Eridanus (Millikin, UG)	Quantitatively Determining Amoxicillin Content in Antibiotic Capsules from Limited Resource Countries Using HPLC
Engineering & Technology – Rm 208		
9:00am	Anne Claud (Oak Park, HS)	Novel Thermopile System to Increase the Fuel Efficiency of Internal Combustion Engines to Help Mitigate Climate Crisis
9:15am	Dolly Gupta (ISU, Grad)	Applied Machine Learning Skills for Autonomous Car
9:30am	Sakila Akter Jahan (ISU, Grad)	Integrating Lean Six Sigma into Project Management for Operational Excellence
9:45am	Jessica Li (Oak Park, HS)	The Biophysical Characterization of Salt-Leached Polylactic Acid (PLA) Bioscaffolds Fabricated by Thermomolding: A Novel Method With Applications for Tissue Engineering
Environmental Science – Rm 208		
10:15am	Tyler McMahon (Bradley, Grad)	Effects of Controlled Burning and Grazing on Macro-Moth Diversity in Illinois Tallgrass Prairie
10:30am	Brianna Cook (Bradley, UG)	Landscape of Fear in Mammals in Response to Anthropogenic Hunting Patterns
10:45am	Ashley De Anda (Bradley, UG)	How Much Genetic Diversity is Present in Ringed Salamanders (Ambystoma annulatum)?
11:00am	Emily Beilert (SIU@, Grad)	Determination of Altered Circadian Rhythm Analysis Following Exposure of Perfluorooctane Sulfonate on Fruit Flies & Planarians
Health Sciences – Rm 115		
11:00am	Brailey Coulter (SIUE, Grad)	Hyperthyroidism and Periodontal Disease - Insights from a Mouse Model Study
11:15am	Camille Herdklotz (SIUE, UG)	Removal of Candida albicans Biofilms by Over-the-Counter Mouth Rinses Compared to Chlorhexidine
11:30am	Abby Falkoff (Oak Park, HS)	The Use of Croton and White Oak Bark Extracts on a Bombyx mori Model as the Basis for Novel Pharmacological Agent to Treat Hyperglycemia
Microbiology – Rm 001		
9:15am	Noah Campbell (Oak Park, HS)	Evaluating the Bioremediation Potential of B. licheniformis as a Novel Method for the Passive Treatment of Acid Mine Drainage (AMD)
9:30am	Rachael Rosenstengel (IC, UG)	Screening Orchid Mycorrhizal Fungi for Antimicrobial Activity
Physics, Mathematics, & Astronomy – Rm 209		
9:00am	Kushal Dahal (WIU, Grad)	Raman Study of Binay Bismuth Borate Glasses Doped with Praseodymium Ions
9:15am	Gabriel Sojka (WIU, UG)	Hydroxyl Masers in the Orion Nebulae
9:30am	Chelsie Hadley (WIU, UG)	Fault-Tolerant Quantum Computing with Three Qubit Codes
10:00am	Kenneth Van Zuiden (WIU, UG)	Identifying Radio Continuum Controls to Characterize Variability of Methanol Masers in the Orion Nebula
10:15am	Md Nazmul Haque Nihad (WIU, Grad)	Quantum Zeros and Ones: Leveraging Quantum Entanglement for Game Strategy Optimization
Plant Biology – Rm 115		
10:15am	Sara Kilar (EIU, Grad)	Optimization of Transformation and Regeneration in the Sunflower (Helianthus annuus)
10:30am	Kurt Schulz (SIUE)	Data, Not Surmise: Weighing the Importance of the Spring and Fall Canopy Light Windows for the Invasive Shrub Lonicera maackii
STEM Education – Rm 001		
9:00am	Dana Morrone (St. Louis)	A Molecular Biochemistry Lab Education Tool Allowing ror Full-Color Experiments

Time	Presenter	Title of Presentation
		Zoology – Rm 001
10:00am	Sophie Dorgan (Millikin, UG)	Repeatability of Corticosterone Stress Response in Songbirds Within and Among Seasons
10:15am	Lanie Chizmark (Millikin, UG)	Birds of Prey and Anticoagulants: Prevalence, and Consequence
10:30am	Chris Theodorakis (SIUE)	Contamination Acts as a Genotype-Dependent Barrier to Gene Flow, Causing Genetic Erosion and Fine-Grained Population Subdivision in Mussels from the Strait of Istanbul
11:00am	Jordan Morgan (IC, UG)	A Comparative Approach to the Analysis of Insectivorous Bat Distress Calls
11:15am	Patrick Menke (Bradley, Grad)	The Effects of Potassium Chloride during Aerial Exposure on Zebra Mussels
11:30am	John Morino (Bradley)	Consequences of Bythotrephes longimanus Effects on Zooplankton for Alewife First-Year Growth and Survival in Lake Michigan

POSTER PRESENTATIONS SCHEDULE – 1:00PM-3:45PM
GRISWOLD GYMNASIUM

Time	#	Presenter	Title of Presentation
		Cell, Molecular, & Developmental Biology	
1:00pm	**1**	Mary Odubote (EIU, Grad)	Can Liver-Specific Master Regulators Reprogram Fibroblast Cells?
2:30pm	**2**	Nathan Balvanz (St. Louis, UG)	Cloning, Expression, and Biochemical Activity of a Small Library of Full-Length and Truncated Plant NADPH-Cytochrome P450 Reductases
1:00pm	**3**	Lucia Thompson (SIUE, Grad)	Correlation between Plasma and Fecal T3 Measurements in Mice
2:30pm	**4**	Zackary Woodall (SIUE, UG)	Determining the Effect of Falling Chloroplasts on the Gravitropic Response in Arabidopsis thaliana
1:00pm	**5**	Jaelyn Boone (SIUE, UG)	Does Mating Pheromone Receptor bar9 Show Activity Necessary for Producing the Mound Mutant Phenotype in Schizophyllum commune HK28?
2:30pm	**6**	Gillian Monroe(Millikin, UG)	Effects of Corticosterone on Cuban Tree Frog Tadpole Gonad Development
1:00pm	**7**	Jacob Weinberg (Bradley, UG)	Expression of DNA Repair Pathways Genes During DNA Damage in the Ciliate Tetrahymena thermophila
2:30pm	**8**	Ashton Gray (SIUE, UG)	Generating CRISPR Cas9 Point Mutations in Arabidopsis GGPPS11
1:00pm	**9**	Lauren Lucykow (SIUE, UG)	Investigating an Abnormal Mating Behavior in Schizophyllum commune
2:30pm	**10**	Sarah Hoffmann-Weitsman (Knox, UG)	Investigating the Function of Intrinsically Disordered Proteins in Stentor coeruleus
1:00pm	**11**	Aminah Haynes(SIUE, UG)	Meristem-Specific Expression of Geranylgeranyl Diphosphate Synthase 11 (GGPPS11) to Rescue the ggpps11-1 Mutant
2:30pm	**12**	Thomas Fowler (SIUE)	PCR-Based Library Screening for Molecular Markers Linked to the mnd Locus in Schizophyllum commune
1:00pm	**13**	Seth Stidham (Bradley, UG)	Putative MUS81 Nuclease-Associated Importin Expression and Evaluation During DNA Repair and Conjugation in Tetrahymena thermophila
2:30pm	**14**	Lyric Johnson (EIU, UG)	Searching Human Chromosome 12 for a Master Regulator of Liver Function
1:00pm	**15**	Kennedy Spears (SIUE, UG)	Strain Development for Exploring the Mound Morphological Mutant of Schizophyllum commune
2:30pm	**16**	Victoria Anselm (SIUE, UG)	The Effects of Genes Upregulated During Spaceflight on Hypoxia in Arabidopsis thaliana
		Chemistry & Biochemistry	
1:00pm	**17**	Michael Combs & Lillie Purcell (WIU, Grad)	Analyzing Illicit Drugs Using Silver Nanoparticles
2:30pm	**18**	Briar Hilsabeck (WIU, Grad)	Ligand Development for F-Metal separations
1:00pm	**19**	Olivia Brinker(WIU, Grad)	Antioxidants in Hot-Brewed and Cold-Brewed Teas
2:30pm	**20**	Ty Ojanovac (WIU, Grad)	Development of an Organometallic Chemistry Reaction for Use in a Senior Level Inorganic Laboratory
1:00pm	**21**	Rocco Jones (Washington, JH)	Electrified Waters: How Conductivity Can Reverse Ocean Acidification
2:30pm	**22**	Sam Hannig (IC, UG)	Journey Towards Goniothalamin: Unveiling Progress and Insights in the Synthesis of an Antitumor Molecule
1:00pm	**23**	Sam Hannig (IC, UG)	Maximizing Efficiency: Investigating the Reusability Potential of a Water-Soluble Ruthenium Catalyst for Benzamide Synthesis
2:30pm	**24**	Foster Amoah (EIU, Grad)	Lanthanide Complexes for Near-Infrared OLEDs
1:00pm	**25**	Shay Adio (SIUE, UG)	On How Nature and Position of Protecting Groups can Direct Sialylation Reactions
2:30pm	**26**	Anthony Aya (EIU, UG)	Photocatalysis for C-N Coupling Reactions
1:00pm	**27**	Emily Jovanovich (WIU, Grad)	Quantification of Cannabichromene among Nineteen Cannabinoids in Key Lime Pie Hemp Flowers by Liquid Chromatography Ultraviolet Detection
2:30pm	**28**	Jake Provis(WIU)	Quantification of Cannabicitran among Nineteen Cannabinoids in Lucky Leaf Hemp Cigarettes by Liquid Chromatography Ultraviolet Detection

Time	#	Presenter	Title of Presentation
1:00pm	**29**	Lindsey LeBlanc (WIU, Grad)	Quantification of Cannabidiol among Nineteen Cannabinoids in Hemp Infused Water by Liquid Chromatography Ultraviolet Detection
2:30pm	**30**	Keszia Fabien (WIU, Grad)	Quantification of Cannabidiol among Nineteen Cannabinoids in Key Lime Pie Hemp Flowers by Liquid Chromatography Ultraviolet Detection
1:00pm	**31**	Olalekan Ogunsola (WIU, Grad)	Quantification of Cannabigerol (CBG) among 19 Cannabinoids in Δ 8-THC (Tetrahydrocannabinol) Fortified White Whale CBG Hemp Flowers by Liquid Chromatography Ultraviolet Detection
2:30pm	**32**	Ammar Al-Bataineh (WIU, Grad)	Quantification of Δ 9 -Tetrahydrocannabinol (THC) among 19 Cannabinoids in Δ 8 -THC Fortified White Whale CBG (Cannabigerol) Hemp Flowers by Liquid Chromatography Ultraviolet Detection
1:00pm	**33**	Ayowole Owolabi (WIU, Grad)	Quantification of Δ 9-Tetrahydrocannabinol (THC) among Nineteen Cannabinoids in Lucky Leaf Hemp Cigarettes by Liquid Chromatography Ultraviolet Detection
2:30pm	**34**	Egzona Tahiri (WIU, Grad)	Synthesis and Application of Macrocyclic Aromatic Tellurides
1:00pm	**35**	Marlena Gabriel (WIU, Grad)	Synthesis and Study of Novel Macrocycles Containing S/Se and Si
2:30pm	**36**	Chinedu Okoro (EIU, Grad)	Synthesis of Photoactive Nickel Complexes for C-N Cross-Coupling Reactions
1:00pm	**37**	Austin Long (EIU, UG)	Understanding the Role of Lipid-Protein Interactions in Modulating the Function of Glutamate Carboxypeptidase II (GCPII)
1:00pm	**85**	Shannon Legge (EIU, UG)	Optimization of Human Carboxylesterase Activity Assays to Enable Personalized Medicine
		Computer Science	
2:30pm	**38**	Amritha Praveen (Adlai, HS)	Early Risk Assessment of Autism Spectrum Disorder: A Novel Approach to Identifying Biomarkers Using 16S rRNA Gut Microbiome Data
		Environmental Science	
1:00pm	**39**	Autumn Belt (SIUE, UG)	Alteration of Perfluorooctane Sulfonate Toxicity via Coexposures with Sublethal Amounts of Ivermectin and Lindane on Drosophila melanogaster
2:30pm	**40**	Alex Krupa (Lewis, UG)	Biochar as an Amendment to Improve Microbial Activity in Soils
1:00pm	**41**	Harriet Barker (Bradley, UG)	Effects of Urbanization on Macro-Moth Species Composition and Diversity within Urban Parks and Protected Areas in Central Illinois
2:30pm	**42**	Thane Woods (Sacrament, JH)	Electric Mud
1:00pm	**43**	Pragya Sharma (Webster, Grad)	Greenhouse Gas Emissions Inventories for City Climate Action
2:30pm	**44**	Nyah Biegler (EIU, UG)	Macroinvertebrate Community Dynamics Post Agricultural Stream Restoration
1:00pm	**45**	Emily Everett (Bradley, UG)	Mosquito Responses to Fungal Entomopathogens Under Elevated Levels of Carbon Dioxide
2:30pm	**46**	Hannah Kolker (SIUE, Grad)	Oxybenzone on Oxidative Stress in Aiptasia: A Model Organism for Coral Research
1:00pm	**47**	Annaliese Oldenburg (Sacrament, JH)	Paint it White
2:30pm	**48**	Alexa Howard (EIU, UG)	Regional and Temporal Comparison Survey of Central Illinois Parasite Abundance and Diversity in the Virginia Opossum (Didelphis virginiana)
		Health Science	
1:00pm	**49**	Elizabeth Pippins (EIU, Grad)	Exploring the Dynamics of Social Behaviors and Viral Mutation: A Mixed-Methods Analysis Utilizing Social Ecology in the Context of COVID-19
2:30pm	**50**	Madison Webb (IC, UG)	Sex-Related Difference of Cognitive Functions among College Soccer Players With and Without Concussion History During Season? Pre vs Post
1:00pm	**51**	Rebecca Hudson (IC, UG)	The Association between Physical Fitness and Academic Performance in College-Aged Students
2:30pm	**52**	Cyrus Darki (IMSA, HS)	The Influence of Patient's Sex on Acute Pulmonary Embolism Outcomes
		Microbiology	
1:00pm	**53**	Ashley Miller (Lewis, UG)	Antimicrobial Properties Osage Orange Fruit Extract
2:30pm	**54**	Chiemeka Emeribe (Nnamdi, Grad)	Biodegradation of Chlorpyrifos Insecticide by Bacillus cereus ST06 and Chryseobacterium sp 6024 Isolated from Agricultural Soil

Time	#	Presenter	Title of Presentation
1:00pm	**55**	Ashleigh Stults (SIUE, Grad)	Developing Protocols to Track the Evolutionary Progress of Paraburkholderia specific Bacteriophages through Dictyostelium discoideum with the Addition of Phage Cocktails
2:30pm	**56**	Oluwaseyi Omodiminiyi (WIU, Grad)	Effect of Clove Oil on Escherichia coli
1:00pm	**57**	Mary Olurunkosebi(WIU, Grad)	Identification and Physiological Properties of Osmotolerant Yeasts Isolated from Sweet Potato
2:30pm	**58**	Danielle Ashton (Bradley, UG)	Investigating Factors that Promote Expression of bcp in Bacillus subtilis
1:00pm	**59**	Diana Guzman (Bradley, UG)	Investigating Regulatory Factors Influencing bcp Gene Expression in Bacillus subtilis Using Transposon Mutagenesis
2:30pm	**60**	Mainprice Essuaman (SIUE, Grad)	Isolation and Characterization of Phages Specific to Model Amoeba and Insect Microbiome Systems
1:00pm	**61**	Harmin Patel (Dunlap, HS)	Novel Effects of Chlorhexidine Gluconate on Gram-Positive vs Gram-Negative Bacteria
2:30pm	**62**	Mark Naom & Caden Matthews (Bradley, UG)	Parasite and Diet Effects on American Bullfrog Tadpole Skin Microbiome
		Physics, Mathematics, & Astronomy	
1:00pm	**63**	Mehbuba Rashid Mouri (WIU, Grad)	Density Measurements of Binary and Ternary Lead/Bismuth Borate Glasses
2:30pm	**64**	Amy Aung (WIU, Grad)	Investigation of the structural Properties of Bismuth Boro-Tellurite Glasses Using Raman Spectroscopy
1:00pm	**65**	Md Khokon Miah (WIU, Grad)	Preparing Glass Samples and Studying the Refractive Index of Borate Glasses Doped with Rare Earth Ions
		Plant Biology	
2:30pm	**66**	Garima Ranabhat (SIUE, Grad)	A Comparison of Vegetation Diversity Among Southwestern Illinois Sand Prairies
		STEM Education	
1:00pm	**67**	Sharon Locke (SIUE)	Broadening Participation in an Environmental Health Sciences Out-of-School Program for Middle School Students
2:30pm	**68**	Pratigyan Bhusal(SIUE, Grad)	Empowering Middle Schoolers: Investigating Scientific Method Understanding and Knowledge Growth in Environmental Health through STEM Education
1:00pm	**69**	Mariam Sani (SIUE, Grad)	Environmental Health Investigators: Impact of a Hands-on STEM Curriculum on Scientific Method Knowledge and STEM Interest Development of Middle School Students.
2:30pm	**70**	Hunter Hansen (SIUE, Grad)	Exploring the Impact and Interdisciplinarity of Geographic Research Among Graduate Students: A Comparative Study of Geoscience Backgrounds
1:00pm	**71**	Farzana Elaf (SIUE, Grad)	Nitrile Glove Permeability Study: Assessing Protective Effectiveness and Educating Students on Glove Safety
2:30pm	**72**	Andreia Dexheimer (SIUE)	Professional Development in Environmental Health for Middle School Science Teachers: A Pathway to STEM-Health Integration
1:00pm	**73**	Yusra Amena(SIUE, UG)	Southern Illinois University Edwardsville Students' Perceptions of Student Experiences in Math Enrichment Sessions
2:30pm	**74**	Marianne Maghamez (SIUE, UG)	Student Perceptions in Courses with Fixed and Growth Mindset Syllabi
		Zoology	
1:00pm	**75**	Dylan Krohe (SIUE, Grad)	Developing a System to Study Competitive Tool Use in Ants
2:30pm	**76**	Sofiane Aiche (EIU, Grad)	Molecular Investigation of Tick-Borne Pathogens in Feral Swine (Sus scrofa) From Seven States in USA
1:00pm	**77**	Felicity Hunt (Warrensburg, HS)	Northern Cardinals and Rose-Breasted Grosbeaks Differ in Immune Investment in the Fall
2:30pm	**78**	Jessica Kuca(SIUE, UG)	Observation of Microplastics in the Stomach Contents of a Benthic Minnow
1:00pm	**79**	Faith Nuss (EIU, UG)	Sarcocystis Incidence and Distribution Among Canis latrans in Eastern Illinois
2:30pm	**80**	Amelia Ayotte (Millikin, UG)	The Effect of Corticosterone on Learning in Cuban Treefrog (Osteopilus septentrionalis) Tadpoles
1:00pm	**81**	Tomi Sewell (Bradley, UG)	The Effect of Substrate Type and Orientation on Zebra Mussel Survival During Aerial Exposure

Time	#	Presenter	Title of Presentation
2:30pm	**82**	Emily Hernandez (Bradley, UG)	The Effects of Urbanization, Noise and Light Pollution on Katydids
1:00pm	**83**	Ava Maria Mendoza (IC, UG)	The Use of Automated Recorders to Assess the Effects of Environmental Factors on Foraging Activity of Insectivorous Bats in Siloam Springs State Park
2:30pm	**84**	Zachary Renken(IC, UG)	The Use of Automated Recorders to Examine Shifting Insectivorous Bat Population Trends in Siloam Springs State Park

ILLINOIS JUNIOR ACADEMY OF SCIENCE
POSTER PRESENTATIONS SCHEDULE – 1:00PM-3:45PM
GRISWOLD GYMNASIUM

Time	#	Presenter	Title of Presentation
1:00pm	101	**Anda Wattanakit** (9th) [Richwoods High School]	Thermoelectricity as a Power Source for a Self-Activating Fall Alert Device
2:30pm	102	**Emily Bah** (10th) [Lane Tech College Prep]	Effect of Fossil Fuels on Artemia Viability
1:00pm	103	**Hannamaria Ulanbek** (7th) [Science Academy of Chicago]	Do Water Filters Help Reduce Pollution?
2:30pm	104	**Hayley Perry** (8th) [Albion Grade School]	Cucumber Science
1:00pm	105	**Ashlynn Pontious & Isabella Rhodes** (7th) [Ramsey Junior High]	Speculating Ducks
2:30pm	106	**Zoya Chowdhury** (8th) [Carbondale Community High School]	Artificial Intelligence-Powered Prediction of Mesoderm Differentiation
1:00pm	107	**Isabelle Hou** (10th) [Carbondale Community High School]	Utilization of Zinc on Chlorophyll Based Dye-Sensitized Solar Cells
2:30pm	108	**Julian Grisius** (10th) [Illinois STEM Society]	The Effects of Medium Richness on Affective and Opinion Polarization
1:00pm	109	**Aditya Prashanth** (12th) [Illinois STEM Society]	Human Body Detection with Occlusion
2:30pm	110	**Savannah Ramsey** (11th) [Southeastern High School]	Eco-Engineered Floating Wetlands - A Promising Technique to Improve Water Quality
1:00pm	111	**Elizabeth Hubbard** (9th) [Southeastern High School]	Exploring the Environmental Impact of Copper II Sulfate on Dugesia tigrina and Lemna minor
2:30pm	112	**Quinn Melendez** (8th) [Holy Family School - Oglesby]	Electrolyte Concentration Which Drink Really Quenches Your Thirst?
1:00pm	113	**Olivia DiGriorgio** (7th) [St. Scholastica School]	Peak Performance
2:30pm	114	**Marcus King** (11th) [Governor French Academy]	Analytic Modeling of Exoplanet Detection via Gravitational Lensing and Orbital Motion
1:00pm	115	**Saisrivarsha Venigalla & Ameenah Abdul-Rasheed** (12th) [Edwardsville High School]	Chlodronate-Liposomes Effect on Number of T-Cells When Infected with Chlamydia
2:30pm	116	**Loyal Flanders** (11th) [Althoff Catholic High School l]	The Complexities Within a Chessplayer's Mind
2:30pm	118	**Anna Tataryn** (10th) [Lane Tech College Prep]	Effect of Waste Materials on Paper Quality
1:00pm	119	**Olivia Jones** (10th) [Lane Tech College Prep]	Effect of Fin Angle on Bottle Rocket Apogee
2:30pm	120	**Yairely Marchan** (10th) [Lane Tech College Prep]	Effect of Allelopathy on Germination Rate
1:00pm	121	**Leah Wu** (10th) [Walter Payton College Preparatory High School]	Powering Tomorrow: Illinois Nuclear Production
2:30pm	122	**Michael Xi, Pranav Dharmappa, & Benjamin Brown** (11th) [University High School – ISU]	Novel AI-Based Adaptive SCN Treatment Medical Device for Circadian Misalignment
1:00pm	123	**Vignesh Tiruvannamalai & Josephine Kim** (12th, 11th) [Illinois Mathematics and Science Academy]	DDX18 Plays a Functional Role in the Association of Centromeres and Heterochromatin to the Nucleolus

Time	#	Presenter	Title of Presentation
2:30pm	**124**	**Close Xu** (12th) [Adlai E. Stevenson High School]	A Comparative ML Approach to Predict Habitability of Confirmed Exoplanets
1:00pm	**125**	**Isaiah Yang** (11th) [Glenbrook South High School]	Optimizing the Best Racing Route through a Turn for F1 Cars

KEYNOTE ADDRESS – DR RICHARD ESSNER – 4:00PM
UNIVERSITY COMMONS BALLROOMS

Honey, I Shrunk the Frogs:
Uncontrolled Landing Behavior in Miniaturized Pumpkin Toadlets

Dr. Essner earned his Ph.D. in Zoology/Animal Behavior at Ohio University and then became a Postdoctoral Research Fellow in Zoology/Animal Biology at the University of Pennsylvania before joining the faculty at Southern Illinois University Edwardsville.

At Southern Illinois University Edwardsville, Dr. Essner teaches Freshman Seminar in Sustainability (BIOL 111-FS), Human Biology (BIOL 140), Human Anatomy and Physiology (BIOL 240A and 240B), Ornithology (BIOL 487), Mammalogy (BIOL 488), Comparative Vertebrate Anatomy (BIOL 489), Wildlife Management (BIOL 460), Vertebrate Natural History (BIOL 490), Travel Study in Biology (BIOL 490/590), Wildlife and Vegetation Techniques (BIOL 490/590), and Topics in Organismal Biology (BIOL 596).

Dr. Essner's research interests are in vertebrate functional and ecological morphology, especially the evolution of locomotor novelty. He combines the traditional tools of functional morphology (e.g., high-speed video, force plates, and electromyography) with techniques from behavioral, ecological, and physiological research to quantify the locomotor form-function complex. These suites of characters are then examined in light of the comparative method to test a priori phylogenetic hypotheses regarding the evolution of locomotor novelty. In addition, he uses biomechanics as a tool for formulating and testing causal links across multiple levels of analysis. He is currently studying locomotion in frogs with ancestral (leiopelmatid) and derived (lalagobatrachian) morphological and behavioral features. He is also interested in wildlife and conservation biology and am engaged in research involving habitat modeling in vertebrates.

MESSAGE FROM THE VICE PRESIDENT

Welcome to the 2024 Annual Meeting of the Illinois State Academy of Science! Thank you to all presenters and participants for contributing to the amazing scientific program at this annual meeting. We hope that your experience at Millikin University is a good one! I am excited that the regional Illinois Junior Academy of Science winners are joining us for the second consecutive year. From long-established researchers to junior high IJAS members, we all share the common goal of advancing science, and the Annual Meeting of ISAS is a true demonstration of that.

We are living in an age where science communication is truly a critical skill. Whether it be making sure the work we do has an impact beyond just the presentation to our peers and publication in journals or helping non-scientists understand the value of basic science, it's critical that we share the value of our work with the broadest possible audience. To that end, I am thrilled to have Dr. Richard Essner as our keynote speaker, sharing research that has amazing evolutionary implications. His work has had quite the tour through media outlets and I know you will find it both scientifically sound and entertaining!

I want to extend thanks to the many Millikin University students who have volunteered to work alongside ISAS Council members to ensure this meeting proceeds as planned. I also thank Executive Secretary Robyn Myers and Director of Communications & Program Planning Tere North for all their work in communicating about the meeting, coordinating registration, managing abstracts, and organizing the scientific program.

Thank you again for participating in the 2024 Annual Meeting and we hope to see you next year!

Sincerely,
Dr. Travis Wilcoxen
VP for the 2024 Meeting

MILLIKIN
UNIVERSITY

ORAL PRESENTATION ABSTRACTS

9:00am – 12noon, Saturday, April 13, 2024, in Leighty-Tabor Science Center

*presenter, [school] with differences noted by superscript

CELL, MOLECULAR, & DEVELOPMENTAL BIOLOGY – RM 115

9:00am UG **Characterizing the Influence of T3 and T4 on the Efficacy of Two Pro-Apoptotic Cytotoxins**

*Melina Hall & Jennifer Schroeder [Millikin University]

Accumulating evidence has indicated that thyroid hormones (T3 and T4) affect the apoptotic efficacy of various cytotoxins. In the present study, rhabdomyosarcoma (RMS) cells were used to evaluate how T3 and T4 influence the efficacy of two apoptosis-inducing cytotoxins, cantharidin and resveratrol. SJCRH30 cells were treated with cantharidin (IC50 2.25 uM; 10x IC50 22.5 uM) or resveratrol (IC50 140 uM) and T3 or T4 (10^{-10} to 10^{-7} M) and changes in cell viability were measured using MTT and resazurin assays. Our study shows that thyroid hormones do not affect SJCRH30 cell viability nor resveratrol efficacy. However, they do reduce the efficacy of lower doses of cantharidin independent of thyroid hormone dosage. Thus, thyroid hormones may pose a potential risk to RMS therapeutics that have similar apoptosis-inducing mechanisms as cantharidin.

9:15am Grad **SLC12 Family Transporters in Schmidtea mediterranea**

*Maede Shahin & Amy Winn [Southern Illinois University Edwardsville]

The kidney plays a pivotal role in filtering blood, ensuring essential substances are retained while waste products are efficiently removed. However, the intricate molecular mechanisms behind this process and the genetic and protein components supporting kidney function are key areas of inquiry. Solute carriers, a diverse group of proteins involved in cellular transport, are particularly significant in kidney function where they facilitate the reabsorption of ions like chloride, sodium, and potassium. Recent research has shed light on the importance of these transporters, linking their dysfunction to conditions such as hypertension and kidney disorders.

Leveraging the unique regenerative capabilities of the planarian flatworm, Schmidtea mediterranea, provides a valuable model for investigating gene function. Planarians, renowned for their ability to regenerate any lost tissue, offer a simplified yet anatomically relevant system for gene manipulation. They possess an excretory system with striking parallels to the human kidney, with their protonephridia acting analogously to nephrons in other species. In my master's research, I have identified planarian homologs of genes in the SLC12 family of solute carriers. Among these genes, SLC12A1 and SLC12A3 are kidney specific, and so I chose to further explore their role in protonephridia function through gene knockdown and drug treatment experiments, aiming to elucidate their functions and interactions.

9:30am UG **Developing of Gene Over-Expression Plasmid Vectors for Plant Functional Studies**

*Jason Miller & Yordan Yordanov [Eastern Illinois University]

Many genes that contribute to plants resistance and adaptation, and crops productivity, remain largely unknown. Therefore, understanding the functional consequences of these genes is crucial for agriculture. In genetics there are two established approaches to identify and characterize the function/s of a gene, called forward and reverse genetics. One alternative, and hybrid approach is using gene overexpression library. In this approach, a highly expressed copy of a gene/s is placed back in the genome to produce an easy detectable dominant mutation. To produce this type of library the expressed genes are cloned in a special plant transformation vector that facilitates the overexpression in plants' cells. We constructed three novel and improved plant transformation vector that can be used for cDNA libraries. These new vectors are much smaller and easier to work with for cloning and plant gene transfer. The difference between them is the bacterial and plant selection genes. We apply GoldenGate modular cloning using GrenGate vectors and in house made cDNA cloning core and directional positioning of rare restriction enzymes cloning sites. The overexpression will be achieved by utilizing the strong RPS5A (ribosomal protein 5a) promoter and tobacco mosaic virus omega sequence, in addition to the pea RBCS terminator. As a plant selection marker, we chose hygromycin under constitutive plant ubiquitin promoter. The only difference between currently constructed expression vectors is the bacterial selection genes, namely spectinomycin, gentamycin or kanamycin. Given the modular nature of our approach future vector with different gene regulatory elements and plant selection genes, can be easily achieved. We will use these vectors to construct a sunflower cDNA expression library for gene functional discovery and characterization.

CHEMISTRY & BIOCHEMISTRY – RM 209

10:45am **Catalytic Enhancement of an Artificial RNA Ligase through Engineered Domain Addition**

*Dana Morrone [University of Health Sciences and Pharmacy in St. Louis]

Naturally evolved extant enzymes often use multiple domains in addition to a catalytic domain. Protein evolution can proceed not only through point mutations, but also through the addition of domains to a catalytic domain. Borrowing from this natural approach of domain acquisition, we sought to improve catalytic activity in a previously isolated artificial RNA ligase that was selected and evolved from a randomized pool of DNA. This earlier work used mRNA display to select and evolve an artificial enzyme catalyzing the 5'PPP to 3'OH ligation of a splinted piece of RNA, a reaction for which there is no known natural enzyme. Despite the novelty of this RNA ligase enzyme, it was found to have low ligation activity. To improve the activity of this artificial RNA ligase, we engineered different combinations of fusion-domain variants with the ligase. These fusion domains ranged from 4 to over 250 amino acids in length and were combinations of various natural nucleic acid binding domains or motifs placed at the N or C termini of the artificial RNA ligase. We hypothesized that an increase in substrate binding through the addition of natural nucleic acid binding domains or motifs could increase catalytic activity. Among our engineered fusion-partner variants we found a range in effect, and some designs increased catalysis several-fold; however, fusion-partner approaches that increased catalysis in DNA ligases were found to be unsuccessful at increasing catalysis with RNA ligases. These results demonstrate the feasibility of applying simple features of natural evolution to improve catalysis.

11:00am UG **Quantitatively Determining Amoxicillin Content in Antibiotic Capsules from Limited Resource Countries Using HPLC**

*Seth Eridanus & Kyle Knust [Millikin University}

We analyzed amoxicillin capsules from Kenya and Liberia using reversed phase high-performance liquid chromatography (HPLC) to identify substandard and/or counterfeit antibiotic capsules as a member of the Distributed Pharmaceutical Analysis Lab (DPAL) led by the University Notre Dame. DPAL is a consortium of universities and labs that utilize HPLC for testing of pharmaceutical samples from resource limited countries. Preceding to submitting results to DPAL, we completed required system suitability tests to validate our HPLC functionality, methodology, and skill in analyzing amoxicillin capsules. Eight amoxicillin capsules were then analyzed, and all found to contain 90-110% active pharmaceutical ingredient, amoxicillin, which met specifications set by United States Pharmacopeia (USP). All results were reported to DPAL and then to the appropriate regulating agency from the country of origin for each capsule.

ENGINEERING & TECHNOLOGY – RM 208

9:00am HS **Novel Thermopile System to Increase the Fuel Efficiency of Internal Combustion Engines to Help Mitigate Climate Crisis**

*Anne Claud [Oak Park and River Forest High School]

Heat recovery systems provide an environmentally friendly way to reduce carbon emissions produced by internal combustion engines. While heat systems vary in form and integration into a cars system, heat recovery systems generally provide additional voltage produced by a temperature gradient, the flow of a liquid or air, or other energy-producing means. The voltage produced by these systems is then reintegrated back into the vehicle. This reintegration of additional electricity reduces the load on the alternator, the part of the car that produces the electricity needed to run a car and charge the battery. When the load on the alternator is reduced, the load on the engine is reduced, limiting the amount of fuel used. This experiment was conducted to determine if using a novel heat recovery system, a thermopile, in addition to a step-up transformer, would produce enough electricity to reduce the load off of the engine, effectively increasing fuel efficiency. The results did not support the experimental hypothesis, as the voltage needed was not produced by the electrical configurations constructed. However, a Bonferroni correction test determined that the correlation between the independent variable temperature and dependent variable voltage is statistically significant, with a p-value of <0.0001. In addition, the results support the continuation of the research in the search for a more advanced modification that would support the experimental hypothesis.

Keywords: heat recovery system, fuel efficiency, internal combustion engine, electrical engineering, carbon emissions

9:15am Grad **Applied Machine Learning Skills for Autonomous Car**

*Dolly Gupta & Jaby Mohammed [Illinois State University]

In today's era, the concept of self-driving cars is a coveted goal for every automotive manufacturer. Despite notable strides made by certain companies, a fully autonomous car has yet to be realized. This pioneering technology is rooted in Artificial Intelligence and relies heavily on machine learning algorithms. As a result, the system can analyze situations and make independent decisions. This presentation endeavors to shed light on the essential skills necessary for applied machine learning in the field of autonomous cars. Presenters will provide a concise overview of these skills to help engineers and scientists understand the requirements for developing self-driving cars.

9:30am Grad **Integrating Lean Six Sigma into Project Management for Operational Excellence**

*Sakila Akter Jahan & Jaby Mohammed [Illinois State University]

This presentation explores the integration of Lean Six Sigma methodologies into project management practices to achieve operational excellence. Lean Six Sigma, a powerful framework combining the principles of Lean manufacturing and Six Sigma quality management, aims to eliminate waste, reduce variation, and enhance efficiency and quality. Project management, on the other hand, provides structured approaches to planning, executing, and controlling projects to achieve specific goals within constraints.

The integration of Lean Six Sigma principles into project management offers a synergistic approach to optimizing processes, managing resources effectively, and delivering successful outcomes. This integration involves aligning project objectives with organizational strategic goals, identifying areas for improvement using Lean Six Sigma tools such as value stream mapping and root cause analysis, and implementing DMAIC (Define, Measure, Analyze, Improve, Control) methodology within project management frameworks.

By incorporating Lean Six Sigma into project management, organizations can streamline workflows, enhance productivity, minimize defects, and maximize customer satisfaction. Moreover, this integration facilitates a culture of continuous improvement, where project teams are empowered to identify inefficiencies, implement solutions, and drive sustainable change.

Ultimately, the integration of Lean Six Sigma into project management represents a holistic approach to achieving operational excellence, where projects are not only completed on time and within budget but also deliver superior quality, value, and competitive advantage for the organization.

9:45am HS **The Biophysical Characterization of Salt-Leached Polylactic Acid (PLA) Bioscaffolds Fabricated by Thermomolding: A Novel Method With Applications for Tissue Engineering**

*Jessica Li [Oak Park and River Forest High School]

Tissue engineering (TE) serves as a promising alternative to relieve the intense demand of conventional tissue grafts, and divert some of the associated risks, such as immunosuppression and rejection. Bioscaffolds are porous and hydrophilic 3D matrices used to support tissue growth in vitro, making them a crucial component of TE. However, despite numerous fabrication protocols reporting viable scaffolds for clinical use, these methods often do not consider time-efficiency, cost-effectiveness, and safety, which hinders their real world applications. This experiment introduced a modified salt particulate leaching method utilizing solvent-free poly-lactic acid (PLA) thermomolding. PLA pellets were melted in a silicone mold using a commercial toaster oven. Sodium chloride crystals were then laid on and allowed to sink into the molten polymer to create the porous structure, before they were leached through dissolution in water. The completed scaffolds were then physically characterized based on their porosity, water contact angle, buoyancy, and degradation rate. While certain qualities were not completely optimized, this procedure provided preliminary evidence and proof of concept. The experimental scaffolds exhibited a porosity of $30.24 \pm 2.380\%$ ($\pm$ 95% CI), the highest of the three groups (ANOVA p-value<0.0001), which was further supported by their frequently buoyant behavior. The porous surface was also significantly hydrophilic ($<90°$), with an average top side water contact angle of $52.59 \pm 4.209°$ ($\pm$ 95% CI). The scaffold weight also remained stable throughout a seven-day degradation test in in vivo conditions. Further research is necessary to draw more definitive conclusions on the viability of these scaffolds.

Keywords: bioscaffold fabrication, polylactic acid (PLA), thermomolding, salt-leaching, tissue engineering

ENVIRONMENTAL SCIENCE – RM 208

10:15am Grad **Effects of Controlled Burning and Grazing on Macro-Moth Diversity in Illinois Tallgrass Prairie**

*Tyler McMahon & Anant Deshwal [Bradley University]

Globally, invertebrates have seen a decline in species diversity and abundance. Pre-agriculture Illinois was 80% tallgrass prairie that supported most arthropod diversity. Insects such as moths and butterflies (Lepidoptera) are critical to food chains, soil formation, pollination, and nutrient cycling. Restoration efforts have been attempted to restore the Illinois Tallgrass Prairie, such as protected areas, urban parks, and wildlife preserves. Controlled burns and grazing of herbivores are implemented to maintain prairies and promote high species diversity. This study shows the effects of grazing from American Bison and controlled burning of prairies on Macro-moth diversity. Blacklight traps were placed in various prairie management types to capture moths in prairies. The captured specimens were identified and compared to calculate diversity and abundance between sites. The results show significant differences between grazed and burning areas hosting the most species diversity. Understanding prairie management can create effective protected areas and offset the Arthropod decline.

10:30am UG **Landscape of Fear in Mammals in Response to Anthropogenic Hunting Patterns**

*Brianna Cook, Anna Berg, & Anant Deshwal [Bradley University]

Urbanization, agriculture and hunting have impacted abundances, behavior, and movement patterns among mammals in Central Illinois, and hunting seasons are no exception. Game species such as White-Tailed Deer have received much higher attention for conservation purposes but relatively fewer studies have studied the impact anthropogenic activities have on

nongame species. This study aimed to answer the question of if nongame mammals exhibit a landscape of fear in response to hunting activity. Using the REM model, we are studying the influence of anthropogenic activities on mammal behavior in Central Illinois. In this study, we used camera traps to quantify movement behavior of nongame mammals during hunting and non-hunting periods in both urban and protected areas. Mammals spent significantly more time in non hunting areas and shifted in their diurnal activity patterns during hunting season. The apex predators of the area were found to have the most drastic change in behavior and range from hunting to non-hunting areas. Smaller mammals were also shown to be more relaxed when unaware of the presence of the cameras.

10:45am UG **How Much Genetic Diversity is Present in Ringed Salamanders (Ambystoma annulatum)?**

*Ashley De Anda, Matthew Slikas, Olivia Smith, Keith Johnson, & Anant Deshwal [Bradley University]

Ringed salamanders or Ambystoma annulatum are a species of salamander endemic to the Ozark plateau in Northwestern Arkansas. These salamanders, unlike their sister species spotted salamanders (Ambystoma maculatum), have not been extensively genetically researched. To begin analyzing the genetics one needs to start by comparing individuals, both within and between different populations. DNA was extracted from collected salamanders using a Zymo quick DNA prep kit. With this DNA, PCR was performed using microsatellite primers selected from Peterman et al., 2012. Gel electrophoresis was performed on the PCR product to visualize differences between the microsatellite genes between samples of salamanders from different locations. These salamanders are important due to their diverse ecological roles of regulating food chains and offering some control of biotic species along grazer and detritus pathways. Human interaction is a primary concern for the salamander populations and with expanding urbanization their habitats are slowly becoming less viable for the salamander's survival.

11:00am Grad **Determination of Altered Circadian Rhythm Analysis Following Exposure of Perfluorooctane Sulfonate on Fruit Flies & Planarians**

*Emily Beilert & Kyong-Sup Yoon [Southern Illinois University Edwardsville]

Perfluorooctance sulfonic acid (PFOS) is a persistent organic pollutant (POP) that is found in nearly all trophic levels. The aim of this study is to compare the acute mortality responses of fruit flies and planarians exposed to a range of PFOS concentrations. Additionally, assays for the locomotor and developmental effects of sublethal PFOS exposure in both organisms are currently conducted. Based on the preliminary data, fruit flies exposed to sublethal concentrations of PFOS (0, 0.02, 0.2, 2, 20, & 200 nM) showed significantly decreased daytime activity at 0.2 nM and significantly increased the daytime activity at 200 nM ($P<0.05$). Planarians are currently undergoing 96 hr mortality bioassay studies to determine acute mortality responses. Preliminary findings have shown acute mortality at 34.3, 52.8, & 81.3 uM PFOS and no mortality at 22.3 & 14.5 uM PFOS. These responses will be used to determine sublethal concentrations for monitoring locomotor activity as well as regenerative developmental exposure. The outcomes in this study are expected to provide behavioral evidence for further understanding PFOS neurotoxicity and its impact on fruit fly and planarian circadian rhythm.

HEALTH SCIENCES – RM 115

11:00am Grad **Hyperthyroidism and Periodontal Disease - Insights from a Mouse Model Study**

*[1]Brailey Coulter & [2]Cinnamon VanPutte [[1]Southern Illinois University Edwardsville, [2]SIUE/School of Dental Medicine]

Periodontal disease, characterized by microbial-induced inflammation leading to alveolar bone loss, remains a significant public health concern. Recent studies suggest a potential link between thyroid hormones and periodontal disease. Thyroid hormones, crucial for regulating homeostasis, metabolism, and bone density, may play a pivotal role in periodontal health. This study investigates the dynamic relationship between induced hyperthyroidism and periodontal disease, presenting results obtained from a mouse model.

I hypothesized that hyperthyroidism induction may lead to measurable alveolar bone loss, serving as a reliable indicator of periodontal disease. Utilizing mice as a model system, we collected plasma samples to measure thyroid hormone levels and examined mandibles to quantify alveolar bone loss. Our study will provide comprehensive results as of the presentation, contributing to a deeper understanding of the interplay between hyperthyroidism and periodontal health.

The implications of our findings extend to potential therapeutic interventions, offering actionable insights into the modifiable risk factors associated with periodontal disease. This presentation aims to share evidence on the impact of hyperthyroidism on periodontal health, emphasizing the need for comprehensive consideration of thyroid function in dental care.

11:15am UG **Removal of Candida albicans Biofilms by Over-the-Counter Mouth Rinses Compared to Chlorhexidine**

*Camille Herdklotz & Barbra McCracken [Southern Illinois University Edwardsville]

Candidiasis, a common opportunistic infection of the oral cavity, is characterized by overgrowth of Candida species including C. albicans. If left untreated, candidemia may occur and cause systemic infection. We compared in vitro biofilm removal of three OTC mouth rinses compared to Chlorhexidine (CHX). OTC mouth rinses included were SmartMouth DDS Clinical Mouthwash (SM), TheraBreath Fresh Breath Rinse (FB), and Listerine Original Antiseptic Mouthwash (LS). C. albicans was

purchased from ATCC (Manassas, VA) and was grown in YM broth at 26oC according to ATCC. Biofilms were allowed to grow for either 24 hours or five days. Biofilms were then exposed to mouth rinses for either 30 or 60 seconds. Remaining biofilm was stained with crystal violet and absorbance was read at 570 nm. At both 30 and 60 seconds, SM and FB reduced 24-hour biofilm more completely than CHX. However, 5-day biofilms were removed more completely with SM and LS compared to CHX. The results of this study suggest that routine use of SmartMouth rinse may reduce the biofilm accumulation of C. albicans.

11:30am HS **The Use of Croton and White Oak Bark Extracts on a Bombyx mori Model as the Basis for Novel Pharmacological Agent to Treat Hyperglycemia**

*Abby Falkoff [Oak Park and River Forest High School]

Hyperglycemia is one of the largest problems that impacts individuals suffering from type 2 diabetes mellitus (T2DM). Chronic hyperglycemia contributes to serious health problems, such as vision loss, sleep apnea, skin contusions, nerve damage, heart, kidney and cardiovascular diseases. There are several treatments currently used for controlling hyperglycemia in T2DM patients; however they often have severe side effects and are inaccessible to a large population, due to their high costs and inability to be obtained in remote areas. This experiment modeled hyperglycemic induced Bombyx mori (silkworms) and tested the effects of hypoglycemic effects of croton and white oak extracts. Hyperglycemic conditions were induced using a high glucose diet over an 18-hour time frame. Croton and white oak extract injections of varying doses were then administered. The effectiveness of croton and white oak extracts was evaluated with respect to hemolymph glucose levels. The results showed a statistically significant reduction (p-value of 0.0111) in glucose levels associated with the administration of 0.04 ml of white oak after 90 minutes. This experiment therefore provides support for the potential effectiveness of white oak—though not of croton or a combination of croton and white oak—as a less-expensive and more-accessible medication to treat T2DM.

Keywords: Hyperglycemia, type 2 diabetes mellitus, croton extract, white oak extract, silkworm diabetic model

MICROBIOLOGY – RM 001

9:15am HS **Evaluating the Bioremediation Potential of B. licheniformis as a Novel Method for the Passive Treatment of Acid Mine Drainage (AMD)**

*Noah Campbell [Oak Park and River Forest High School]

Acid mining drainage (AMD) waste, a byproduct of mining and bioleaching operations, poses a severe environmental threat due to its high acidity and toxic metal content. Current AMD treatment methods are costly and inadequate. This experiment explored Bacillus licheniformis as a potential AMD bioremediation agent. Its versatility in oxygen environments, sulfur reduction capabilities, and wide pH tolerance (3.0-9.0) make it an ideal candidate for addressing AMD hazards. This experiment tested the ability of B. licheniformis to raise the pH of a simulated AMD solution and grow its population. Parameters included the pH and absorbance of visible light at 600 nm (measured via Vernier SpectroVis spectrophotometer compared to a standard curve). Final pH values were recorded after a 24-hour treatment period, and final absorbance values were taken after a 48-hour period to calculate its change. Each of the experimental groups resulted in a substantial increase in pH in several Welch's two-tailed t-tests, compared to the control showing statistical significance ($p < 0.0001$). These findings suggest that B. licheniformis can potentially be used as an effective treatment method for AMD.

Keywords: B licheniformis, acid mining drainage (AMD), bioremediation, sulfur-reducing bacteria, bioremediation, increasing pH.

9:30am UG **Screening Orchid Mycorrhizal Fungi for Antimicrobial Activity**

*Rachael Rosenstengel, Max Balding, Brent D. Chandler, Lawrence W. Zettler, & Gwendowlyn S. Knapp [Illinois College]

In 1928, Alexander Flemming observed the fungus, Penicillium rubens, inhibiting the growth of Staphylococcus aureus which led to the discovery of the antibiotic penicillin. Nearly 100 years later, antibiotic resistance is now a serious global problem. By 2050, infections from antibiotic-resistant bacteria could kill 10 million people annually. Consequently, the discovery of new antibiotics to combat this global public health threat is the subject of intensive study. To our knowledge, orchid mycorrhizal fungi have yet to be screened for their antibiotic potential. In this study, we tested 10 different kinds of orchid mycorrhizal fungi for their ability to inhibit a Gram-positive actinomycete, Micrococcus luteus, via an assay. These fungi, assignable to three genera of basidiomycetes (Ceratobasidium, Serendipita, Tulasnella), were isolated from different species of terrestrial and epiphytic orchid species spanning the Midwest into southern Florida, respectively. The mycorrhizal fungi were then screened for their ability to inhibit the growth of a strain of this bacterium (BSL-1 representatives of the ESKAPE pathogens) known as the leading cause of nosocomial infections. Thus far, 4 of the 10 fungi tested have shown signs of bacterial inhibition in our screen. Research is underway to characterize the chemical compounds that may be involved.

PHYSICS, MATHEMATICS, & ASTRONOMY – RM 209

9:00am Grad **Raman Study of Binay Bismuth Borate Glasses Doped with Praseodymium Ions**

*Kushal Dahal, Saisudha B. Mallur, & P.K. Babu [Western Illinois University]

Glass is a supercooled liquid that lacks long-range order. Raman spectroscopy is a powerful technique for studying structures and structural changes following the inelastic light scattering of photons. Extensive research has been done to study the structural properties of glasses using Raman spectroscopy. We prepared a series of glass samples of bismuth borate doped with praseodymium ions [x Bi_2O_3: (100-x) B_2O_3 where x: 30, 40, 50, and 60] by varying the glass composition. Sample preparation is carried out using the following steps: composition collection, weighing & mixing, melting, quenching, annealing, and smoothing & polishing. The Raman data were taken using a Nano-photon Spectrometer. Different Raman peaks can be seen in the graph for intensity versus wavenumber. We deconvoluted the peaks by the Gaussian fitting method. Once the peaks are resolved, the functional groups corresponding to different peaks are identified by comparing them with prior studies in similar glasses. A preliminary analysis indicates that peaks between 100- 500 cm^{-1} correspond to different vibrational frequencies of bismuth oxide (Bi – O) groups, and peaks > 500 cm^{-1} correspond to borate groups (B-O). The compositional effects on the intensity of the peaks are being studied.

9:15am UG **Hydroxyl Masers in the Orion Nebulae**

*Gabriel Sojka, Kenneth Vanzuiden, & Estaban Araya [Western Illinois University]

The Orion Nebula, which is found in the sword of the Orion constellation, is a high mass star forming region located about 1344 light years from Earth. We are investigating this region using spectroscopy, an essential tool in astronomy, which is based on the detection and analysis of spectral lines (certain wavelengths of light either absorbed or emitted by objects in space). This emission or absorption is commonly thought of in the sense of electrons absorbing and emitting photons to jump between energy levels but this also occurs when molecules transition between different angular momentum energy states. This work is based on data from VOLS (the VLA Orion A Large Survey; P.I. G. Busquet Rico), which is an international project using the Very Large Array in New Mexico surveying the Orion Nebula. VOLS is conducting radio continuum (to detect ionized gas) as well as spectral line observations, including hydroxyl (OH) transitions. We report detection of six molecular masers (the equivalent of microwave lasers) corresponding to the 6.035 GHz transition of the hydroxyl molecule, one of which is a confirmation of an earlier detection made by Caswell and Vaile in 1995. We are in the process of analyzing the variability of these six masers over approximately 3 months of observations. Our preliminary results include detection of variability at the 20% level in two of the maser components, and the detection of circular polarized emission from two maser components, one of them shows a V-Stokes spectral profile consistent with Zeeman splitting. This research is partially supported by NSF grants AST-1814063 and AST-1814011, and computational resources donated by WIU Distinguished Alumnus Frank Rodeffer.

9:30am UG **Fault-Tolerant Quantum Computing with Three Qubit Codes**

*Chelsie Hadley & Kishor T. Kapale [Western Illinois University]

Current quantum error correction literature suggests that it is not possible to correct one qubit of information from X, Z, and Y errors with only a three qubit code. This research suggests that not only is it possible, but that it is also possible to achieve fault-tolerant quantum computing using this method.

The baseline code starts with one logical qubit which consists of three qubits that are entangled and are in a state of superposition. The idea is that the logical qubit will encode one qubit worth of information, protecting it from X (bit-flip), Z (phase-shift), and Y (combination) errors. Since direct observation of the logical qubit will alter its state, the state information is encoded in ancilla qubits which exist outside of the logical qubit. One ancilla qubit is used for each qubit in the logical qubit. Through a series of CNOT and Hadamard gates, the state information is protected and if an error occurs, the type of error and the location of the error can be extrapolated from the ancilla qubits without producing any additional errors.

The code becomes fault tolerant when an additional logical qubit is introduced. A CNOT gate is applied between each qubit of the first logical qubit to every qubit in the second logical qubit. This ensures that at max one error is propagated for each qubit in the logical qubit. Achieving fault-tolerance with only a three qubit code has important implications in the world of quantum computing. Reducing the number of qubits needed to successfully error correct reduces the cost to manufacture quantum computers, reduces computational time, and could greatly accelerate the timeline of achieving large-scale quantum computers.

10:00am UG **Identifying Radio Continuum Controls to Characterize Variability of Methanol Masers in the Orion Nebula**

*Kenneth Van Zuiden, Gabriel Sojka, & Esteban Araya [Western Illinois University]

The VLA Orion Large Survey (VOLS) is an international collaboration that is conducting a large field of view and high resolution radio survey of the Orion Nebula (an area known for multiple stages of star formation) using the Very Large Array radio telescope in New Mexico. The Orion Nebula contains regions of ionized gas that emit radio continuum radiation, and regions from where intense spectral line emission from different molecules have been found, including methanol (CH3OH) masers. One of the goals of the VOLS project is to detect variability of CH3OH masers, which could provide insights of the star formation process occurring in the Orion Nebula. To have reliable measurements of CH3OH variability, we need to

identify radio continuum sources near the CH3OH masers to be used as positive controls. Using the continuum sources listed in Felli et al. (1993), we selected six sources as controls, with the addition of two sources that we found in our data but were not reported in their paper. One radio source was offset with respect to the original position, which could have been caused by proper motion or variability. However, we analyzed another epoch and found a radio continuum source at the original expected position in addition to the newly detected source, indicating variability. We discuss the properties of the other continuum sources that will be used as controls for the study of CH3OH maser variability in Orion. This work is based on data from VOLS (P.I. G. Busquet Rico), and is partially supported by NSF grants AST-1814063 and AST-1814011, and computational resources donated by WIU Distinguished Alumnus Frank Rodeffer.

10:15am Grad **Quantum Zeros and Ones: Leveraging Quantum Entanglement for Game Strategy Optimization**

*Md Nazmul Haque Nihad & Kishor Kapale [Western Illinois University]

In the realm of competitive gaming, achieving a consistent winning streak is not possible due to inherent classical limitations. This project aims to revolutionize game strategy by harnessing the power of quantum entanglement.

The game involves two teams and a referee, operating within a 3x3 grid. Each team is tasked to fill either one of the rows or columns of the grid, adhering to specific rules: the row team must maintain an even number of ones, while the column team must fill an odd number of ones. The referee randomly assigns choices of rows and columns to the teams for each round. To win against the referee the digits put in the overlapping square are needed to match. This leads to a dynamic and unpredictable gameplay experience. The classical strategy, because of the parity differences between row and column choices, works only 8 out of 9 in each try. Thus, the probability of winning diminishes rapidly with multiple tries.

The proposed strategy exploits quantum entanglement to synchronize the choices made by both the row and column teams. Due to the entanglement in the specially prepared initial state, the teams ensure that despite not being aware of each other's decisions, their picks (which result from quantum measurement) inevitably coincide, resulting in victory. This game, which we call "Quantum Zeros and Ones", demonstrates how quantum entanglement can be harnessed to go beyond what is classically achievable. This new approach to classical games, using predefined quantum strategy, may have practical implications in the field of game theory.

PLANT BIOLOGY – RM 115

10:15am Grad **Optimization of Transformation and Regeneration in the Sunflower (Helianthus annuus)**

*Sara Kilar & Yordan Yordanov [Eastern Illinois University]

Horizontal gene transfer, the transfer of genetic information between two different species, is often acknowledged as an important tool for creating genetic diversity. One example of this gene transfer is with agrobacteria (Agrobacterium tumefaciens) transferring a tumor-inducing (Ti) plasmid into its host plant to cause crown gall disease. Because of its naturally occurring efficiency of transferring DNA, agrobacteria is often used in genetically improving plants. Creating genetically modified plants has become more important in today's world to create higher crop yields, greater nutritional composition, and plant resistance to herbicides and infections. This is especially important in crops like the sunflower (Helianthus annuus) which is depended on as a source of food. In our experiment, we are working to introduce herbicide and bacterial resistance into the sunflower by using transformed agrobacteria. The idea of transforming plants using the GreenGate method, a method based off GoldenGate, has been done with tobacco (Nicotiana benthamiana) and arabidopsis (Arabidopsis thaliana) plants, but not for the sunflower. This will be achieved by introducing the plasmid into E. coli (Escherichia coli) cells for replication and extraction purposes. Once the transformed E. Coli DNA is extracted, it will be transformed into the Agrobacterium and then introduced to the sunflower. Since an infection to the sunflower will be localized as the plant will try to activate its defense system to prevent the bacteria from spreading, we will harvest infected cells from the hypocotyl. This plant part is responsible for pushing up the embryonic leaves (cotyledons) to the light. Once we harvest the infected hypocotyl cells, we will then attempt to grow a fully transformed plant as the hypocotyl cells are totipotent.

10:30am **Data, Not Surmise: Weighing the Importance of the Spring and Fall Canopy Light Windows for the Invasive Shrub Lonicera maackii**

*Kurt Schulz [Southern Illinois University Edwardsville]

Considerable attention has focused on the characteristics and circumstances which allow exotic plants to become troublesome invaders. One hypothesis has been that leaf display in early spring and late fall, when the tree canopy is absent, provides understory invaders with additional and superior photosynthetic opportunities. This behavior is regularly attributed to invasive Amur honeysuckle (Lonicera maackii) because its leaves emerge early in spring and are retained until late fall. However, the presence of leaves is not indicative of photosynthetic ability or opportunity. In fact, the actual photosynthetic behavior of honeysuckle across the seasons is undocumented.

I examined patterns of overhead canopy cover and photosynthetic light response from spring through hard frost over four years in Madison County, IL (−90.000 W, 38.800 N). Spring photosynthetic capacity of shrubs growing under ca. 30% canopy cover was about 50% higher than shrubs under 80-90% cover in summer and fall. Photosynthetic rates at lower light (< 200 µmol m^{-2} s^{-1} PAR, bright shade) were nearly identical. Photosynthetic behavior remained stable through the summer while dark respiration became less, indicating increasingly more efficient carbon gain through time. Tree canopy loss occurred after hard

frosts (-2 °C), ca. November 1. Honeysuckle photosynthetic capacity collapsed a few days after hard frost. The short spring light window, ca. 30 days, compared to the longer full canopy period, ca. 200 days, would require about 20% more time be spent at light saturation to achieve a 10% increase in carbon gain over continuously shaded conditions. The loss of photosynthetic capacity synchronized with tree canopy senescence suggests the fall light window is an unreliable photosynthetic opportunity at best. It appears that the importance of the spring and fall light windows are exaggerated for honeysuckle.

STEM EDUCATION – RM 001

9:00am **A Molecular Biochemistry Lab Education Tool Allowing ror Full-Color Experiments**

*Dana Morrone [University of Health Sciences and Pharmacy in St. Louis]

Previously we had developed and tested an engineered version of fluorescent proteins fused with a dihydrofolate reductase enzyme (mCherry-DHFR). This DHFR-fusion protein made for a nearly ideal teaching tool in the biochemistry lab and we observed some gains in student learning and satisfaction in the lab. However, this first-generation molecular tool suffers in that the enzymatic activity of dihydrofolate reductase was not a colorimetric assay whereby students would monitor NADPH depletion on a spectrophotometer in a colorless reaction. Further, this assay required the addition of two substrates, which complicates kinetic studies for students. Building upon this earlier project, we sought to develop a biochemistry lab education tool to facilitate the learning of protein expression, purification, and enzymology. Accordingly, we wanted this tool to have the following four properties: 1) it is highly expressed, stable, and soluble; 2) its expression and purification can be monitored visually; 3) its catalytic activity can be monitored visually and kinetic parameters obtained; 4) it allows for an economical teaching lab. Our initial version of the mCherry-DHFR tool only had the first two properties. Our new approach made use of an engineered mCherry-GUS fusion that now satisfies all the criteria we are looking for in a molecular teaching tool. In addition to the mCherry-GUS being well-expressed, soluble, stable, and easily purified to near homogeneity with a single 6His tag, it also catalyzes several colorimetric assays with readily available substrates. Additionally, students can easily obtain kinetic parameters of these substrates. We have found our mCherry-GUS fusion protein to be an ideal teaching tool for biochemistry lab education that could be used in labs from high school through undergraduate.

ZOOLOGY – RM 001

10:00am UG **Repeatability of Corticosterone Stress Response in Songbirds Within and Among Seasons**

*Sophie Dorgan & Travis E. Wilcoxen [Millikin University]

Birds secrete a hormone called corticosterone in response to stressful stimuli. Stressful stimuli activates the HPA axis, and one effect of this is that the adrenal cortex releases corticosterone. Acute stress responses are known to increase the rigidity and consolidation of memories; however, very severe, acute stressors, or traumatic stress, may alter, or dysregulate future stress responses and memory pathways. This study examined songbirds in Decatur, Illinois and whether this memory formed from a stress response during the initial capture altered the stress level during the recapture. A baseline sample was taken at 5 minutes after capture, when the stress-induced release of the hormone corticosterone (CORT) had yet to enter the system, and another sample was taken at 30 minutes when the corticosterone had reached its peak in the bloodstream. Samples were collected from birds twice, with at least a two week window of time in between captures. Plasma samples were analyzed using the DetectX Corticosterone Enzyme Immunoassay Kit. We found no significant difference in CORT levels ($p=0.415$) between the initial capture and the recapture. This indicates that the stress response is consistent regardless of previous interaction with the stressor. There was, however, a significant difference in CORT levels ($p<0.001$) based on the season of capture. The stress response was highest during the summer months and lower in the Spring and Fall. This may be because during the summer the stress response is most beneficial as it aids in breeding and care of offspring. This shows that variation in CORT levels is much more strongly influenced by seasonal environmental changes (eta sq = 0.414), than it is influenced by being captured for research purposes (eta sq = 0.005).

10:15am UG **Birds of Prey and Anticoagulants: Prevalence, and Consequence**

*[1]Lanie Chizmark, [1]Travis Wilcoxen, [2]Beth Chan, J[2]acques Nuzzo, & [2]Jane Seitz [[1]Millikin University, [2]Illinois Raptor Center]

Use of anticoagulant-based rodenticides is widespread, and non-target species are subject to poisoning. We have been monitoring prevalence of poor blood coagulation in birds of prey admitted to the Illinois Raptor Center since 2015. In addition to blood clotting, we assessed packed cell volume, and blood protein levels for five of our most commonly admitted species, totaling 570 birds over this time period. We also used a Factor VIII ELISA to explore potential genetic vs. environmental sources of blood clotting issues in the raptors. Overall, we found that approximately 10% of admitted birds failed to clot blood properly, and plasma protein levels were reduced in those with clotting issues. Further, Factor VIII was elevated in birds with failed clotting, suggesting an attempt to compensate for the other clotting factors that are disrupted by rodenticides.

10:30am **Contamination Acts as a Genotype-Dependent Barrier to Gene Flow, Causing Genetic Erosion and Fine-Grained Population Subdivision in Mussels from the Strait of Istanbul**

*[1]Chris Theodorakis, [1]Mary-Ann Meyer, [2]Sevil Deniz, [2]Oya Okay, & [3]Karl-Werner Schramm [[1]Southern Illinois University Edwardsville; [2]Istanbul Technical University, Istanbul Turkey; [3]Helmholz Zentrum, Munich Germany]

This study provides evidence of fine-grained genetic structuring in Mediterranean mussels (Mytilus galloprovencialis) from the Strait of Istanbul, caused by barriers to gene flow via contaminant-mediated selection. In this study, mitochondrial D-loop sequences were analyzed in mussels from 8 localities, all less than 30 kilometers apart, with differing contaminant loads. The results were: 1) Intra-population genetic differentiation (ΦST) between sites with high and low contaminant loads was high (up to 0.459), even at distances of only a few kilometers. 2) Genetic diversity was negatively correlated with the contaminant load ("genetic erosion"). 3) There was evidence of selection, based on haplotype frequencies and neutrality tests (Tajima's D), with purifying selection at the most contaminated site and balancing selection at the least contaminated. 4) Genetic distance was not correlated with geographic distance (no isolation-by-distance), but was correlated with contaminant load at each site. 5) Population dendrograms and Bayesian estimators of migration indicated that gene flow between sites was affected by contamination. For the dendrograms of the sampling sites, the clades clustered according to contaminant load more than geographic distance. Overall, the conclusions are that 1) contamination serves as a genotype-dependent dispersal barrier (i.e., selection-mediated gene flow) for pelagic mussel larvae, leading strong population differentiation over short distances, and 2) this selection-mediated gene flow also lead to genetic erosion within contaminated sites. These effects may be more pronounced in the Strait of Istanbul than in other locations because of the riverine nature and strong, uni-directional current of the strait.

11:00am UG **A Comparative Approach to the Analysis of Insectivorous Bat Distress Calls**

*Jordan Morgan & Bryan Arnold [Illinois College]

Distress calls are vocalizations produced by animals when faced with a potential threat. From a behavioral perspective, reasons for producing these calls vary throughout different taxa. In bats, functions of distress calls may range from eliciting help from a social groupmate, serving as a warning signal to conspecifics, or startling the predator to allow time for the individual to escape. The goal of this study is to utilize the comparative approach to analyze distress calls given by captured adult and juvenile insectivorous bat species in Illinois to examine call structure and variability amongst individuals and different species as a whole. Through a detailed analysis of shared call types among different species and an examination of call structure as a function of characteristics such as body size, age, and sex we hope to examine how call structure relates to function. To collect recordings, we captured bats using mist nets, and from each individual we documented their age, reproductive status, forearm length, and weight. Our distress call recording methods consisted of one researcher holding the bat within their hand, exposing the bat's mouth to receive a clear recording, and tapping lightly on the bat to agitate it enough to produce a call while the other researcher recorded the bat from a distance of 6 meters using an Avisoft UltraSoundGate microphone. We then analyzed these sounds using the Avisoft SAS Lab Pro Bioacoustics program to measure and characterize calls into unique groups based on their structure. Thus far, we have analyzed calls from 6 species and found that distress calls contain elements that can be grouped into 11 different types of calls, 8 of which are shared among different species. This is an ongoing study, but future goals include playback studies to examine the responses of different species to specific distress call types.

11:15am Grad **The Effects of Potassium Chloride during Aerial Exposure on Zebra Mussels**

*Patrick Menke & Jen Jost [Bradley University]

Zebra mussels, Dreissena polymorpha, are an invasive bivalve that cause great economic and ecological damage. These mussels are particularly invasive due to their ability to survive aerial exposure for extended periods of time, allowing them to be transported across land between bodies of water. Since their introduction, there have been attempts to control their spread through the use of lethal chemicals, such as potassium chloride (KCl), but these are often limited to smaller bodies of water. Therefore, the objective of this study was to determine the impact KCl has on mussels during aerial exposure. Firstly, the dose of KCl that caused complete mortality within 72 hours was determined. This was done by exposing mussels to different concentrations (400, 450, and 500 mg/L) in non-stressful aerial conditions (15°C, 75% RH) for 72 hours, followed by a 24-hour aquatic recovery. We found the KCl doses used did not cause complete mortality, but did inhibit valve closure. Since valve inhibition could increase desiccation, KCl may still be a useful tool in more severe aerial conditions. Given this, mussels were exposed to KCl (500mg/L or 0 mg/L) at three different aerial conditions (15°C, 20°C, or 25°C; 75% RH). For all three aerial conditions, mortality was significantly higher when mussels were exposed to KCl. Since complete mortality was not achieved at cooler temperatures, post-exposure growth was measured to determine how this aerial event could impact long-term performance. Mussels were exposed to KCl (500 mg/L or 0 mg/L) for 72 hours in non-stressful aerial conditions and then moved into a four-week growth tank at different water temperatures (15, 20, 25ºC). We plan to evaluate change in shell size, tissue mass, and shell mass to see if there is an effect of KCl exposure or water temperature on long-term performance.

11:30am **Consequences of Bythotrephes longimanus Effects on Zooplankton for Alewife First-Year Growth and Survival in Lake Michigan**

*[1]John Morino, [2]Kevin L. Pangle, [3]Mahir Demir, [3]James R. Bence, & [3]Scott D. Peacor [[1]Bradley University, [2]Central Michigan University, [3]Michigan State University]

The introduction of the invasive predatory zooplankter, Bythotrephes longimanus, into the Laurentian Great Lakes has dramatically affected zooplankton communities. Such effects are hypothesized to influence populations of planktivorous fish, although few studies have attempted to quantify these effects. To address this gap, we used a modeling analysis to quantify Bythotrephes effects on an a planktivorous fish (alewife, Alosa pseudoharengus) that is a primary forage fish for salmon in Lake Michigan. We first fit models to offshore time series data from Lake Michigan to estimate predation effects (including consumptive and nonconsumptive effects) of Bythotrephes on two common cladoceran zooplankton, Daphnia mendotae and Bosmina longirostris, which are potentially important prey items for both Bythotrephes and alewife. We then used outputs from the zooplankton models as inputs to a fish bioenergetics model to estimate impacts on alewife first-year growth and survival. Preliminary model results indicate that reductions in Bosmina caused by Bythotrephes have little effect on first-year alewife, but reductions in Daphnia that occur at high Bythotrephes densities led to substantial reductions (>50%) in first-year alewife recruitment (using growth and survival). We discuss how differences in the life history and vulnerability of these zooplankton may contribute to this disparity. Overall, our results suggest that effects of this invader on zooplankton may have consequences for the upper food web, with implications for fisheries management. This study also exemplifies the value of combining long term data and mechanistic models to explore predator effects.

POSTER PRESENTATION ABSTRACTS

1:00pm – 3:45pm, Saturday, April 13, 2024, in Griswold Gymnasium

*presenter, [school] with differences noted by superscript

CELL, MOLECULAR, & DEVELOPMENTAL BIOLOGY

1:00pm **1** Grad **Can Liver-Specific Master Regulators Reprogram Fibroblast Cells?**

*Mary Odubote & Gary Bulla [Eastern Illinois University]

The mammalian liver, a vital organ with complex functions, relies on a network of transcription factors to regulate gene expression. Fusion of hepatoma cells with fibroblasts results in hybrids that have been shown to extinguish liver gene expression, impacting approximately 400 genes, including liver-enriched transcription factors. Among these genes are transcription factors HNF4 and HNF1a. We previously showed that ectopic expression of HNF4 and HNF1a in rat fibroblasts failed to prevent extinction of the SERPINA1 gene (whose expression is driven by these factors) upon subsequent fusion with the hepatoma cells. Here, we asked to what extent ectopic expression of liver-enriched factors HNF4 and HNF1a can reprogram fibroblast cells. We conducted whole genome expression analysis comparing RAT1 fibroblasts with RAT1 fibroblasts expressing introduced HNF4 and HNF1 transcription factors (termed Rn16 cells) as well as their extinction profiles when fused to hepatoma cells. Surprisingly, results indicate 394 genes were activated >2.5-fold (110 genes by >5-fold) in the Rn16 cells, 73 (20%) of which are liver enriched. Promoter analysis indicated that only 13 (18%) of these 73 genes have promoters which bind HNF4 and/or HNF1a in hepatocytes. Furthermore, upon fusion of the Rn16 cells with hepatoma cells, a much larger number of genes were repressed (529 genes) compared to a fusion between the RAT1 fibroblasts and hepatoma cells (355 genes). Notably, all genes known to bind HNF4 and HNF1 and were activated in the Rn16 cells were silenced in the resulting hybrid cells, suggesting that the process of gene extinction overrides these transcription factor effects. Further analyses are being done to shed light on the intricate regulatory mechanisms underlying gene expression changes and the broader implications of liver-specific transcription factors in cellular reprogramming strategies.

2:30pm **2** UG **Cloning, Expression, and Biochemical Activity of a Small Library of Full-Length and Truncated Plant NADPH-Cytochrome P450 Reductases**

*Nathan Balvanz , Averi Hubert, Gage Wilson, & Caeley Dolan [University of Health Sciences and Pharmacy in St. Louis]

Plants produce a wide array of small molecule natural products serving a variety of ecological roles. These natural products are typically biosynthesized from central metabolism precursors. Cytochrome P450 oxidoreductases often serve as key biosynthetic enzymes in these catabolic pathways and use O_2 to oxidize substrates. However, these membrane-associated P450 enzymes must act in concert with their associated NADPH-cytochrome P450 reductase (CPR). CPRs use NADPH to supply electrons to the catalytic cycle of the P450. While plants typically contain dozens or hundreds of various P450s, they often have fewer than four different CPR paralogs in their genomes - suggesting CPRs have wide catalytic flexibility in serving P450s. Nonetheless, far fewer CPRs have been biochemically characterized than P450s. With the ever-increasing usage of synthetic biology and metabolic engineering approaches to produce small molecules using P450s, it would useful to expand our molecular toolbox of known CPRs to assist the P450s. Accordingly, we have explored various genomic databases and sequencing results to obtain a collection of plant CPR genes comprising a small library of 12 orthologs and paralogs across several plant species. Due to their membrane localization, it can be difficult to express CPRs and we sought to test both full-length variants and truncated variants with the membrane anchor removed. We have cloned, expressed, and biochemically characterized both the full-length and truncated versions of plant CPRs and found varying levels of heterologous expression and biochemical activity which we present here.

1:00pm **3** Grad **Correlation between Plasma and Fecal T3 Measurements in Mice**

*[1]Lucia Thompson & [2]Cinnamon VanPutte [[1]Southern Illinois University Edwardsville, [2]Southern Illinois University School of Dental Medicine]

Fecal and whole blood samples were collected from C57Bl/6J mice used for various experiments. These experiments involved treatments with an antibiotic cocktail to induce gut dysbiosis, l-thyroxine to induce hyperthyroidism, and methimazole to induce hypothyroidism in addition to untreated, wildtype animals. T3 concentrations of these fecal and plasma samples collected from the same individuals were measured in parallel by ELISA. Pearson correlation coefficient was calculated to determine if the correlation between these measurements is statistically significant.

2:30pm **4** UG **Determining the Effect of Falling Chloroplasts on the Gravitropic Response in Arabidopsis thaliana**

*Zackary Woodall & Darron Luesse [Southern Illinois University Edwardsville]

Gravity is one of the most important environmental signals for determining how a plant orients its organs. During development, directed growth in response to a change in gravity is known as gravitropism. The cellular mechanisms behind how plants sense gravity and respond are not completely understood, but it is clear that falling components within the cell function as statoliths. Sedimenting starch-filled amyloplasts play this role, as demonstrated by the reduced gravitropism in Arabidopsis thaliana with a mutation in the PHOSPHOGLUCOMUTASE gene (pgm), which limits starch production. However, it is unknown what other organelles can function as statoliths, and if the signaling is caused by their weight on the plasma membrane, or if specific molecular interactions with membrane-associated receptors are required. The goal of this project is to investigate the gravitropism response in mutants that display sedimenting chloroplasts. While chloroplasts are normally suspended in, and positioned by, a network of actin, mutants in CHLOROPLAST UNUSUAL POSITIONING 1 (chup1) prevent that association and lead to chloroplast sedimentation to the abaxial membrane of the cell. We hypothesize that these falling chloroplasts can replace the amyloplasts and restore full gravity sensing in pgm1 mutants. To test this, pgm1 chup1 double mutants will be isolated. Gravitropism in hypocotyls, roots, and inflorescence stems will be measured and compared to single mutants and wild type. F2 plants from a chup1 x pgm1 cross have been isolated and are being confirmed as double mutants via PCR. Gravitropism will be measured via timelapse image capture for 24h after 90 degree gravistimulation and analyzed by a modified version of PlantCV python package. Restoration of gravitropism would suggest that the identity of the statolith is not as important as its physical presence.

1:00pm **5** UG **Does Mating Pheromone Receptor bar9 Show Activity Necessary for Producing the Mound Mutant Phenotype in Schizophyllum commune HK28?**

*Jaelyn Boone, Lauren Lucykow, & Thomas J. Fowler [Southern Illinois University Edwardsville]

Schizophyllum commune is a basidiomycete fungus that has thousands of mating types. Its mushrooms develop sexual spores that will generate hyphae. Mating occurs through the exchange of small lipopeptide pheromones between hyphae, and if compatible, a G-protein coupled receptor will recognize the pheromone and begin the mating process. We have recognized a predicted full-length receptor gene found in the matB α9 region of the mutant HK28 strain of S. commune. After conducting a series of mating tests, this gene has now been determined to be bar9. The HK28 strain of S. commune produces a visual mutation called mound, which can be described as a dome-like growth of hyphae. Through random insertion mutagenesis, one insertion made its way into the bar9 gene, along with different insertions going into other places in the genome. One transformant from this random insertion mutagenesis was unable to express the mound phenotype (Banerjee, 2008). It was then hypothesized that bar9 has some role in producing this mutant hyphal phenotype (Banerjee and Leonard, personal communication). We have been developing a homologous recombination knockout technique of bar9 to see if we can create a similar phenomenon that was produced by random mutagenesis. We hypothesize that if bar9 does have function in producing the mound phenotype, that we will see no mounds are produced when this gene is knocked out. Through reintroduction of bar9 we would then expect to see restoration of the mound phenotype

2:30pm **6** UG **Effects of Corticosterone on Cuban Tree Frog Tadpole Gonad Development**

*Gillian Monroe & Travis E. Wilcoxen [Millikin University]

There are a variety of stressors that amphibians experience during development. It is known that these stressors can affect development in many species. The mechanism for sex determination in amphibians is largely unknown. Genes play a role in differentiation, but in some species environmental factors and stressors may play a role in sex differentiation. For our study species, Cuban tree frogs (Osteopilus septentrionalis), it is known that the stress hormone, corticosterone, increases the rate of metamorphosis. We manipulated corticosterone levels in Cuban tree frog tadpoles in order to determine if corticosterone levels effected gonad development and differentiation. This was done by adding corticosterone to their rearing water during development, starting with Gosner stage 19 (when they still had yolk sacs). It was found that individuals given corticosterone were significantly more developed after 6 weeks than individuals given the ethanol control. There was no significant difference found between the two treatments and gonad development. Male determined individuals had significant smaller gonads than female determined individuals. Male determined individuals had significantly higher levels of testosterone than female determined individuals and not developed individuals. Undifferentiated individuals had significantly more testosterone than female determined individuals and not developed individuals. From this it can be determined that corticosterone does not have an effect of gonad development or differentiation in Cuban tree frogs.

1:00pm **7** UG **Expression of DNA Repair Pathways Genes During DNA Damage in the Ciliate Tetrahymena thermophila**

*Jacob Weinberg, Jonathon Campos, & Alexander Sebastian [Bradley University]

DNA can be damaged in specific ways by different mutagens. In return, cells have multiple pathways available to repair the types of damage created. Here we compare the cellular responses to three different DNA alkylating agents to assess the expression of repair pathways and see if the cells preferentially respond with one pathway versus another. For this study, we have chosen representative genes of two different DNA repair pathways, nucleotide excision repair (NER) and double-strand break repair, and compared the expression ratios of these genes using qRT-PCR in response to three different alkylating agents: Cisplatin, Claflin, and Temozolomide. The adducts formed by these cytotoxic compounds are well known

in other organisms due to their popularity as chemotherapeutic drugs in cancer treatment. This study will help show how often DNA repair of these adducts leads to further mutations that require additional pathways to repair.

2:30pm 8 UG **Generating CRISPR Cas9 Point Mutations in Arabidopsis GGPPS11**

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

Geranylgeranyl diphosphate synthase (GGPPS) is a class of enzymes that synthesize the production of the geranylgeranyl diphosphate (GGPP), a branchpoint compound that leads to the production of a variety of isoprenoid products including chlorophylls and carotenoids. Within the Arabidopsis thaliana genome, there are 11 functional isoforms of the GGPPS enzyme. Of these, plastid localized GGPPS11 is thought to be the most significant, providing the bulk of GGPP from the MEP pathway. In the Arabidopsis ggpps11-1 mutant, a single amino acid change next to the First Aspartate Rich Motif (FARM) led to the development of a variegated phenotype under normal growth conditions that became exacerbated under higher heat. However, TDNA insertions in the chloroplast targeting peptide region or the C-terminus led to seedling albino and embryo lethal phenotypes, respectively. It remains unclear why ggpps11-1 is variegated rather than completely albino or uniformly pale. In an attempt to gain a better mechanistic understanding of GGPPS11 and isolate more partially functional mutant alleles, we are using a CRISPR-Cas9 approach. Specifically, we have designed an sgRNA to target the region of GGPPS11 just upstream of the conserved Second Aspartate Rich Motif (SARF) Agrobacterium-mediated transformation was used to insert Cas9, the sgRNA, and a Basta selection gene into wild-type Arabidopsis. Preliminary results have yielded very few transformants, suggesting that most mutations in this region will be lethal. Transformants that survive Basta selection will be positively identified using PCR for the Cas9 gene. An additional PCR with a reverse primer that binds at the predicted CRISPR cut site will be used to identify lines with mutations in the desired region, followed by DNA sequencing to confirm the details of the mutation. After isolation, these lines will undergo phenotypic analysis and chlorophyll quantification under a variety of temperature conditions.

1:00pm 9 UG I**nvestigating an Abnormal Mating Behavior in Schizophyllum commune**

*Lauren Lucykow, Jaelyn Boone, & Thomas J. Fowler [Southern Illinois University Edwardsville]

Schizophyllum commune is a basidiomycete fungus that sexually reproduces through basidiospore-containing fruiting bodies. Hyphal contact initiates mate formation, with mate signaling mediated by lipopeptide pheromones that signal unidirectionally along hyphae and interact with G-protein coupled receptors. S. commune has thousands of different mating types that specify a variety of mating pheromone and receptor genes at the matB locus. Fosmid clones with potential pheromone and pheromone receptor genes were previously isolated from a developmental mutant with matB version matBa9-b6. A potential pheromone-producing gene bap9 was revealed at the matB a9 region of the mutant HK28 strain of S. commune. This gene was confirmed to produce pheromone-like activity through transformations of the matB-null strain. The transformants were confronted with various strains of S. commune, all containing different matB mating types. Mating was confirmed by the presence of clamp connections, which facilitate nuclear travel. One specific tester strain, V131-5, exhibited abnormal mating activity after several days. Further investigation of these testers revealed a large number of pseudoclamps, or incomplete clamp connections, throughout both the tester and transformant sides of the mating. A strain from the same origin, V131-16, appeared phenotypically similar and produced a very large number of pseudoclamps. Pseudoclamps are produced upon complete matAactivation and incomplete matB activation. The specific cause of the pseudoclamps is unknown, but many previous studies have attempted to explain the molecular basis of this abnormal behavior. Ras signaling has been confirmed to be necessary for complete clamp connections. Decreased pheromone signal strength has been predicted to be a possible molecular component of these incomplete clamp connections. We are investigating why the signaling leads to an incomplete mating reaction in this case.

2:30pm 10 UG **Investigating the Function of Intrinsically Disordered Proteins in Stentor coeruleus**

*Sarah Hoffmann-Weitsman & Mark Slabodnick [Knox College]

“Form fits function” is a fundamental biological principle that is true on many size scales, especially for proteins and enzymes. However, intrinsically disordered proteins (IDPs) deviate from this paradigm and were once ignored by the scientific community because of their lack of tertiary structure. The prevalence of IDPs implies their importance, though their specific roles and mechanisms by which they achieve their function are difficult to predict based on their sequence. One known role of IDPs is driving the process of liquid-liquid phase separation to form membraneless compartments for cellular organization. In some large cells, IDPs spatially control signaling events and protein translation to allow for complex organization within a single cytoplasm. A large number of highly expressed, disorder proteins have recently been identified in the giant trumpet-shaped ciliate Stentor coeruleus. Stentor is a millimeter-long single-celled organism with a complex morphology and the ability to regenerate. Although these processes are not well understood, we hypothesized that IDPs may play a role. We cloned 11 highly expressed genes whose protein products were highly disordered. RNAi was performed to knock down the candidates and investigate morphology and regeneration through microscopy and microsurgery. We also hypothesized that due to the strong negative charge possessed by several candidates that they may also be important in the regulation of positively charged proteins or ions. In particular, calcium and potassium are crucial for motility, contraction, and extension of the cells, but there is much unknown about the uptake or storage mechanisms of these ions. While no IDPs we investigated appear to have individual requirements for Stentor morphogenesis or

regeneration, there is still much work to be done with simultaneous knockdowns of IDPs, investigating protein binding partners, exploring the regulation of ions, and determining localization and behavior of IDPs within the cell.

1:00pm 11 UG **Meristem-Specific Expression of Geranylgeranyl Diphosphate Synthase 11 (GGPPS11) to Rescue the ggpps11-1 Mutant**

*Aminah Haynes, Tessa England, & Darron Luesse [Southern Illinois University Edwardsville]

The biosynthesis of isoprenoids in plants is an important pathway required for the subsequent production of downstream products such as carotenoids and chlorophyll. Although much is known about chlorophyll, there are still some questions remaining on how plants prioritize the partitioning of chlorophyll and carotenoid precursor molecules. One such precursor, Geranylgeranyl Diphosphate (GGPP), is produced in the plastid via the MEP pathway. A point mutation in GERANYLGERANL DIPHOSPHATE SYNTASE 11 (ggpps11-1), one member of a family of enzymes that produces GGPP, induces a reproducible variegated leaf phenotype. In this work, we are testing the hypothesis that the variegated leaf patterns of ggpps11-1 are established in the shoot apical meristem and early leaf primordia. For this, wild-type GGPPS11 is being expressed behind three distinct meristem-specific promoters (AtML1, STM, and WUS) in Arabidopsis thaliana and transformed into ggpps11-1 mutant plants. T_1s and T_2s transformants will be isolated, followed by PCR confirmation. Transformed plants will be examined for the ggpps11-1 phenotype to determine if the transformed constructs are able to rescue the variegated phenotype.

2:30pm 12 **PCR-Based Library Screening for Molecular Markers Linked to the mnd Locus in Schizophyllum commune**

*Thomas Fowler & Ibrahim Bello [Southern Illinois University Edwardsville]

The mnd mutant of the wood-rotting mushroom fungus Schizophyllum commune has morphological and mechanistic features that are of interest. The rounded, indeterminate hyphal mounds produced by the mutant have some gene expression patterns that suggest a relationship with dikaryotic mushroom development, but a clear link has not been established. Additionally, in some dikaryotic cells the mnd mutant recessive allele appears to heritably supplant or override the wild-type allele in an internuclear process that can also affect linked loci. One key to understanding the mound mutant is to define the mnd locus and the gene or genes associated with the hyphal morphology and genetic mechanism. Some genetic and molecular genetic markers map to a linkage group with mnd, but none are very tightly linked. If some closely linked markers were available, the published wild-type S. commune genome sequence and molecular techniques that are well established for S. commune might sort out the nature of mnd phenomena. We screened a genomic library of a mnd mutant strain to identify DNA sites polymorphic with the wild-type genome sequence along a 1.8 Mb chromosomal region predicted to include the mnd locus. The PCR-based screen targeted positions roughly 200 kb-300 kb apart. Thirteen unique fosmid clones were isolated and their inserts were end-sequenced and mapped to the reference genome. Alignment of the DNA sequences revealed no SNP or small indel difference between the cloned mound mutant strain DNA and the reference genome that could be used as a marker. One clone is being further analyzed as a potential large indel. A total of 25.5 kb, or ~1.5% of the region of interest, was analyzed. Sequence identity between the strains across this region was unanticipated and will modify our strategies to identify the mndlocus.

1:00pm 13 UG **Putative MUS81 Nuclease-Associated Importin Expression and Evaluation During DNA Repair and Conjugation in Tetrahymena thermophila**

*Seth Stidham, Emma White. & Naomi Stover [Bradley University]

Mus81 is an endonuclease that has been investigated in Tetrahymena thermophila due to its unique roles in meiotic recombination for years. However, in humans, this enzyme has been recently investigated due to its potential as a chemotherapeutic target in BRCA2-related cancers. Last year, we investigated potential MUS81-related genes under varying conditions, based on expression correlation. Of these, a putative importin subunit (TTHERM_00335700) yielded the most potential for further investigation. Here, we further investigated this gene to understand whether MUS81 relies on an importin for transportation; and discuss the implications of targeting an importin for chemotherapeutic effects in humans, utilizing Tetrahymena thermophila as a model organism.

2:30pm 14 UG **Searching Human Chromosome 12 for a Master Regulator of Liver Function**

*Lyric Johnson & Gary Bulla [Eastern Illinois University]

Chronic liver disease is responsible for over 2 million deaths per year, and is the fourth major cause of cancer-related deaths worldwide. Despite much knowledge on the regulation of genes in normal and diseased liver, the mechanisms responsible for loss of liver function in the diseased state are largely unknown. We previously reported a selection technique to derive cells from rat liver tumor cell lines which have a dramatic loss of liver function (termed “hepatoma variants”). A previous study suggested that the introduction of human chromosome 12 (Hsa12) from cultured human liver cells into these liver variant cell lines could rescue liver function. At that time, it was not cost-effective to further map human chromosomes. However, with the current state of the Human Genome Project and new technologies, this question is being revisited. We utilized data from the Human Genome Project as well as from whole genome studies to identify rat genes that are repressed in the hepatoma variant cell lines and whose homologs exist on Hsa12. Based on this idea, we have identified and mapped

49 candidate genes on Hsa12. We are now determining which of these Hsa12 genes are present in the hepatoma variant cells that correlate to hepatic rescue in a panel of hepatoma cells containing various Hsa12 fragments. Our initial mapping using a panel of 5 Hsa12 markers suggests that the gene of interest lies on the short arm (Hsa12p). Our hypothesis is that a gene on human Hsa12 is at least partially responsible for the driving of liver identify in mammals.

1:00pm **15** UG **Strain Development for Exploring the Mound Morphological Mutant of Schizophyllum commune**

*Kennedy Spears & Thomas Fowler [Southern Illinois University Edwardsville]

Schizophyllum commune is a mushroom fungus readily found in the wild, but what interests us are formations called 'mounds' in a recessive mutant strain (mnd). A mound is a collection of hyphae that creates a dome shape arising from the mycelium of the fungus. The mnd mutant locus is genetically connected to Scaffold 1 of the sequenced S. commune genome (JGI-DOE v.3.0). To explain mounds occurring within a heteroallelic (mnd + mnd+) mycelium, Leonard and colleagues proposed that an internuclear information transfer occurs unidirectionally between two haploid nuclei in a dikaryotic cell in the absence of diploidization. Their experimental observations by genetic and physical dissection showed one donor nucleus containing the mnd chromosomal region and one recipient nucleus were present. While the mnd donor was genetically unchanged, the recipient was changed, but only by the substitution of the mnd mutant chromosomal region that, at times, included a linked ad-2(ade2) marker gene. There were no other genetic modifications in the recipient nuclear genotype and the wild-type mnd and its linked markers were no longer detected. Leonard and colleagues suggested several mechanisms for this somatic recombination-like result, yet there is no hypothesis of known mechanisms that can explain the entirety of mnd observations. Markers have been identified around mnd displaying genetic linkage. Attempts have been made to locate the mnd gene by identifying polymorphisms on Scaffold 1 for mapping its location. However, polymorphisms between the sequenced strain (H4-8) and a mnd mutant strain are limited. We would like to recreate the internuclear information exchange reported by Leonard. We've developed strains with multiple genetic and molecular markers that include the mutant mnd allele and nutritional markers ade2 and nic1 on the same homolog. Insertion of polymorphic physical markers on Scaffold 1 is underway to facilitate mapping and capture of internuclear information exchanges.

2:30pm **16** UG **The Effects of Genes Upregulated During Spaceflight on Hypoxia in Arabidopsis thaliana**

*Victoria Anselm, Jill Lambrechts, & Darron Luesse [Southern Illinois University Edwardsville]

The spaceflight environment presents several difficulties for plants. Solar radiation, normally absorbed or reflected by Earth's atmosphere, can cause mutations. The lack of gravity robs a plant of one of its most reliable and consistent signals responsible for organ patterning and positioning. Finally, the loss of gas convection in microgravity can lead to a hypoxic environment in non-photosynthetic tissues. To better understand how plants mount a global response to these stresses, the BRIC-20 spaceflight mission compared Arabidopsis seedlings grown on the International Space Station with those grown in identical conditions on Earth via RNAseq and discovery proteomics. In total, over 1000 differentially-expressed mRNA and proteins were identified. A small subset of these remain annotated as Unknown. The overall goal of this work is better understand how some of these unknown genes are impacting plant development and survival in space, and ultimately determine their molecular function. SALK T-DNA inserts have been obtained and confirmed to be homozygous via PCR. The goal for this project is to determine if hypoxia has an effect on the isolated mutants. To determine if hypoxia resistance is altered in the mutants, we submerge five-week-old plants in a plastic tank. To determine the ideal duration of hypoxic exposure, we removed plants on consecutive days to identify the wild type's tolerance. In these conditions, wild-type plants survived after four days of exposure, but died if they remained in the tank longer. Current experiments are focused on determining if the mutants show altered tolerance to hypoxic conditions.

CHEMISTRY & BIOCHEMISTRY

1:00pm **17** Grad **Analyzing Illicit Drugs Using Silver Nanoparticles**

*Michael Combs, *Lillie Purcell, John Determan, Mette Soendergaard, Dane Pfeiferling, Bradee Finley, Harley Davidson [Western Illinois University]

The goal of this research project is to detect illicit drugs such as a methamphetamine analog using silver nanoparticles. Coinage metals such as copper, silver, and gold generate stable nanoparticles with high refractive indices, which allows for a visual color change in the presence of a target drug. Detection of illicit drugs efficiently is helpful for forensic field testing of unknown substances. Previously, research has been performed using gold nanoparticles, however this is not efficient due to the high cost of gold. Using a similar metal such as silver that has the same chemical and optical characteristics of gold, the target methamphetamine analog can be efficiently detected while reducing the cost of the test.

Silver nanoparticles have vivid colorations due to their high refractive indices. This makes it possible to detect the methamphetamine analog using a colorimetric test, where the color of the nanoparticles changes due to their interactions with the analog. Silver nanoparticles were synthesized this semester using a double reduction method with citrate and ascorbic acid. Aptamers are peptide molecules, also known as oligonucleotides, that can selectively interact with a specific drug and enhance the interactions between the nanoparticles and the methamphetamine analog. These interactions cause changes in the surface of the nanoparticles, producing the visible color change of the aptamer coated nanoparticles. The size and shape of the nanoparticles will then be imaged and analyzed by a Transmission Electron Microscope (TEM). TEM is a

form of imaging that is used to measure the size of nanoparticles by producing a beam of electrons through a specimen to produce an image. It has been demonstrated from previous research that the smaller the particles, the better the interaction with the aptamer. At the same time, the larger the particles, the easier it is to observe a visual color change.

2:30pm **18** Grad **Ligand Development for F-Metal separations**

*[1]Briar Hilsabeck, [1]Brian Bellott, [2]Scott Daly, & [2]Blake Anastasia [[1]Western Illinois University, [2]University of Iowa]

The goal of this project is to develop ligands with potential use for removing minor actinoids (namely plutonium, americium, curium, and neptunium) from waste solutions. Removing these can reduce the required storage time for nuclear waste significantly, with an estimate of the time scale of 9000 years to under 300 years for decay to natural, stable isotopes. Soft donors (like nitrogen and sulfur) have been shown selective binding and properties for different metals based on the minute differences in atomic radii and Lewis acidity of these elements. We have developed a set of ligands that show promising selectivity for f-metal separations. The ligands and complexes are characterized by FT-IR, NMR, UV-Vis, and single-crystal X-ray diffraction where applicable.

1:00pm **19** Grad **Antioxidants in Hot-Brewed and Cold-Brewed Teas**

*Olivia Brinker & Brian Bellott [Western Illinois University]

It has been postulated that individuals exposed to free radicals have a higher likelihood of developing diseases such as cancer, hypertension, and Alzheimer's. Free radicals are highly reactive species that are naturally produced as a result of normal metabolism and cellular respiration, but they have also been known to enter the body through sources like fast food, air pollutants, and pesticides. Free radicals lack an electron and attack healthy cells in the human body to compensate for their electron deficiency. Antioxidants can neutralize the reactivity of free radicals through electron transfer, at which a single electron from an antioxidant is transferred to a free radical species. Black and green teas have been studied as antioxidant sources, and they can be prepared in different ways. The hot-brewed method is the most common method used for preparing tea and entails soaking tea leaves in hot water for a few minutes. Cold-brewed teas are prepared by soaking tea leaves in cold water for several hours.

In this study, the antioxidant capacity of hot-brewed teas and cold-brewed teas will be compared. Both black and green teas will be tested using a method called the ferric-reducing ability of plasma (FRAP) assay. In this method, antioxidants are used to reduce an iron complex; this reaction mimics what happens when antioxidants neutralize free radicals. The reduction of the iron complex results in a color change that can be monitored with a spectrophotometer. The kinetics of the reaction are currently being investigated, with the next step being determining which brewing method produces a healthier tea.

2:30pm **20** Grad **Development of an Organometallic Chemistry Reaction for Use in a Senior Level Inorganic Laboratory**

*Ty Ojanovac & Brian Bellott [Western Illinois University]

The goal of this work was to develop an organometallic chemistry reaction which yielded an organometallic product in high yield, high purity, can be analyzed by several physical methods (FTIR, ^{1}H NMR, and ^{31}P{^{1}H} NMR), and be completed in one three-hour laboratory period. The synthesis of trans-$Fe(CO)_2(PR_3)$ is well studied and an ideal candidate for this laboratory exercise. Organoiron complexes are versatile reagents in inorganic and organic chemistry. The starting materials for the reaction are cost effective and can be stored indefinitely under proper storage conditions. This poster will present modifications to the published procedure which reduce the reaction time and make the experiment more accessible for those without air sensitive capabilities.

1:00pm **21** JH **Electrified Waters: How Conductivity Can Reverse Ocean Acidification**

*Rocco Jones [Washington Junior High and Academy Program]

After I conducted my experiment using a saline solution, my hypothesis that, at the negative terminal of a closed circuit of 5V electrical current, the pH would decrease while the pH at the positive terminal would increase as hydrogen ions moved towards the negative solution was proven. On average, the pH at the negative terminal decreased by 1.56 during the experiment. This proves that the concentration of hydrogen ions in the negatively charged solution increased over time. Additionally, in the positively charged solution, the pH increased by an average of 1.91. This also follows my hypothesis that hydrogen ions from the positively charged solution would move toward the negatively charged solution. In total, a net positive pH change was achieved.

This experiment can be applied to form real-life solutions concerning altering the pH of polluted seawater to make it suitable for release. My experiment could be utilized by collecting ocean water and filtering debris out, leaving behind only acidic water. This water would then be pumped into a tank connected to another tank of distilled water before it is introduced with a closed-circuit positive electrical current while the distilled water is introduced with a negative current. The pH of the ocean water would increase and then be released into the ocean again, providing a safer habitat for sea life. The distilled water can be reused repeatedly and eventually released as well, producing a net positive pH change. To negate any possible pollution, exclusively renewable energy would be used to create current to be introduced into the water. In the

future, with a team of researchers working, it would be not only possible but plausible and necessary to change ocean pH and make the world a better place for future generations of humans and sea life.

2:30pm **22** UG **Journey Towards Goniothalamin: Unveiling Progress and Insights in the Synthesis of an Antitumor Molecule**

*Sam Hannig, Nikolas Wollenhaupt, & Jocelyn Lanario [Illinois College]

Goniothalamin, renowned for its diverse therapeutic potential encompassing immunosuppression, anti-inflammation, antifungal, and anticancer effects, faces a challenge due to its limited natural extraction rate. With only 0.0356 gram per gram of dry material obtainable, a shift toward cost-effective gram-scale synthesis and testing is imperative. Traditional methods using Grubbs' catalyst are hindered by air instability, necessitating exploration of air-stable ruthenium catalysts.

This study pursues two primary objectives: first, the synthetic production of goniothalamin from trans-cinnamaldehyde, and second, the assessment of air-stable ruthenium complexes as alternative catalysts. Results emphasize the necessity of excess allyl magnesium bromide for complete conversion of trans-cinnamaldehyde, yielding an 86.6% of high-purity racemic-alcohol. Efficient separation of (R)-acetate from (S)-alcohol was achieved through column chromatography, validated by Rf values.

Successful enzymatic resolution was confirmed via FTIR spectroscopy with the disappearance of $\boldsymbol{\nu}$O-H at 3340 cm^{-1} and the appearance of $\boldsymbol{\nu}$C=O at 1737 cm^{-1}. These findings highlight the viability of the synthetic approach used. Future work will investigate alternative ruthenium complexes, promising more cost-effective and efficient gram-scale synthesis. This research advances goniothalamin synthesis, offering opportunities for the development of pharmaceutical agents with exceptional therapeutic potential. In summary, this study addresses the imperative need for scalable and cost-efficient synthesis methods for goniothalamin.

1:00pm **23** UG **Maximizing Efficiency: Investigating the Reusability Potential of a Water-Soluble Ruthenium Catalyst for Benzamide Synthesis**

*Sam Hannig, Nikolas Wollenhaupt, & Jocelyn Lanario [Illinois College]

Benzamides, crucial components in pharmaceuticals and agrochemicals, are traditionally synthesized from benzonitrile, a process marred by slow rates, harsh conditions, and limited selectivity. This research investigates the potential of RuCl2(PTA)4, a water-soluble catalyst, in the context of ruthenium-catalyzed benzonitrile hydration. Our primary goal is to establish an efficient and sustainable approach by leveraging RuCl2(PTA)4's reusability to enhance reaction rates, selectivity, and conditions. Successful utilization of RuCl2(PTA)4 promises a reduction in environmental impact and opens doors to industrial applications. Additionally, this research marks a step forward in advancing benzamide synthesis and explores broader applications of transition metal catalysis in organic transformations.

To achieve our objectives, we employed a comprehensive methodology, encompassing vial reactions for hydration, recycling experiments, and the use of aqueous biphasic catalyst systems. Characterization techniques included TLC, GC-MS, IR, and NMR analyses.

RuCl2(PTA)4 emerges as an excellent catalyst for the controlled hydration of benzonitrile, yielding no observable byproducts. Furthermore, it exhibits remarkable recyclability, maintaining effectiveness over five consecutive runs, with signs of degradation only on the fifth cycle. Importantly, water-soluble ruthenium(II) complexes like RuCl2(PTA)4 showcase potential as biphasic aqueous catalysts, simplifying product-catalyst separation through straightforward decantation.

This research advances benzamide synthesis and holds promise for reducing environmental impact while expanding industrial applications. It also lays the foundation for broader exploration in the field of transition metal catalysis in organic transformations.

2:30pm **24** Grad **Lanthanide Complexes for Near-Infrared OLEDs**

*Foster Amoah & Hongshan He [Eastern Illinois University]

There has been considerable interest in infrared imaging systems because of their potential uses in biomedical imaging studies and night vision. One of the primary challenges facing modern materials research is developing novel materials for high-performance near-infrared-emitting organic light-emitting diodes (OLEDs). Luminescent metal−organic frameworks containing functional absorption ligands represent an emerging class of luminescent materials because they possess the advantages of both organic dyes and transition-metal-based emitters. Trivalent rare earth ions (lanthanide ions) are known for their unique optical properties such as sharp emission lines and long luminescence lifetime. However, many lanthanide ions are characterized by weak absorption of light in the visible region due to the forbidden nature of their electronic transition state. To overcome this problem, organic chromophores can act as sensitizers, effectively absorbing light and transferring energy to the lanthanide ion. Herein, we designed and synthesized a novel metal complex (Yb^{3+}-porphyrin complex). The porphyrin acts as a sensitizer that absorbs strongly at the visible region and transfers the energy to Yb^{3+} for efficient emissions. To achieve the aim of efficient emission to the NIR region, the HOMO-LUMO gap of the porphyrin-based ligand must be narrowed. These can be achieved by expanding the π-conjugation of the Porphyrin-based ligand. In this presentation, details of the synthesis, characterization, and photophysical properties of the complex will be discussed.

1:00pm **25** UG **On How Nature and Position of Protecting Groups can Direct Sialylation Reactions**

*Shay Adio, Jeremiah Brincken, & Cristina De Meo [Southern Illinois University Edwardsville]

Glycoconjugates containing N-Acetyl neuraminic acid are important synthetic targets, whose chemical synthesis is compromised by challenges in stereocontrolling glycosylations to obtain the natural glycosidic linkage (α). In the last two decades, advancement in the field has allowed the synthesis of a wide range of sialosides. Our group has been developing novel methodologies in sialylations, with a particular focus acquiring a better understanding of how O-protecting groups can influence the stereoselectivity of sialylations. Herein we report our findings in the synthesis and testing of sialyl donors bearing different protecting groups at the glycerol chain and O-4.

2:30pm **26** UG **Photocatalysis for C-N Coupling Reactions**

*Anthony Aya & Hongshan He [Eastern Illinois University]

Many C-N coupling reactions used by pharmaceutical companies require multiple photosensitizers, multiple component catalysts, or high heat. Previous photocatalytic systems use nickel and an exogenous iridium (III) or ruthenium (III) photocatalyst, which are quite expensive and inefficient. To overcome this problem, we designed and synthesized a BODIPY-functionalized nickel (II) complex for C-N coupling reactions under light irradiation. Here, BODIPY represents 4,4'-difluoro-4-bora-3a,4a-diaza-s-indacene and has strong absorption of light. The ligand was prepared from the reaction between 2,4-dimethylpyrrole and 4,7-diformyl-2,2'-bipyridine. In this presentation, synthesis and characterization of the ligand will be reported. The absorption and fluorescence spectra as well as catalytic reaction between 4-iodobenzentrifluoride and morpholine in dimethylacetamide at room temperature under irradiation of white LED lamps will be discussed.

1:00pm **27** Grad **Quantification of Cannabichromene among Nineteen Cannabinoids in Key Lime Pie Hemp Flowers by Liquid Chromatography Ultraviolet Detection**

*Emily Jovanovich, Jillian Mulholland, & Liguo Song [Western Illinois University]

A liquid chromatography ultraviolet detection (LC-UV) method was developed for the quantification of cannabichromene (CBC) in key lime pie hemp flowers among nineteen cannabinoids. 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% CBC in hemp flowers. To recover CBC, the sample 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 CBC content in key lime pie hemp flowers was measured to be 0.59% with relative standard deviation (RSD) of 1.6% in triplicate The method was not interfered by other cannabinoids present in hemp flowers.

2:30pm **28** **Quantification of Cannabicitran among Nineteen Cannabinoids in Lucky Leaf Hemp Cigarettes by Liquid Chromatography Ultraviolet Detection**

*Jake Provis, Liguo Song, & Brocke Bain [Western Illinois University]

A liquid chromatography ultraviolet detection (LC-UV) method was developed for the quantification of cannabicitran (CBT) among 19 cannabinoids in lucky leaf hemp cigarettes. The quantification was achieved using external standard calibration between 0.02 and 12.5 mg/mL. The limits of quantitation (LOQ) were determined to be 0.04% CBT in hemp cigarettes. To recover CBT, a sample 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 CBT content in the lucky leaf hemp cigarettes sample was measured to be 0.11% with 9.8% relative standard deviation in triplicate. The method is not interfered by other cannabinoids present in hemp cigarettes.

1:00pm **29** Grad **Quantification of Cannabidiol among Nineteen Cannabinoids in Hemp Infused Water by Liquid Chromatography Ultraviolet Detection**

*Lindsey LeBlanc & Liguo Song [Western Illinois University]

A liquid chromatography ultraviolet detection (LC-UV) method was developed for quantification of cannabidiol (CBD) among nineteen cannabinoids in hemp infused water. The quantification was achieved using external standard calibration between 0.02 and 25 μg/mL. The limits of quantitation (LOQ) was determined to be 0.0008% CBD in hemp infused water. To recover CBD, hemp infused water was combined with methanol to prepare a 25 mg/mL mixture. After ultrasonication, centrifugation and filtration, the extract was diluted to 2.5 mg/mL and analyzed by LC-UV. The relative standard deviation (RSD) of the measurement in triplicate was 1.9%. The method is not interfered by other cannabinoids present in the sample.

2:30pm **30** Grad **Quantification of Cannabidiol among Nineteen Cannabinoids in Key Lime Pie Hemp Flowers by Liquid Chromatography Ultraviolet Detection**

*Keszia Fabien, Maggie Schoener, & Liguo Song [Western Illinois University]

A liquid chromatography ultraviolet detection (LC-UV) method was developed for the quantification of cannabidiol (CBD) among nineteen cannabinoids in key lime pie hemp flowers. The quantification was achieved using external standard calibration between 0.02 and 25 ug/mL. The limits of quantitation (LOQ) were determined to be 0.04% CBD in hemp flowers. To recover CBD, a sample was combined with methanol to prepare a 25 mg/mL mixture. After ultrasonication, centrifugation and filtration, the extract was serially diluted to 50 ug/mL and analyzed by LC-UV. The measurement precision in triplicate was 0.7%. The method is not interfered with by other cannabinoids present in hemp flowers.

1:00pm **31** Grad **Quantification of Cannabigerol (CBG) among 19 Cannabinoids in Δ 8-THC (Tetrahydrocannabinol) Fortified White Whale CBG Hemp Flowers by Liquid Chromatography Ultraviolet Detection**

*Olalekan Ogunsola, Nayali Licea, & Liguo Song [Western Illinois University]

A liquid chromatography ultraviolet detection (LC-UV) method was developed for the quantification of cannabigerol (CBG) in D^8-THC (tetrahydrocannabinol)-fortified white whale CBG hemp flowers among nineteen cannabinoids. The quantification was achieved using an external standard calibration between 0.02 and 25 µg/mL. The limits of quantitation (LOQ) were determined to be 0.04% CBG in hemp flowers. To recover CBG, a sample was combined with methanol to prepare a 25 µg/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 7.6%. The method is not interfered with by other cannabinoids present in hemp flowers.

2:30pm **32** Grad **Quantification of Δ 9 -Tetrahydrocannabinol (THC) among 19 Cannabinoids in Δ 8 -THC Fortified White Whale CBG (Cannabigerol) Hemp Flowers by Liquid Chromatography Ultraviolet Detection**

*Ammar Al-Bataineh, Liguo Song, Ayowole Owolabi, & Kate Dosch [Western Illinois University]

A liquid chromatography ultraviolet detection (LC-UV) method was developed for the quantification of Δ9-THC among 19 cannabinoids in Δ8-THC fortified white whale CBG hemp flowers. The quantification was achieved using external standard calibration between 0.02 and 25 µg/mL. The limits of quantitation (LOQ) were determined to be 0.04% Δ9-THC in hemp flowers. To recover Δ9-THC, a sample 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 10.5%. The method is not interfered by other cannabinoids present in hemp flowers.

1:00pm **33** Grad **Quantification of Δ 9-Tetrahydrocannabinol (THC) among Nineteen Cannabinoids in Lucky Leaf Hemp Cigarettes by Liquid Chromatography Ultraviolet Detection**

*Ayowole Owolabi, Ammar Mohammad Al-Bataineh, Erin Johnson, & Liguo Song [Western Illinois University]

A liquid chromatography ultraviolet detection (LC-UV) method was developed for the quantification of 9-THC among 19 cannabinoids in lucky leaf hemp cigarettes. The quantification was achieved using external standard calibration between 0.02 and 25 µg/mL. The limits of quantitation (LOQ) were determined to be 0.04% 9-THC in hemp cigarettes. To recover 9-THC, a sample 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 had a relative standard deviation (RSD) of 4.5% in triplicate . The method is not interfered by other cannabinoids present in hemp cigarettes.

2:30pm **34** Grad **Synthesis and Application of Macrocyclic Aromatic Tellurides**

*Egzona Tahiri, Shaozhong Zhang, & Jin Jin [Western Illinois University]

Macrocyclic compounds are of considerable interests due to their construction of molecular-recognition and ion-binding systems. There are many well-known examples of macrocycles such as crown ethers, cyclodextrins and aromatic diimides, etc.

Cycloparaphenylenes (CPPs) are macrocyclic molecules with 5 to 20 units of benzene rings joined together at para position. They have attracted much attention from researchers in various perspectives. Their applications in electronic materials and as the building blocks for the preparation of p-expanded and p-layered materials have been investigated. Cycloparaphenylene (CPP) is the shortest repeat unit of carbon nanotubes. The recent synthesis of CPP represents an opportunity to explore bottom-up nanotube synthesis and once produced, these additional features might be used to arrange the nanotubes into a device.

The objective of this research is to explore a method to make macrocyclic aromatic tellurides. The macrocyclic aromatic tellurides will then undergo detelluration reaction (removal of the tellurium atom from the ring) with a palladium catalyst to give CPP. The synthesis of macrocyclic aromatic tellurides starts from 1,4-diiodobenzene or other dihalides compounds, reacting with a nucleophile sodium telluride. Once the macrocyclic aromatic tellurides are synthesized, they will be proceeded the detelluration reactions to remove tellurium atoms and lead to the final target CPPs.

Compared to the previous methods to synthesize CPPs, our synthetic route will be much shorter and easier to operate.

1:00pm 35 Grad **Synthesis and Study of Novel Macrocycles Containing S/Se and Si**

*Marlena Gabriel, Shaozhong Zhang, & Jin Jin [Western Illinois University]

Macrocycles, as important and powerful ligands, are applied in many areas such as ion and molecular sensing, metal ion protection in biomedical imaging, treatment of heavy metal waste streams, drug delivery and increase of drug efficacy, etc. Considerable effort has been directed towards the design and synthesis of sulfur and selenium containing macrocyclic ligands.

The objective of this research is to synthesize novel macrocycles containing sulfur, selenium and silicon atoms and study their coordination chemistry with metal ions. The incorporation of the Si atom is to increase the coordination ability of the ligand due to the beta-silicon effect.

The target molecules are 12 to 16 membered cyclic thioethers or selenoethers containing silicon. A small molecule bis(chloromethyl)dimethyl silane was used as the starting material. Several macrocycles containing S/Se and Si were synthesized through multi-step synthesis and purified by column chromatography. The products are characterized by ^{1}H NMR and ^{13}C NMR spectroscopy.

The obtained macrocycles will further react with various metal ions since it is a tetra-dentate ligand with four soft donor selenium atoms in the ring. These sulfur and selenium containing ligands should bind easily to many metals.

2:30pm 36 Grad **Synthesis of Photoactive Nickel Complexes for C-N Cross-Coupling Reactions**

*Chinedu Okoro, Hongshan He, Anthony Aya, & Andrew Brinkschroeder [Eastern Illinois University]

C–N bond formation is a way of introducing nitrogen atoms into organic molecules. Compounds with nitrogen atoms are important to life because of numerous biological activities. Synthesis of these compounds is problematic to organic chemists because of the high reacting conditions associated with this molecule synthesis and expensive catalyst use. To overcome these problems, we synthesized BODIPY-functionalized ligands for the formation of nickel (II) complex in situ so that it can catalyze the C-N cross-coupling reactions upon light illumination at room temperature. Preliminary studies showed the formation of tertiary amines between morpholine and iodobenzene derivatives is efficient with a yield of up to 88%. Details of this study will be presented.

Keywords: Catalysis; Photocatalysis; C-N Couplings, Nickel Complex; BODIPY.

1:00pm 37 UG **Understanding the Role of Lipid-Protein Interactions in Modulating the Function of Glutamate Carboxypeptidase II (GCPII)**

*Austin Long & Gopal Periyannan [Eastern Illinois University]

Glutamate carboxypeptidase II (GCPII) is transmembrane zinc metallopeptidase that is found in a variety of organisms, including humans. Human GCPII (hGCPII) plays key roles in human physiology and disease development. hGCPII is produced as five paralogs in various tissues including the central nervous system, intestine, kidneys as well as in cancerous prostate, angiogenesis of most solid tumors. Activated hGCPII in the brain leads to excess glutamate production, which has been proven to contribute to many neurological disorders including brain tissue damage and stroke. While GCPII's role in glutamate production in the brain is known, many functions and behaviors in other tissues are not known. GCPII transmembrane domain (TMD) contains a unique amino acid sequence known as GXXXG, where G stands for the amino acid glycine and X is a set of hydrophobic amino acids. GXXXG protein motif is known to induce protein dimerization with the help of the surrounding lipids. I hypothesize GXXXG induced dimerization in GCPII is influenced by surrounding lipids thus impacts the functions of GCPII in a tissue-dependent manner. If the lipid compositions that surrounds the GCPII-TMD in the plasma membrane can be controlled then the influence of membrane lipids on GCPII function in conjunction with GXXXG motif can be investigated. In this study, a synthetic membrane system known as lipid nanodiscs with unique cellular lipid compositions, such as neuronal and intestinal cell membrane lipids, were synthesized and used to incorporate GCPII-TMD to study lipid-protein interactions. We produced GCPII-TMD with fluorescent proteins labels to characterize the lipid mediated protein dimerization via fluorescence energy transfer (FRET) spectroscopy technique. This artificial membrane system study will lead to greater understandings of how lipids influence protein functions in general as well as the function and behaviors of GCPII in different tissues.

1:00pm 85 UG **Optimization of Human Carboxylesterase Activity Assays to Enable Personalized Medicine**

*Shannon Legge, Samuel J. Knebel, Anchal Singh, & Michael W. Beck [Eastern Illinois University]

Human carboxylesterases (CESs) are serine hydrolases that play a key role in the metabolism of different medications that contain ester, amides, thioester, carbonate, or carbamate functional groups. These moieties can be found in a variety of small molecule pharmaceuticals that are commonly prescribed, such as oseltamivir (Tamiflu), meperidine (Demerol), and temocapril (Acecol). CES activity levels among individuals has been known to be impacted by a variety of biological and environmental factors. In addition to drug-to-drug interactions (DDIs), CES activity is known to be influenced by alternative RNA splicing and single nucleotide polymorphisms (SNPs) which can result in alteration of the protein sequence of CESs. Despite the established influence of these factors on human drug metabolism, the activity of CES sequence

variations are poorly studied. We hypothesize that this is due to the high cost and time-consuming nature of the current state of the art methods used to study their activity. To address this, we have previously developed a fluorescence microscopy-based approach using a CES1-specific fluorogenic chemical tool, FCP-1, that can be used to monitor the activity of overexpressed CES1 isoforms in live cells. Here, we present our work to optimize these assays to enable rapid annotation of the activity of known CES1 sequence variants. Improvements in the ability to study CES sequence variant activity will result in better treatments with CES substrate drugs by enabling the implementation of personalized medicine approaches to address interindividual drug metabolism variations.

COMPUTER SCIENCE

2:30pm **38** HS **Early Risk Assessment of Autism Spectrum Disorder: A Novel Approach to Identifying Biomarkers Using 16S rRNA Gut Microbiome Data**

*Amritha Praveen [Adlai Stevenson High School]

Autism Spectrum Disorder (ASD) is a prominent neurodevelopmental disorder that affects 1 in 36 children. This disorder is rapidly increasing in prevalence; however, it still lacks a reliable and objective diagnostic test. Clinical diagnostic criteria rely on subjective behavioral assessments. According to the CDC, many children do not receive a final diagnosis until they are older, causing delays in intervention. To address this challenge, this study proposes a novel machine learning-based prediction tool that aims to identify the potential microbial signatures from 16S rRNA sequences extracted from gut microbiomes as biomarkers

To construct the model**,** 16S ribosomal RNA sequencing data of 140 children with ASD and 140 non-ASD children containing 1323 bacterial clusters were collected from the National Center for Biotechnology Information (NCBI). However, the microbial sequence data exhibits sparsity and high dimensionality. The tree-based models, regression models, and deep-learning neural networks were selected due to their efficacy in handling high-dimensional data. The data was utilized to train and evaluate 6 different machine-learning classification models for predicting ASD. The most important features of the high-performing model were analyzed and the statistical tests were performed to identify biomarkers.

The findings indicate that the Random Forest Model had an accuracy of 92.91% ± 5.49 and an AUC score of 0.99. The optimal features from the microbial data were identified and classified as biomarkers using an independent sample t-test. The p-values of these biomarkers were < 0.001 proving the statistical significance of the results. These results suggest that the proposed study enables researchers to efficiently and precisely detect microbial signatures that can serve as biomarkers for assessing the risk of ASD and facilitating early diagnosis. Additionally, the developed model could be used as a non-invasive screening tool for identifying individuals at risk of ASD based on their stool samples making it more accessible.

ENVIRONMENTAL SCIENCE

1:00pm **39** UG **Alteration of Perfluorooctane Sulfonate Toxicity via Coexposures with Sublethal Amounts of Ivermectin and Lindane on Drosophila melanogaster**

*Autumn Belt, Kyong-Sup Yoon, & Emily Beiler [Southern Illinois University Edwardsville]

This research aimed to determine if sublethal concentrations of the gamma-aminobutyric acid type A (GABAA) receptor agonist, ivermectin (IVM), change perfluorooctane sulfonate (PFOS) mortality responses. Wildtype male flies were exposed to 20 μM of PFOS via ingestion, with the addition of IVM via topical exposure, for 12, 24, 48, and 72 hours. Results showed that ivermectin significantly decreased PFOS mortality responses ($p<0.05$). To compare the PFOS + IVM bioassay results with bioassays using a PFOS + GABAA antagonist mixture treatment, lindane was selected. Wildtype male flies were exposed to sublethal concentrations of lindane via topical exposure for 12, 24, 48, and 72 hours with the addition of 20 μM of PFOS via ingestion. Results showed that lindane significantly increased PFOS mortality responses ($p<0.05$). This data confirms that PFOS action is caused by a disruption in the excitatory nervous system.

2:30pm **40** UG **Biochar as an Amendment to Improve Microbial Activity in Soils**

*Alex Krupa, Angelina Martinez, Jerry Kavouras, & Jenna Staszwski [Lewis University]

Biochar is a sustainable solution to increase soil health and productivity that can address extensive soil degradation issues due to the combined effects of pollution, climate change, and the use of agrochemicals. The purpose of this experiment was to determine the effects of biochar on microbial activity and plant growth in agriculturally relevant plants. Two separate experiments using sterilized and unsterilized soil from the campus prairie plot were utilized to grow three different crop types: cilantro, onion, and lettuce, in the presence or absence of student-made biochar. After 12 weeks of growth, plants were removed and weighed. Soil samples were collected for EcoPlate analysis and plate counts were performed. There were weeds in every treatment of unsterilized soil, which may have affected the results, as germination in sterilized soils had greater germination rates than unsterilized soils. The microbial activity of the initial soil was similar to the observed activity of all treatments at the end of the experiment. The plate counts did not indicate any differences in microbial densities among biochar and soil treatments, but there was a significant difference between plant types. EcoPlate analysis did not indicate any significant differences in treatments with biochar additions. The literature supports biochar as an amendment for

degraded soil, however the soils utilized in this study were collected from a prairie plot which may have been too fertile. Future studies will utilize soils that better reflect the properties of the degraded soils in Colombia.

1:00pm **41** UG **Effects of Urbanization on Macro-Moth Species Composition and Diversity within Urban Parks and Protected Areas in Central Illinois**

*Harriet Barker & Anant Deshwal [Bradley University]

In recent years, there has been a concerning decline in invertebrate populations worldwide, coined an "Ecological Armageddon" with studies suggesting an alarming 82% decrease in populations. Insects, as crucial components of many ecosystems play vital roles in nutrient cycling, pollination, and food web support. Various arthropod populations, including that of moths and butterflies, have shown significant declines, impacting ecosystems globally. Central Illinois, once dominated by tallgrass prairies, has experienced extensive agricultural and urban expansion, leading to habitat loss and degradation resulting in a reduced invertebrate population.

This study aims to assess the impact of habitat type using urban vs. protected areas on macro moth diversity from universal blacklight moth traps placed in selected sites throughout Peoria and Tazewell counties. Once species are identified, the study will replicate insect community metrics to quantify species composition, richness, and diversity, comparing urban and protected sites using R Statistical Software by utilizing alpha diversity (species richness and evenness) and beta diversity (species turnover) calculations, creating species rarefaction curves. The first sampling was completed in November 2023. The second Sampling will occur monthly from March to November 2024. It is hypothesized that protected areas will show more diversity with larger Alpha and Beta numbers than urban areas.

2:30pm **42** JH **Electric Mud**

*Thane Woods [Blessed Sacrament School]

Soil and sediment from a natural ecosystem, as simulated using a Winogradsky column, can generate electricity in volts. This experiment is relevant because it may lead to the development of a new renewable energy source.

Procedure: To investigate the ability of sediment and water to generate electricity, Winogradsky columns were created using source material from a pond, lake, river, and creek and compared to controls. Winogradsky columns consisted of a layer of sediment mixed with newspaper and epsom salt to mimic the natural breakdown materials of carbon and sulfate in the environment, a layer of sediment, and topped with source water. Bell wire was inserted into the mud and water and the electrical voltage was measured across the columns for 11 weeks.

Conclusion: My hypothesis is that if Winogradsky columns using four different sources (pond, river, lake, and creek) are measured every other week for 11 weeks, then the river source will generate the most amount of electricity in volts because the nitrogen content is highest. My hypothesis was not supported. The pond source produced the most electricity with over one volt. Based on the results of this experiment, it would appear that sediment and water are capable of producing small, measurable amounts of electricity.

1:00pm **43** Grad **Greenhouse Gas Emissions Inventories for City Climate Action**

*[1]Pragya Sharma & [2]Sharon Locke [[1]City of Webster Groves, [2]Southern Illinois University Edwardsville]

In the face of global challenges such as climate change, cities play a pivotal role in greenhouse gas emissions due to rapid developmental activities and innovations. City X is actively engaged in a greenhouse gas inventory research project utilizing the ClearPath Software developed by ICLEI (Local Governments for Sustainability). This ongoing initiative assesses emissions at both the Community Scale (public facilities) and Government Scale (governmental organizations and businesses). The research aims to identify key sources producing large amounts of greenhouse gases, focusing on reducing emissions by addressing specific means of mitigation. Utilizing ClearPath Software, the inventory is being conducted for the base year 2022, with a total population of 23,610 encompassing data from local companies (e.g., Ameren, Spire), such as electricity and natural gas consumption. Activities examined span the residential, commercial, and industrial sectors at the Community Scale, as well as governmental buildings, streetlights, traffic signals, vehicle fleets, and wastewater at the Government Scale. Quantification of emission sources primarily involves calculation-based methodologies, multiplying activity data (fuel consumption and electricity usage) by emission factors to convert them into emission quantities, expressed as carbon dioxide equivalents (CO2e). The urgency of identifying emission sources and activities underscores the need for collective actions to reduce emissions within the community and governmental sectors. By disseminating awareness of the environmental degradation caused by human actions, the research aims to promote a shift towards clean energy and energy efficiency within City X. Ultimately, this project contributes to a comprehensive understanding of the city's greenhouse gas emissions landscape and establishes a foundation for informed, sustainable policy decisions.

2:30pm **44** UG **Macroinvertebrate Community Dynamics Post Agricultural Stream Restoration**

*Nyah Biegler, Sydney McAndrews, & Eden Effert-Fanta [Eastern Illinois University]

Many streams in the Midwest have been severely modified by agricultural activities that disrupt aquatic communities and natural ecosystem processes. Stream restoration projects aim to mitigate these negative effects by improving instream habitat and water quality. This study examined the long-term impacts of stream habitat restoration of Kickapoo Creek

(Coles County, IL), which was completed in 2010. Previous studies conducted habitat surveys and biotic monitoring before (in 2009) and immediately after the instream enhancements (2010-2015). We assessed the current habitat conditions and sampled the macroinvertebrate communities in control and restored portions of Kickapoo Creek in 2021 and 2022. The Qualitative Habitat Evaluation Index (QHEI), species richness, and diversity indices were calculated to evaluate stream habitat quality and community changes after restoration. Although habitat variety and quality increased immediately following the restoration, macroinvertebrate communities may be slow to recover due to limits in their mobility and distances from source populations. We seek to establish trends that positively reflect the response of macroinvertebrates in relation to current and previous years data. This comparison should not only provide insights into the success of the restoration in revitalizing macroinvertebrate communities but must guide future restoration plans to achieve a comprehensive ecosystem restoration. In addition to instream habitat enhancements, restoration must address other factors that may contribute to the impairment of macroinvertebrate communities, such as agricultural stressors such as sedimentation and nutrient pollution. We are optimistic that improvements in the macroinvertebrate communities will be observed resulting from the stream restoration efforts and indicate a fully functioning stream ecosystem.

1:00pm **45** UG **Mosquito Responses to Fungal Entomopathogens Under Elevated Levels of Carbon Dioxide**

*Emily Everett & Swaksha Kallepalli [Bradley University]

Human activities are greatly increasing atmospheric concentrations of carbon dioxide, which is a major contributor to climate change. In addition, increases in atmospheric carbon dioxide levels results in the acidification of aquatic ecosystems due to the reaction between carbon dioxide and water, which may influence host-pathogen interactions. The goal of this study was to assess the effects of elevated carbon dioxide levels on mosquitoes, which are organisms of great medical and ecological importance. The objectives were to evaluate effects of elevated carbon dioxide on larval mosquito survival, time to pupation and susceptibility to pathogens. Mosquito larvae were hatched from eggs and held in environmental chambers in rearing pans at (28ºC). Aedes aegypti larvae were exposed to either atmospheric (420 ppm) or elevated concentrations of CO2 (1000 ppm) and challenged with 2 different fungal entomopathogens (Isaria javanica and Beauveria bassiana) with 3 replicates of each treatment (n=10) per experiment. Pathogen susceptibility was measured by daily monitoring of time to pupation, adult emergence, and survival. In addition, we also evaluated gene expression of a select set of immune markers so evaluate the effects of increased CO2 on mosquito immune defense. Preliminary results indicate that infection by entomopathogen appears to play a larger role in mosquito time to pupation and survival than CO2 levels, but results will need to be evaluated in conjunction with previous results to make further conclusions. Our findings thereby may provide insight into how changing atmospheric conditions are affecting mosquito physiology and host-pathogen interactions, with implications for their potential control under likely future conditions.

2:30pm **46** Grad **Oxybenzone on Oxidative Stress in Aiptasia: A Model Organism for Coral Research**

*Hannah Kolker & Christopher Theodorakis [Southern Illinois University Edwardsville]

The focus of this research project is to study the effects of oxybenzone and other chemicals commonly found in sunscreens and how they impact aquatic ecosystems, including the environment in these ecosystems and the organisms that live in them. The sea anemone Aiptasia – a common research model for coral - will be used to study these effects and see if there are any particular chemicals that have more of an effect than others and how exactly Aiptasia is impacted by these different chemicals. Aquatic ecosystems, especially reefs and ecosystems near coastlines in places like Hawaii, are incredibly prone to the runoff of sunscreen and its chemicals, most commonly by either snorkeling or from rinsing off at a beach shower. The availability of oxybenzone (an active ingredient) and other chemicals from these 2 sources allows for huge amounts of it to enter the water and thus the aquatic ecosystems, which can be toxic and dangerous for the organisms living there. The overall goal of this research is to assess the risk of oxybenzone to corals. The specific aim is to test the effects of oxybenzone and other chemicals on Aiptasia, a marine organism that resembles corals, in order to develop Aiptasia as a research model for sunscreen toxicity in corals. The hypothesis is that the above chemicals, as they increase in concentration, will have more adverse effects on Aiptasia and further inhibit their physiological and anatomical functions. The endpoints will be indicators of oxidative stress (defined as “an imbalance between the generation of reactive oxygen species (ROS) and their quenching by antioxidants in a specific cell or tissue”). The indicators of oxidative stress to be used include lipid peroxidation (TBARS) and levels of glutathione.

1:00pm **47** JH **Paint it White**

*Annaliese Oldenburg [Blessed Sacrament School]

Purpose: Which type of reflective paint will decrease a cinder block’s temperature the most? The purpose of my experiment was to find out which type of reflective paint would decrease a cinder block’s temperature the most after 20 minutes. This will help concrete structures stay cooler, and may reduce carbon emissions if painted on rooftops of buildings in larger cities. My independent variables are the different colors of reflective paint. My dependent variable is which type of reflective paint decreased the cinder block’s temperature the most. My controlled variable is the amount of paint that is applied to a cinder block and the amount of heat that the paint receives.

Procedure: First get cinder blocks. Then mix standard color paints with white reflective paint. Then put each block underneath a heat lamp for 20 minutes. Finally record temperatures and put a new block under for testing.

Conclusion: My hypothesis is that if four different reflective paints are applied to a cinder block, white reflective paint, gray reflective paint, yellow reflective paint, pink reflective paint, and a blank cinder block, to see which one will decrease the temperature the most after 20 minutes under a heat lamp, then the white reflective paint will reduce the temperature of the cinder block the most because white reflects all wavelengths of light. My hypothesis was supported. The overall best scores in all groups were the white reflective paint blocks that reduced thetemperature significantly more than any other color.

2:30pm **48** UG **Regional and Temporal Comparison Survey of Central Illinois Parasite Abundance and Diversity in the Virginia Opossum (Didelphis virginiana)**

*Alexa Howard, Elliot Zieman, & Sofiane Aiche [Eastern Illinois University]

Parasites are often overlooked in the study of ecology; however, within ecosystems their evolutionary, pathogenic, and energetic impact is broad and significant. In invading and weakening hosts much like top predators, they can initiate cascading community effects, alter other parasite species' abundance within their hosts, and even change host phenotypes, leading to changes in susceptibility to future parasites. Virginia Opossums (Didelphis virginiana) are synanthropic mesocarnivores with the ability to transmit zoonotic diseases to humans and both wild and domestic animals. Updating what is known about the Virginia opossum's parasites could reveal more about their potential to spread disease in this region and measure current parasite abundances and infection rates in Central Illinois. The prevalence and abundance of parasites in opossums will be determined through necropsy of opossums from Central Illinois and morphological identification of their parasites. Necropsy includes dissection of each internal organ, flushing of gastrointestinal organs, and inspection for parasites. Twenty opossums were dissected, and cestode, nematode, and trematode parasites were found in the stomachs and intestines. Nematodes were the most prominent group, with the most abundant species of parasites being pinworms and Turgidia turgidia. In the future, exact parasite abundances, diversity, and infection rates will be determined.

HEALTH SCIENCE

1:00pm **49** Grad **Exploring the Dynamics of Social Behaviors and Viral Mutation: A Mixed-Methods Analysis Utilizing Social Ecology in the Context of COVID-19**

*Elizabeth Pippins [Eastern Illinois University]

The ongoing COVID-19 pandemic has prompted an interdisciplinary investigation into the interplay between social behaviors and viral mutation. Drawing on Social Ecology Theory, this mixed-methods study examines the complex relationship between individual actions, social structures, and the genetic evolution of the virus. A comparative analysis across 6 countries distinguishes the varied impact of social behaviors on viral mutation and prevalence rates as it considers factors at the micro and macro levels. Utilizing both qualitative insights and quantitative data representation, this research contributes to a nuanced understanding of how preventative measures, public policies, and societal response can influence a virus's genetic diversity. The findings reveal mutation and prevalence patterns across countries with varying pandemic response policies, providing valuable insights for public health interventions and future research. This research sheds light on the importance of considering social dynamics in the study of infectious diseases as it could offer a comprehensive framework for examining the intersection of biology and sociology during a global health crisis.

2:30pm **50** UG **Sex-Related Difference of Cognitive Functions among College Soccer Players With and Without Concussion History During Season? Pre vs Post**

*[1]Madison Webb, [1]Prasanna Acharya, [2]Matthew A. Yeomans, & [3]Mark Dalecki [[1]Illinois College, [2]University of South Carolina, [3]German University of Health and Sports]

Young college athletes can show cognitive deficits after concussions earlier in life, and female athletes seem to show longer-lasting symptoms than males. However, whether sex-related differences exist for cognitive functions in NCAA Division III college players across a soccer season is unclear. This study examined whether sex-related differences exist in cognitive functions among Division III soccer players across a soccer season (Pre/Post) with (CH) and without (NoH) concussion history. We hypothesized sex-related differences in cognitive functions between CH and NoH players across seasons.

Thirty athletes (M=19.2 yrs.), including 17 CH players (6 females, 11 males) and 13 NoH players (9 females, 4 males), participated in the study. Two cognitive tests: a Stroop Color word test (48 congruent, 48 incongruent trials) and a D2 sustained attention test (computerized version of the D2 test, with varying sequences of the letters d and p, and participants had to correctly mark d′s surrounded by two vertical lines) were performed on a laptop during pre- and post-season.

Repeated ANOVAs were used to analyze response time (RT; milliseconds), error rate (ER; %), and sustained attention score (CS; D2 test only) in males and females with CH and NoH across a season. For the Stroop test, there was a significant Time*CH interaction in the congruent condition ($p<0.05$), showing a higher ER in CH post-season and a trend for a Sex*Group*Time interaction in the incongruent condition ($p=0.01$), showing CH females tended to have a higher ER post-season.

Our results suggest cognitive deficits with decision-making in a Stroop task in CH soccer players post-season, which may be larger in female athletes when the task requires response inhibition. Further, we plan to analyze further cognitive and mental state data collected from the participants from the SCAT 5 test screenings.

1:00pm **51** UG **The Association between Physical Fitness and Academic Performance in College-Aged Students**

*Rebecca Hudson & Alex Wolfe [Illinois College]

Background: The purpose of this study was to investigate the relationship between physical fitness measurements and the performance of college students.

Methods: 78 students from two collegiate institutions in Illinois, collectively (19.9 +/1.3 years; range: 18-24 years) participated in this study. All participants self-reported their college grade point average. Body mass index (BMI), handgrip strength, and estimated maximal oxygen consumption (VO2 max) were measured to determine physical fitness. Participants also completed a questionnaire on their sociodemographic profile.

Results: Statistically significant correlations were observed between GPA and BMI (r =-.403), grip strength (r =.459), and VO2 max (r =.416) while controlling for sex, race/ethnicity, and household income.

Conclusion: Results of the present study indicate that academic performance and physical fitness in collegiate students are significantly related while controlling for potential confounding variables

2:30pm **52** HS **The Influence of Patient's Sex on Acute Pulmonary Embolism Outcomes**

*[1]Cyrus Darki, [2]Jawed Fareed, & [1]Allison Hennings [[1]Illinois Math and Science Academy, [2]Loyola University Chicago]

Pulmonary embolism (PE) is a common cause of morbidity and mortality. Gender differences have been increasingly recognized in the presentation and management of coronary artery disease and heart failure, however, few studies have examined acute PE representing a significant gap in the literature. The primary aim of this analysis was to determine the impact of patient sex on PE outcomes. In this experiment, 889 study subjects were sourced from Loyola University Medical Center PE registry. The inclusion criteria for enrollment was a confirmed acute PE diagnosed by a physician. Patients were excluded if the patient's sex or treatment modality for PE management were unknown. Patients were divided into males and females. Predictor variables included baseline demographics, laboratory biomarkers, and imaging parameters were evaluated. The primary outcome of interest was in-hospital mortality. Secondary outcomes included length of stay, major bleeding events, ICU admission, and a six-minute walk test to measure functional capacity. Utilizing a large cohort of patients from a quality assurance database, this experiment demonstrated significant differences in the outcomes between males and females presenting with acute PE. Specifically, as compared to males, females had increased inpatient mortality (t-test, $p = 0.03$) and, for the first time reported, decreased functional cardiopulmonary capacity as assessed by a six-minute walk test (t-test, $p = 0.01$).

MICROBIOLOGY

1:00pm **53** UG **Antimicrobial Properties Osage Orange Fruit Extract**

*Ashley Miller, Maciej Zalinski, Jerry Kavouras, & James Rago [Lewis University]

Numerous bacterial pathogens are associated with resistance to routine antibiotics commonly administered in treatments. Studies have shown that the natural products found in the fruit of the Osage orange tree (Maclura pomifera)exhibit antimicrobial properties. The purpose of this study was to investigate the degree to which extracts from the Osage orange fruit inhibited microbial growth. Extracts were prepared by pulverizing the orange into a paste and then using a standard ethanol extraction protocol. Various concentrations of extract were added to tubes of sterile TSB, which were inoculated with 100 uL of selected species of microbes, including Gram positive and Gram negative bacteria. After 18 hours of incubation at 37°C, the turbidity of the samples was measured using a spectrophotometer. Overall, samples of microbes inoculated with a higher concentration of extract generated lower absorbance values, which resulted in lower turbidity due to the inhibition of microbial growth. This indicated that an inverse relationship existed between turbidity and extract volume. On average, concentrations of 1.33% extract were the most effective. Gram-positive bacteria, including multiple species of Staphylococcus, two Gram-negative species, P. putida and E. coli, and a fungus, S. cerevisae, all displayed similar trends. In conclusion, the extract obtained from the Maclura pomifera fruit has shown appreciable antimicrobial activity against select Gram-positive species, as well as several Gram-negative species and fungi.

2:30pm **54** Grad **Biodegradation of Chlorpyrifos Insecticide by Bacillus cereus ST06 and Chryseobacterium sp 6024 Isolated from Agricultural Soil**

*Chiemeka Emeribe & Samuel Onuorah [Nnamdi Azikiwe University, Nigeria.]

Soil bacteria have the potential to degrade chlorpyrifos insecticide, this identifies the importance of biodegradation in pollutant cleanup. The aim of the study is to compare the potential of Bacillus cereus ST06 and Chryseobacterium sp 6024 in biodegrading chlorpyrifos insecticide singly or as a consortium in a liquid medium. Enrichment culture technique was

used for the study. Agricultural soil sample containing chlorpyrifos degrading bacteria was obtained from agricultural soil from depths of 15cm. Previously identified B. cereus and Chryseobacterium sp was used for the experiment. Their growth response to 20mg/l and 60mg/l chlorpyrifos in mineral salts medium singly and as a consortium was compared by monitoring the optical density at 600nm at the optimum condition of pH 6.5 and 30^{o}C temperature for 28 days. The residual chlorpyrifos concentration after 28 days was also compared and determined using Gas Chromatography- Electron Cathode Detector (GC-ECD).The result showed a significant difference ($P< .05$) as Bacillus cereus ST06 and Chryseobacterium sp 6024 responded differently to different concentration of chlorpyrifos. Bacillus cereus ST06 and Chryseobacterium sp 6024 reached maximum growth in medium containing 20mg/l chlorpyrifos with a mean OD of 0.23±0.20 and 0.42±0.02 than 60mg/l chlorpyrifos with a mean OD of 0.47±0.02 and 0.81±0.02 respectively. The bacterial consortium also reached maximum growth on 20mg/l and 60mg/l of chlorpyrifos with mean OD of 0.21±0.31 and 0.29±0.02. The result of residual chlorpyrifos concentration shows that the bacteria consortium degraded 79% and 78% of 20mg/l and 60mg/l chlorpyrifos respectively, while Bacillus cereus ST06 and Chryseobacterium sp 6024 degraded 63% and 57% of 20mg/l chlorpyrifos and 61% and 37% of 60mg/l chlorpyrifos. The study shows that bacteria consortium possessed greater potential for biodegradation of Chlorpyrifos. Further studies on RNA profiling of each bacterium and consortium is paramount to understand regulation of genes in degradation chlorpyrifos efficiently.

1:00pm **55** Grad **Developing Protocols to Track the Evolutionary Progress of Paraburkholderia specific Bacteriophages through Dictyostelium discoideum with the Addition of Phage Cocktails**

*Ashleigh Stults & Susanne DiSalvo [Southern Illinois University Edwardsville]

The outcomes of symbiotic relationships are influenced by the unique genotypes of the parties involved and by the environmental conditions in which they are placed. Adding additional players to a symbiotic system may also modify outcomes in unpredictable ways. A particularly important third-party player for bacterial based symbioses includes bacteriophages, which may reduce or alter symbiont populations and features. Here, we sought to develop a protocol to investigate the population and evolutionary dynamics of symbionts and symbiont targeting phages in a model amoeba host symbiosis system and the impact of phages on host fitness outcomes. We also assessed higher throughput methods to increase processing speed and replication, focusing on the development of multi-well methodologies. Specifically, we integrated symbiont targeting phages into the natural Paraburkholderia-Dictyostelium discoideum symbiosis system for three transfers and assessed the viability of growth within this new system. We reasoned that phage addition may indirectly benefit D. discoideum's fitness by reducing symbiont infection loads, however phages may drive other less predictable outcomes that may result in altered bacterial phenotypes. To investigate these possibilities, we exposed symbiont infected amoebas to specific phages (and phage cocktails) and tracked the amoeba-bacteria-phage phenotypes through amoeba social cycles. To assess phage-symbiont-host interactions in the 12 well system, we re-cultured amoebas weekly for 3 transfers from developed fruiting bodies and quantified amoeba spore productivity, symbiont infection rates, and phage persistence at each transfer. Outcomes may vary according to conditions, but we typically observed an initial decrease in symbiont infection after phage addition, however, symbiont infections often recovered after the first transfer. Interestingly, this occurred despite phage persistence in amoeba cultures. For future work, we plan to further investigate the mechanisms mediating these outcomes and assess the variability of these relationships with more replicates, longer-term transfers, and new phages.

2:30pm **56** Grad **Effect of Clove Oil on Escherichia coli**

*Oluwaseyi Omodiminiyi & Calyn Dupis [Western Illinois University]

The inability of commercially available antibiotics to solve the problem of antibiotic-resistant bacteria increases the need for research and development of alternative forms of treatment, particularly from natural products like plants. Hence, this research examined the antibacterial effect of clove oil on Escherichia coli 25922 ATCC. Antibiotic susceptibility tests were done using clove oil and commercially available antibiotics for comparative study. Gene expression assays were also done using real-time quantitative PCR to check for the effect of the oil on gene expression of genes. Clove oil was found to be effective against Escherichia coli. There were differences in the expression of several genes in E. coli in response to treatment with clove oil. These results provide information on the mechanism of action of clove oil against E. coli.

1:00pm **57** Grad **Identification and Physiological Properties of Osmotolerant Yeasts Isolated from Sweet Potato**

*Mary Olurunkosebi [Western Illinois University]

Sweet potato, a starchy tuber, is recognized for harboring various fungi, particularly yeasts that exhibit the ability to withstand high solute concentrations due to low water activity—common characteristics found in many high-sugar-containing foods. This study aims to identify and investigate the physiological traits of osmotolerant yeasts present in sweet potatoes. Samples were collected from five distinct locations to isolate and identify osmotolerant yeasts. The study encompassed the observation of colonial, cellular, biochemical, and physiological characteristics, including urea hydrolysis, acid production test, gelatin liquefaction, tolerance to 1% acetic acid, and growth in 15% NaCl. A total of seventy-eight isolates were obtained from representative sweet potato samples. The identified osmotolerant yeasts comprised Saccharomyces cerevisae, Saccharomycessp, Candida tropicalis, Candida sp, Schizosaccharomyces pombe, and Torulaspora delbruekii. Acid production was observed in only 2 strains of Candida sp and 1 strain of Saccharomyces cerevisae. Conversely, all isolates tested negative for gelatin liquefaction, growth in 15% NaCl, urea hydrolysis, and tolerance to 1% acetic acid. These results enhance our understanding of osmotolerant yeasts in sweet potatoes, providing

insights into their physiological capabilities and potential applications in various industrial processes related to processing and preservation of high solute foods.

2:30pm **58** UG **Investigating Factors that Promote Expression of bcp in Bacillus subtilis**

*Danielle Ashton [Bradley University]

Oxygen is a fundamental element for everyday function in bacteria, but it can be damaging when left in abundance. Reactive oxygen species (ROS) are formed from O2 as a natural byproduct of normal cellular activity and can cause disruptions in the functioning of bacteria. This disruption is called oxidative stress. Nitrogen can undergo similar reactions, forming reactive nitrogen species (RNS). Bacteria and other organisms express scavenger enzymes to help reduce the concentration of ROS and RNS in bacteria. One type of scavenger enzyme is a peroxiredoxin; bacterioferritin comigratory protein (Bcp) is an example of a peroxiredoxin found in Bacillus subtilis. Bcp have been shown to scavenge peroxides in vitro, but little is known about its in vivofunction. In this study, a strain containing the promoter of bcp transcriptionally fused to lacZ was used to monitor bcpexpression. This strain was exposed to a range of oxidants including diamide, sodium nitroprusside (SNP), dithiothreitol (DTT), cumene hydroperoxide (CHP), hydrogen peroxide (H2O2), and tert-butyl hydroperoxide (tBHP), and bcp-lacZ expression was observed on agar plates containing X-gal. SNP, DTT, and diamide induced expression of bcp the most in this assay. Current studies aim to quantify these results. To do this, I am growing the bcp-lacZ strain in broth culture, exposing the culture to different oxidants, and using β-galactosidase assays to measure bcp expression.. The overall aim of this project is to gain more knowledge on the function of Bcp in the oxidative stress response of B. subtilis.

1:00pm **59** UG **Investigating Regulatory Factors Influencing bcp Gene Expression in Bacillus subtilis Using Transposon Mutagenesis**

*Diana Guzman & Melinda Faulkner [Bradley University]

Aerobic living organisms inherently produce reactive oxygen species (ROS) as byproducts of cellular metabolism (Imlay, 2008). They are generated through the interaction of unstable free radicals with oxygen molecules. However, accumulation of ROS becomes toxic to bacterial cells and can result in poor growth, high rates of mutagenesis, and even death (Mishra and Imlay, 2012). To counteract the harmful effects of ROS, bacteria have evolved a defense mechanism involving multiple ROS scavenging enzymes. For example, Bacillus subtilis codes for nine distinct peroxide scavenging enzymes (Zwick et al., 2016). Among these enzymes, the physiological role and the regulatory factors controlling the production of bacterioferritin comigratory protein (Bcp) is not well established. The aim of my research project is to identify the regulators responsible for altering the expression of the bcp gene in B. subtilis using transposon mutagenesis. In my initial screens, I identified 8 transposon insertions that potentially increase the expression of bcp. I am currently verifying a subset of the insertions and using inverse PCR and DNA sequencing to identify their location in the bacterial chromosome. The overall goal of this project is to better understand the role of Bcp in the complex oxidative stress response of B. subtilis.

2:30pm **60** Grad **Isolation and Characterization of Phages Specific to Model Amoeba and Insect Microbiome Systems**

*Mainprice Essuaman & Susanne DiSalvo [Southern Illinois University Edwardsville]

Identifying alternative therapies to combat microbial infections has become increasingly urgent due to the growing threat imposed by antimicrobial resistance. One promising alternative to traditional antibiotics is bacteriophage therapy, which involves using viruses that can kill bacteria to treat infections caused by the bacteria. Bacteriophages are selective and can co-evolve with their bacterial hosts, reducing off-target effects and resistance. This research focused on identifying bacteriophages specific to amoeba and insect microbiomes. By examining the impact of bacteriophage in these symbiotic systems, this study may serve as a model for phage therapy in more complex eukaryotic hosts.

Soil samples obtained from several locations around the United States were screened for the presence of bacteriophages specific to microbiome members of the amoeba Dictyostelium discoideum, the locust Schistocerca cancellate, and the termite Reticulitermes flavipes. Soil samples were suspended in YG liquid media, spiked with select bacterial isolates for bacteriophage enrichment, and filter-sterilized to obtain cell-free bacteriophage suspensions. The aliquots were spot-tested on bacterial lawns to detect phage presence via the observation of plaque formation, and resulting plaques were purified and amplified to obtain pure bacteriophage stocks.

This multi-strain enrichment process yielded several bacteriophages that could infect our amoeba and insect bacterial isolates, demonstrating that soil samples contain phages capable of targeting symbionts associated with amoeba and insects. Future screening assays will help to elucidate whether certain samples (such as type of soil or insect guts) are more likely to harbor symbiont-targeting phages. In addition to further characterizing these bacteriophages, we plan to ultimately investigate their effect on host-symbiont associations.

1:00pm **61** HS **Novel Effects of Chlorhexidine Gluconate on Gram-Positive vs Gram-Negative Bacteria**

*Harmin Patel [Dunlap High School]

Chlorhexidine Gluconate (CHG) is a widely used antiseptic which has extensive necessity in reducing the amount of germs on one's skin, oral area, and cleansing oneself for surgery. We have recently found novel effects of CHG upon various gram-positive (Candida albicans and Staphylococcus aureus) and gram-negative (Pseudomonas aeruginosa and Escherichia coli) bacteria. Previously, it was assumed that gram-positive bacteria would be more susceptible and less resistant to CHG. This was thought to be the case as gram-negative bacteria are enclosed by a peptidoglycan cell wall and an outer membrane containing lipopolysaccharide which was supposedly thought to provide more resistance to CHG. However, through the use of a minimum bactericidal concentration (MBC) and specifically focusing on the effects between the two types of bacteria rather than the use of a minimal inhibitory concentration (MIC) or serial dilutions, we have collected data which greatly challenges the previous hypothesis. Through testing a range of CHG concentrations (0-9%), we have reached dose response curves for each bacteria and have seen a greater resistance among the gram-positive bacteria than the gram-negative.

2:30pm **62** UG **Parasite and Diet Effects on American Bullfrog Tadpole Skin Microbiome**

*Mark Naom & *Caden Matthews [Bradley University]

Amphibian populations are declining in many parts of the world, in part due to infectious diseases. A range of diverse pathogens and parasites can cause disease in frogs, including the skin burrowing trematode parasites in the family Plagiorchiidae. Besides direct negative effects on amphibian host health, these parasites may also have other negative effects, such as disruptions to the skin microbiome. Changes in the microbiome may be further affected by other environmental factors, such as variation in diet quality. In our study, we are investigating the effects of plagiorchid parasite infection in combination with variation in dietary protein on skin microbiomes in American bullfrog tadpoles. Tadpoles were divided into treatment groups fed diets with low and high protein content and exposure to the presence or absence of parasites. After two weeks, their skin was swabbed, DNA was extracted, and PCR was run to amplify and sequence the ribosomal 16S gene of bacteria on the tadpoles' skin. We analyzed the influence of diet and infection on the diversity and makeup of the skin microbiome. There was no significant effect of diet protein content, parasite treatment, or the diet x parasite interaction on the number of bacteria genera observed. However, we found that diet protein content affected the community composition of the microbiome. Some of the most common genera observed were Cetobacterium and Runella. The results from this study give insight into the effects of environmental conditions on amphibian skin microbiome. Given the potential protective role of the amphibian skin microbiome against other pathogens, our findings may also advance our understanding of the decline of amphibians.

PHYSICS, MATHEMATICS, & ASTRONOMY

1:00pm **63** Grad **Density Measurements of Binary and Ternary Lead/Bismuth Borate Glasses**

*Mehbuba Rashid Mouri, Saisudha B. Mallur, & P.K. Babu [Western Illinois University]

Glass is an amorphous solid with a non-periodic arrangement of atoms. Because of its unique property to refract, reflect, and transmit light, glasses are widely used in optical devices, electronics and laser technology. In this study, we prepared binary lead borate glass (35PbO: $65B_2O_3$), ternary europium doped lead borate glass (35PbO: $64B_2O_3$: 1.0 Eu_2O_3), binary bismuth borate glass ($35Bi_2O_3$: $65B_2O_3$), and ternary europium doped bismuth borate glass ($35Bi_2O_3$: $64B_2O_3$: 1.0 Eu_2O_3) by melt quenching techniques. The density of the glass sample is measured by the Archimedes method. When a body is immersed in a fluid, either completely or partially, an upward buoyant force is exerted on the body which will be equal to the weight of the fluid displaced by the body. By using this principle, the densities of the glass samples are measured. Densities of binary and ternary lead borate glasses are 3.892 g/cm^3 and 3.889 g/cm^3, respectively. Densities of binary and ternary bismuth borate glasses are 5.568 g/cm^3 5.448 g/cm$^{3.}$, respectively. The densities of bismuth borate glasses are larger due to the presence of heavy bismuth oxide groups in the glass samples. Molar volume and rare earth ion concentration in these glasses are calculated from the density values.

2:30pm **64** Grad **Investigation of the structural Properties of Bismuth Boro-Tellurite Glasses Using Raman Spectroscopy**

*Amy Aung, P.K. Babu, & Saisudha B. Mallur [Western Illinois University]

Raman Spectroscopy. The structural properties of glasses are of vital importance in commercial, industrial and research applications. The glass samples of the following compositions(xBi_2O_3:(89-x) B_2O_3:$10TeO_2$:$1Pr_2O_3$) are prepared by melt quenching technique. This technique involves melting raw materials followed by rapid quenching to solidify molten materials into non- crystalline solid glass, and annealing to remove thermal strains. Analyzing the detailed structure of glass requires a profound investigation into the arrangement of structural groups within the glass samples clarifying their unique properties and behavior. Raman spectroscopy measures a shift in frequency of scattered light when monochromatic light from a laser interacts with the samples. The molecular vibrational and rotational information of the structural groups in the samples can be deducted from the Raman shift. In our glass samples, the Raman peaks corresponding to 135-372 cm^{-1}, 655-740 cm^{-1} and 930-1250 cm^{-1} are identified with the vibrational frequency of bismuth

groups, tellurite groups and borate groups, respectively. Detailed analysis of the vibrational frequency of specific groups are under study.

1:00pm **65** Grad **Preparing Glass Samples and Studying the Refractive Index of Borate Glasses Doped with Rare Earth Ions**

*Md Khokon Miah, P.K. Babu, & Saisudha B. Mallur [Western Illinois University]

Glasses are transparent, non-crystalline materials. They are widely used in applications such as vacuum flasks, barometers, thermometers, microscopes, telescopes, solar panels, and camera lenses. Lead and bismuth borate glasses have broad range of glass formation and are promising candidates for technological applications due to their high transparency in the visible and near-infrared ranges. For this investigation, we prepared lead borate/bismuth borate glasses doped with europium ions using appropriate amounts of lead monoxide (PbO), bismuth oxide (Bi_2O_3), analytical-grade boric acid (H_3BO_3), and high purity (99.9%) europium oxide (Eu_2O_3). Glass are made using the melt-quench method followed by an annealing process close to the glass transition temperature to eliminate thermal stresses. Refractive index (RI) of a material is crucial in understanding various optical phenomena such as refraction, reflection, dispersion, and diffraction. RI can be measured by the Brewster's angle method. From the Brewster's angle measurements, we determined the RI for binary and ternary lead borate glasses to be 1.80 and 1.78, respectively. The corresponding values and for binary and ternary bismuth borate glasses are 2.03 and 1.89, respectively. Our measurements show that the bismuth borate glasses have a higher refractive index compared to lead borate glasses. This is due to the highly polarizing nature of heavy bismuth ions.

PLANT BIOLOGY

2:30pm **66** Grad **A Comparison of Vegetation Diversity Among Southwestern Illinois Sand Prairies**

*Garima Ranabhat, Richard Essner , & Deja Johnston [Southern Illinois University Edwardsville]

Illinois sand prairies are found on sand deposits resulting from erosional events related to Pleistocene glaciation. These prairies contain few trees or shrubs and are dominated by grasses and sedges. In addition, they support an assemblage of non-graminoid herbaceous forb species and a unique community of animal species, including the Illinois chorus frog (Pseudacris streckeri illinoensis), which is a sand prairie specialist. Today sand prairies are becoming increasingly degraded due to human disturbances such as urban expansion, overexploitation of prairie species, conversion to agricultural fields, fire suppression etc., which are negatively impacting plant and animal communities. This is particularly true in Southwestern Illinois, which continues to lose sand prairie habitat at a rapid pace. To assist with management efforts in remaining sand prairie habitat, we conducted vegetation surveys in three sand prairies located in the Poag sand terrace and managed by Heartlands Conservancy—Heartlands Easement, Poag Sand Prairie, and the Knoll Family Wildlife Sanctuary which has not been managed as a sand prairie and has features that make it suitable as a reference site. We divided the three prairies into six sites to exclude woody vegetation and non-sand prairie plant communities. We then compared diversity based on family abundance and species richness. A total of 104 plots were sampled using 1 m^2 quadrats in fall 2023. We identified plants to species when possible and estimated cover percentages using Braun-Blanquet cover classes. Species were grouped into their respective families and statistical analysis of species richness, percent forb cover, compositional variation among quadrats and sites are being done. We hypothesize that sites that have been least exposed to human disturbance will have more diverse plant communities with fewer invasive species. This study will provide insight into the types of vegetation currently present in Southwestern Illinois sand prairies and aid in future restoration efforts.

STEM EDUCATION

1:00pm **67** **Broadening Participation in an Environmental Health Sciences Out-of-School Program for Middle School Students**

*[1]Sharon Locke, [1]Georgia Bracey, [2]Ben K. Greenfield, [1]Charlie Blake, [3]Carol E. Colaninno, [1]Andreia F. Dexheimer, [1]Jen Zuerche, & [1]Candice Johnson [[1]Southern Illinois University Edwardsville, [2]University of Southern Maine, [3]Emory University]

Engaging the community is a crucial component in the recruitment strategy for out-of-school programs when partnering with historically minoritized populations. We present an innovative, evidence-base recruitment strategy to target underrepresented minority communities in a post-pandemic context. Our team designed and conducted a five-year project comprising an after-school and summer program named Environmental Health Investigators (EHI). EHI offers middle school students from traditionally underserved communities the opportunity to use authentic scientific methods to investigate the connection between environment and human health. Our goal is to increase participant interest in science and ultimately to diversify the health sciences workforce. The original recruitment plan for the program focused on participants of low-income or racial minority backgrounds from one school district and was initially successful. The collaboration was disrupted by the COVID19 pandemic resulting in a decrease in student participation. This required the team to adapt by providing more flexible and relevant programming options. The project team came up with improved

strategies to recruit participants including inviting new school districts to partner, more closely involving teachers within those districts through communities of practice, and connecting with community members through a Community Ambassadors Committee. Despite difficulties during the COVID19 pandemic, we surpassed the initial goal for participant numbers by 114% in the current and final year of the project due to the improved program recruitment strategy. Our recruitment model is based on involving the community in every step of the project, gaining their trust, buy-in, and discovering their wants and needs, which are crucial elements to establishing an effective relationship that allows for their students to see the value and appeal of an out-of-school environmental science program.

2:30pm **68** Grad **Empowering Middle Schoolers: Investigating Scientific Method Understanding and Knowledge Growth in Environmental Health through STEM Education**

*[1]Pratigyan Bhusal, [1]Amanda Jane, [1]Mariam Sani, [1]Ozaveshe Paul Amune, [1]Andreia F. Dexheimer, [1]Charlie K. Blake, [1]Candice L. Johnson, [1]Carol E. Colaninno, [2]Ben K. Greenfield, [1]Georgia Bracey, & [1]Sharon M. Locke [[1]Southern Illinois University Edwardsville, [2]University of Maine]

In underserved communities, environmental health risks due to pollution and inadequate access to resources affect the overall health of the community. Addressing these challenges necessitates empowering people through educational initiatives. Education programs, particularly those focusing on STEM (science, technology, engineering, and math) play a vital role in helping to reduce environmental health risks. STEM education fosters innovation and equips individuals with the tools to adapt to changing environmental conditions, thereby promoting resilience and enhancing overall well-being in underprivileged communities. This study investigated the efficacy of a multi-week summer research academy of two consecutive years (2022–2023) as an educational intervention to enhance middle school students' understanding of the scientific method and their knowledge of environmental health, including air pollution, noise pollution, soil pollution, and their impacts on human health. In 2022, 17 of 19 middle school students who attended the multi-week summer research academy provided survey data, while in 2023, 22 of 26 students did so. The survey included 40 questions, focusing on scientific method understanding and environmental health content knowledge. These questions were rated on a four-point Likert scale. The Wilcoxon-signed rank tests in R revealed that the intervention did not significantly enhance students' understanding of the scientific method ($V= 261$, $p = 0.9627$). However, a statistically significant improvement was observed in students' content knowledge regarding environmental health topics ($V=154$, $p = 0.04023$). The results argue for the importance of continued efforts to refine and enhance educational interventions to better equip students with the skills and knowledge necessary to address environmental health disparities effectively. The study demonstrates the potential value of educational programs for enhancing students' knowledge of environmental health issues in underserved communities and helping them understand environmental problems.

1:00pm **69** Grad **Environmental Health Investigators: Impact of a Hands-on STEM Curriculum on Scientific Method Knowledge and STEM Interest Development of Middle School Students**

*[1]Mariam Sani, [1]Pratigyan Bhusal, [1]Amanda Janem, [1]Ozaveshe [1]Paul Amune, [1]Andreia F. Dexheimer, [1]Charlie K. Blake, [1]Candice L. Johnson, [2]Carol E. Colaninno, [3]Ben K. Greenfield, [1]Georgia Bracey, & [1]Sharon M. Locke [Southern Illinois University Edwardsville, [2]Emory University, [3]University of Southern Maine]

This work is part of a larger project designed to educate underserved middle school students about environmental health and encourage them to choose careers in the health sciences through a semester-long, after-school program. This abstract focuses on how participants respond to a curriculum that is filled with hands-on activities and incorporates the use of scientific tools, such as, handheld air and sound monitors. The objectives of these activities are to increase their knowledge of the scientific method and foster interest in STEM. Participants were taken through several hands-on activities which explained the scientific method in a step-by-step fashion and then introduced to environmental monitoring tools. Students were encouraged to select and complete projects on preferred topics, using tools which they found interesting, and finally, present their results in school. A total of 103 students attended our program, and we administered surveys at the beginning and end of the semester. Surveys contained a set of seven questions measuring student's understanding of the scientific method and five questions measuring science interest. Questions were on a 4-point Likert-scale. A total of six students completed all the surveys. Participants' answers for each set of questions were averaged and analyzed separately. Half of the students showed an increase in knowledge of the scientific method (average increase of 17.5%) and science interest (average increase of 27.5%), the other half showed insignificant change for both scientific method understanding and science interest (less than 5% decrease). We conclude that student-centered, hands-on STEM curricula can help increase students' knowledge of the scientific method and make them more likely to develop an interest in STEM. We believe that including such a curriculum in the school design will significantly raise the awareness of students on environmental health and eventually steer them towards choosing health science majors.

2:30pm **70** Grad **Exploring the Impact and Interdisciplinarity of Geographic Research Among Graduate Students: A Comparative Study of Geoscience Backgrounds**

*Hunter Hansen, Adriana Martinez, Andreia Dexheimem, Alan Black, Carol Colaninno, Sharon Locke, & Rohan Benjankar [Southern Illinois University Edwardsville]

Geographic understanding is paramount within the academic sphere, especially in geoscience, as it provides scholars with essential frameworks to interpret natural phenomena. Science and geoscience research often necessitate interdisciplinary

collaboration and an appreciation of the interconnectedness of natural processes across various spatial scales. Despite its significance, limited research has explored the broader implications of geographic methods in shaping scholars' research methodologies and communication strategies. This study investigates the impact and interdisciplinarity of geographic research among graduate students in the Watershed Scholars program, focusing on comparing scholars with geoscience and non-geoscience backgrounds. The Watershed Scholars Program at Southern Illinois University Edwardsville, funded by the National Science Foundation, seeks to dismantle financial barriers and enhance diversity in STEM disciplines by providing graduate students with additional support, including mentoring and professional development. This innovative model aims to cultivate scholars whose research significantly contributes to the scientific comprehension of sustainable watersheds through interdisciplinary approaches and cross-cutting skills, sought after by local and regional employers. Graduates of the program will be equipped to address substantial environmental challenges precipitated by human interventions and alterations to watersheds, including climate change repercussions. This study aims to determine whether Watershed Scholars within multiple disciplines comprehend the broader geographic context of their research and how they engage with interdisciplinary thinking and geographic methodologies. It will also investigate if scholars integrate geographic framework perspectives into their research and work. Furthermore, the research evaluates scholars' efforts to disseminate their findings to diverse audiences. By addressing these research questions, this study contributes to advancing geoscience education and research practices, fostering a deeper understanding of the intricate relationships between geography, science, and society. Through a comparative analysis this study displays the role of geographic understanding in shaping students' preparedness and communication abilities, ultimately enhancing the integration of geographic perspectives in scientific inquiry and communication.

1:00pm **71** Grad Nitrile Glove Permeability Study: Assessing Protective Effectiveness and Educating Students on Glove Safety

*Farzana Elaf & Susan Wiediger [Southern Illinois University Edwardsville]

This research delves into the permeability characteristics of nitrile gloves, aiming to assess their effectiveness as protective barriers against various organic solvents, such as acetone, isopropyl alcohol, toluene, and ethyl acetate. Using a gravimetric analysis method, we have studied the gloves' permeability with different liquids. In the next phase, we're planning to use gas chromatography (GC) for a more detailed analysis. The main goal is to teach first and second-year chemistry students about the protective capabilities of nitrile gloves. We want them to understand the importance of testing nitrile gloves thoroughly for a practical grasp of safety measures in real-world situations. To enhance our research, we gathered perspectives through a survey completed by the students who actively participated in the glove safety experiment. We explored how the students perceived the permeability of the gloves and their usage with different solvents before and after the experiment. Through hands-on involvement in the study, we hope students will gain valuable insights, bridging theoretical knowledge with practical applications. Gravimetric analysis results and student survey data will be presented.

2:30pm **72** **Professional Development in Environmental Health for Middle School Science Teachers: A Pathway to STEM-Health Integration**

*[1]Andreia Dexheimer , [1]Jennifer L. Zuercher, [1,2]Carol E. Colaninno, [1]Charlie K. Blake, [3]Ben K. Greenfield, [3]Madeline Jones, [1]Candice L. Johnson, [1]Georgia Bracey, & [1]Sharon M. Locke [[1]Southern Illinois University Edwardsville, [2]Emory University, [3]University of Southern Maine]

Environmental health science lies at the intersection of environmental science and public health science, addressing how exposure to environmental hazards can affect human health. Thus, it's crucial for all students, especially those historically more vulnerable to exposure to environmental pollution, to have access to empowering environmental health education. Despite a growing public awareness of and concern for the link between environmental pollution and human health risks, there is a relative lack of research regarding teacher perceptions of including environmental health topics in K-12 classrooms. We propose a pathway to integrate STEM (Science, Technology, Engineering, and Math) and Health Education through a teacher professional development on Environmental Health. We designed and examined the impact of an environmental health-focused professional development (PD) program on middle school teachers. We conducted the teacher PD over three years (2020-2022) and had a total of 49 teacher participants, representing 17 school districts across four states. We used a concurrent nested mixed methods approach to measure teachers' pre-/post-perceptions of environmental health science concepts and their integration into the science curriculum and classroom practices. Our analysis revealed three primary themes: teachers (1) found the PD and curriculum on environmental health beneficial; (2) emphasized that the material and curriculum promote multiple scientific connections with students; and (3) had increased confidence in teaching the topic and using environmental monitoring tools. The findings suggest that environmental health is a promising content area for teachers to integrate in the classroom. Our teacher PD is among the first studies documenting teacher perceptions of the relevance of Environmental Health to science learning and ways to support science teachers incorporating environmental health content in their classrooms.

1:00pm **73** UG **Southern Illinois University Edwardsville Students' Perceptions of Student Experiences in Math Enrichment Sessions**

*Yusra Amena, Madison Curtis, Brenden Auerbach, Cameron Colemanm, Maurina Aranda & Cristina de Meo [Southern Illinois University Edwardsville]

This study is designed to gauge students' perspectives, opinions, and feedback regarding the Mathematics Enrichment Sessions designed specifically for Calculus 1 (Math 150). Math Enrichment Sessions are extra class periods led by students who have previously excelled in the course, developed to supplement instruction from a professor. The goal of these sessions is to boost students' understanding of the material by presenting them with a packet of questions based upon what has been learned in the class previously. The packets can only be worked on inside of class in a group setting. Groups are chosen at the Supplemental Instruction Leaders' discretion. The Supplemental Instruction Leaders (previous students chosen by faculty) cannot provide answers, only general guidance. Many students in the STEM undergraduate program at SIUE take this course including, but not limited to, Biological Sciences, Engineering, and Chemistry majors. The primary purpose of this study is to investigate the effectiveness of these sessions in improving students' learning experiences in Calculus 1 (Math 150) at SIUE. Through surveys, data is being collected from students who have already participated in the sessions throughout the semester as well as students who enrolled in Math 150 (Calculus 1) this semester. The analysis will highlight the positive or negative effects such as confidence of students, problem-solving skills, and challenges faced in or during the math enrichment sessions. Overall, this research study is trying to figure out the strategies to improve student engagement and achievements in Math 150 and related courses based on the data collected and aims to improve student experiences in calculus courses.

2:30pm **74** UG **Student Perceptions in Courses with Fixed and Growth Mindset Syllabi**

*Marianne Maghamez, Kennedy Collier, & Maurina Aranda [Southern Illinois University Edwardsville]

A professor's mindset may influence students' motivation, academic outcome, and overall class performance in STEM courses. For example, when students perceive that their STEM professor possesses a fixed mindset, they will anticipate a more negative psychological experience in that course and this results in lowered course performance and course interest (LaCrosse et al., 2020). Students are first introduced to their professor through a course syllabus and this syllabus messages to students the professor's mindset – which can be a fixed or growth mindset. Therefore, this project focuses on student perceptions of an introductory biology course between a growth vs. fixed mindset professors via syllabus messaging. We hope to learn the impact of a professor's mindset on biology students and their performance in class which will help us create a better learning environment for STEM students. The research questions guiding this study are: To what extent are student perceptions of a course different between a growth-mindset oriented syllabus compared to a fixed-mindset oriented syllabus? To address this, we performed 10 semi-structured interviews with college students enrolled in biology courses where we presented them with two different syllabi of an introductory biology course. One syllabus was generated with a tone of a growth mindset professor, and the second syllabus with a fixed mindset. They were asked a set of 15 questions based on the type of syllabus they read. The questions were qualitatively divided into six categories to assess their perspective on the perceived faculty mindset, anticipated belonging, personal mindset, anticipated course performance, fair treatment, evaluative concerns, and course interest. We predict that a professor's mindset impacts the student's class performance, specifically growth mindset professors, will improve the six categories assessed in the syllabi. Our data has been collected, and we are currently analyzing the results from these semi-structured interviews.

ZOOLOGY

1:00pm **75** Grad **Developing a System to Study Competitive Tool Use in Ants**

*Dylan Krohe, Ty Lan, & Paul E. Brunkow [Southern Illinois University Edwardsville]

Ants display diverse strategies for nutrient acquisition, with some species relying on an expandable abdomen to transport liquid carbohydrates back to the colony, while others, like Aphaenogaster rudis, utilizing soil and other absorbent materials as tools for liquid absorption. Recent observations indicate that competing ants avoid harvesting tools left by Aphaenogaster in liquid food sources, potentially providing a competitive advantage to Aphaenogaster by preserving liquid carbohydrates for later harvest. This study aims to develop a controlled system to investigate competing ants' response to altered harvesting potential using agar solutions of varying concentrations. Harvestability of liquid carbohydrate containing soil versus equivalent agar solutions were compared. Competing ant colonies were also presented with control and agar solutions simultaneously, with liquid weight loss and ant foraging effort assessed. Results indicate similarities in liquid removal efficiency in baits containing natural tools and agar solutions. Data revealed that both natural dirt and lower concentrations of agar showed high harvestability. However, the addition of soil or agar systematically reduced the harvestability in similar fashions. Competing ants also altered foraging efforts in response to agar concentration, suggesting potential differences in feeding efficiency. Feeding trials highlighted that competitor ants were more efficient at extracting carbohydrates from lower agar concentrations, aligning with harvestability data. Using agar in place of potentially highly variable natural tools provides a way to more systematically study the competitive value of tool use by Aphaenogaster.

2:30pm 76 Grad **Molecular Investigation of Tick-Borne Pathogens in Feral Swine (Sus scrofa) From Seven States in USA**

*Sofiane Aiche & Elliott Zieman [Eastern Illinois University]

Feral swine (Sus scrofa) have been proposed as part of the lifecycles of multiple tick-borne pathogens (TBP). This is a result of the increase in feral swine populations and increased tick populations and geographic ranges. Few surveys exist of the TBP relevant to human and veterinary health of feral swine in the US. The aim of this study is to investigate the prevalence of 10 TBP: Borrelia spp, Cytauxzoon felis, Hepatozoon spp, Babesia spp, Theileria spp, Mycoplasma spp, Trypanosoma cruzi, Toxoplasma gondii, Yersinia pestis, and Rickettsia spp. A total of 90 feral swine blood samples were acquired from 29 counties in 7 different states by the USDA Wildlife Services as part of feral swine control. Blood samples were screened via polymerase chain reaction for the detection of the aforementioned TBP DNA. The result indicated the presence of two Mycoplasma spp.in 81% of the samples. The 16S rRNA gene sequence analysis (170-193 bp) indicates a close relationship to the M. Suis/M. parvuum cluster. The presence of Babesia spp was not detected in any of the feral swine samples. The presences of babesia in feral swine hasn't been reported in the United States. These initial results are the first on feral swine in the 7 states. Our investigation will continue to screen feral swine samples for additional TBP and investigate feral swine as a potential reservoir of TBP.

1:00pm 77 HS **Northern Cardinals and Rose-Breasted Grosbeaks Differ in Immune Investment in the Fall**

*[1]Felicity Hunt & [2]Travis Wilcoxen [[1]Warrensburg-Latham High School, [2]Millikin University]

During fall in central Illinois, two closely related species of songbirds can be found, one of which migrates (Rose-Breasted Grosbeaks) and one that does not (Northern Cardinals). We hypothesized that Rose-Breasted Grosbeaks would invest more in immune defense and have higher natural antibody levels during this period than Northern Cardinals because the grosbeaks will encounter more pathogens during their winter in the tropics. To test this, we collected blood samples from 53 birds from each species and ran an indirect ELISA using keyhole limpet hemocyanin as an antigen target that the birds should have never experienced. We then ran Analysis of Variance and found a significant difference in natural antibodies between the species, with 51.7% higher natural antibodies in Rose-Breasted Grosbeaks than Northern Cardinals. These results suggest that these two species differ in their investment in innate immunity during the fall.

2:30pm 78 UG **Observation of Microplastics in the Stomach Contents of a Benthic Minnow**

*Jessica Kuca & Paul Brunkow [Southern Illinois University Edwardsville]

Microplastic presence in the environment is a growing environmental concern, due to both increases in the amount of microplastics deposited as well as expansion in our search efforts to find it. In aquatic environments, microplastics have been most heavily studied in marine habitats, both in open ocean and in marine fishes and birds; microplastic contamination of freshwater habitats has been relatively understudied. In this study, we present results of preliminary examination of microplastic occurrence in the gut contents of central stonerollers (Campostoma anomalum), a benthic foraging minnow commonly found in Ozark streams and rivers. Potassium hydroxide digestion revealed microplastics in the guts of several stonerollers, especially from the Big River, a historically lead-contaminated river in east-central Missouri. Almost all microplastics observed were filamentous, of a wide variety of colors (blue, black, pink, clear) suggesting multiple sources of plastic fragments. We hope to expand this study to include other fish species of multiple feeding guilds and to develop techniques for sampling microplastics from lotic habitats.

1:00pm 79 UG **Sarcocystis Incidence and Distribution Among Canis latrans in Eastern Illinois**

*Faith Nuss & Elliott Zieman [Eastern Illinois University]

Sarcocystosis is a disease caused by single-celled protozoal parasites in the genus Sarcocystis. Known as rice breast disease in waterfowl, Sarcocystis spp. are common in tropical countries, with muscular Sarcocystis being commonly reported within Southeast Asia. For more than 150 species of Sarcocystis, parasites infect numerous species of vertebrates, such as Canis Latrans (coyotes) and humans. The definitive hosts have intestinal Sarcocystis sp. infections, while intermediate hosts have sarcocysts in the muscle cells. However, compared to intestinal Sarcocystis (S. hominis and S. suihominis), reports of muscular Sarcocystis spp. within coyotes are scarce with only about four in literature. Two studies have reported muscular sarcocysts in captive coyotes infected with S. hemionilatrantis and S. fusiformis. All previous infections of North American Sarcocystosis in coyotes have been documented from the western United States, with one study from Oklahoma, United States. In this study, we report the first case of Sarcocystis in coyotes as intermediate hosts, from the Midwest region of the United States. Sarcocystic caninum is suspected, as it is the only other species found intramuscularly within coyotes. The specimens were collected and documented from a licensed nuisance fur trapper/hunter from the eastern portion of Illinois. Muscle samples from 13 coyotes were screened microscopically for Sarcocystis, with a result of two positives. These results suggest that Sarcocystis is among coyotes from this region and would need to be further investigated.

2:30pm **80** UG **The Effect of Corticosterone on Learning in Cuban Treefrog (Osteopilus septentrionalis) Tadpoles**

*Amelia Ayotte & Travis E. Wilcoxen [Millikin University]

Tadpoles can serve as model organisms for the developmental process of vertebrates that are in utero or in ovo at comparative developmental stages in their free-living larval state. The purpose of these experiments was to determine the effects of corticosteroid levels on learning in Cuban Treefrog (Osteopilus septentrionalis) tadpoles as a proxy for how elevated glucocorticoids during vertebrate development may influence learning. We completed three experiments. Experiment 1 explored differences in learning among individuals with acute and chronic elevations of corticosterone. Experiment 2 explored differences in learning among individuals exposed to high and low doses of exogenous corticosterone. Experiment 3 explored differences in learning among individuals with acute and chronic exposure to metyrapone, a glucocorticoid release blocker. For each experiment, groups of tadpoles were also distinguished between pseudo conditioned or true conditioned in the learning component of the experiment. After the conditioning period, learning behaviors were tested with a behavioral assay and data were analyzed through a two-way ANOVA. Overall, our findings indicate that having corticosterone reduced is detrimental for learning just like having increased levels of corticosterone or sustained low level elevations of corticosterone for too long negatively impacts learning.

1:00pm **81** UG T**he Effect of Substrate Type and Orientation on Zebra Mussel Survival During Aerial Exposure**

*Tomi Sewell, Kiki Fisher, & Jen Jost [Bradley University]

Zebra mussels, Dreissena polymorpha, have become one of the most costly invasive species in the US. The number of mussels has grown rapidly since their first discovery in 1986, leading to both economic and ecological repercussions. They have grown in numbers due to their ability to not only spread through waterways, but also to new locations overland via trailered boats. Previous work in our lab confirms zebra mussels can survive at least 72 hours in air when conditions are cool and moist. However, little is known about the effect of their substrate and orientation on survivorship. Therefore, the objectives of this study were to evaluate zebra mussel performance during a 72-hour aerial exposure, and determine whether substrate type or substrate orientation will affect survival. Mussels were collected by hand from rocks at Banner Marsh and randomly assigned to a substrate (fiberglass, red oak, or aluminum). Mussels were added to jars containing water from the collection site, given a 2-week period to attach to the substrates, and the percent of mussels attached to each substrate was recorded. The substrate tiles were removed from each jar and placed in an environmental chamber set to 15°C with 75% relative humidity. Tiles were randomly assigned to one of three orientations: horizontal (laying flat), vertical (suspended from a tension rod), or slanted (placed at a 45° angle on a wooden stand). Mussels were aerially exposed for 72 hours and then resubmerged in their respective jars for a 24-hour recovery period. Percent survival was checked after 72-hours in air and again after the recovery period. There was a significant effect of substrate type on initial mussel attachment, with mussels preferring wood, but there was no significant effect of either substrate type or orientation on mussel survival during aerial exposure.

2:30pm **82** UG **The Effects of Urbanization, Noise and Light Pollution on Katydids**

*Emily Hernandez , Bri Cook , & Sophia Borjon [Bradley University]

Acoustic communication is important, especially for Orthoptera (Katydids) and the intra- and inter-population dynamics. Male Katydids vocalize to attract mates, making them conspicuous and ubiquitous (Gerhardt and Huber, 2002). Thus, they are prone to predation. Female Katydids have sensitive hearing compared to male Katydids. However, the unique challenges posed by urbanization (light and sound pollution) have affected the ability to vocalize, which may lead to decreased population size and overall fitness. We placed the Autonomous Recording Units (ARUs) in urban parks and protected areas across Peoria, Illinois. The ARUs record the vocalization of Katydid calls. The vocalizations of these Katydids have been analyzed using Raven Pro 1.6, which analyzes amplitude, frequency, number of chirps, and number of vocalizations. Our study indicates differences in vocalization parameters, such as frequency, amplitude, and number of vocalization events per individual.

1:00pm **83** UG **The Use of Automated Recorders to Assess the Effects of Environmental Factors on Foraging Activity of Insectivorous Bats in Siloam Springs State Park**

*Ava Maria Mendoza & Bryan Arnold [Illinois College]

A feeding buzz is a rapid burst of echolocation pulses produced by a bat to pinpoint the location of its prey. These are easily distinguished from search phase echolocation calls which are more spread out in time as the bat attempts to locate the presence of a potential prey. We used these distinct calls to examine the foraging behavior of insectivorous bats in Siloam Springs State Park as a function of habitat type and prescribed burn activity. We placed Wildlife Acoustics SM4 automated acoustic recorders in six locations in the park in habitats consisting of open and closed woodland corridors in areas that have been subjected to different levels of prescribed burns (burned in the year of recording, burned the previous year, and unburned). Recorders were deployed from May 2023 to August 2023. We analyzed recordings using the Kaleidoscope program and documented the presence of a bat flying within range of the microphone (defined as a bat pass) and the

presence or absence of any feeding buzzes associated with the bat pass. The program also identified each bat pass to species based on the characteristic frequency and temporal changes of their echolocation calls, which were manually vetted and checked for accuracy, allowing us to examine species differences in foraging activity. Our findings thus far suggest that foraging activity is higher in open habitats versus woodland flight corridors which is information that will be useful to the biologists at the park as they manage the habitat for various species including bats.

2:30pm **84** UG **The Use of Automated Recorders to Examine Shifting Insectivorous Bat Population Trends in Siloam Springs State Park**

*Zachary Renken & Bryan Arnold [Illinois College]

Bat populations have faced a decline in recent years due to human-induced factors like wind farm development, habitat destruction, and white-nose syndrome. White-nose syndrome is a fungal disease that most prominently affects cave-hibernating bats. Among those affected, the tricolored bat, northern long-eared bat, and little brown bat are species that have been hit the hardest with the northern long-eared bat recently listed as a federally endangered species. To better understand the changes in bat species populations in west central Illinois, we analyzed acoustic data collected using automated recorders from the summers of 2017 to 2023 in Siloam Springs State Park. This is part of a long-term study investigating the effects of prescribed burns and habitat type (open areas vs. woodland flight corridors) on bat activity at the park with recorders placed in areas that are historically unburned, burned the year of recording, and burned the previous year. The recorders gathered data daily from 30 minutes before sunset until 30 minutes after sunrise. The files were then uploaded to Kaleidoscope Pro's Bat Auto-ID software and processed. We then analyzed the data and determined if there was a bat presence in each file to distinguish noise files from bat passes and manually check the identifications made by the program. Upon doing so, we observed any changes in bat populations from 2017 to 2023 in the park in terms of species distribution changes as well as activity changes as a function of prescribed burning activity and habitat type. The information gathered will be used to help manage and conserve bat habitats in the park.

IJAS POSTER PRESENTATION ABSTRACTS

1:00pm – 3:45pm, Saturday, April 13, 2024, in Griswold Gymnasium

1:00pm	**101**	**Anda Wattanakit** (9th) [Richwoods High School]	**Thermoelectricity as a Power Source for a Self-Activating Fall Alert Device**
2:30pm	**102**	**Emily Bah** (10th) [Lane Tech College Prep]	**Effect of Fossil Fuels on Artemia Viability**
1:00pm	**103**	**Hannamaria Ulanbek** (7th) [Science Academy of Chicago]	**Do Water Filters Help Reduce Pollution?**
2:30pm	**104**	**Hayley Perry** (8th) [Albion Grade School]	**Cucumber Science**
1:00pm	**105**	**Ashlynn Pontious & Isabella Rhodes** (7th) [Ramsey Junior High]	**Speculating Ducks**
2:30pm	**106**	**Zoya Chowdhury** (8th) [Carbondale Community High School]	**Artificial Intelligence-Powered Prediction of Mesoderm Differentiation**
1:00pm	**107**	**Isabelle Hou** (10th) [Carbondale Community High School]	**Utilization of Zinc on Chlorophyll Based Dye-Sensitized Solar Cells**
2:30pm	**108**	**Julian Grisius** (10th) [Illinois STEM Society]	**The Effects of Medium Richness on Affective and Opinion Polarization**
1:00pm	**109**	**Aditya Prashanth** (12th) [Illinois STEM Society]	**Human Body Detection with Occlusion**
2:30pm	**110**	**Savannah Ramsey** (11th) [Southeastern High School]	**Eco-Engineered Floating Wetlands - A Promising Technique to Improve Water Quality**
1:00pm	**111**	**Elizabeth Hubbard** (9th) [Southeastern High School]	**Exploring the Environmental Impact of Copper II Sulfate on Dugesia tigrina and Lemna minor**
2:30pm	**112**	**Quinn Melendez** (8th) [Holy Family School - Oglesby]	**Electrolyte Concentration Which Drink Really Quenches Your Thirst?**
1:00pm	**113**	**Olivia DiGriorgio** (7th) [St. Scholastica School]	**Peak Performance**
2:30pm	**114**	**Marcus King** (11th) [Governor French Academy]	**Analytic Modeling of Exoplanet Detection via Gravitational Lensing and Orbital Motion**
1:00pm	**115**	**Saisrivarsha Venigalla & Ameenah Abdul-Rasheed** (12th) [Edwardsville High School]	**Chlodronate-Liposomes Effect on Number of T-Cells When Infected with Chlamydia**
2:30pm	**116**	**Loyal Flanders** (11th) [Althoff Catholic High School l]	**The Complexities Within a Chessplayer's Mind**
1:00pm	**117**	**Agrini Heekhra** [Dunlap High School]	**Design of Fully Closed-Loop Feedback Control System for Insulin Delivery In Response To Blood Glucose Levels**
2:30pm	**118**	**Anna Tataryn** (10th) [Lane Tech College Prep]	**Effect of Waste Materials on Paper Quality**
1:00pm	**119**	**Olivia Jones** (10th) [Lane Tech College Prep]	**Effect of Fin Angle on Bottle Rocket Apogee**
2:30pm	**120**	**Yairely Marchan** (10th) [Lane Tech College Prep]	**Effect of Allelopathy on Germination Rate**
1:00pm	**121**	**Leah Wu** (10th) [Walter Payton College Preparatory High School]	**Powering Tomorrow: Illinois Nuclear Production**

2:30pm	**122**	**Michael Xi, Pranav Dharmappa, & Benjamin Brown** (11th) [University High School – ISU]	**Novel AI-Based Adaptive SCN Treatment Medical Device for Circadian Misalignment**
1:00pm	**123**	**Vignesh Tiruvannamalai & Josephine Kim** (12th, 11th) [Illinois Mathematics and Science Academy]	**DDX18 Plays a Functional Role in the Association of Centromeres and Heterochromatin to the Nucleolus**
2:30pm	**124**	**Close Xu** (12th) [Adlai E. Stevenson High School]	**A Comparative ML Approach to Predict Habitability of Confirmed Exoplanets**
1:00pm	**125**	**Isaiah Yang** (11th) [Glenbrook South High School]	**Optimizing the Best Racing Route through a Turn for F1 Cars**