TRANSACTIONS OF THE ILLINOIS STATE ACADEMY OF SCIENCE

SUPPLEMENT TO VOLUME 118

118TH ANNUAL MEETING
APRIL 18, 2026

WITH ILLINOIS JUNIOR ACADEMY OF SCIENCE REGIONAL WINNERS

IN PERSON ALL-DAY EVENT @
PERE MARQUETTE HOTEL, PEORIA, ILLINOIS

HOSTED BY
ILLINOIS JUNIOR ACADEMY OF SCIENCE

ILLINOIS STATE ACADEMY OF SCIENCE

FOUNDED 1907

AFFILIATED WITH THE ILLINOIS STATE MUSEUM
SPRINGFIELD, IL

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118TH ISAS ANNUAL MEETING

April 18, 2026
Pere Marquette Hotel, Peoria, Illinois
Host: Ms. Emily Dawson

MEETING SCHEDULE

All Events are Conveniently Located in the Pere Marquette Hotel
Badges are Required for Room Entry

SATURDAY, APRIL 18TH

MORNING EVENTS

- 8:00am – 11:45am Check-in, On-Site Registration if Needed, Break Area [Cotillion Foyer]
  Continental Breakfast Available 8am – 10am
- 8:40am – 8:55am Opening Remarks [Cotillion Foyer]
- 9:00am – 11:15am Oral Presentations [Cheminee, LaSalle, and Marquette Ballrooms]

ISAS LUNCHEON AND KEYNOTE ADDRESS

- 11:30am – 1:00pm tickets required for lunch (slider bar & fixin's) [Marquette Ballroom]

AFTERNOON EVENTS

- 12:30pm – 3:30pm Check-in, On-Site Registration if Needed, Break Area [Cotillion Foyer]
- 1:00pm – 2:15pm Poster Sessions A (odd numbers) [Cotillion Ballroom]
- 2:30pm – 3:45pm Poster Sessions B (even numbers) [Cotillion Ballroom]
- 3:45pm – 4:15pm Student Spotlight / Judging / Division Meetings [LaSalle Ballroom]
- 4:15pm – 5:00pm Award Presentations, Closing [Cotillion Ballroom]

ABBREVIATIONS USED IN PROGRAM

Division Abbreviations

Anthro & Archeo	Anthropology & Archeology
Cell Biology	Cell, Molecular, & Developmental Biology
Chem & Biochem	Chemistry & Biochemistry
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 Steventon	Adlai E. Stevenson High School	ISU	Illinois State University
Augustana	Augustana College	Joliet JC	Joliet Junior College
Beacon	Beacon Academy	Lewis	Lewis University
Benjamin Franklin	Benjamin Franklin Middle School	Millikin	Millikin University
Bradley	Bradley University	Oak Park	Oak Park and River Forest High School
DePaul	DePaul University	Palatine STEM	Palatine STEM Society
Dunlap	Dunlap High School	Richwoods	Richwoods High School
EIU	Eastern Illinois University	SIUE	Southern Illinois University Edwardsville
Gregory	Gregory Middle School	Skinner North	Skinner North Classical School
Governor French	Governor French Academy	Spoon River	Spoon River Valley High School/Spoon River College
Hinsdale Central	Hinsdale Central High School	Twin Groves	Twin Groves Middle School
IC	Illinois College	Waubonsie Valley	Waubonsie Valley High School
Illinois STEM	Illinois STEM Society	WIU	Western Illinois University
IMSA	Illinois Math and Science Academy		

ISAS ORAL PRESENTATIONS OVERVIEW

	Marquette Ballroom	LaSalle Ballroom	Cheminee Ballroom
9:00 – 9:15	**Aarya Sobti** Health Sciences	**Magaranth Rajkumar** Environmental Science	**Angelica Strack** Physics, Math, & Astronomy
9:15 – 9:30	**Jaelyn Hammersley** Health Sciences	**Hailey Gula** Environmental Science	**Krish Patel & Brandon Ross** Physics, Math, & Astronomy
9:30 – 9:45	**Prasanna Acharya** Health Sciences	**Monika Dallakoti** Environmental Science	**Philip Ambe Omiah** Physics, Math, & Astronomy
9:45 – 10:00	**Sahasra Marni** Health Sciences	**Blake Rentz** Environmental Science	**Liz Awour** Engineering & Technology
10:00 – 10:15	**Zi Wang** Health Sciences	**Anda Wattanakit** Environmental Science	**Jaby Mohammed** Engineering & Technology
10:30 – 10:45	***BREAK***	***BREAK***	***BREAK***
10:45 – 11:00	**Gabrielle McGee** Microbiology	**Jennifer Teibowei** Chemistry & Biochemistry	**Thanveer Aslam** Zoology
11:00 – 11:15	**Laura Corey** STEM Education	**Arnav Chaphalkar** Cell Biology	**Atharva Vase** Computer Science
11:15 – 11:30			**Sidharth Brahmandam** Computer Science

ISAS POSTER PRESENTATIONS OVERVIEW

Cotillion Ballroom				Cotillion Ballroom			
Group A [1:00pm – 2:15pm] – Odd Numbers				Group B [2:30pm – 3:45pm] – Even Numbers			
1	**Ella Eathington** Agriculture	45	**Mohamed Saady** Environmental Science	2	**Grace Vaughn** Anthro & Archeo	46	**Taylor Morey** Environmental Science
3	**Holly Pettit** Anthro & Archeo	47	**Viola Stangle** Environmental Science	4	**Jerica LaMarsh** Anthro & Archeo	48	**Aarush Bhagwat** Health Sciences
5	**Abhinav Sathamraju Venkata** Cell Biology	49	**Agam Nanda** Health Sciences	6	**Alexander Sebastian** Cell Biology	50	**Ayesah Mehwish** Health Sciences
7	**Lauren Kooi** Cell Biology	51	**Angela Manevska** Microbiology	8	**Lexie Bartimus** Cell Biology	52	**Arwen Como** Microbiology
9	**Livia Kimberlin & Cody Clayton** Cell Biology	53	**Ashley Miller** Microbiology	10	**Matias Bowens** Cell Biology	54	**Bryn Bates** Microbiology
11	**Morgan Guppy** Cell Biology	55	**Cody Clayton & Livia Kimberlin** Microbiology	12	**Mustafa Altamimi** Microbiology	56	**Davide Giambagli** Microbiology
13	**Mythrey Govindarajan** Cell Biology	57	**Hansini Gamage Don** Microbiology	14	**Onyinye Umealajekwu** Cell Biology	58	**Rarius Stancu** Microbiology
15	**Sasvat Chigurupati** Cell Biology	59	**Maryam Sohail Warraich** Microbiology	16	**Alayna Brown** Chemistry & Biochem	60	**Reid Kleeman** Microbiology
17	**Angela Balderas** Chemistry & Biochem	61	**Sara Shafii** Microbiology	18	**Ashley Perez** Chemistry & Biochem	62	**Yusra Amena** Microbiology
19	**Beamlak Hiltework** Chemistry & Biochem	63	**Zahra Haji** Microbiology	20	**Deep Patel** Chemistry & Biochem	64	**Anuj Subramanian** Physics, Math, & Astronomy
21	**Jessica (Yunan) Jiang** Chemistry & Biochem	65	**Benjamin Cole** Physics, Math, & Astronomy	22	**Princess Akyea-Obesebea** Chemistry & Biochem	66	**Chelsie Hadley** Physics, Math, & Astronomy
23	**Rachel James** Chemistry & Biochem	67	**John Reed IV** Physics, Math, & Astronomy	24	**Abiodun Adebanjo** Computer Science	68	**Nathan Oliveira** Physics, Math, & Astronomy
25	**Andy Dong** Computer Science	69	**Srinithi Kambhampati** Physics, Math, & Astronomy	26	**Bowen Li** Computer Science	70	**Aidan Bein** Plant Biology
27	**Femi Oke** Computer Science	71	**Michaela Barter** Plant Biology	28	**Kelly Liu** Computer Science	72	**Cody Clayton** STEM Education
29	**Ekaansh Ravuri** Earth Science	73	**Paige Kern** STEM Education	30	**Arav Moonat** Engineering & Technology	74	**Helen Ratchford** Zoology
31	**Elliott Choi** Engineering & Technology	75	**Addison Oyer** Zoology	32	**Ethel Asamoah** Engineering & Technology	76	**Adrian Davis** Zoology
33	**Maithri Govardhana** Engineering & Technology	77	**Amari Terrell** Zoology	34	**Amina Mohammed** Environmental Science	78	**Avril Enciso** Zoology
35	**Ankit Kumar Mahato** Environmental Science	79	**Dylan Krohe** Zoology	36	**Clover Villanueva** Environmental Science	80	**Grace Witsken** Zoology
37	**Cynthia Elisia Mrong** Environmental Science	81	**Isabell Walker** Zoology	38	**David Estrada** Environmental Science	82	**Kortney Stage** Zoology
39	**Eyram Setrana** Environmental Science	83	**Melvin Hodge** Zoology	40	**Ezekiel Tosin Babatunde** Environmental Science	84	**Milla Helton** Zoology
41	**Garrett Vanfossan** Environmental Science	85	**Miranda Araujo** Zoology	42	**Kailani Vazquez** Environmental Science	86	**Ishan Suresh Kumar** Health Sciences
43	**Magdalene Amankwaa** Environmental Science	87	**Ansh Mehta** Health Sciences	44	**Manoj Chand** Environmental Science	88	**Camille Prefountain** Chemistry & Biochem
		89	**Lakhi Ananthula** Engineering & Technology			88	**Wyatt Kinney & Brandon Wood** Cell Biology

ILLINOIS JUNIOR ACADEMY OF SCIENCE POSTER PRESENTATIONS OVERVIEW

Cotillion Ballroom			Cotillion Ballroom		
Group A [1:00pm – 2:15pm] – Odd Numbers			**Group B [2:30pm – 3:45pm] – Even Numbers**		
101	**Raghav Tuppal (10th)** *(Microbiology)*	Dunlap High School	102	**Mohammed Mubarak Ali (11th)** *(Environmental Science)*	Dunlap High School
103	**Ravi Shah (10th)** *(Biochemistry)*	Illinois Math & Science Academy	104	**Darius Jones (10th)** *(Mathematics)*	Latin School of Chicago
105	**Bogdan Jones (12th)** *(Mathematics)*	Walter Payton College Prep	106	**Aditya Dara (9th)** *(Computer Science)*	Dunlap High School
107	**Joey Li (10th)** *(Microbiology)*	Lane Tech High School	108	**Eman Imran (11th)** *(Health Science)*	Niles West High School
109	**Zainab Nathani (11th)** *(Material Science)*	Niles West High School	110	**Aditya Dinesh (10th)** *(Health Science)*	Metea Valley High School
111	**Neysa Thumma** *(Biochemistry)*	Illinois STEM Society	112	**Bethany Huhr (10th)** *(Health Science)*	Glenbrook North High School
113	**Sia Verma (9th)** *(Chemistry)*	Dunlap High School	114	**Sydney Huhr (9th)** *(Behavioral Science)*	Glenbrook North High School
115	**Daniel Aguirre (12th)** *(Health Science)*	Carver Military Academy	116	**Sohum Kodilkar (10th)** *(Health Science)*	Illinois Science & Math Academy
117	**Julia Kwiek (12th)** *(Earth Science)*	Northside College Prep	118	**Amit Prakash (11th)** *(Computational Biology / Bioinformatics)*	Illinois Science & Math Academy
119	**Anushka Moonat (8th)** *(Biochemistry)*	Benjamin Franklin Middle School	120	**Rania Fahim (9th)** *(Cellular & Molecular Biology)*	Islamic Foundation School
121	**Yusha Junald (8th)** *(Health Science)*	Governor French Academy	122	**Benaya Gbadebo-Goyea (10th)** *(Engineering)*	Governor French Academy

ORAL PRESENTATIONS SCHEDULE – 9:00AM-11:30AM
CHEMINEE, LASALLE, AND MARQUETTE BALLROOMS

Time	Presenter	Title of Presentation
Cell, Molecular, & Developmental Biology – LaSalle Ballroom		
10:45am	Arnav Chaphalkar (Adlai Stevenson, HS)	Spatial Transcriptomics-Conditioned Latent Diffusion Models for Synthetic Histopathology Tissue Patch Generation
Chemistry & Biochemistry – LaSalle Ballroom		
10:30am	Jennifer Teibowei (EIU, Grad)	Design and Synthesis of Fluorogenic Chemical Tools Based on Rhodol Scaffolds to Study Human Carboxylesterase 1 (CES1)
Computer Science – Cheminee Ballroom		
10:45am	Atharva Vase (Illinois STEM, HS)	VOCL: Non-Invasive EMG-LLM Interface for Restoring Expressive Speech
11:00am	Sidharth Brahmandam (IMSA, HS)	Novel Dimensionality Reduction of Quantum Approximate Optimization Algorithm Parameter Space with Radial Basis Kernel for Max-Cut
Engineering & Technology – Cheminee Ballroom		
9:45am	Liz Awour (ISU, Grad)	Generative Artificial Intelligence as a Decision-Support Tool: Implications for Risk Management in Technology Projects
10:00am	Jaby Mohammed (ISU)	Experimental Evaluation of Static Charge Mitigation
Environmental Science – LaSalle Ballroom		
9:00am	Magaranth Rajkumar (Independent, HS)	RESOUND: Revealing Sound Driven Avian Barriers in Urbanized Landscapes
9:15am	Hailey Gula (Millikin, UG)	Habitat Quality and Its Effects On Cortisol Levels of Orangethroat and Johnny Darters in Macon County, Illinois
9:30am	Monika Dallakoti (SIUE, Grad)	Transport Pathways of Selenium in Soil-Crop Systems under Long-term Swine Manure Application
9:45am	Blake Rentz (SIUE, Grad)	Comparative Life-History Parameters of DDT-Susceptible and -Resistant *Drosophila melanogaster* Strains
10:00am	Anda Wattanakit (Richwoods, HS)	Characterization of Lead Oxide Colloids Through Chemical Synthesis to Optimize Water Conditions in Lead-Bearing Pipes
Health Sciences – Marquette Ballroom		
9:00am	Aarya Sobti (Gregory, HS)	Evaluating Allele-Specific CRISPR gRNAs for Safer SOD1-ALS (D91A) Editing
9:15am	Jaelyn Hammersley (Oak Park, HS)	Therapeutic Potential of Gedunin on the Effects of Parkinson's Disease in a *Drosophila melanogaster* Model
9:30am	Prasanna Acharya (IC))	The Effect of Controlled Breathing on Cognitive Performance Among Young, Healthy College Students
9:45am	Sahasra Marni (Illinois STEM, HS)	GutDetector: A Noninvasive Diagnostic Strip to Detect Early Signs of Acidity and Inflammation for Early Prevention of Chronic Gastrointestinal Disease
10:00am	Zi Wang (Beacon, HS)	Spirulina-Powered Self-Oxygenating Antibacterial Hemostatic Hydrogel Dressing for Enhanced Wound Healing
Microbiology – Marquette Ballroom		
10:45am	Gabrielle McGee (Skinner North, HS)	How Do Wavelengths Affect Bioluminescence?
Physics, Mathematics, & Astronomy – Cheminee Ballroom		
9:00am	Angelica Strack (WIU, Grad)	Physical and Optical Properties of Europium (Eu_3^+) and Neodymium (Nd_3^+) Co-Doped Bismuth Boro-Tellurite Glasses
9:15am	Krish Patel & Brandon Ross (Governor French, HS)	Determining the Acceptable Range of Estimation for Bolometric Temperature of an Infrared Spectrum Utilizing Trapezoidal Integration and Spectral Energy Distribution
9:30am	Philip Ambe Omiah (WIU, Grad)	Fluorescence Properties of Dysprosium and Praseodymium (Dy_3+ / Pr_3^+) Co-Doped Bismuth Boro-Tellurite Glasses
STEM Education – Marquette Ballroom		
10:45am	Laura Corey (IC)	Aiming at the Wrong Target: What's Wrong With How We Teach Logarithms in Precalculus and How To Fix It?

Time	Presenter	Title of Presentation
		Zoology – LaSalle Ballroom
10:30am	Thanveer Aslam (EIU, Grad)	Prevalence of *Cytauxzoon felis* Cytochrome-b Variants in Domestic Cats and Bobcats

POSTER PRESENTATIONS SCHEDULE –1:00PM-3:45PM
COTILLION BALLROOM

Time	#	Presenter	Title of Presentation
		Agriculture	
1:00pm	**1**	Ella Eathington (Spoon River, HS)	Time of Thaw of Bull Semen Versus Motility Rate of Semen
		Anthropology & Archeology	
2:30pm	**2**	Grace Vaughn (IC, UG)	The Roles of Sexual Dimorphism and Age in Human Cranial Angle Measurements
1:00pm	**3**	Holly Pettit (IC, UG)	Permanent Tooth Eruption Timing and Malocclusion Class in Modern Humans: A Dental Cast Analysis
2:30pm	**4**	Jerica LaMarsh (IC, UG)	Nasal Bone Development in Extant Humans
		Cell, Molecular, & Developmental Biology	
1:00pm	**5**	Abhinav Sathamraju Venkata (Adlai Stevenson, HS)	Formula Feeding Downregulates Key Selenoproteins and Remodels Inflammatory Correlation Networks in the Neonatal Small Intestine
2:30pm	**6**	Alexander Sebastian (Bradley, UG)	Investigating the Transcriptomic Response of Chitin Synthase Genes and Novel Cold-Induced Factors in *Tetrahymena thermophila* Following Cold Shock
1:00pm	**7**	Lauren Kooi (Bradley, UG)	Effects of Low Protein Diet on Inner Ear Morphology in *Mus musculus*
2:30pm	**8**	Lexie Bartimus (SIUE, UG)	Mound Formation in *Schizophyllum commune* Does Not Require Blue Light Signaling
1:00pm	**9**	Livia Kimberlin & Cody Clayton (Bradley, UG)	Search for New Antimicrobial Compounds from *Paenibacillus* sp. Collected from Asian Carp
2:30pm	**10**	Matias Bowens (Bradley, UG)	Transcriptomic Analysis of Methionine Sulfoxide Reductase-Associated Oxidative Stress Networks in *Tetrahymena thermophila*
1:00pm	**11**	Morgan Guppy (Spoon River, HS)	Different Genres of Music vs the Speed of a Mouse Through a Maze
1:00pm	**13**	Mythrey Govindarajan (Twin Groves, HS)	Next-Generation Computational Design of Ultra-Precise Prime Editing Systems for Safe and Targeted Correction of the Cardiac Sodium Channel Gene (SCN5A)
2:30pm	**14**	Onyinye Umealajekwu (EIU, UG)	Reactivation of Liver Function Through Genomic Modification
1:00pm	**15**	Sasvat Chigurupati (Adlai Stevenson, HS)	The Effect of LRRK2 Mutations on Presynaptic Endocytosis and Synaptic Vesicle Recycling: A Novel Approach to Understanding LRRK2's Role in the Pathogenesis of Parkinson's Disease
2:30pm	**90**	Wyatt Kinney & Brandon Wood (DePaul)	Characterization of the K14TRT Mouse Mammary Cell Line as Epithelial/Mesenchymal Hybrid Cells
		Chemistry & Biochemistry	
2:30pm	**16**	Alayna Brown (WIU, Grad)	Quantitative Analysis of Polycylic Aromatic Hydrocarbons in Recycled Tire Materials Using Gas Chromatography
1:00pm	**17**	Angela Balderas (WIU, UG)	Synthesis of ZnO Nanoparticles
2:30pm	**18**	Ashley Perez (WIU, UG)	Comparison of Different Preparation Methods for Analysis of Catfish Skin
1:00pm	**19**	Beamlak Hiltework (IC, UG)	Recycling Copper Catalysts for Sustainable Triazole Synthesis in Aqueous Media
2:30pm	**20**	Deep Patel (EIU, Grad)	GXXXG Motif Mediated Protein Dimerization in Glutamate Carboxypeptidase II
1:00pm	**21**	Jessica (Yunan) Jiang (Adlai Stevenson, HS)	Using ML to Determine Whether Single Atom Catalysts Function Under the Same Fundamental Properties as Bulk Metal Catalysts for Carbon Dioxide Reduction Reactions
2:30pm	**22**	Princess Akyea-Obesebea (IC, UG)	Exploring Zinc(II) Catalysis in Aqueous Azide–Alkyne Cycloaddition for Sustainable Triazole Formation
1:00pm	**23**	Rachel James (WIU, UG)	Examination of Different Digestion Media for Microplastics Analysis
2:30pm	**88**	Camille Prefountain (IC, UG)	Can Ordinary Nickel Do the Job? Exploring Common Nickel Salts in Click Chemistry.

Time	#	Presenter	Title of Presentation
			Computer Science
2:30pm	**24**	Abiodun Adebanjo (WIU, Grad)	AI-Based Framework for Intrusion Detection and Automated Prevention in Cloud Computing Environments
1:00pm	**25**	Andy Dong (Hinsdale Central, HS)	Uncovering the Hidden Regulators in the Human Interactome via Hyperbolic Graph Convolutional Network Learning
2:30pm	**26**	Bowen Li (Independent, HS)	A Machine Learning Approach to Identify Features Governing Molecular Photostability from a Small Experimental Dataset
1:00pm	**27**	Femi Oke (WIU, Grad)	Operationalizing AI on Secure FHIR Pipelines: A Zero-Trust Cloud Reference Architecture for EHR Interoperability
2:30pm	**28**	Kelly Liu (Skinner North, HS)	Can People Identify AI vs. Human Writing?
			Earth Science
1:00pm	**29**	Ekaansh Ravuri (Adlai Stevenson, HS)	The Effect of Sea Surface Temperature on the Distribution and Carbon Sequestration Potential of *Prochlorococcus*
			Engineering & Technology
2:30pm	**30**	Arav Moonat (Benjamin Franklin, HS)	Which Wind Turbine Generates the Most Voltage?
1:00pm	**31**	Elliott Choi (Adlai Stevenson, HS)	The Effect of Different Machine Learning Surrogate Models for Bayesian Optimization on the Thrust-to-Power Ratio of Physical Electrohydrodynamic Ion Thrusters
2:30pm	**32**	Ethel Asamoah (ISU, Grad)	Artificial Intelligence (AI) in the Project Team: Assistant, Analyst, or Decision Maker
1:00pm	**33**	Maithri Govardhana (ISU, Grad)	Integrating Value Stream Mapping and Demand Variability Analysis to Optimize Inventory Placement in Manufacturing Systems
1:00pm	**89**	Lakhi Ananthula (Waubonsie Valley, HS)	Optimizing a Hybrid Supercapacitor-Battery Energy Buffer for Renewable Microgrid Stability Using Experimental Testing and GPU-Based Simulation
			Environmental Science
2:30pm	**34**	Amina Mohammed (SIUE, Grad)	Assessing the Toxicological Impacts of Glyphosate on *Schmidtea mediterranea*
1:00pm	**35**	Ankit Kumar Mahato (SIUE, Grad)	Assessment of Microplastic Concentration, Types, and Distribution in the Middle Mississippi River
2:30pm	**36**	Clover Villanueva (SIUE, UG)	Concentrations of Selenium in Draught Beers Commonly Consumed in the U.S.
1:00pm	**37**	Cynthia Elisia Mrong (SIUE, Grad)	Cross-Resistance and Behavioral Effects of Insecticides in a DDT-Resistant Strain of *Drosophila melanogaster*
2:30pm	**38**	David Estrada (Bradley, UG)	Using Call Surveys to Characterize Frog Communities in Banner Marsh
1:00pm	**39**	Eyram Setrana (SIUE, Grad)	Green Synthesis of Silver Nanoparticles Using Alfalfa (*Medicago sativa*) Leaf Extract and Evaluation of Antimicrobial Activity Against *Escherichia coli*
2:30pm	**40**	Ezekiel Tosin Babatunde (SIUE, Grad)	Oxybenzone-Induced Oxidative Stress and Genotoxicity in *Aiptasia pallida*: A Coral Model for Risk Assessment in Coastal Ecosystems
1:00pm	**41**	Garrett Vanfossan (SIUE, UG)	Determination of Altered Responses to Starvation Stress in DDT-Susceptible and -Resistant Strains of *Drosophila melanogaster*
2:30pm	**42**	Kailani Vazquez (Independent, Grad)	Assessing the Effects of Carbon Dioxide and pH on Amphibian Development and Susceptibility to Parasitism
1:00pm	**43**	Magdalene Amankwaa (SIUE, Grad)	Spatial Analysis of Turbidity and Total Suspended Solids in an Agricultural Watershed Using Remote Sensing and GIS: The Upper Sangamon River
2:30pm	**44**	Manoj Chand (SIUE, Grad)	Time-Dependent Glutathione Response to Chronic Oxybenzone Exposure in *Aiptasia pallida* (A Model for Corals)
1:00pm	**45**	Mohamed Saady (SIUE, UG)	Investigation of Chill Coma Recovery and Negative Geotactic Behavior in DDT-Susceptible and -Resistant Fruit Flies
2:30pm	**46**	Taylor Morey (Spoon River, HS)	Microplastics Found in Accessible Facial Cleansers
1:00pm	**47**	Viola Stangle (SIUE, UG)	Towards Assessing Reactive Oxygen Species Generation from Natural Organic Matter-Capped Nanoparticles

Time	#	Presenter	Title of Presentation
			Health Science
2:30pm	**48**	Aarush Bhagwat (Adlai Stevenson, HS)	Evaluating the Impact of CNN Architectures on Colorectal Cancer Detection
1:00pm	**49**	Agam Nanda (Palatine STEM, HS)	Drug-Eluting Neurovascular Stent for Local MMP-9 Inhibition After Stroke
2:30pm	**50**	Ayesah Mehwish (ISU, Grad)	Evaluating the Impact of an AI Chatbot on Self-efficacy and Advising Support Among Students Enrolled in Didactic Program of Dietetics
2:30pm	**86**	Ishan Suresh Kumar (Waubonsie Valley, HS)	Implementation of Graphene Oxide Nanoparticles and Amino Acid Infused Alginate Hydrogels for Antimicrobial Applications
1:00pm	**87**	Ansh Mehta (Dunlap, HS)	Illuminating Intelligence
			Microbiology
2:30pm	**12**	Mustafa Altamimi (Lewis, UG)	The Effects of Allicin on Clinically Relevant Bacteria
1:00pm	**51**	Angela Manevska (Bradley, UG)	Utilizing Recombinant Expression of Tardigrade Protein for the Development of UV-Resistant *Chlamydomonas*
2:30pm	**52**	Arwen Como (Bradley, UG)	Effects of Parasitism and Carbon Dioxide on Tadpole Skin Microbiota
1:00pm	**53**	Ashley Miller (Lewis, UG)	Examining the Antimicrobial Properties within Osage Orange (*Maclura pomifera*) Extract Against Clinically Relevant Bacterial Strains
2:30pm	**54**	Bryn Bates (Bradley, UG)	Investigating the Function of Txp and Bcp in Oxidative Stress in *Bacillus subtilis*
1:00pm	**55**	Cody Clayton & Livia Kimberlin (Bradley, UG)	Search for New Antimicrobial Compounds from *Bacillus velezensis* Collected from Asian Carp
2:30pm	**56**	Davide Giambagli (Joliet JC, UG)	In Pursuit of Novel Bacteriophages
1:00pm	**57**	Hansini Gamage Don (EIU, Grad)	Investigation of Bacterial Biofilm Formation Mechanisms
2:30pm	**58**	Marius Stancu (Bradley, UG)	Exploring Hydrogen Peroxide's Role in Inducing bcp Gene Expression in *Bacillus subtilis*
1:00pm	**59**	Maryam Sohail Warraich (Lewis, UG)	Characterization of Communities in Experimentally Reduced Microbiomes of *Daphnia dentifera*
2:30pm	**60**	Reid Kleeman (SIUE, Grad)	Exploration of Bacteriophage defense mechanisms in *Paraburkholderia* sp. – A *Dictyostelium discoideum* Symbiont
1:00pm	**61**	Sara Shafii (SIUE, Grad)	Temperate Phages as Drivers of Strain-Level Variation in *Paraburkholderia–Dictyostelium* Symbiosis
2:30pm	**62**	Yusra Amena (SIUE, UG)	Influence of Photodynamic Inactivation on Phage-Mediated Lysis of *Paraburkholderia bonniea* 859
1:00pm	**63**	Zahra Haji (Millikin, UG)	Determining the Ability of *Pseudomonas* sp. to Inhibit the Growth of Various Bacterial Strains in the Presence of Naphthalene
			Physics, Mathematics, & Astronomy
2:30pm	**64**	Anuj Subramanian (Adlai Stevenson, HS)	Physics-Informed Reduced-Order Model for Active Aerodynamics Prediction and Dynamic Wing Control
1:00pm	**65**	Benjamin Cole (SIUE UG)	Studying the Formation of Persistent Holographic Grating in Europium-Doped Barium-Tellurite Glass
2:30pm	**66**	Chelsie Hadley (WIU, UG)	Variations in Refractive Index and Sm-Fluorescence in Cadmium Bismuth Borate Glasses
1:00pm	**67**	John Reed IV (WIU, UG)	Variation of Refractive Index and Optical Band Gap in Tellurium-Zinc-Bismuth-Borate Glasses
2:30pm	**68**	Nathan Oliveira (SIUE, UG)	Studying the Formation of Persistent Holographic Grating in Praseodymium-Doped Barium-Tellurite Glass
1:00pm	**69**	Srinithi Kambhampati (Adlai Stevenson, HS)	Examining the Effects of Auction Format and Sector-Specific Valuation Distributions on Reserve Price Maximization Using Order-Statistic Theory, Expected Revenue Modeling, and FAucS Simulation Analysis
			Plant Biology
2:30pm	**70**	Aidan Bein (SIUE, UG)	Spatial Distribution of Horned Oak Galls Produced by *Callirhythis cornigera* on Pin Oaks (*Quercus palustris*) and Their Correlation with the Local Environment
1:00pm	**71**	Michaela Barter (SIUE, UG)	Isolation of a Nitrogen-Fixing Bacterium from the Roots and Soils of *Platanthera leucophaea* and *Epipactis helleborine*

Time	#	Presenter	Title of Presentation
			STEM Education
2:30pm	**72**	Cody Clayton (Bradley, UG)	Infanticide or Genetics: Calmodulin Mutations and Kathleen Folbigg
1:00pm	**73**	Paige Kern (Augustana, UG)	Comparison of Floating Wetland Treatment (FTW) Model for Secondary Classroom Use
			Zoology
2:30pm	**74**	Helen Ratchford (Bradley, UG)	Trematode Communities in Wetlands at Two Restored Sites in Central Illinois during Fall
1:00pm	**75**	Addison Oyer (Millikin, UG)	Increasing Evidence of Zika Virus Exposure in Neotropical Migratory Songbirds Arriving in Macon County, Illinois
2:30pm	**76**	Adrian Davis (SIUE, UG)	How Small Mammal Foraging Activity Contributes to Seed Dispersal
1:00pm	**77**	Amari Terrell (Millikin, UG)	Sex-Specific Behavioral Responses of *Drosophila melanogaster* (Diptera: Drosophilidae) to Odorant Stimuli: Examining Response to Acetic Acid, Ethyl Acetate, and Ethanol
2:30pm	**78**	Avril Enciso (Bradley, Grad)	Effects of Elevated CO_2 and Body Size on American Bullfrog Tadpole Growth, Survival, and Susceptibility to Trematode Parasites
1:00pm	**79**	Dylan Krohe (SIUE, Grad)	Adaptive Tool Use in Response to Resource Viscosity: A Study of *Aphaenogaster rudis*
2:30pm	**80**	Grace Witsken (SIUE, UG)	Foraging Behavior of Field Mice in Disturbed Natural Habitats
1:00pm	**81**	Isabell Walker (SIUE, Grad)	Behavioral Flexibility in Tool Use of *Aphaenogaster rudis*: Forced Choice Trials
2:30pm	**82**	Kortney Stage (SIUE, UG)	Microplastic Accumulation in Fish with Different Feeding Strategies
1:00pm	**83**	Melvin Hodge (IC, UG)	Social Calls as Indicators of Foraging Activity in Big Brown Bats (*Eptesicus fuscus*)
2:30pm	**84**	Milla Helton (EIU, UG)	Population Differences in Corticosterone During Molt in a Wild Songbirds
1:00pm	**85**	Miranda Araujo (IC, UG)	The Structure and Context of Social Calls Produced by Tree Roosting Bats *Lasiurus* and *Lasionycteris*

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

Time	#	Presenter	Title of Presentation
1:00pm	**101**	**Raghav Tuppal** (10th) *Microbiology* Dunlap High School	Cancer Gone, Guts Gone: Effects of Cancer Medication on Gut Flora
2:30pm	**102**	**Mohammed Mubarak Ali** (11th) *Environmental Science* Dunlap High School	Comparative Analysis of Field Methods for Detecting Cyanobacteria in Freshwater
1:00pm	**103**	**Ravi Shah** (10th), **Pragyan Misra** (10th), & **Neeraj Movva** (10th) *Biochemistry* Illinois Math & Science Academy	Computational Analysis of a GluN1 Synthetic Peptide Mimetic for Neutralization of Autoantibodies in Anti-NMDAR Autoimmune Encephalitis
2:30pm	**104**	**Darius Jones** (10th) *Mathematics* Latin School of Chicago	Counting SIDH Primes
1:00pm	**105**	**Bogdan Jones** (12th) *Mathematics* Walter Payton College Prep	Counting Twist Secure Elliptic Curves
2:30pm	**106**	**Aditya Dara** (9th) *Computer Science* Dunlap High School	Determining Cocoa Bean Fermentation with an ML Image Recognition Program
1:00pm	**107**	**Joey Li** (10th) *Microbiology* Lane Tech High School	Effect of Herbal Compounds on Bacteria Growth
2:30pm	**108**	**Eman Imran** (11th) *Health Science* Niles West High School	Effect of Stress on the Development and Progression of Alzheimer's Disease
1:00pm	**109**	**Zainab Nathani** (11th) *Material Science* Niles West High School	Emulsion-Templated Biogels for Solar-Driven Atmospheric Water Generation
2:30pm	**110**	**Aditya Dinesh** (10th) *Health Science* Illinois STEM Society	Flat-Plate vs NACA 63A-010 Airfoil Performance for Subsonic, Low Re-Rocketry
1:00pm	**111**	**Neysa Thumma** *Biochemistry* Illinois STEM Society	Modeling Targeted Cancer Drug Delivery: Effects of Nanoparticle Surface Coatings on Yeast Cell Binding
2:30pm	**112**	**Bethany Huhr** (10th) *Health Science* Glenbrook North High School	Machine Learning-Based Classification of Malignant and Benign Breast Tumors Using Quantitative Cellular Features
1:00pm	**113**	**Sia Verma** (9th) & **Anvita Parimal** (10th) *Chemistry* Dunlap High School	Nullifying Nitrosamines: Can the Chemical Components of Natural Antioxidants be Chemically Recreated to Inhibit Carcinogen Formation?
2:30pm	**114**	**Sydney Huhr** (9th) *Behavioral Science* Glenbrook North High School	Multivariate Prediction of Psychoactive Substance Use from Five Factor Personality Dimensions Using Python-Based Machine Learning

Time	#	Presenter	Title of Presentation
1:00pm	**115**	**Daniel Aguirre** (12th) *Health Science* Carver Military Academy	The Best Sports Drink
2:30pm	**116**	**Sohum Kodilkar** (10th), **Yatharth Gohel** (10th), & **Seth Taukolo** (10th) *Health Science* Illinois Math & Science Academy	Quantifying Multiplicative Barriers to Timely Neuroimaging in Pediatric Emergency Transfers: A Hospital Systems Analysis
1:00pm	**117**	**Julia Kwiek** (12th) *Earth Science* Northside College Prep	Weighing Hurricane Impact via Recovered Light
2:30pm	**118**	**Amit Prakash** (11th) *Computational Biology/Bioinformatics* Illinois Math & Science Academy	Towards an Accurate Quantum Support Vector Module for Predicting Cancer Cell Dynamics
1:00pm	**119**	**Anushka Moonat** (8th) *Biochemistry* Benjamin Franklin Middle School	Predictive Effects of Nitrate and Phosphate Enrichment and Copper Sulfate Stress on Algal Bloom Formation in Freshwater Systems
2:30pm	**120**	**Rania Fahim** (9th) & **Huda Ajmeri** (9th) *Cellular & Molecular Biology* Islamic Foundation School	Which Antioxidants Prevent or Protect from Oxidative Stress-Induced Neurodegeneration?
1:00pm	**121**	**Yusha Junald** (8th) *Health Science* Governor French Academy	The Effect of Aluminum and Its Potential Role in Causing Ataxia and Other Neurological Diseases
2:30pm	**122**	**Benaya Gbadebo-Goyea** (10th) *Engineering* Governor French Academy	One Tremor at a Time: Analyzing Effects of Earthquake Seismic Waves On 2-Story Buildings

ISAS ORAL PRESENTATION ABSTRACTS

9:00am – 11:15am, Saturday, April 18, 2026, in Cheminee, LaSalle, and Marquette Ballrooms
*presenter, [school] with differences noted by superscript

CELL, MOLECULAR, & DEVELOPMENTAL BIOLOGY – LASALLE BALLROOM

10:45am HS **Spatial Transcriptomics-Conditioned Latent Diffusion Models for Synthetic Histopathology Tissue Patch Generation**

* Armav Chaphalkar [Adlai E. Stevenson High School]

Whole-slide histopathology images (WSIs) form the backbone of development in cancer prognosis and tumor microenvironment (TME) analysis. However, their high curation cost, gigapixel complexity, and limited availability across institutions make them largely inaccessible for research. While synthetic WSI generation has emerged as a promising alternative, current approaches fail to reproduce important tumor features with biological relevance, making them unsuitable for analysis and AI model development. This work presents a novel spatial transcriptomic-conditioned AI pipeline for biologically grounded synthetic WSI generation. To provide rich training data, whole-slide images and matched 10x Genomics Visium spatial profiles from 41 colorectal cancer tumors were segmented into 255,744 aligned tissue patches with their corresponding gene expression vectors. GeneCondNet, a custom encoding algorithm, was developed to translate continuous spatial transcriptomic profiles into the CLIP embedding space used by the Stable Diffusion image-generation model. These embeddings guide the UNet-based diffusion neural network through cross-attention layers, allowing spatial information to serve as the blueprint for histology image reconstruction. The pipeline achieved a Frechet Inception Distance(FID) of 55, reflecting strong image fidelity. It also demonstrated robust transcriptome-morphology alignment, with Pearson/Spearman correlations of 0.72. By linking spatial transcriptomics and tissue structure in a generative model for the first time, this work enables scalable, scientifically usable WSI generation, advancing cancer research, broadening access to computational pathology, and empowering the creation of more advanced and equitable AI models across the field.

CHEMISTRY & BIOCHEMISTRY – LASALLE BALLROOM

10:13-am Grad **Design and Synthesis of Fluorogenic Chemical Tools Based on Rhodol Scaffolds to Study Human Carboxylesterase 1 (CES1)**

*Jennifer Teibowei, Jemma Booth, & Michael W. Beck [Eastern Illinois University]

Human carboxylesterase 1 (CES1) is a serine hydrolase that plays a key role in drug metabolism, but is understudied compared to other drug metabolizing enzymes. Fluorogenic chemical tools that can monitor CES1 activity in live cells show promise to help better undersand the details of CES1's role in drug metabolism, but many are poorly characterized, limiting their utility. Currently, the best characterized CES1 fluorogenic chemical tools have been limited to BODIPY and fluorescein fluorophore frameworks. In this work, we introduce a new class of rhodol-based fluorogenic chemical tools designed to expand the chemical space of well characterized tools to CES1 activity monitoring. Building on our previously reported carbonate-based substrate design, we adapted this strategy to design tools to improve tool solubility, specificity, and ease of application. By diversifying the available fluorogenic chemical tools to study CES1, this work lays the foundation for deeper insights into CES1 biology and its role in human health.

COMPUTER SCIENCE – CHEMINEE BALLROOM

10:45am HS **VOCL: Non-Invasive EMG-LLM Interface for Restoring Expressive Speech**

*Atharva Vase, Idhant Ranjan, Craig de Fiesta [Illinois STEM Society]

Around 5 million Americans suffer from speech-impairing disorders such as ALS, dysarthria, and aphasia (NIDCD, 2025). Current solutions fail to meet basic convenience or efficiency criteria. Brain–computer interfaces require risky neurosurgery and cost upwards of $100,000, while AAC tablets are agonizingly slow at 10–15 words per minute, causing most users to abandon the devices entirely (Johnson, 2008). This problem deprives millions of their right to speech simply because a proper solution is scientifically difficult to create; fortunately, this study presents one. VOCL is a non-invasive wearable headset that captures facial electromyographic signals from four key muscles. Using a fine-tuned CNN–LSTM, recorded signals from attempted speech are classified into phonemes and concatenated using an LLM to output natural sentences. EMG data were collected at 250 Hz during vocalized and attempted pronunciation of 44 English phonemes. Signals were segmented into 20-ms non-overlapping windows, min–max normalized, and classified into 45 classes. On vocalized speech, the system achieved 98.14% test-set accuracy and 96.43% ± 0.91 under five-fold cross-validation. Principal component analysis revealed a PC1 correlation of 0.84 between conditions, and our pipeline yielded an estimated 87.4% ±1.2% phoneme-level accuracy on attempted speech through correlation-based domain-shift simulation. The prototype weighs 365.9 g, targets sub-300 ms latency, and costs only $645. In all, this study provides the first quantitative evidence that attempted speech EMG is viable for

phoneme classification, alongside a complete hardware and software system capable of restoring voice for the speech-impaired.

11:00am HS **Novel Dimensionality Reduction of Quantum Approximate Optimization Algorithm Parameter Space with Radial Basis Kernel for Max-Cut**

*Sidharth Brahmandam [Illinois Math and Science Academy]

Many important graph problems, including protein-protein interaction and circuit interference modelling, can be formulated as Max-Cut optimization problems. Max-Cut is NP-Hard, which has motivated the use of Quantum Approximate Optimization Algorithms (QAOAs). QAOAs use classical parameters that dictate cost and mixer Hamiltonians to produce approximate solutions. While increasing QAOA circuit depth improves solution quality, it also exponentially increases the search space and the number of quantum evaluations. Previous work has shown that optimal QAOA parameters across different graphs follow patterns that dimensionality reduction techniques such as principal component analysis (PCA) can leverage to reduce the search space. However, as circuit depth increases, QAOA parameters follow a nonlinear manifold that PCA cannot capture. To address this limitation, I propose a novel method for dimensionality reduction of QAOA parameter space using a radial basis kernel with PCA (KPCA), aiming to improve solution quality and reduce quantum evaluations. I optimized QAOA parameters on 300 training graphs with 8-10 nodes at four circuit depths with COBYLA, using exact Max-Cut solutions as ground truth. KPCA and PCA performance were compared on 30 test graphs of 12 nodes, optimized in their reduced 2D parameter spaces. Paired *t*-tests were used for comparison. KPCA significantly outperforms PCA at circuit depths greater than 2 and uses 96.4% fewer quantum evaluations than unrestricted QAOA at depth 4, while achieving comparable performance. These results demonstrate that nonlinear dimensionality reduction can enable efficient QAOA optimization, which could accelerate its applications for complex graph problems in areas like molecular modeling and circuit design.

ENGINEERING & TECHNOLOGY – CHEMINEE BALLROOM

9:45am Grad **Generative Artificial Intelligence as a Decision-Support Tool: Implications for Risk Management in Technology Projects**

* Liz Awour & Jaby Mohammed [Illinois State University]

The rapid advancement of Artificial Intelligence (AI), particularly Generative AI, has introduced strong analytical and predictive capabilities that are being applied in project management. Technology projects often face technical, financial, operational, regulatory, stakeholder, and scope related risks that hinder the achievement of set objectives. As these projects become more complex, there is greater need for innovative tools that can enhance decision-making and improve risk management processes. Traditional risk management frameworks emphasize systematic identification, analysis, prioritization and mitigation of risks throughout the project life cycle. However, their effectiveness is constrained by reliance on manual processes which limit large data-processing capabilities, dependence on subjective judgement, and periodic assessments that fail to adequately analyze emerging risks in dynamic environments. Generative AI potentially addresses these limitations by augmenting human judgement and improving information processing. Its ability to analyze large volumes of both structured and unstructured data, detect patterns, and generate predictions leads to faster identification, analysis, monitoring and control of risks. There is still, however, limited empirical understanding of how it influences risk management practices within project teams despite its growing adoption. This gap creates uncertainty regarding its practical value, governance implications and integration within established frameworks. This proposed study explores how Generative AI can support decision-making and enhance existing risk management practices in technology projects. It also examines the challenges associated with its adoption, such as data quality issues, governance concerns, skills gaps and system integration difficulties. The findings of this study are expected to contribute to a better understanding of the opportunities and limitations of utilizing Generative AI in project environments to manage risks, and to offer recommendations for technology teams on its integration as a decision-support tool. It also highlights the importance of balancing AI's use with human judgement and following clear AI data governance and regulatory frameworks for ethical implementation.

10:00am **Experimental Evaluation of Static Charge Mitigation**

*Jaby Mohammed & Kartheek Arangi [Illinois State University]

Electrostatic discharge (ESD) poses significant risks in manufacturing environments, particularly in electronics, plastics, and precision assembly processes. This study investigates the effectiveness of an ionizer system in neutralizing static charges under controlled laboratory conditions. The research focuses on quantifying charge decay time, ion balance, and environmental influences such as humidity, distance, and airflow.

ENVIRONMENTAL SCIENCE – LASALLE BALLROOM

9:00am HS **RESOUND: Revealing Sound Driven Avian Barriers in Urbanized Landscapes**

*Magaranth Rajkumar [Independent]

Urban environments expose wildlife to persistent anthropogenic noise. However noise is rarely considered as an ecological variable in urban planning and conservation. Human generated noise can interfere with bird communication, alter their behavior, and degrade their habitat quality. Existing approaches to urban noise assessment typically rely on average sound levels. Average sound levels miss important ecological factors such as sound source composition, frequency overlap with bird communication, and the temporal persistence of noise. This paper presents RESOUND, a framework for inferring the impact of human-generated noise on birds. RESOUND integrates machine learning based sound source classification with sound feature analysis to translate raw audio recordings into Avian Resistance Maps (ARMs). ARMs highlight areas where anthropogenic noise is most likely to constrain bird behavior. The framework combines sound intensity, frequency characteristics, and temporal persistence into a composite Avian Impact Score (AIS). It then aggregates AIS across spatial regions to produce interpretable resistance maps. RESOUND was evaluated using SONYC data in the Washington Square Park region of New York City and through a pilot deployment of six acoustic sensors in DuPage Riverfront Park in Naperville, Illinois, and Blackwell forest preserve in Warrenville, IL. In each case, inferred resistance patterns were compared with independent multi year bird observation data. Comparison with the Cornell eBird datasets suggest that lower inferred resistance regions correspond with higher observed bird activity. The results support the interpretation of Avian Resistance as a meaningful representation of relative acoustic constraint. RESOUND provides a scalable and interpretable framework for incorporating sound structure into ecological analysis.

9:15am UG **Habitat Quality and Its Effects On Cortisol Levels of Orangethroat and Johnny Darters in Macon County, Illinois**

*Hailey Gula & Travis Wilcoxen [Millikin University]

In Macon County, 316,545 acres are primarily agricultural fields, which comprise 84% of the total county area, and 31,514 acres are urban and built-up land, accounting for 8.4% of the total county area. A combined total of 92.4% of Macon County is being used for agricultural and urban land use. With urbanization and agriculture come alterations in stream habitat qualities. The Orangethroat darter (*Etheostoma spectabile*) and Johnny darter (*Etheostoma nigrum*) are two common and native darters to Illinois. Both of these darters are found in rivers and streams with gravel or rocky bottoms, with no silt present. The Johnny and Orangethroat darters are great indicator species as they are both sensitive to habitat quality. Silt is sediment of rock and minerals that is dust-like and is larger than clay particulates but smaller than sand particulates. Slit can change landscapes and habitats, such as streams. When the flow of a stream is slow, silt can settle to the bottom and clog the flow of the stream. Aquatic life that thrives in gravel and rocky-bottomed streams and rivers is threatened when silt is introduced into their habitat. We explored the relationship between stream riffle habitat quality and the stress levels of Johnny and Orangethroat darters by sampling darters from various streams in Macon County and measuring cortisol levels. We found a significant, inverse linear relationship between cortisol and flow, which darters in slower moving riffles having higher cortisol. We also found significantly higher cortisol in Johnny darters than Orangethroat darters. Overall, our results demonstrate that riffle structure and flow rate can influence stress physiology of darters.

9:30am Grad **Transport Pathways of Selenium in Soil-Crop Systems under Long-Term Swine Manure Application**

*[1]Monika Dallakoti, [2]Tiequan Zhang, & [1]Zhi-Qing Lin [[1]Southern Illinois University Edwardsville; [2]Harrow Research and Development Centre, Agriculture and Agri-Food Canada]

Selenium (Se) is an essential nutrient for humans and animals, and daily Se dietary intake is highly depending on soil Se status and agricultural practices. Because of Se supplementation in feed for swine production, long-term application of swine manure becomes an important source of Se input to agricultural soils. Few studies have been conducted to evaluate effects of long-term swine manure application on soil Se accumulation and transport pathways in the soil-crop system. This long-term field study determined the Se concentration variation in the soils treated with different fertilizers including inorganic fertilizer, liquid manure, solid manure, and manure compost. Surface soil (0-15 cm), soil core (0-90 cm), and grain samples of each treatment or control were collected in three replicates. All samples were acid-digested and Se concentrations in the digestion solutions were determined using ICP-MS. The preliminary results showed that concentrations of Se in surface soils of different treatments varied from 0.21 ± 0.015 mg/kg to 0.28 ± 0.065 mg/kg. The swine manure treatments did not show significant (p>0.05) increase in topsoil Se concentration compared to the control. Soybean grain accumulated more Se than corn grain, with a concentration range of 0.078 ± 0.009 to 0.412 ± 0.256 mg/kg in soybean but 0.033 ± 0.007 to 0.160 ± 0.124 mg/kg in corn. The soil cores collected in 2005, 2014, and 2022 showed a significant stratified distribution pattern, with higher Se concentration in the rootzone (0-30 cm) but lower Se concentrations below the rootzone (>30 cm), which demonstrates no significant Se leaching to the deeper soils from the long-term swine manure application.

9:45am Grad **Comparative Life-History Parameters of DDT-Susceptible and -Resistant *Drosophila melanogaster* Strains**

*Blake Rentz & Kyong-Sup Yoon [Southern Illinois University Edwardsville]

An analysis of life-history parameters was conducted on the DDT-susceptible (CS and 91-C) and -resistant (91-R) strains to determine if a fitness disadvantage is induced by insecticide exposures. Sub-populations were prepared to minimize genetic variance and designated as progeny of mating pair (PMP). LD50 and LT50 to DDT indicated 91-RPMP females were 1.74 and 1.4 times more insensitive to DDT than CSPMP and 91-CPMP, respectively. Male 91-RPMP were 4.29 and 1.93 times more resistant than CSPMP and 91-CPMP. Significant differences in total body weights were found between strains for both males and females. 91-RPMP females weighed significantly more than both other strains 10- and 30-days post-emergence, and significantly more than CSPMP at 20-days post-emergence. Males of the resistant strain had a significantly higher total body weight than CSPMP males at 20- and 30-days post-emergence. Significant variations in dry body weights were also witnessed. Furthermore, 91-RPMP of both sexes displayed a significantly increased median lifespan—under optimal conditions—in comparison to both susceptible strains. However, when examining the resilience of the strains to various environmental stressors, 91-RPMP flies of both sexes proved to be significantly more sensitive to heat and starvation stress compared to their susceptible counterparts. Conversely, when measuring chill coma recovery times, both sexes of the resistant strain proved to have significantly faster recovery times than either other strain. Additionally, resistant females at 30-days post-emergence showed elevated levels of activity during the day time compared to CSPMP females, and resistant females 10, 20, and 30-days post emergence showed elevated levels of activity during the night time compared to susceptible strains. Resistant males—10 and 20-days post-emergence—showed elevated day time activity levels compared to both other strains; and resistant males displayed increased activity levels in comparison with susceptible strains at 30-days post-emergence for night time activity. Analysis of circadian rhythms indicated that the resistant strain may display a shift in the peak of their pattern.

10:00am HS **Characterization of Lead Oxide Colloids Through Chemical Synthesis to Optimize Water Conditions in Lead-Bearing Pipes**

*Anda Wattanakit [Richwoods High School]

Currently, 4 million lead pipes are still used in the U.S., increasing the chance of lead toxicity through consumption. Lead colloids, particles 1 to 1000 nm, can form through corrosion in aging lead-bearing pipes within municipal drinking water systems. These toxic heavy metal particulates are mobile in pipe systems and can potentially travel to consumers' tap water. Due to their rapid mobility and higher biological uptake within the human body, smaller particles have the ability to easily enter human organs and cause toxicity at the cellular level. Thus, todevelop effective water treatment strategies in order to reduce Pb bioavailability in pipes, it is critical to identify the range of water conditions in which these particles can form. Using a potentiometric titration method, this study increased the pH of a dissolved Pb solution to investigate the range of sizes of lead oxide (PbO) colloids that can form. Conditions, such as temperature (25°C, 50°C, 75°C) were applied. The color change indicated that the size of the PbO colloids were very small and remained suspended in the solution. Dynamic Light Scattering and Nanoparticle Tracking Analysis further supported the presence of lead colloids and was used for size range estimates.The result also showed that at higher temperatures, lead colloids formed faster at a neutral pH compared to at a higher pH. This finding will help characterize Pb particles and inform water utility companies to optimize water conditions to prevent lead particle formation.

HEALTH SCIENCES – MARQUETTE BALLROOM

9:00am HS **Evaluating Allele-Specific CRISPR gRNAs for Safer SOD1-ALS (D91A) Editing**

*Aarya Sobti [Gregory Middle Schoo]

Amyotrophic Lateral Sclerosis (ALS) is a fatal neurodegenerative disease in which CRISPR–Cas9 gene editing may offer therapeutic potential, but off-target effects and mutation-specific constraints limit safety. This study examines how computational modeling can improve the design of CRISPR guide RNAs (gRNAs) targeting the SOD1 gene, with a focus on the clinically relevant D91A mutation. Five SOD1 gRNAs generated using CHOPCHOP were compared using predicted on-target efficiency and mismatch-based off-target burden, which were combined into a composite Safety Index. To assess allele-specific feasibility, 120-bp wild-type and mutant sequence windows centered on the D91A mutation were constructed and analyzed for selective CRISPR targeting. Computational screening showed that high predicted efficiency alone does not ensure safety or allele specificity, as top-ranked generic SOD1 guides failed to discriminate between mutant and wild-type alleles. In contrast, mutation-centered modeling identified a single SpCas9-compatible guide with a PAM-proximal mismatch that maximized allele discrimination. These findings indicate that effective CRISPR strategies for SOD1-ALS require mutation-aware guide selection and are most likely to result in non-homologous end-joining (NHEJ) mediated disruption of mutant alleles in neurons.

9:15am HS **Therapeutic Potential of Gedunin on the Effects of Parkinson's Disease in a *Drosophila melanogaster* Model**

*Jaelyn Hammersley [Oak Park and River Forest High School]

Parkinson's disease (PD) is a progressive neurodegenerative disorder characterized by motor dysfunction and neuron loss, with limited current treatments, revealing a critical gap. Heat shock proteins (HSPs) maintain protein homeostasis and protect against neurodegeneration; as a result, the heat shock response (HSR) pathway offers a novel pharmaceutical agent for PD.

This experiment evaluated the effects of a novel HSP-inducing compound, gedunin, on a PD model of *Drosophila melanogaster* (*D.melanogaster*). Male and female F1 flies, PD (genetically modified with a dj-1β mutation, analogous to the human PARK7 gene causing PD) and wild-type flies, were exposed to DMSO (-/ vehicle control), celastrol (+ control), or two different volumes of gedunin (2.5 µl and 10 µl) beginning at 10 days old. Locomotor performance was quantified weekly for five weeks using the startle-induced negative geotaxis assay. Supplemental evidence was gathered using tyrosine hydroxylase immunofluorescence. Gedunin significantly improved locomotor performance in PD *D. melanogaster*, with effects varying by sex and dosage. Statistically significant findings $p<0.0001$ (two-way ANOVA) for both treatment and treatment and sex interaction. While survival was unaffected and neurodegeneration could not be quantified due to imaging limitations, these findings suggest that Hsp90 inhibition via gedunin may mitigate PD-associated motor deficits. The findings of this experiment demonstrate promise for the use of gedunin as a novel pharmaceutical therapeutic agent for PD, as well as established a foundation for future investigations into gedunin as a potential disease-modifying therapy for PD.

9:30am **The Effect of Controlled Breathing on Cognitive Performance Among Young, Healthy College Students**

*[1]Prasanna Acharya, [1]Tsilate Mussie Tadesse, [2]Marc Dalecki [[1]Illinois College; [2]German University of Health & Sports]

Controlled breathing, the intentional regulation of inhalation and exhalation, is a key component of meditative and mindfulness practices and may reduce stress and optimize physiological arousal for cognitive performance. This study examined whether controlled box breathing (4-4-4-4 seconds pattern of inhaling, holding, exhaling, and holding) enhances selective and sustained attention compared to baseline and non-controlled breathing conditions. Forty-college students (26 females: 19 yrs; 14 males: 20.8 yrs) completed a Baseline condition, followed by two test conditions, Controlled and Non-Controlled Breathing, which were counterbalanced across participants. Each condition lasted 3 minutes and 12 seconds. Following each breathing condition, participants completed two computerized cognitive tasks: Stroop Color Word test (48 congruent, 48 incongruent trials) and D2 sustained attention test (with varying sequences of d and p letters). Response time (RT; ms) and error rate (ER; %) were analyzed for the Stroop test while RT, ER and Sustained Attention (KL) Score were analyzed for the D2 test. A 2 × 3 repeated-measures ANOVA was used to analyze Stroop RT; one-way repeated-measures ANOVAs assessed breathing effects on Stroop ER and d2 task measures. In the Stroop task, breathing conditions significantly affected RT, suggesting shorter RT in controlled breathing condition ($p<0.05$), independent of congruency levels ($p>0.05$), indicating breathing conditions did not alter the magnitude of Stroop interference. Stroop ER were not significantly affected by breathing condition ($p>0.05$). In the D2 task, breathing significantly influenced KL scores, overall mean RT, and ER (all $p<0.05$), suggesting improvements in sustained attention and processing speed in the controlled breathing condition. Our results suggest an improvement in cognitive performance and reaction time following a brief intentional regulation of breathing. Regular practice of controlled breathing may be a simple but effective strategy to improve attention and alertness in academic and high-cognitive-demanding tasks. However, further research is needed to corroborate these assumptions.

9:45am HS **GutDetector: A Noninvasive Diagnostic Strip to Detect Early Signs of Acidity and Inflammation for Early Prevention of Chronic Gastrointestinal Disease**

*Sahasra Marni [Illinois STEM Society]

Pediatric gastrointestinal (GI) irritance is often overlooked, which often leads to chronic GI disease in the future, such as inflammatory bowel disease and colon cancer, but GI scanning for inflammation is often expensive and hard to spot early. This diagnostic provides an affordable and accessible way for caregivers to test adolescents for early GI disease detection without the need for any expensive equipment or technology. These pH and inflammation biomarker detection strips would allow for IBD to be detected at an early stage if the strip indicates a concerning level of acidity indicator with pH levels and stool proteins linked to inflammation. Procedure: 1) Prepare cellulose strips with two zones (phenol red for pH detections and iodine-protein solution for inflammation). 2) Create six simulated stool samples with combined variations of neutral, high protein, high acidity, etc. 3) Apply equal drops of each chemical indicator to each strip and dry for 25 minutes. 4) Test all six stool samples on each of the three designs for the 12 trials and record each zone's optimal density using absorbance units (AU). Repeat this process until all trials for each design and adjust accordingly until completed. The results demonstrate that an optimized protein and iodine combination consistently produced the highest normalized intensity response of up to 0.90 AU., shown by Design 3. It maintained the lowest neutral background, distinguishing regular conditions in contrast to sensitive ones. All six conditions pointed to Design 3 with the highest indications. The low cost of this product and easily understandable scale of reading ensures that lining tract inflammation is identified in early stages to prevent chronic GI diseases and flare-ups using the acidity and protein biomarker detection.

10:00am HS **Spirulina-Powered Self-Oxygenating Antibacterial Hemostatic Hydrogel Dressing for Enhanced Wound Healing**

*Zi Wang [Beacon Academy]

Chronic and diabetic wounds often exhibit delayed healing due to persistent hypoxia, bacterial infection, excessive oxidative stress, and impaired hemostasis. Existing wound dressings frequently rely on antibiotics, growth factors, or chemical oxygen-releasing agents, which may increase cost, risk of resistance, or instability. In this study, a Spirulina-powered self-healing hydrogel dressing was developed using a carboxymethyl chitosan–oxidized hyaluronic acid (CMC–OHA) dynamic network. By incorporating Spirulina and protamine, the hydrogel autonomously generates oxygen under light exposure while providing antibacterial, antioxidant, and hemostatic functions without external drugs or chemical oxygen sources. Compared with a

conventional CMC–OHA hydrogel, the Spirulina-containing hydrogel demonstrated sustained oxygen production, significantly enhanced blood clotting performance, strong antibacterial activity (up to ~95% inhibition against *E. coli*), increased antioxidant capacity, and rapid self-healing behavior. These results suggest that integrating biologically active components into soft hydrogels offers a sustainable and multifunctional strategy to reconstruct the wound microenvironment and improve healing outcomes, particularly for chronic and diabetic wounds.

MICROBIOLOGY – MARQUETTE BALLROOM

10:45am HS **How Do Wavelengths Affect Bioluminescence?**

*Gabrielle McGee [Skinner North Classical School]

Have you ever experienced seeing a vibrant glow in the waters of a coastal area or on a beach? This natural phenomenon is called bioluminescence. Over centuries, bioluminescence has been utilized by humans, from cavemen using it as a source of light in dense forests, to the current application in neuroscience. The purpose of my experiment is to test the limits of bioluminescent creatures by understanding how far they can control stress caused by heat. This experiment provides evidence on how functional bioluminescent trees are to replace street lamps. This indirectly reduces the release of greenhouse gases into the atmosphere. For my experiment, there were 5 groups of 3 test tubes. Each test tube contained approximately 6 milliliters of water, containing *Pyrocystis usiformis* cells. These 15 test tubes were grouped, each assigned to the light they would absorb during the 12 hours of the light part of their cycle. For 14 days, I tested each test tube's bioluminescence levels 4 times a day and observed averages and patterns of each group over the days. I recorded the time, date, level of bioluminescence, room temperature, and humidity each time I tested, as these factors can influence the levels, along with the light bulb temperature. I concluded that because LED light bulbs have the best temperature control and emit minimal UV rays, the cells were the healthiest, which supported my hypothesis. It showed that the dinoflagellates absorbing that light were able to create the necessary proteins for their system best.

PHYSICS, MATHEMATICS, & ASTRONOMY – CHEMINEE BALLROOM

9:00am Grad **Physical and Optical Properties of Europium (Eu_3^+) and Neodymium (Nd_3^+) Co-Doped Bismuth Boro-Tellurite Glasses**

*Angelica Strack, P. K. Babu, & Saisudha B. Mallur [Western Illinois University]

Rare Earth (RE) doped bismuth boro-tellurite glasses are expected to exhibit compositional dependence in their physical and optical properties due to changes induced by variations in the electronic structure of the base glass with increasing Nd_3^+ content. A series of bismuth boro-tellurite glasses with composition $30Bi_2O_3$:B:$0.5Eu_2O_3$:xNd_2O_3 and $30Bi_2O_3$:[69.5-y] B_2O_3:yTeO_2:$0.5Eu_2O_3$ (x=0.5,1.0,1.5 mol %: y=10,20 mol %), were prepared using the melt-quench technique followed by 3 hours of annealing near the glass transition temperature. We used the Brewster's Angle experiment, Archimedes Principle, and UV-VIS Spectroscopy to obtain the refractive index, density, optical absorption, and fluorescence spectra of the glass samples. Data for each sample was analyzed to determine the effect of increasing Nd_3^+ concentration on the physical and optical properties of these glasses. Preliminary analysis has shown that the glass density increases with Nd_2O_3 content, while the refractive index shows very little variation. Judd-Ofelt intensity parameters and stimulated emission cross-section vary significantly with composition.

9:15am HS **Determining the Acceptable Range of Estimation for Bolometric Temperature of an Infrared Spectrum Utilizing Trapezoidal Integration and Spectral Energy Distribution**

*Krish Patel & *Brandon Ross [Governor French Academy]

Trapezoidal integration serves as an essential tool for evaluating bolometric temperature, often used by computers and as a manual method because of its simplicity and smoothness. In terms of the viability of trapezoidal integration for estimating bolometric temperature, two factors must be considered: time and accuracy. If trapezoidal integration is not sufficiently close to the accepted bolometric temperature value before having to break the infrared spectrum into an unreasonable number of parts for manual evaluation, it cannot efficiently serve as a tool for estimation. Procedure: Use the Herschel Orion Protostar Survey (HOPS) and select SEDs Quick Look for the full SED graph catalog. From SEDs, select HOPS images and spectra and then HOPS_IRS_SPECTRA.tbl to see the values of the IRS window spectra. Copy and paste the table's values into a separate document. Take the first and last values to be each end of the area being integrated. Depending on the number of trapezoids desired for integration, split the dataset into the appropriate number of points. Convert the units from μm to m, then divide 2.998 x108 by that number. The output from this conversion will be the ν value for that point. Write the Jy values of the points on a sheet of paper. Convert these values to W m^{-2} Hz^{-1} by lowering them by x1026 (Ex: 8.820^{-2} becomes 8.820^{-28}). Your output is your $\nu F\nu$ for that point. In order to find $F\nu$ for each point, divide their respective $\nu F\nu$ by their respective ν. With these values, do trapezoidal integration first using $\Delta\nu$ as the height and $\nu F\nu$ as the bases, then with $\Delta\nu$ as the height and $F\nu$ as the bases. Substitute values into the following formula for the estimated bolometric temperature.

$$T_{bol} = (1.25x10^{-11})\left(\frac{\int_0^\infty \nu F_\nu d\nu}{\int_0^\infty F_\nu d\nu}\right)$$

Trapezoidal integration as a method for approximating bolometric temperature manually can be inaccurate, but when using 6 subsections or more you are likely to get a good approximation of the exact bolometric temperature. Beyond 6 trapezoids,

manual trapezoidal integration becomes laborious and impractical. The unique relationship between the shape of the spectra and the bolometric temperature makes trapezoidal integration a uniquely useful tool for evaluating bolometric temperature

9:30am Grad **Fluorescence Properties of Dysprosium and Praseodymium (Dy_3+ / Pr_3^+) Co-Doped Bismuth Boro-Tellurite Glasses**

*Philip Ambe Omiah, P. K. Babu, & Saisudha B. Mallur [Western Illinois University]

Dy^{3+} ions have strong emission in the blue and yellow region which can be used for many photonic applications. The main question our study seeks to provide answer to is how the variation of the composition of Dy^{3+} affects the fluorescence performance of our glass system. This work presents the spectroscopic analysis of Dy^{3+} ions in Dy^{3+}/Pr^{3+} co-doped bismuth boro-tellurite glasses. We excited Pr^{3+} in the easily available visible wavelength of 445 nm and observed emission from Dy^{3+} ions due to energy transfer from Pr^{3+} to Dy^{3+}. The optical absorption and fluorescence data of our glass systems were analyzed using OriginPro2021 and Mathematica software to obtain key radiative parameters to evaluate Dy^{3+} ions potential for possible lasing and other luminescent applications. The stimulated emission cross-section (σ) obtained for Dy^{3+} is of the same order of magnitude as that obtained from direct excitation. In addition, the CIE 1931 chromaticity coordinates were calculated from fluorescence data to explore the overall color quality of the emitted light. The resulting coordinate lies in the orange region. For x = 0.5 mol % of Dy^{3+} it is near the edge showing a purer color, but moves towards the center white region indicating mixed colors as Dy^{3+} increases to 1.0 mol % and 1.5 mol %. This shows that the color coordinates depend on the composition of Dy^{3+} and can be engineered to produce white light or near white light. Overall, the combined spectroscopic and chromaticity analysis demonstrate that Dy^{3+}/Pr^{3+} co-doped bismuth boro-tellurite glasses are promising candidates for solid state lighting and some laser-based technologies.

STEM EDUCATION – MARQUETTE BALLROOM

10:45am **Aiming at the Wrong Target: What's Wrong With How We Teach Logarithms in Precalculus and How To Fix It?**

*[1]Laura Corey & [2]Jeremy Alm [[1]Illinois College; [2]Southern Illinois University, Carbondale]

Familiarity with and ability to use logarithmic functions is critical to understanding a variety of key scientific concepts. However, the standard presentation of logarithms in mathematics textbooks tends to focus on mechanical manipulations of expressions involving logarithms and on graphs of the logarithm function under standard transformations. We argue that this traditional paradigm for instruction in logarithms is not only inadequate for the actual needs of students in the sciences, but far from ideal even for mathematics students. We propose shifting the focus of instruction from symbolic manipulation and mechanical application of log rules to authentic quantitative uses of logarithms to analyze exponential processes and understand extremely large or extremely small measurements and quantities. We provide specific examples from chemistry and biology.

ZOOLOGY – CHEMINEE BALLROOM

10:30am Grad **Prevalence of *Cytauxzoon felis* Cytochrome-b Variants in Domestic Cats and Bobcats**

*Thanveer Aslam & Elliott A. Zeeman [Eastern Illinois University]

Cytauxzoonosis, a highly fatal disease of domestic cats and other felids caused by the apicomplexan *Cytauxzoon felis* is treated with atovaquone and azithromycin (A&A) with 60% (highest) survival rates. Atovaquone, a structural analog of a protozoan mitochondrial protein called ubiquinone, inhibits binding of ubiquinone to cytochrome bc1 in the electron transport chain. Atovaquone resistance has recently been associated with M128 cytochrome-b mutations in *C. felis*, however its prevalence and relationship to clinical disease in natural populations remains poorly defined. This study evaluated cytochrome-b mutations at M128 to determine the prevalence of each mutation in two felid populations, bobcats (*Lynx rufus*) and domestic cats (*Felis catus*). We also evaluated if these mutations were associated with clinical outcomes in domestic cats (clinically ill or subclinical infections). Domestic cat samples included subclinical infections (n=23) and clinical cytauxzoonosis cases (n=20), while the bobcat samples were subclinical. In domestic cats, 87% subclinical cats and 85% clinical cats were associated with M128V mutations. Likewise, M128I mutation was associated with 9% subclinical and 50% clinical cats' "A" point mutations, and 13% subclinical and 45% clinical cats' "T" point mutations. In bobcats (n=69), T was rare (10%), while A (67%) and G (80%) were common with all 3 documenting heteroplasmy. Overall T mutation was observed in 11% subclinical and 45% clinical infections. These outcomes establish enrichment of T mutation in clinical domestic infections and demonstrate a foundational cytochrome-b variant distribution in untreated populations. This supports a need to continue molecular surveillance of *C. felis* for probable resistance-associated variants.

ISAS POSTER PRESENTATION ABSTRACTS

1:00pm – 3:45pm, Saturday, April 18, 2026, in Cotillion Ballroom

*presenter, [school] with differences noted by superscript

AGRICULTURE

1:00pm **1** HS **Time of Thaw of Bull Semen Versus Motility Rate of Semen**

*Ella Eathington [Spoon River Valley High School/Spoon River College]

The purpose of this study was to investigate the effect of the time between thaw of bull semen and use and the motility rate of the sperm in each sample. Three trials were run in this experiment with all straws of semen collected from Bedrock, the bull. All semen samples were thawed in water at 95 degrees Fahrenheit for 45 seconds. The semen samples were then viewed under a light microscope on a petri dish that had a grid pattern used for counting the samples. The nonmotile sperm were counted and recorded. According to the results of this experiment, longer thaw times leads to lower motility in the sperm.

ANTHROPOLOGY & ARCHEOLOGY

2:30pm **2** UG **The Roles of Sexual Dimorphism and Age in Human Cranial Angle Measurements**

*Grace Vaughn & Miranda Karban [Illinois College]

Many studies have analyzed sexual dimorphism in adult skulls; however, little research has been done to investigate differences in male and female cranial angles pre- and post-puberty. Cranial angles were measured from a sample of lateral radiographs from 46 European-derived extant human subjects (22 male, 24 female) from The University of Toronto Burlington Growth Study. Subjects were sampled at two longitudinal age groups, before and after the onset of puberty (Age 1: 8.0-9.2 years Age 2: 14.0-16.4 years). Sex- and age-related variation in cranial angles was assessed at both age points using *t*-tests. In both sexes, the rhinion-nasion-glabella angle and gonion-gnathion-infradentale angle were found to change significantly between the two sampled age groups. The glabella-nasion-sella angle was found to change significantly between the two sampled age groups only in females, while the gonial angle was found to change only in males. No significant sexual dimorphism was found at Age 1, but the gonial angle was found to significantly vary between the sexes at Age 2. This timing corresponds with puberty, and could be caused by hormonal variation that leads to males developing a more protruding jawline. These results are relevant to forensic age and sex estimation from skeletal remains.

1:00pm **3** UG **Permanent Tooth Eruption Timing and Malocclusion Class in Modern Humans: A Dental Cast Analysis**

*Holly Pettit & Miranda Karban [Illinois College]

This study was conducted to assess the association between deviations in permanent tooth eruption times (based on American Dental Association guidelines) and malocclusion classification within modern humans. The sample of this study consists of dental casts of 30 North American subjects (15 female, 15 male) primarily of European descent obtained from the American Association of Orthodontists Foundation (AAOF) Craniofacial Growth Legacy Collection. Each malocclusion class was represented by 10 subjects. The deviation of eruption times from established norms was calculated based on the observation of initial gingival emergence for each tooth in the permanent dentition. Statistically significant deviations in eruption time were found between malocclusion classes for teeth #2, #4, #7, #10, and #14 (Universal Numbering System). These deviations were confined to the maxillary arch, with no significant deviations observed in the mandibular dentition. These deviations occurred mostly in subjects with Class II or Class III malocclusion, showing a general trend of early eruption in Class III and late eruption in Class II. This pattern of deviation may exist due to differences in bone density between the mandible and maxilla, leading to more complexity in root structure and eruption paths in the maxilla. Knowledge on standard eruption times of the permanent dentition and levels of deviation from those standard eruption times, especially of maxillary teeth, could potentially aid orthodontic treatment planning.

2:30pm **4** UG **Nasal Bone Development in Extant Humans**

*Jerica LaMarsh & Miranda Karban [Illinois College]

Human nasal bone development begins during gestation and continues throughout adolescence until maturity. Some studies suggest bone degeneration occurs in older adults. This study focuses on the development of nasal bone structure to determine if nasal bone shape is altered during childhood development or later in life. Cephalograms from a total of 30 European-derived extant human subjects were measured, including 15 longitudinal growth study participants, each sampled at two age points (age 1: 4.0-4.42 years and age 2: 15.83-18.17 years), and 15 adult postmortem crania. A total of 19 landmark and sliding landmark points were collected spanning from the glabella to the rhinion. Generalized Procrustes Analysis, Relative Warps Analysis (RWA), and Kruskal-Wallis tests were performed to analyze the data. Some shape variation was found between age group 1 and the other ages in RW1. Age group 2 and the postmortem sample clustered

together. Kruskal-Wallis tests found sexual dimorphism along RW3 in the postmortem sample. These results suggest that between age group1 and age group 2, the nasal root and the mid-nasal bridge develop and reach maturity. The sexual dimorphism is likely due, in part, to differences in the supraorbital (brow ridge) projection. Further studies could assess additional age points to determine more precise timing of nasal and anterior frontal bone development.

CELL, MOLECULAR, & DEVELOPMENTAL BIOLOGY

1:00pm **5** HS **Formula Feeding Downregulates Key Selenoproteins and Remodels Inflammatory Correlation Networks in the Neonatal Small Intestine**

*Abhinav Sathamraju Venkata [Adlai E. Stevenson High School]

Formula Feeding (FF) is a well-studied risk factor for necrotizing enterocolitis (NEC), a devastating gastrointestinal inflammatory disease in premature infants. Evidence shows that FF increases NEC incidence 6- to 10-fold versus Breastfeeding (BF). Although advances have been made in understanding how FF primes the gut for injury, specific mechanisms and relationships remain unknown. This study investigated how FF impacts members of the selenoproteome, which are proteins containing selenocysteine (Sec). Sec is a crucial amino acid in antioxidant and anti-inflammatory pathways and prevents ferroptosis-mediated injury associated with NEC. Using Reverse Transcription Quantitative PCR (RT-qPCR), this project measured the gene expression of a 9-gene panel, consisting of selenoprotein-encoding genes (SelW, SelM, Gpx4, SelP, SelI, SelS) and pro-inflammatory signaling molecules (Il6, Tlr4, Tnfa) in a feeding-based neonatal murine model. Results revealed widespread downregulation of selenoproteins, with a 32% ($p < 0.05$) decrease across the 6-gene selenoproteome panel, and a corresponding ~6-fold increase ($p < 0.05$) across inflammatory markers. Crucially, this study discovered a novel molecular uncoupling of the homeostatic link within the Gpx4-Tlr4 axis (BF: r = 0.92; FF: $r = -0.07$), the Gpx4-Tnfa axis (BF: $r = -0.68$; FF: $r = -0.06$), and a dysregulated coupling of the Gpx4-Il6 axis (BF: $r = 0.16$; FF: $r = 0.75$), with $p < 0.05$ for all significant correlations. This change in molecular co-regulation suggests a potential novel framework for understanding how FF influences inflammatory and selenoprotein pathways. These findings highlight the selenoproteome as a potential therapeutic target for NEC.

2:30pm **6** UG **Investigating the Transcriptomic Response of Chitin Synthase Genes and Novel Cold-Induced Factors in *Tetrahymena thermophila* Following Cold Shock**

*Alexander Sebastian, Jonathan Campo, Asha Chhatwal, David Santiago Suarez Mesa, & Hannah Organ [Bradley University]

Tetrahymena thermophila, unlike other ciliates, has not been observed to undergo encystment, which in similar species involves the formation of a chitin-based cyst wall in response to environmental stress. Despite this, the *T. thermophila* genome maintains 12 Chitin Synthase (CHS) genes, suggesting these cells either perform chitin biosynthesis under different conditions, or that they utilize these genes for another purpose. To help understand their functions in *T. thermophila*, we tested their expression under a condition known to trigger encystment in other ciliates, cold stress. In this pilot project, cells were allowed to grow to a high density at 30 °C, then half of the cells were shifted to 4 °C for four hours. Total cell lysates were produced and sent for RNA-Seq whole transcriptome analysis. Differential gene expression analysis suggested no substantial increase or decrease for the twelve chitin synthase genes. Conversely, many genes encoding proteins previously known to be expressed under cold stress, including granule lattice proteins, did show these expected changes. Interestingly, several genes encoding proteins of unknown function also showed higher expression during cold stress. We are currently cataloging and characterizing these genes to better understand the complement of proteins necessary for growth under different temperatures in *T. thermophila*.

1:00pm **7** UG **Effects of Low Protein Diet on Inner Ear Morphology in *Mus musculus***

*Lauren Kooi & Robert W. Burroughs [Bradley University]

The tetrapod inner ear is a complex structure which contains the organs responsible for hearing, balance, acceleration, and rotation. Because the inner ear contains organs essential to terrestrial locomotion and hearing, it should resist variation during embryonic development. Here, we present the results of an analysis of inner ear morphology of the common mouse, *Mus musculus.* These specimens are from a controlled feeding experiment where pregnant and nursing mothers were fed either a low-dietary protein (10%) treatment or control (20%) diet. Low-dietary protein has been associated with perturbed embryonic development, such as changes to tooth and cranial morphology, and protein and gene expression. Specimens from treatment and control groups were euthanized at 28-days postnatal to ensure that the bulk of cranial development had occurred and that they were weaned from mother's milk. These specimens were µCT scanned at a resolution of 19.9-20µm and post-processed by a single author (LEK). Post-processing consists of creating a 3D digital endocast of the inner ear via segmentation of the µCT scan, which allows for observation of morphological variation. We have observed, qualitatively, changes in the orientation of the horizontal canal and decreased definition of the cochlear spiral. Based on these observations our future efforts will involve quantitative assessment using morphometric landmarks of semi-circular canal and cochlea variation.

4:30pm 8 UG **Mound Formation in *Schizophyllum commune* Does Not Require Blue Light Signaling**

*Lexie Bartimus, *Elizabeth R. Moss, & Thomas J. Fowler [Southern Illinois University Edwardsville]

The wood-rotting, mushroom-producing basidiomycete *Schizophyllum commune* has been a model genetic organism in the laboratory for understanding mating-types, hyphal structure, and mushroom formation for over a century. The recessive mound (*mnd*) mutant of *S. commune* makes indeterminately-growing hemispherical formations of hyphae on solid media. Some developmental markers and hyphal formations typical for dikaryotic fruiting are also found in mounds to support a hypothesis that mounds represent a malfunction in fruiting body development. Dikaryons that are homoallelic for the mound mutation (*mnd*, *mnd*) do not produce fruiting bodies. Blue light perception through the WC-1/WC-2 complex is required for successful fruiting body formation. Dark and light treatments indicated that mound formation may not require blue light signaling. To look at this genetically, *wc-2* disruption and *mnd* double mutants were constructed and mated with compatible wild-type and mutant strains. Mounds were observed to form on homoallelic disrupted *wc-2* dikaryons, but no fruiting bodies formed from these matings. Our results support a hypothesis of a developmental pathway for mounds that does not require blue light signaling. Mound formation may represent an early diversion from the developmental pathway for fruiting prior to critical blue light signaling. Complete disruption of fruit body development in homoallelic *mnd* strains either places *mnd* directly in the pathway toward fruiting or shows it indirectly inhibits an essential component of the dikaryotic fruiting pathway.

1:00pm 9 UG **Search for New Antimicrobial Compounds from *Paenibacillus* sp. Collected from Asian Carp**

*Livia Kimberlin, *Cody Clayton, & Keith Johnson [Bradley University]

Antimicrobial resistance is a major global health threat, driven by antibiotic overuse and misuse. Resistant bacteria render treatments ineffective, increasing mortality and costs. Antibiotic discovery has stagnated, with only one new class introduced in two decades. Antimicrobial compounds have traditionally been isolated from soil, but the gastrointestinal tract of Asian carp offer a novel source due to their invasive presence in the Illinois River, their abundance, and non-exploitation, potentially promoting the development of antimicrobial compounds to protect against pathogens. A promising intestinal bacterial isolate derived from Asian carp, termed NB 8-1, was previously identified as a *Paenibacillus sp.* The bacteria produces an unknown antimicrobial compound that is effective against 7 of 10 tested ESKAPE-like bacterial strains. The antimicrobial compound has been shown to be more effective on TSA and NB media in the absence of glucose. Genomic information regarding the *Paenibacillus sp.* will be presented in addition to solubility and composition of the compound.

2:30pm 10 UG **Transcriptomic Analysis of Methionine Sulfoxide Reductase-Associated Oxidative Stress Networks in *Tetrahymena thermophila***

*Matias Bowens & Naomi Stover [Bradley University]

Oxidative stress, driven by reactive oxygen species (ROS), contributes to protein damage, aging, and neurodegenerative disease. Methionine sulfoxide reductases (MXRs) are conserved enzymes that repair oxidized methionine residues and help restore protein function. Previous work in *Tetrahymena thermophila* has identified multiple MXR genes and demonstrated their upregulation in response to oxidative stress; however, the broader transcriptional networks in which these genes function are still unknown. This study characterized genome-wide gene expression changes associated with oxidative stress and identified genes co-regulated with MXRs in *T. thermophila*. Cultured cells were exposed to oxidative stress conditions, and whole cell lysates were sent for RNA sequencing (RNA-seq) transcriptomic analysis. Differential gene expression analysis to identify genes and pathways altered under oxidative stress conditions is underway. We anticipate identifying coordinated upregulation of antioxidant defense genes, protein quality control pathways, and unique metabolic regulators that may function alongside MXRs. This study will provide insights into the integrated oxidative stress response network in a eukaryotic model organism and may contribute to a broader understanding of conserved mechanisms that protect cells from oxidative damage.

1:00pm 11 HS **Different Genres of Music vs the Speed of a Mouse Through a Maze**

*Morgan Guppy [Adlai E. Stevenson High School]

This experiment aimed to examine how different genres of music (reggae, pop, and classical) affect learning and success rates. I hypothesized that the type of music played during the experiment would significantly influence the ability of the mice to complete a maze successfully. Three mice were exposed to all three genres of music in different trials to ensure a fair assessment. For each trial, the mice were placed at the start of the maze, and selected genres of music were played throughout their attempts to find the food at the end of the maze. The results of these trials indicate that classical music was the most successful out of the three genres of music, after averaging all three times of each mouse, classical music was significantly faster than the other genres of music.

1:00pm 13 HS **Next-Generation Computational Design of Ultra-Precise Prime Editing Systems for Safe and Targeted Correction of the Cardiac Sodium Channel Gene (SCN5A)**

*Mythrey Govindarajan [Twin Groves Middle School]

This research demonstrates a computational approach to designing highly specific pegRNAs for prime editing of the SCN5A gene. By reducing off-target effects, it contributes to safer gene-editing therapies, which could eventually help prevent life-threatening heart rhythm disorders and serve as a framework for improving therapies for other genetic diseases globally. This is accomplished by developing and computationally validating an optimized prime editing sgRNA targeting a conserved Exon 2 region of the SCN5A gene, designed to improve predicted editing efficiency by at least 25% and reduce potential off-target interactions by 40% compared to a reference sgRNA. This study analyzes SCN5A Exon 2 by identifying conserved regions to design a prime editing guide RNA (pegRNA) and a reference sgRNA. In silico tools will evaluate predicted editing efficiencies and genome-wide off-target risks. The optimized pegRNA will be quantitatively compared to the sgRNA to assess improvements in specificity and safety. Results will be visualized and documented to support conclusions regarding the performance and safety of the prime editing system. The optimized design exceeded the 25% efficiency goal, showing a 34.2% predicted improvement over the reference, mainly due to the shorter RTT. Off-target analysis revealed zero high-risk hits for the champion spacer, compared to two for the reference, achieving a 100% reduction and surpassing the 40% reduction target.

2:30pm 14 UG **Reactivation of Liver Function Through Genomic Modification**

*Onyinye Umealajekwu & Gary Bulla [Eastern Illinois University]

Hepatocellular carcinoma (HCC) is the most common primary malignant tumor of the liver, and poor diagnosis of HCC patients is associated with the poorly differentiated state of the majority of HCC tumors. Differentiation therapy targets the potential reversal of dedifferentiation of the tumor cells and is considered a promising target for anti-tumor therapy. Here we use a model cell culture system to understand the genetic pathways driving differentiation. Our studies are designed to study the role of chromatin remodeling in the reactivation of silenced liver-specific gene expression, using a well-characterized tissue culture model. First, we have introduced expression vectors containing genes that encode liver-enriched transcription factors into hepatoma variant cells. These cells, which show only partial rescue of liver function, were epigenetically modified using a demethylation agent (5-aza-cytosine) and a hyperacetylation agent (sodium butyrate). Liver gene expression was monitored by measuring RNA levels (via RT-qPCR analysis) and by the ability of cells to survive in selective medium that requires gene reactivation.

1:00pm 15 HS **The Effect of LRRK2 Mutations on Presynaptic Endocytosis and Synaptic Vesicle Recycling: A Novel Approach to Understanding LRRK2's Role in the Pathogenesis of Parkinson's Disease**

*Sasvat Chigurupati [Adlai E. Stevenson High School]

Parkinson's disease(PD) is the second most prevalent neurodegenerative disorder, affecting over 11.7 million people globally. It's characterized by the progressive degeneration of nigrostriatal dopaminergic neurons and motor system disorders. While neuronal death ultimately drives the clinical symptoms of PD, accumulating evidence indicates that synaptic dysfunction is an early and consequential event that precedes overt neurodegeneration. Currently, the effect of Leucine-Rich Repeat Kinase 2(LRRK2) G2019S—an activating kinase mutation, the most common cause of familial PD, and a major risk factor for sporadic PD—on these synaptic processes remains unclear. This experiment employed a LRRK2 G2019S mouse model (n=4) with matched C57BL/6 wild-type controls (n=4) to elucidate if the LRRK2 mutation impairs presynaptic endocytosis and synaptic vesicle recycling. Mice 3 months of age, which exhibited no overt motor deficits, allowed for a window to investigate prodromal synaptic changes. Immunohistochemistry analysis of the dorsal striatum in LRRK2 mutant mice, where vulnerable dopaminergic neurons form synapses, revealed dysregulation of key presynaptic endocytic proteins such as auxilin (p<0.0001), a clathrin uncoating protein that's vital in presynaptic endocytosis and synaptic vesicle recycling, and clathrin light chains (p<0.0001), crucial regulatory subunits of the clathrin molecule. Consistent with these molecular changes, primary dopaminergic neuronal cultures derived from LRRK2 G2019S mice showed a reduction in auxilin expression (p<0.0001) by 27.5%, supporting a model in which LRRK2-linked PD converges on presynaptic endocytosis impairment. These findings suggest a promising new clinical target for early intervention in LRRK2-related PD.

2:30pm 90 **Characterization of the K14TRT Mouse Mammary Cell Line as Epithelial/Mesenchymal Hybrid Cells**

*Wyatt Kinney, *Brandon Wood, Isabella Nieto, Talitha T. Rajah, & Stephanie Dance-Barnes [DePaul University]

Epithelial-mesenchymal transition (EMT) is a key feature of how epithelial tumors acquire mesenchymal traits, leading to cancer cell invasiveness, motility, and drug resistance. Recent literature reports suggest that transitions from EMT and the reverse process, "MET", are not binary processes, but rather involve a spectrum of epithelial/mesenchymal (E/M) hybrid states on an epithelial-mesenchymal continuum. Further, cancer cells seem to have an ability to dynamically shift their phenotypic expression along this spectrum in both directions; a phenomenon now known as epithelial/mesenchymal plasticity (EMP). These (E/M) hybrid cells have been shown to exhibit greater EMP, stemness, and adaptability, resulting in a heightened metastatic potential leading to the lethality attributed to breast cancer. This clinical relevance underscores a

current demand for a model E/M hybrid cell line. Preliminary microarray data suggest that K14TRT cells, a mouse mammary cell line that is deficient in BRCA 1, Claudin 7, and p53, exhibit both mesenchymal and epithelial characteristics. This cell line also shows a hybrid epithelial-spindloid morphology. The current study aimed to better characterize K14TRT cells as E/M hybrid cells by comparing protein expression relevant to EMT/MET by western blotting and immunodetection. MDA-MB-231 cells, a well know human breast cancer cell line that has mesenchymal traits and is highly aggressive, was thus chosen to represent the baseline for protein expression on the mesenchymal end of the spectrum. Our results indicate that the K14TRT cells have the following unique set of alterations in EMT/MET signal protein expression when compared to the highly aggressive MDA-MB-231 human breast cancer cell line: Snail 1, SLUG and TWIST 1 (inducer of EMT) were highly expressed in K14TRT cells compared to MDA-MB-231 cells. Shared targets of these EMT proteins showed an increase in Vimentin and N-Cadherin (mesenchymal markers) and suppression of the epithelial marker E-Cadherin in K14TRT cells. Surprisingly, despite K14TRT cells being deficient in Claudin 7, expression of Claudin 1 (an epithelial cell marker and tight junctional protein) was maintained. ZO1 (another tight junctional protein that pairs with of Claudin 1) was absent in K14TRT cells. The higher expression of Claudin 1 and an absence of ZO1 as compared to MDA-MB-231 cells supports the idea that the epithelial junctions have been partially destabilized. These E/M marker proteins results taken together with the epithelial-spindloid morphology of K14TRT cells, could suggest that K14TRT cells exist in a hybrid E/M cell type and might show plasticity in transitioning between the epithelial and mesenchymal states according to the needs of the cell. This plasticity would allow cells to utilize the epithelial characteristics of cell proliferation in tumor development and the initial stages of secondary colonization, while using mesenchymal characteristics for migration, invasion, and metastasis.

CHEMISTRY & BIOCHEMISTRY

2:30pm **16** Grad **Quantitative Analysis of Polycylic Aromatic Hydrocarbons in Recycled Tire Materials Using Gas Chromatography**

*Alayna Brown & Brian Bellott [Western Illinois University]

Polycyclic aromatic hydrocarbons (PAHs) are a class of organic pollutants commonly associated with petroleum-derived materials, including recycled tire rubber. Due to their known carcinogenic and mutagenic properties, accurate detection and quantification of PAHs in tire-derived materials is critical for environmental and forensic applications. In this study, selected PAHs were extracted from recycled tire crumb samples and analyzed using gas chromatography with flame ionization detection (GC-FID). Sample preparation involved solvent-based extraction followed by filtration to remove particulate matter prior to instrumental analysis. External calibration curves were constructed using PAH standards to enable quantitative determination of target analytes. Method performance was evaluated through assessment of linearity, precision, and repeatability, including interday and intraday variability. The results demonstrated good linearity across the calibration range with acceptable reproducibility, indicating the method's suitability for PAH determination in complex rubber matrices. This work contributes to ongoing efforts to characterize PAH content in recycled tire materials and supports the development of reliable analytical methods for forensic and environmental monitoring.

1:00pm **17** UG **Synthesis of ZnO Nanoparticles**

*Angela Balderas & Brian J. Bellott [Western Illinois University]

There are two major metals used in sunscreens for UV protection. Titanium and zinc metals are well known to absorb UV-rays and prevent penetration of those rays to the skin. This helps prevent skin damage due to the sun. This study is focused on only zinc oxide particles. Zinc oxide nanoparticles of different size regimes and morphology are examined via UV-Vis spectroscopy and Scanning Electron Microscopy to see the correlation between size/shape and effectiveness of UV absorption.

2:30pm **18** UG **Comparison of Different Preparation Methods for Analysis of Catfish Skin**

*Ashley Perez & Brian J. Bellott [Western Illinois University]

When working with catfish, the first obstacle to analysis is the mucus layer. The mucus layer protects catfish from numerous sources of harm such as UV-radiation, infections/parasites, and has antibacterial properties. This layer is a complex matrix composed of glycoproteins. This matrix forms a thick mucus layer upon contact with water. This makes imaging samples difficult. In addition to the mucus layer, catfish skins typically contain dark pigments which mask features on the skin. This project is designing a preparation procedure for the removal of the mucus layer, lightening of the pigment, and leaving the remaining features of the catfish skin unchanged.

1:00pm **19** UG **Recycling Copper Catalysts for Sustainable Triazole Synthesis in Aqueous Media**

*Beamlak Hiltework & Jocelyn Lanorio [Illinois College]

The copper(I)-catalyzed azide-alkyne cycloaddition (CuAAC) reaction is a central reaction in click chemistry due to its high regioselectivity, efficiency, and functional group tolerance. While extensively used, the reusability of Cu(II) precursors in aqueous conditions remains underexplored. This study investigates the catalytic performance and recyclability of $CuSO_4$,

$CuCl_2$, and CuSCN in CuAAC reactions between benzyl azide and phenylacetylene. $CuSO_4$ and $CuCl_2$ facilitated the regioselective formation of 1-benzyl-4-phenyl-*1H*-1,2,3-triazole with yields exceeding 90% in the initial cycle. Cu(I) compound, CuSCN exhibited complete conversions, but of low yields. Reactions using $CuSO_4$ with sodium ascorbate as the reducing agent retained activity over four cycles with minimal catalyst leaching, whereas $CuCl_2$ remained efficient for up to three cycles. Products were characterized by FTIR, TLC, GC-MS, and yield trends were tracked to assess catalyst degradation. These findings support the use of aqueous Cu(II) catalysts for sustainable, scalable, and selective synthesis in triazole chemistry.

2:30pm **20** Grad **GXXXG Motif Mediated Protein Dimerization in Glutamate Carboxypeptidase II**

*Deep Patel & Gopal Periyannan [Eastern Illinois University]

Glutamate Carboxypeptidase II (GCPII) is a transmembrane, zinc-dependent metallopeptidase found in various organisms, including humans. In humans, GCPII is expressed as five paralogs across multiple tissues—such as the brain, prostate, and intestine—and is predicted to exhibit distinct, tissue-specific hydrolase activities. Documented activities include the cleavage of folyl-poly-γ-glutamate in enterocytes and *N*-acetyl-aspartyl-glutamate (NAAG) in neurons. While GCPII is known to facilitate folate uptake across the intestinal mucosa and influence stroke pathology, its functions in many other tissues remain elusive. Because protein dimerization is essential for GCPII enzymatic activity, a comprehensive understanding of its diverse proteolytic and biochemical roles requires a molecular-level investigation of its structural complexity. Comparative sequence analyses reveal a GxxxG dimerization motif (where 'x' is a hydrophobic residue) within the GCPII transmembrane domain (TMD). We hypothesize that the tissue-specific functional variations of GCPII in higher organisms are mediated by the modulation of this GxxxG motif through unique lipid-protein and protein-protein interactions. Notably, the four transmembrane paralogs of GCPII feature GxxxG motifs at varying depths within the membrane, suggesting specialized lipid environments. Ab Initio Density Functional Theory (DFT) calculations further indicate that the flanking sequences of these motifs influence dimer stability. To investigate these dynamics, we have cloned, purified, and characterized a FRET-labeled (SfTq-mNG) GCPII-TMD construct. Future studies will utilize synthetic lipid nanodiscs mimic biological membrane to analyze GxxxG-mediated interactions in the native-like lipid environment via spectroscopy.

1:00pm **21** HS **Using ML to Determine Whether Single Atom Catalysts Function Under the Same Fundamental Properties as Bulk Metal Catalysts for Carbon Dioxide Reduction Reactions**

*Jessica (Yunan) Jiang [Adlai E. Stevenson High School]

The purpose of this study is to determine whether single-atom catalysts (SAC) operate under the same fundamental catalytic principles as bulk-metal catalysts (BMC) for electrochemical CO_2 reduction (CO_2RR). While BMC follow strict thermodynamic scaling relations, SAC are hypothesized to break these due to their structure. This study aims to see if elemental properties preserve scaling relations in atomic isolation or if metal-based theory fails to extrapolate to SAC performance. A dataset of CO, COOH, H adsorption energies, applied potentials, and experimental faradaic efficiencies (FE CO) for various BMC and SAC was compiled. A Random Forest Python machine learning model was trained exclusively on BMC descriptors to establish a scaling relation baseline, then used to predict FE CO of unseen SAC data. Feature importance rankings were also analyzed to compare the primary descriptors driving performance in each catalyst class. Accuracy was evaluated using mean absolute error (MAE) and linear regression. The BMC model failed to predict SAC performance (MAE = 22.89%, *r*-squared =0.00). Feature importance analysis revealed a logic shift between the two catalysts. While BMC performance is determined by H-adsorption, SAC performance is driven by the selectivity gap (COOH adsorption - H adsorption). SAC achieved a near- ideal selectivity gap of -0.004 eV, a zone that BMC can't reach. This shows that the structure of SAC enables the decoupling of intermediates, allowing them to ignore the thermodynamic limits of BMC. However, high CO adsorption importance on SAC performance shows product poisoning, where strong binding prevents product release, which limits performance.

2:30pm **22** UG **Exploring Zinc(II) Catalysis in Aqueous Azide–Alkyne Cycloaddition for Sustainable Triazole Formation**

*Princess Akyea-Obesebea & Jocelyn P. Lanorio [Illinois College]

The copper(I)-catalyzed azide–alkyne cycloaddition (CuAAC) is a widely used reaction in synthetic chemistry, producing 1,2,3-triazoles with high yield and regioselectivity. However, concerns over copper toxicity in biological systems and waste treatment have prompted the investigation of greener alternatives. In this study, we evaluate common Zn (II) salts—$Zn(OAc)_2$, $ZnCl_2$, and $ZnSO_4$—as catalysts for the cycloaddition between benzyl azide and phenylacetylene. Reactions were conducted in aqueous and solvent-free conditions. Product mixtures were analyzed using TLC, IR, GC–MS, and ^1H NMR spectroscopy. $Zn(OAc)_2$ provided near-quantitative conversion and favored the formation of the 1,5-disubstituted triazole, contrasting with CuAAC, which yielded the 1,4-isomer exclusively. $ZnSO_4$ gave moderate conversion and a higher proportion of the 1,4-isomer, while $ZnCl_2$ was less effective and required modified extraction methods due to solubility issues. These results demonstrate that Zn (II) salts offer tunable reactivity and greener pathways for triazole synthesis.

1:00pm **23** UG **Examination of Different Digestion Media for Microplastics Analysis**

*Rachel James & Brian J. Bellott [Western Illinois University]

Microplastics are a growing concern on the global scale appearing in rivers, ponds, oceans, soil, and air. Microplastics have also been found in commercial food and drink products consumed by humans. Microplastics are plastic materials on the order of 5 mm or smaller in size. They are added to the environment through numerous different processes with the largest contributor being personal care products and lesser contributions from the breakdown of other plastic debris. Microplastics in humans can cause several different problems including cell damage and hormone disruption via the endocrine system. This work will look at different digestion media for processing samples from the MIssissippi river basin. This study has resulted in showing that the leaf extracts contained the most flavonoids, next to the the stem of the *Acmella calirrhiza* then the stem of the *Acmella alba.* This correlated with the previous anticancer research performed. These results further prove that these *Acmella* extracts are a great candidate for further research toward cancer treatment drugs.

2:30pm **88** UG **Can Ordinary Nickel Do the Job? Exploring Common Nickel Salts in Click Chemistry.**

*Camille Prefountain & Jocelyn Lanorio [Illinois College]

Click chemistry, particularly the azide–alkyne cycloaddition (AAC), is a cornerstone in modern synthetic methods due to its high selectivity, biocompatibility, and functional group tolerance. While Cu(I)-catalyzed AAC (CuAAC) is widely utilized, nickel presents an earth-abundant and potentially less cytotoxic alternative. This study explores the catalytic efficiency of three inexpensive Ni(II) salts—$NiCl_2$, $NiSO_4$, and $NiCl_2(PPh_3)_2$—in promoting the cycloaddition between benzyl azide and phenylacetylene under aqueous conditions. Using sodium ascorbate as a reductant and distilled water as a green solvent, optimized conditions yielded up to 78% product. GC-MS and NMR analyses revealed that the NiAAC reaction produced both 1,4- and 1,5-disubstituted triazole isomers in an approximately 1:1 ratio, contrasting with the regioselectivity typical of CuAAC. These findings demonstrate ordinary nickel salt's potential to access underexplored regioisomers like 1,5-triazoles, offering a customizable and eco-friendly path in click chemistry.

COMPUTER SCIENCE

2:30pm **24** Grad **AI-Based Framework for Intrusion Detection and Automated Prevention in Cloud Computing Environments**

*Abiodun Adebanjo & Tahir Khan [Western Illinois University]

Cloud computing has become a foundational infrastructure for modern organizations across sectors such as education, healthcare, business, and government. Despite its scalability and flexibility, cloud environments introduce significant security challenges due to their dynamic architecture and expansive attack surface. Traditional security mechanisms, including rule-based firewalls and signature-based intrusion detection systems, often struggle to detect and respond to sophisticated and previously unseen threats. This research proposes and evaluates an Artificial Intelligence (AI)-based framework that integrates both intrusion detection and automated prevention within cloud computing environments. Unlike many existing AI-driven security solutions that focus primarily on detection and depend on human intervention for mitigation, this study introduces a closed-loop system that autonomously detects, analyzes, and responds to threats in real time. A simulated cloud environment was developed using virtualized and containerized services representing common cloud components such as web servers, databases, and authentication systems. Realistic normal and malicious traffic patterns were generated, including denial-of-service attacks, scanning activities, brute-force login attempts, and injection attacks. Network telemetry was collected and analyzed using open-source monitoring tools, and relevant features were extracted to train supervised, unsupervised, and hybrid machine learning models. A forensic correlation layer enhanced detection confidence, while an automated response module executed mitigation actions such as blocking malicious sources and isolating compromised services. Results demonstrate that the AI-based framework effectively detects both known and previously unseen attacks. Autonomous prevention significantly reduced response time compared to detection-only systems, while forensic correlation improved decision transparency and reliability. Overall, this study demonstrates the feasibility and effectiveness of an AI-driven autonomous intrusion detection and prevention system in enhancing cloud security resilience.

1:00pm **25** HS **Uncovering the Hidden Regulators in the Human Interactome via Hyperbolic Graph Convolutional Network Learning**

*Andy Dong [Hinsdale Central High School]

Protein–protein interaction (PPI) networks are widely used to identify molecular drivers of diseases (e.g., cancers). However, traditional computational analyses tend to prioritize highly connected proteins ("hubs"). Although these hub proteins are often biologically important, less-connected proteins may also play critical regulatory roles but are frequently overlooked by existing methods. To address this limitation, this project proposes a novel approach: embedding the interactome into hyperbolic space to identify non-hub "Hidden Regulators" that could represent previously unrecognized therapeutic targets. A Hyperbolic Graph Convolutional Network (HGCN) was trained to embed the human interactome into the Poincaré disk model, a geometry that naturally reveals hierarchies. "Hidden Regulators" were identified as geometrically central proteins with low connectivity. Biological significance was validated via Kaplan-Meier survival

analysis in breast cancer patients. Additionally, context-specificity was evaluated using 156 cell-type-specific networks across diverse physiological systems (e.g., immune and neurological). The model successfully identified "Hidden Regulators" that standard algorithms overlooked. In breast cancer analysis, 78% of the top-ranked candidates significantly predicted patient survival, outperforming randomly selected proteins (38%, $p<0.01$). Furthermore, these regulators are not generic housekeeping genes but are highly specialized: on average, 76% of identified top candidates were unique to their specific physiological system. The application of this system may offer a strategy to identify novel therapeutic targets that are critical to disease progression.

2:30pm **26** HS **A Machine Learning Approach to Identify Features Governing Molecular Photostability from a Small Experimental Dataset**

*Bowen Li [Independent]

The NSF Molecule Maker Lab Institute recently published a study that used machine-learning models to investigate molecular features governing photostability. The researchers synthesized 44 molecules, performed DFT calculations, and generated 114 physical and chemical descriptors. The researchers then used backward stepwise feature selection and trained 12,996 two-feature and 2.5 million four-feature support vector regression (SVR) models, and identified the most common features in the models. The analysis found that the triplet density of states (TDOS) and the number of heteroatoms are the top features in determining molecular photostability, and discovered an important photodegradation mechanism via triplet energy transfer. The data used in the study is subject to the typical “high-dimensional, low-sample-size” problem, where a small number of molecules are described by a large number of features, many of which might be irrelevant. As the experiments are expensive and the data are limited, this project uses more advanced feature engineering and machine learning algorithms to extend the study. Particularly, the project uses regularized regression (LASSO) and recursive feature elimination approaches for feature selection, investigates the feature importance and model explainability to extract deeper scientific insights from the experimental data.

1:00pm **27** Grad **Operationalizing AI on Secure FHIR Pipelines: A Zero-Trust Cloud Reference Architecture for EHR Interoperability**

*Femi Oke [Western Illinois University]

Healthcare organizations increasingly need to move beyond standards-based data exchange and deploy AI capabilities directly on electronic health record (EHR) data. Yet an interoperability pipeline alone does not solve cloud security, consent-aware data use, workload identity, auditability, or model governance. This paper proposes a zero-trust cloud reference architecture that extends a secure FHIR integration pipeline into an AI-ready operating model for interoperable EHR systems. The design is grounded in HL7 FHIR for structured exchange, SMART App Launch and Bulk Data Access for controlled application and population-level access, NIST zero-trust guidance for identity-centered policy enforcement, the HIPAA Security Rule for safeguards over electronic protected health information, and recent U.S. policy direction on predictive AI transparency in certified health IT. The architecture organizes the solution into five layers: clinical data sources, an interoperability edge, a zero-trust control plane, a secure cloud data and AI plane, and a governance and monitoring layer. A representative readmission-risk use case illustrates how FHIR resources can be standardized, tokenized, transformed into features, scored by a registered model, and returned to clinical applications without weakening consent, least-privilege access, or audit requirements. The primary contribution is not an empirical benchmark, but a practical reference model that clarifies how secure FHIR exchange can evolve into cloud-scale AI deployment with policy-based access control, consent services, key management, lineage, drift monitoring, transparency artifacts, and incident response. The paper also outlines a phased implementation roadmap for health systems that want to operationalize AI on interoperable EHR infrastructure while preserving security, privacy, and regulatory accountability.

2:30pm **28** HS **Can People Identify AI vs. Human Writing?**

*Kelly Liu [Skinner North Classical School]

As AI technology is advancing rapidly, we must prevent misinformation and promote safe and responsible AI use. The purpose of my study was to analyze if humans could distinguish between AI generated text from human written text, and to understand whether AI experience, education level, and topic had a significant impact on AI writing recognition. I administered 55 surveys to participants with different AI use experience [rarely to frequently] and education level [middle school, undergraduate, graduate]. Responders were asked to assess AI-generated versus human written texts in informational and persuasive topics, and select the criteria they used to make their decisions. In conclusion, I found that humans can distinguish between AI and human text, but with limited capability. Those with more AI experience did not perform better in the assessment. Contrary to my hypothesis, there was no clear correlation between general education level and recognition ability. Persuasive text was slightly more challenging to assess than informative. Sentence structure and vocab were the two most commonly selected criteria. In the future, I would consider increasing sample size and investigating if further training improves performance.

EARTH SCIENCE

1:00pm 29 HS **The Effect of Sea Surface Temperature on the Distribution and Carbon Sequestration Potential of *Prochlorococcus***

*Ekaansh Ravuri [Adlai E. Stevenson High School]

This project investigated the effect of sea surface temperature (SST) on the global distribution and carbon sequestration potential of *Prochlorococcus marinus*, a marine cyanobacterium that plays a major role in the global carbon cycle. Global SST data from the NOAA ERSST v5 dataset were analyzed using Python to evaluate how changes in temperature influence the percentage of ocean surface within the thermally suitable range for *Prochlorococcus* growth. A defined optimal temperature range for the high-light ecotype (HLII) was applied to long-term SST records to calculate temporal changes in habitable surface waters, and spatial maps were generated to identify suitable and unsuitable regions. Modeled distributions were compared with published observations to assess consistency with known *Prochlorococcus* occurrence patterns. Results support the hypothesis that increasing SSTs are associated with an expansion of thermally suitable habitat for HLII *Prochlorococcus*. Statistical analysis revealed a strong, positive, and statistically significant relationship between global mean SST and the percentage of ocean surface within the optimal temperature range, with habitable area increasing by approximately 1.6% per 1°C rise in SST. These findings suggest that recent ocean warming has expanded surface conditions favorable to *Prochlorococcus*, potentially enhancing its contribution to marine carbon sequestration. Understanding this temperature-dependent response improves predictions of how climate change may influence phytoplankton distribution, global carbon cycling, and future ocean ecosystem dynamics.

ENGINEERING & TECHNOLOGY

2:30pm 30 HS **Which Wind Turbine Generates the Most Voltage?**

*Arav Moonat [Benjamin Franklin Middle School]

The purpose of this experiment is to determine which blade shape and size on a wind turbine will generate the most electricity. The experimenter chose this topic because they want to develop the most renewable energy possible using wind turbines since fossil fuels are running out. Energy users can benefit from the results of this experiment because then there would be more renewable electricity being produced. There will be higher net electricity production. Find a clear, stable place with no wind. Get your wind turbine mount and attach it to a table. Attach your wind turbine base to the mount and secure it in place. Take the multimeter and attach it to the motor. Attach a light bulb to the motor. Get the HAWT(Horizontal Axis Wind Turbine) blade and attach it to the wind turbine base. Attach the motor to the blade. Now that the circuit is complete and the motor is connected to the blade, get a paper and pencil or a device to record results. Place the table fan in front of the wind turbine 10 cm away from the wind turbine. Ensure everything is securely in place, then turn the fan on. Record the highest amount of energy seen, and turn the fan off after 30 seconds. Record results and repeat the experiment four more times with the same blade, for a total of five trials. Remove the HAWT blade and repeat steps 1-11 with all the other types of blades. Out of the five types of wind turbines tested, the Horizontal Axis Wind Turbine performed the best and produced the most voltage, proving the hypothesis to be correct. Amongst the Vertical Axis Wind Turbines (VAWT), the Savonius did the best with the H-rotor next, and then the Helical, and last was the Darrieus. This data led to the solution that the HAWT generates the most voltage, but it costs more to make and is a lot bigger in size than VAWTs. To get this solution, some problems needed outside variables to be taken into consideration, like the fan used in the experiment. Something changes for next time is to make a bigger scale wind turbine with a motor that can generate more, so the wind turbines can actually light up the LED. Also, try to switch the material being used to something lighter so that the weight is around the same for all of them to sum it up, the hypothesis was correct with HAWT the most voltage.

1:00pm 31 HS **The Effect of Different Machine Learning Surrogate Models for Bayesian Optimization on the Thrust-to-Power Ratio of Physical Electrohydrodynamic Ion Thrusters**

*Elliott Choi & Avitej Akula [Adlai E. Stevenson High School]

Humanity continues to be constrained by terrestrial resource requirements, necessitating decarbonized propulsion for space and atmospheric applications. Ion thrusters are known to achieve 10 times the efficiency of traditional rocket engines; moreover, atmospheric electrohydrodynamic (EHD) ion thrusters offer a thrust-to-power ratio 55 times that of turbofan aircraft engines. Despite this potential, EHD thrusters are insufficient for extended atmospheric flight, especially as current methods for traditional simulation-based thruster optimization remain extremely time intensive. Therefore, this study investigates Bayesian Optimization as an engineering tool to accelerate ion thruster optimization, specifically on surrogate model selection. An EHD thruster was constructed and continuously calibrated to generate an empirical dataset of 7,222 datapoints, then preprocessed through methods of standardization and outlier removal to reduce selection bias. An XGBRegressor (R-Squared = 97%, MAE = 0.04 N/kW) was then trained to serve as the objective function, and the surrogate models Gaussian Process (GP), Random Forest (RF), and Extra Trees (ET) were tested by utilizing a weighted sum that combines optimization time and thrust-to-power ratio into a single score, with both metrics given equal weights. ET achieved a thrust-to-power ratio of 0.304 N/kW, and an optimization time of 9.2 seconds. This resulted in the highest weighted sum of 0.781, on average 15.2% higher than the other models. From this study, ET's proficiency as a surrogate

model reduces the reliance on exhaustive methods of manual parameter sweeping and facilitates testing of broader variables with fewer iterations, significantly accelerating development of high-performing ion thrusters.

2:30pm **32** Grad **Artificial Intelligence (AI) in the Project Team: Assistant, Analyst, or Decision Maker**

*Ethel Asamoah & Jaby Mohammed [Illinois State University]

Artificial Intelligence since its beginning has moved from theory to teammate, quietly taking up space alongside project managers, analysts, and coordinators in tools that schedule our work, flag our risks, and even suggest what we should do next. With its evolution traced as far back to the 1950s where Alan Turing published "Computing Machinery and Intelligence" proposing the Imitation Game, now known as the Turing Test, to determine if a machine could exhibit intelligent behavior. The quick advancement of AI is inspiring both enthusiasm and concern because its uses range from clearly beneficial to deeply problematic. Within Project Management specifically, AI influences projects in ways that link directly to the question of whether it should act as an assistant, analyst, or decision maker in teams. In project teams, AI can act as an assistant support, an analyst to generate data and a decision-making tool that autonomously selects actions within defined constraints. All these roles build on each other and raise important questions about the responsibility, transparency and human versus AI collaboration. This research uses academic literature and reports to delve into the role AI plays in these three capacities, using secondary data in exploring the benefits and risks of the AI in the project team, acting as an Assistant, an Analyst or a Decision maker in the phases of Project Management. The findings indicate that AI functions most effectively as a co-pilot rather than a replacement for project managers, operating behind the scenes to enhance accuracy and support proactive project control. The study concludes that AI will play an essential role across all five stages of the project lifecycle, contributing significantly to planning, execution, monitoring, and overall project success.

1:00pm **33** Grad **Integrating Value Stream Mapping and Demand Variability Analysis to Optimize Inventory Placement in Manufacturing Systems**

*Maithri Govardhana & Jaby Mohammed [Illinois State University]

Supply chain often face challenges due to demand variability, which can lead to inefficient inventory placement and higher operational costs. This study presents an approach that integrates Value Stream Mapping(VSM) with demand variability analysis to improve inventory positioning across different stages of the supply chain. Key metrics such as average demand, demand standard devation, coefficient of variation, and lead time variability are evaluated to understand incertainity and system performance. By incorporating variability metrics into value stream map, the framework supports more informed decisions regarding buffer locations and inventory levels. The approach helps enhance supply chain responsiveness, minimize waste, and improve overall efficiency in inventory management.

1:00pm **89** HS **Optimizing a Hybrid Supercapacitor-Battery Energy Buffer for Renewable Microgrid Stability Using Experimental Testing and GPU-Based Simulation**

*Lakhi Ananthula (Waubonsie Valley High School)

Illinois targets an energy storage capacity of 3 GW by 2030. Rapid voltage fluctuations caused by the intermittency of solar generation, specifically due to variable cloud cover, create critical grid instability problems. Supercapacitors can address these issues during battery management system response delays of 0.25 to 1 second. In this study, we used a physical microgrid and GPU-based Monte Carlo simulation to explore the optimal supercapacitance for 95% grid reliability. Constructed a 5V microgrid with a motor load and an LED. Collected 1,968 voltage decay data points with varying capacitor values from 0 to 10 °F. The corresponding model is based on the Linear Constant Current Discharge Model. The testbed capacitance values of 1, 5, and 10 °F are used to validate the model and compare it with R^2 (coefficient of determination) and RMSE (Root Mean Square Error). The Monte Carlo simulation with 100,000 trials, with tolerances set to ±10% Capacitance and ±20% Resistance, is used to determine the optimal capacitance value to achieve 95% reliability. The validation is successful with high R^2 values between 76.1% and 99.2%. The RMSE is very low, between 0.014V and 0.072V. The optimized value is 0.18 °F to achieve the BMS delay time of 0.5 seconds with over 95% reliability. The 1 °F baseline value is overestimated, as the total capacitance is 82% lower than baseline, which is an important saving in raw materials for Illinois proposed 3 GW of renewable infrastructure.

ENVIRONMENTAL SCIENCE

2:30pm **34** Grad **Assessing the Toxicological Impacts of Glyphosate on *Schmidtea mediterranea***

*Amina Mohammed & Kyong-Sup Yoon [Southern Illinois University Edwardsville]

Glyphosate is the most widely used herbicide worldwide and the active ingredient in formulations such as Roundup®. Its increasing application, driven by the expansion of glyphosate-tolerant crops and the emergence of resistant weeds, has raised concerns regarding potential impacts on freshwater ecosystems. This study aimed to determine acute mortality responses of the freshwater planarian *Schmidtea mediterranea* to glyphosate. 96-hour mortality bioassays revealed clear

concentration- and time-dependent toxicity, with LC_{50} values decreasing from 0.242 mg/mL at 24 hr to 0.213 mg/mL at 96 hr. Mortality reached approximately 92% at the highest concentration tested (0.282 mg/mL) after 96 hr. Based on these findings, sublethal concentrations were selected for subsequent investigations. Regeneration assays are currently conducted to evaluate the rate of head regeneration in the presence of glyphosate over an eleven-day assay period. The results of this study will provide mechanistic insight into glyphosate toxicity and contribute to improved environmental risk assessment of herbicide contamination in freshwater systems.

1:00pm **35** Grad **Assessment of Microplastic Concentration, Types, and Distribution in the Middle Mississippi River**

*Ankit Kumar Mahato [Southern Illinois University Edwardsville]

Microplastics defined as plastic particles less than 5 mm in diameter have emerged as concerning pollutants in aquatic environments. Once introduced into water sources, microplastics can persist for decades, interacting with aquatic organisms, absorbing toxic chemicals, and disrupting ecological balance. While marine systems have been the primary focus of microplastic research, freshwater ecosystems, including rivers, lakes, and reservoirs, are increasingly recognized as important pathways and sinks for plastic pollution. The Mississippi River, one of the largest river systems in North America, receives substantial urban, agricultural, and industrial runoff, making it highly vulnerable to microplastic pollution. This study quantifies microplastic concentrations across different segments of the Middle Mississippi River. Water samples were collected from multiple sites along the river. The samples were filtered to isolate microplastic particles and then examined under a stereomicroscope to identify and classify them based on their physical characteristics. Microplastic concentrations and types were also quantified for the study areas. The results provide baseline information on microplastic contamination in the Middle Mississippi River and contribute to understanding pollutant levels in freshwater environments. They also highlight the need for long-term monitoring, improved stormwater management, and enhanced wastewater treatment technologies to mitigate microplastic contamination in the Middle Mississippi River basin.

2:30pm **36** UG **Concentrations of Selenium in Draught Beers Commonly Consumed in the U.S.**

*Clover Villanueva & Zhi-Qing Lin [Southern Illinois University Edwardsville]

Selenium (Se) is an essential micronutrient for humans. The Recommended Dietary Allowance (RDA) for Se is 55 μg/day and the Tolerable Upper Intake Level (UL) is 400 μg/day for adults in the U.S. To evaluate the Se dietary intake from commonly consumed alcoholic beverage, different draught beers were collected in St. Louis city, and concentrations of Se were measured using inductively-coupled plasma mass spectrometry (ICP-MS). A total of 32 different beers were evaluated according to their country of origin, style, alcohol by volume (ABV), and inclusion of adjuncts. Preliminary results show that concentrations of Se in different draught beers varied significantly. Beers produced in the U.S. contain relatively higher Se concentrations (23.80 ± 19.63 μg/L, n=24) than beers from European and other foreign countries (3.92 ± 2.50 μg/L, n=8). Ales showed relatively higher Se concentrations (26.46 ± 21.88 μg/L, n=18) than lagers (9.02 ± 7.57 μg/L, n=14). In addition, high-ABV beers (i.e. ABV>7%) likely contain higher Se concentrations (40.97 ± 31.39 μg/L, n=6) than beers with a low ABV of <7% (13.72 ± 10.45 μg/L, n=26). Beers with adjunct inclusions of fruits or nuts also showed higher Se concentrations (35.58 ± 29.11 μg/L, n=6) than beers without adjuncts (14.96 ± 0.41 μg/L, n=26).

1:00pm **37** Grad **Cross-Resistance and Behavioral Effects of Insecticides in a DDT-Resistant Strain of *Drosophila melanogaster***

*Cynthia Elisia Mrong & Kyong Sup Yoon [Southern Illinois University Edwardsville]

Insecticide resistance poses a significant challenge in pest management due in part to the prolonged exposure to chemical treatments. While resistance to DDT in *Drosophila melanogaster* has been extensively studied, cross-resistance, where resistance to one insecticide confers resistance to others, remains a critical concern. A DDT-selected strain of *Drosophila melanogaster* (91R) was evaluated to determine whether resistance to DDT is associated with altered susceptibility to other insecticides. A susceptible laboratory strain was used as the control population for comparison. Male and female flies were exposed to DDT, imidacloprid, and fipronil using the topical application method. Mortality data were analyzed to determine LD_{50} values and resistance ratios. In comparison to the control strain, the LD50 value for DDT in the 91R strain was found to be 600 ng/fly for male and 2216.5 ng/fly for female with resistance ratios of 13.0-fold and 20.7-fold, respectively. For imidacloprid, the LD_{50} value was estimated at 203 ng/fly for male and 812.5 ng/fly for female, with resistance ratios of 3.9-fold for male and 5.742-fold for female. For fipronil, the LD_{50} value was found to be 0.499 ng/fly for male and 2.052 ng/fly for female, with resistance ratios of 1.96-fold for male and 2.86-fold for female. Additional experiments are being conducted to evaluate the susceptibility of the 91R strain to insecticides including chlorpyrifos, permethrin, and ivermectin. Mortality and regeneration assays are also being conducted in the freshwater planarian Schmidtea mediterranea following exposure to DDT, imidacloprid, and chlorpyrifos. Circadian rhythm is also being examined in male and female DDT-resistant 91R flies. This study aims to better understand cross-resistance patterns and the acute and sublethal effects of insecticide exposure.

2:30pm **38** UG **Using Call Surveys to Characterize Frog Communities in Banner Marsh**

*David Estrada, Helen Ratchford, & John Marino [Bradley University]

Amphibians are known to be key indicators for freshwater ecosystem health due to their sensitivity to environmental stressors such as pollution, temperature fluctuations, and sedimentation. They also play important ecological roles by

regulating trophic dynamics and nutrient cycling across aquatic and terrestrial systems. Banner Marsh State Fish and Wildlife Area in central Illinois was previously used for agriculture and surface coal mining, making it a valuable site for evaluating amphibian responses to wetland restoration. To characterize the frog community within Banner Marsh, six call surveys were conducted during spring 2025 from March to May at two sites. Data for weather conditions were also collected on each date. Results revealed distinct temporal and spatial patterns in frog call activity at the sites. Overall call intensity was low in early March, increased through April, and peaked in late April, before declining in May, and calling activity differed between sites. *Pseudacris triseriata* (Western Chorus Frog) and *Acris crepitans* (Northern Cricket Frog) were detected early in spring, *Hyla versicolor* (Gray Treefrog) showed high activity towards the middle, and *Rana pipiens* (Northern Leopard Frog) emerged as the more dominant caller in mid-April. These patterns align with known temperate amphibian phenological patterns. Based on these patterns, habitat characteristics at our sites provide suitable conditions for breeding. This study establishes a baseline for long-term frog community monitoring at Banner Marsh and nearby areas and helps show the value of amphibian acoustic monitoring in assessing restoration success. Further research should also take into account water quality and vegetation surveys to better understand why the frog communities differ between the sites.

1:00pm **39** Grad **Green Synthesis of Silver Nanoparticles Using Alfalfa (*Medicago sativa*) Leaf Extract and Evaluation of Antimicrobial Activity Against *Escherichia coli***

*Eyram Setrana [Southern Illinois University Edwardsville]

Silver nanoparticles (AgNPs) are effective antimicrobial agents, but traditional synthesis methods often use toxic chemicals that pose environmental and health risks. This study investigated the eco- friendly synthesis of AgNPs using *Medicago sativa* (alfalfa) leaf extracts. This study compared green-synthesized AgNPs antimicrobial activity with that of citrate and uncoated AgNPs using *Escherichia coli* as a model bacterium. Green-synthesized, citrate-coated, and uncoated AgNPs were synthesized and characterized using standard protocols in our laboratory. Antimicrobial activities of the three nanoparticles were assessed at 0, 50, 100, 200, 400, and 800 µg/L of broth containing *E. coli.* Bacterial growth was assessed by measuring the optical density of the broth at 400 nm after a 24-hour incubation. The results showed varying AgNP particle sizes ranging from 20 to 500 nm. The average particle sizes of citrate-coated, uncoated, and green-synthesized AgNPs were 25.6nm, 21.3 nm, and 400.0 nm, respectively. Bacterial growth in all three AgNPs decreased with increasing concentration. Uncoated AgNPs caused the greatest bacterial growth inhibition at 400 and 800 µg/L, due to the direct silver ion interaction with bacterial cells. Citrate-coated and green-synthesized AgNPs both have coating agents that stabilize the nanoparticles. However, green-synthesized AgNPs caused more inhibition effect. This study's results demonstrate that alfalfa leaf extract can be used as a coating and reducing agent to synthesize eco-friendly AgNPs with effective antimicrobial activity. These findings show that while coatings influence nanoparticle behavior, green-synthesized AgNPs maintain good antimicrobial activity and offer a safer, more environmentally sustainable alternative.

2:30pm **40** Grad **Oxybenzone-Induced Oxidative Stress and Genotoxicity in *Aiptasia pallida*: A Coral Model for Risk Assessment in Coastal Ecosystems**

*Ezekiel Tosin Babatunde & Chris Theodorakis [Southern Illinois University Edwardsville]

Organic ultraviolet (UV) filters such as oxybenzone (benzophenone-3, OBZ) are increasingly recognized as contaminants of concern in coastal ecosystems. Commonly found in sunscreens and personal care products, OBZ is frequently detected in nearshore waters, where it may persist and bioaccumulate. Growing evidence suggests that even at low concentrations, OBZ can induce sub-lethal physiological and molecular changes in marine organisms, including those within coral reef communities. This study evaluates the potential of OBZ to induce oxidative stress and genotoxicity in *Aiptasia pallida*, a symbiotic cnidarian model widely used for coral toxicology. Specimens were exposed to environmentally relevant concentrations of OBZ (20, 200, 2,000, and 5,000 micrograms per liter) under static renewal conditions across three exposure durations: 5, 10, and 30 days. Biochemical responses were assessed through measurements of antioxidant enzyme activities, including catalase (CAT) and superoxide dismutase (SOD), along with DNA damage evaluated via comet assay. Preliminary results from the 5-day exposure period revealed a dose-dependent increase in CAT activity, while SOD activity was variably inhibited at higher concentrations. Notably, comet assay results showed significant DNA fragmentation in OBZ-exposed groups compared to controls, supporting the hypothesis that OBZ elicits both oxidative stress and genotoxic responses in *A. pallida*. These findings highlight the organism's sensitivity to organic UV filters and underscore its value as a sentinel species for assessing pollutant effects on reef-associated organisms. Ongoing analysis of longer exposure durations will offer further insight into the chronic impacts of OBZ and inform future ecological risk assessments.

1:00pm **41** UG **Determination of Altered Responses to Starvation Stress in DDT-Susceptible and -Resistant Strains of *Drosophila melanogaster***

*Garrett Vanfossan & Kyong Sup Yoon [Southern Illinois University Edwardsville]

A DDT resistant strain of *Drosophila melanogaster* (91-R) was analyzed to determine if the DDT-resistance was associated with altered sensitivity to starvation stress exposures. The results clearly showed that the 91-RPMP subpopulation was significantly more sensitive to starvation stress compared to the DDT-susceptible 91-CPMP and CSPMP subpopulations. Additionally, 91-RPMP individuals (10, 20, and 30 days old) of both sexes were consistently more sensitive to starvation than either of the DDT-susceptible subpopulations (Kaplan-Meier survival analysis, $P < 0.05$), respectively. These findings suggest that 91-RPMP may be particularly vulnerable to environmental stresses, potentially reflecting a trade-off between

DDT resistance and starvation stress resilience. We further explored these findings with recently selected 91-R flies with different concentrations of DDT (20mg/ml, 50mg/ml & 70mg/ml). By increasing the resistance to DDT in the recently selected 91-R flies, we aim to clarify the relationship between insecticide resistance and fitness levels. Additional stress assays are needed to explore how DDT resistance may be influencing fitness in this population.

2:30pm **42** Grad **Assessing the Effects of Carbon Dioxide and pH on Amphibian Development and Susceptibility to Parasitism**

*Kailani Vazquez [Independent]

Amphibian populations are experiencing global declines driven in part by environmental stressors associated with climate change. Elevated carbon dioxide (CO_2) can alter aquatic chemistry and contribute to reduced pH, potentially affecting amphibian development and host–parasite interactions. Understanding how these stressors influence amphibian performance is critical for predicting species responses to changing environmental conditions. This project examines how elevated CO_2 and decreased pH (independently) influence amphibian development and susceptibility to parasitic infection. In a controlled laboratory experiment, bullfrog tadpoles were exposed to treatments manipulating CO_2 levels and pH conditions. Tadpole survival, mass, development, and infection intensity were measured to evaluate how these environmental stressors affect amphibian performance and disease susceptibility. Preliminary results suggest that changes in CO_2 and pH influence tadpole development and infection dynamics. Additional analyses are ongoing to quantify the interaction between CO_2, pH, and parasite exposure. These findings provide insight into how climate-related changes in aquatic chemistry may affect amphibian physiology and host–parasite dynamics, contributing to a better understanding of amphibian vulnerability under changing environmental conditions.

1:00pm **43** Grad **Spatial Analysis of Turbidity and Total Suspended Solids in an Agricultural Watershed Using Remote Sensing and GIS: The Upper Sangamon River**

*Magdalene Amankwaa * Sanoar Rahman [Southern Illinois University Edwardsville]

Sediment-related water-quality deterioration is a persistent problem in Midwestern rivers, where row-crop agriculture, rising urban footprints, channel modification, and riparian vegetation loss all contribute to the delivery of fine sediment to streams. This study integrated Sentinel-2 imagery with in-situ sampling to spatially analyse and map turbidity and total suspended solids (TSS) concentration across the Upper Sangamon River watershed. Water samples were collected from 23 sampling sites (20 on the main stem, 3 within ±3 days of a Sentinel-2 satellite overpass, with site selection guided by upstream-downstream gradients, land-use composition in each subbasin, and major tributary input. Turbidity was measured in the field using a turbidimeter (NTU), and TSS was analysed in the laboratory using the gravimetric method. Empirical and semi-empirical models were developed from Sentinel-2 reflectance and validated against in-situ measurements using R^2, RMSE, MAPE, and Bias, with validation indicating that the retrieval models captured observed variability in turbidity and TSS concentrations. Continuous spatial patterns of TSS and turbidity were mapped using GIS interpolation (IDW and kriging), and degraded/hotspot areas were identified using Moran's I and Getis-Ord Gi* spatial statistics. The results produced high-resolution sediment-related water-quality maps and identified watershed areas most strongly associated with elevated TSS and turbidity in the Upper Sangamon River watershed.

2:30pm **44** Grad **Time-Dependent Glutathione Response to Chronic Oxybenzone Exposure in *Aiptasia pallida* (A Model for Corals)**

*Manoj Chand & Christopher Theodorakis [Southern Illinois University Edwardsville]

Although oxybenzone (benzophenone-3), a common UV filter found in sunscreens, can enter aquatic systems, its sublethal metabolic effects under long-term exposure remain poorly understood in cnidarian models under non-UV conditions. Here, we measured time-dependent changes in reduced glutathione (GSH) under long-term exposure to oxybenzone under ordinary LED illumination (no UV) using the Apo-symbiotic *Aiptasia pallida*. Anemones were sampled on Day 5, Day 10, and Day 30 (n = 4 biological replicates per treatment/time) under six conditions: control, solvent control(acetone), and oxybenzone at 0.02, 0.2, 2, and 3 ppm. GSH was measured using fluorometry and adjusted to the Bradford assay's protein concentration. A two-way ANOVA on log-transformed normalized GSH was used to assess the effects of time and treatment. Tukey-adjusted post hoc comparisons were then performed; diagnostic tests confirmed model assumptions following transformation. Time (F=801.48, $p<2\times10^{-16}$), treatment (F=11.47, $p=1.43\times10^{-7}$), and a substantial time × treatment interaction (F=3.89, $p=5.23\times10^{-4}$) all had significant effects on log-normalized GSH. Day 10 readings were considerably lower than Day 5 and Day 30 across all treatments, suggesting a marked mid-exposure drop in glutathione level. Higher oxybenzone exposures (particularly 2 ppm and, in some cases, 3 ppm) were observed at Days 5 and 10 compared to lower-dose groups and controls, but no treatment differences were seen at Day 30, indicating convergence of antioxidant status with extended exposure. These findings suggest that single-time-point measurements may miss significant temporal dynamics and that antioxidant responses to long-term [contaminant name] exposure are very time-dependent. This work supports the use of time-resolved oxidative stress biomarkers in aquatic toxicology and coral-relevant contaminant research by showing that exposure duration and concentration both influence glutathione homeostasis in *Aiptasia pallida*.

1:00pm **45** UG **Investigation of Chill Coma Recovery and Negative Geotactic Behavior in DDT-Susceptible and -Resistant Fruit Flies**

*Mohamed Saady, Kyong-Sup Yoon, & Blake Rentz [Southern Illinois University Edwardsville]

The present study aimed to determine chill coma recovery time in DDT-susceptible (CSPMP and 91-CPMP) and DDT-resistant (91-RPMP and recently DDT-selected 91-R) fruit flies. Negative geotactic behavior assays were conducted to determine if 91-RPMP shows significant differences when compared to CSPMP and 91-CPMP. In the initial experiment, 91-RPMP females recovered from chill coma at 1.6 times faster than 91-CPMP females, while 91-RPMP males recovered 1.5 times and 1.9 times faster than CSPMP and 91-CPMP, respectively (one-way ANOVA, $p < 0.05$). No significant differences in negative geotactic activity were observed between strains or sexes. To extend these findings using the same chill coma protocol, a new experiment is underway using 91-R flies, recently selected with different concentrations of DDT (20 mg/mL, 50 mg/mL, and 70 mg/mL) to determine whether the chill coma recovery time is associated with different levels of DDT selection pressure.

2:30pm **46** HS **Microplastics Found in Accessible Facial Cleansers**

*Taylor Morey [Spoon River Valley High School/Spoon River College]

The purpose of this experiment is to determine if microplastics are present in common facial cleansers. Four cleansers (Equate Beauty, Clean & Clear, Olay, and Neutrogena) were obtained from Walmart. I hypothesized that the facial cleansers that contain exfoliating agents would contain microplastics. A 1g sample of cleanser was combined with 5g of acetone into a glass beaker. The cleanser mixture was poured into a beaker of 50mL of water. A coffee filter was used to separate the microplastics from the cleanser. After drying out for a few days, the residue on the coffee filter was weighed. The experiment was repeated three times per cleanser in order to find the average amount of residue. According to the results, microplastics were not found in any of the cleansers tested.

1:00pm **47** UG **Towards Assessing Reactive Oxygen Species Generation from Natural Organic Matter-Capped Nanoparticles**

*Viola Stangle, Brenden Auerbach, Taufiq Khan, Andrés M. Durantini, & N. Femi Adegboyega [Southern Illinois University Edwardsville]

Nanoparticle-generated reactive oxygen species (ROS) can shape microbial behavior in aquatic systems and are therefore important in both nanotoxicology and environmental chemistry. In this work, we synthesized natural organic matter (NOM)–stabilized gold nanoparticles (n-AuNPs) at elevated temperature and characterized their physicochemical properties in the context of light-activated antimicrobial applications. Formation of n-AuNPs was verified by the appearance of a strong surface plasmon resonance (SPR) band centered at 520 nm. Dynamic light scattering measurements showed hydrodynamic diameters ranging from 29.49 to 38.31 nm, while zeta potentials ranged from −28.33 to −18.03 mV, indicating stable dispersions under the conditions tested. Current and future work will focus on biological activity studies. *Escherichia coli* will be exposed to varying concentrations of n-AuNPs and then irradiated with green light. Additional work will focus on identifying the dominant ROS produced during irradiation and determining the mechanism(s) responsible for ROS formation in this NOM-stabilized AuNP system. Overall, these results will provide a practical platform for connecting nanoparticle photochemistry with microbial outcomes and for developing AuNP-based strategies relevant to photodynamic therapy.

HEALTH SCIENCE

2:30pm **48** HS **Evaluating the Impact of CNN Architectures on Colorectal Cancer Detection**

*Aarush Bhagwat [Adlai E. Stevenson High School]

AI-driven classification methods for Colorectal Cancer (CRC) are often limited by computational inefficiency and inclusion of non-diagnostic tissue regions. While microbiome-based detection methods exist, histopathological tissue analysis has been shown to provide more direct and clinically relevant diagnostic information. This study evaluates established convolutional neural network (CNN) architectures augmented with an entropy-driven patch selection strategy. It was hypothesized that combining architectural depth with entropy-based data filtering would improve classification performance while maintaining computational efficiency. The NCT-CRC-HE-100K dataset, consisting of 100,000 histopathological images, was preprocessed using a patch-selection strategy to isolate high-complexity spatial regions and reduce non-informative background. This research evaluates three CNN architectures (VGG16, DenseNet, and baseline CNN) using a standard 80-20 training-validation data split. Models were trained for 20 epochs using categorical cross-entropy loss and optimized with the Adam optimizer. Performance was assessed through validation accuracy, Area Under the Curve (AUC), and F1 scores. All architectures benefited from entropy-based preprocessing. DenseNet emerged as the optimal architecture, achieving highest validation accuracy with ~98% and F1 score of 0.98, demonstrating efficient feature-reuse ability. The patch-selection strategy improved baseline CNN performance, increasing F1 score from 0.52 to 0.60. While VGG16 achieved strong performance (F1 score = 0.88), it required greater storage and computational resources. Entropy-driven patch selection significantly enhances histopathological classification performance and improves scalability across CNN architectures. DenseNet demonstrated the strongest balance between diagnostic accuracy

and computational efficiency, suggesting complexity-driven preprocessing and architectural depth may improve AI-assisted pathological analysis, supporting scalable clinical workflows.

1:00pm **49** HS **Drug-Eluting Neurovascular Stent for Local MMP-9 Inhibition After Stroke**

*Agam Nanda [Palatine STEM Society]

Matrix Metalloproteinase-9 (MMP-9) contributes to secondary injury after ischemic stroke by degrading the extracellular matrix and disrupting the blood–brain barrier. Current therapies are either systemic, risking off-target effects, or invasive, limiting timely inhibition of MMP-9, which peaks ~24 hours post-stroke. This study presents a computationally designed neurovascular drug-eluting stent for localized, time-relevant MMP-9 inhibition. A 3D nitinol stent was coated with a 10 µm 2-methacryloyloxyethyl phosphorylcholine polymer loaded with 251 ng of the selective MMP-9 inhibitor JNJ-0966. Finite Element Analysis assessed radial stress and deformation under physiological (15.3 kPa) and supraphysiological (5–1000 kPa) pressures. Drug release was modeled using Crank's planar diffusion solution. A sensitivity analysis explored the impact of varying diffusion coefficients (5×10^{-11} to 5×10^{-10} m²/s), estimated from prior literature on small-molecule inhibitors in hydrophilic polymer matrices, due to uncertainty in the diffusivity of JNJ-0966 through MPC. CFD simulations evaluated spatial drug distribution and wall shear stress in a 2 mm-radius, 30 mm-long vessel under normal (3.15×10^{-6} m³/s) and hyperemic (4.58×10^{-6} m³/s) flow. FEA indicated a maximum von Mises stress of 43.15 MPa under physiological pressure, well below the nitinol yield threshold (814 MPa). Drug modeling showed >50% release within 6 hours and near-complete release by 24 hours. CFD revealed 77.3% drug retention under normal flow and 73.4% under hyperemia, with WSS within safe physiological ranges (2–6 Pa and 3–8 Pa, respectively). Sensitivity analyses confirmed that diffusion coefficient variations modestly affect release timing but maintain therapeutic relevance. These results suggest the stent can deliver localized, temporally precise MMP-9 inhibition while maintaining structural integrity and safe hemodynamics, supporting computational design as a strategy to mitigate secondary post-stroke injury.

2:30pm **50** Grad **Evaluating the Impact of an AI Chatbot on Self-efficacy and Advising Support Among Students Enrolled in Didactic Program of Dietetics**

*Ayesah Mehwish & Julie Raeder Schumacher [Illinois State University]

Students enrolled in the Didactic Program of Dietetics (DPD) often face challenges when navigating program requirments, preparing for dietetics internships, and planning their professional career. when access to advising resources is limited or delyed students may experience uncertainity and reduced confidence in making academic and career related decisions. Artificial intelligence (AI) tools ,such as chatbots, may provide an additional resource to support students by offering quick and accessible guidance related to the dietetics pathway. The purpose of this study is to evaluate the usefulness of an AI chatbot designed to assist DPD students with advising questions and academic concerns. students will be introduced to the chatbot and encouraged to use it when they have questions related to program requirements, internship preparation, or career planning within the field of dietetics. After interacting with the chatbot, students will be invited to complete a survey that evaluates their experience using the tool. The survey will assess how helpful the chatbot was in addressing the advising needs and whether it influenced student's confidence and self-efficacy in navigating their academic and professional pathways. The findings from this study may provide insight into the potential role of AI-supported advising tools in improving student support and decision-making within dietetics education programs.

2:30pm **86** HS **Implementation of Graphene Oxide Nanoparticles and Amino Acid Infused Alginate Hydrogels for Antimicrobial Applications**

*[1,2]Ishan Suresh Kumar, [1]Jayaditya Akhauri, [2]Katey M. Sheets, [2]Jason J. Keleher [[1]Waubonsie Valley High School; [2]Keleher Research Group]

Over 100 million individuals globally suffer from persistent, infected wounds, where rapid bacterial proliferation and toxin production severely impair healing. Alginate-based scaffolds have emerged as a promising strategy to combat wound infections due to their combined controlled drug delivery capabilities and intrinsic wound-healing properties (moisture retention, high absorbency, hemostatic activity, infusion with antimicrobial agents, and biocompatibility). To enhance these properties, alginate scaffolds were modified with graphene oxide (GO), amino acids, and calcium in a controlled 2:1:1:4 ratio, followed by a freeze-drying process to produce a porous composite scaffold. Additionally, GO has been shown to act as an effective antimicrobial agent through surface contact killing, localized oxidative stress, and biofilm inhibition. Scaffold performance was evaluated through swelling behavior, mechanical strength testing, infrared spectroscopy (IR), and scanning electron microscopy (SEM) for structural ordering and scaffold integration. Among the five scaffold formulations in this study, the AlgCal-GO composite demonstrated superior performance, exhibiting the highest swelling capacity (average degree of swell at 4432 g/min, p=0.0014) and the greatest mechanical stiffness (Young's modulus of 79.34 N/in2, p=9.14 x 10^{-9}). The antimicrobial effectiveness of the scaffold was evaluated utilizing Kirby-Bauer disk diffusion assays. The results exhibited no zones of inhibition, suggesting that GO is a non-diffusive antimicrobial agent. Population viability and single-cell death kinetics testing utilizing an epi-fluorescent optical tweezer will aid in the elucidation of the mechanism of microbial

1:00p, 87 HS **Illuminating Intelligence**

*Ansh Mehta & Hariom Thaker [Dunlap High School]

High school students often face high levels of stress and mental fatigue due to demanding academic workloads. This often leads to poor sleep habits and reliance on caffeine or energy drinks, which can affect academic performance. Research suggests that artificial daylight mimicking natural daylight can positively affect cognitive function, mood, and alertness, especially in environments with limited natural light. This study investigates whether exposing students to an artificial daylight (6500 K) environment for 30 minutes improves cognitive functions, such as processing speed and memory recall, compared to standard yellow lighting (2700 K). This research is important because it proposes a noninvasive, low-cost environmental intervention to improve student well-being and performance. We studied 30 high school students (aged 15-18), divided them into two groups, exposed them to different light temperatures for 30 minutes at the same time of the day, tested them on the Stroop Color Word Test and Twenty Word Memory Test, and measured their processing speed and memory recall by measuring how many questions they answered correctly. The findings of this study support the hypothesis. The results indicate that lighting quality plays a measurable role in student performance, suggesting that "daylighting" in classrooms could be a low-cost intervention to improve academic outcomes.

MICROBIOLOGY

2:30pm 12 UG **The Effects of Allicin on Clinically Relevant Bacteria**

*Mustafa Altamimi & Husam Aldajah [Lewis University]

The rise of antimicrobial resistance caused by the overuse of antibiotics has created a need for alternative strategies. Studies have shown that allicin, a biologically active sulfur-containing compound derived from garlic, exhibits broad antimicrobial properties. The purpose of this study was to investigate the extent to which allicin inhibited microbial growth across multiple organism types and environmental conditions. Allicin was diluted in ethanol to preserve biological activity. A minimum inhibitory concentration assay was used to test the effectiveness of allicin. Varying concentrations of allicin (0, 25, 50, 100, and 150 µL/mL) were added to tubes containing sterile tryptic soy broth for bacterial cultures and YM broth for yeast species. Each tube was inoculated with 100 µL of selected microorganisms, including Gram-positive bacteria (*Listeria monocytogenes*, *Staphylococcus aureus*, *Bacillus subtilis*, *Enterococcus faecalis*, and *Micrococcus luteus*), Gram-negative bacteria (*Escherichia coli*), and fungi (*Candida albicans*). Cultures were incubated at 37°C for approximately 22-24 hours, after which the turbidity was measured to quantify microbial growth and compare to non-inoculated growth media used as a negative control. Overall, microbial samples exposed to higher concentrations of allicin resulted in decreased turbidity. The Gram-positive, Gram-negative, and fungi tested exhibited some inhibition with concentrations of 100 and 150 µg/mL producing the greatest inhibition of microbial growth that was statistically significant ($p<0.05$). Gram-positive species demonstrated the highest sensitivity. Future studies will examine the ability of allicin to inhibit or disrupt biofilms.

1:00pm 51 UG **Utilizing Recombinant Expression of Tardigrade Protein for the Development of UV-Resistant *Chlamydomonas***

*Angela Manevska & Keith Johnson [Bradley University]

Coral reefs are large structures in aquatic environments made up of many organisms called coral polyps. These reefs, which provide habitat for numerous species, have consistently declined for several decades. Previous research has investigated DNA damage due to UV radiation in symbiotic algal species as a leading reason for their decline. It is essential to investigate solutions that will decrease the negative impact of UV damage on algae with the intent of decreasing the DNA damage that symbiotic corals experience. Through further investigation, a protein unique to tardigrades (Damage suppressor protein - Dsup) was discovered to be responsible for environmental resilience. The scope of this research includes determining if recombinant expression of the tardigrade protein might create an algal species more resistant to DNA damage. We hypothesize that the expression of the Dsup protein in *Chlamydomonas reinhardtii* will result in resistance to UV damage of DNA in the organism.

2:30pm 52 UG **Effects of Parasitism and Carbon Dioxide on Tadpole Skin Microbiota**

*Arwen Como [Bradely University]

Unfavorable conditions, like disease or high carbon dioxide, are known to cause systemic reactions in organisms, which may also influence their microbiota. In a laboratory experiment, American bullfrog tadpoles were exposed to either elevated or ambient carbon dioxide (CO_2) concentrations and the presence or absence of trematode parasites. The skin of the tadpoles was swabbed at the end of the experiment, and DNA was sent off for sequencing. 16S rRNA sequences were then looked at for data collection and identification. All samples were compared, and differences were observed across the phyla abundances in the different treatment categories; most notable were the differences in the presence of Chloroflexi, Armatinomadetes, Actinobacteria, and Acidobacteria. Chlorofelxi was observed to be more abundant in ambient CO_2 and non-parasitic samples. Armatinomadetes had a greater presence in the parasitic samples compared to the non-parasitic samples. Actinobacteria showed a pronounced bias toward non-parasitic samples, with a minor presence in parasitic samples. Acidobacteria showed the opposite trend, with some presence in most samples but a higher observed presence in the parasitic samples. A few phyla took over a majority of the samples, with Proteobacteria making up roughly 52% and

Bacteroidetes making up roughly 32% of the total phyla seen. This suggests that environmental factors may influence what is present in an organism's microbiota through a chemical or immunological alteration. Something as simple as an acidification of the aqueous environment can alter what microbes are able to succeed on the host due to preferences for specific environmental chemistry. Immunological changes due to parasitism may also affect the microbiome, as the host has to allocate a response that may affect some microbes more than others.

1:00pm **53** UG **Examining the Antimicrobial Properties within Osage Orange (*Maclura pomifera*) Extract Against Clinically Relevant Bacterial Strains**

*Ashley Miller, Shaylin Roark, Maciej Zalinski, Ethan Brooks, Jerry Kavouras, & James Rago [Lewis University]

Extracts from various components of the Osage orange tree (*Maclura pomifera*) have been shown to inhibit the growth of several microbial species. This group explored the ability of the extracts from the fruit to inhibit the growth of microbes, including fungi and Gram-positive and Gram-negative bacteria, while characterizing properties of the antimicrobial agent within the extract. The current objective is to assess extracts from the fruit of the Osage orange tree for antimicrobial activity against clinically relevant microbial species. An extract was prepared from an orange pulverized into a paste and then subjected to a standard ethanol extraction protocol. Various concentrations of the extract were added to sterilized tubes containing liquid growth media, which were also inoculated with select species of microbes. These samples were then incubated at 37°C for 18 hours. Sample turbidity was measured using a spectrophotometer after the incubation period to assess microbial growth. Minimum inhibitory concentration analysis demonstrated that higher concentrations of extract yielded lower sample turbidity, with a concentration of 0.66% extract demonstrating the most significant reduction in growth. Findings indicated that the extract was effective in limiting the growth of clinically relevant Gram-positive species, including *L. monocytogenes*and multiple strains of antibiotic-resistant *S. aureus,* while Gram-negative species and fungi were unaffected. These results are promising, as the extract demonstrated significant inhibitory effects against clinically relevant Gram-positive bacteria, supporting its potential as a possible therapeutic candidate.

2:30pm **54** UG **Investigating the Function of Txp and Bcp in Oxidative Stress in *Bacillus subtilis***

*Bryn Bates & Melinda Faulkner [Bradley University]

Aerobic organisms face constant oxidative challenges due to reactive oxygen species (ROS), which can damage proteins, lipids, and nucleic acids. *Bacillus subtilis* combats this stress in part through peroxide-scavenging enzymes such as thiol peroxidase (Tpx) and bacterioferritin comigratory protein (Bcp), which putatively detoxify peroxides and maintain redox balance. Most of the studies on the functions of Bcp and Tpx have been done on the enzymes from *E. coli* using *in vitro* techniques. However, the functions of Tpx and Bcp in *B. subtilis* have not yet been explored. This study investigated the contributions of Tpx and Bcp to oxidative stress resistance by challenging the organism with diamide, a thiol-specific oxidant, and thermal stress. Four *B. subtilis* strains (wild-type, Δ*tpx*, Δ*bcp*, and Δ*tpx*Δ*bcp*) were assessed via spot assays and microtiter plate assays to evaluate growth dynamics and stress tolerance. These complementary approaches quantified both terminal and real-time responses to oxidative stress, providing insight into the cooperative function of Tpx and Bcp in preserving cellular integrity under redox pressure.

1:00pm **55** UG **Search for New Antimicrobial Compounds from *Bacillus velezensis* Collected from Asian Carp**

*Cody Clayton, *Livia Kimberlin, & Keith Johnson [Bradley University]

Antimicrobial resistance is a major global health threat, driven by antibiotic overuse and misuse. Resistant bacteria render treatments ineffective, increasing mortality and costs. Antibiotic discovery has stagnated, with only one new class introduced in two decades. Antimicrobial compounds have traditionally been isolated from soil, but the gastrointestinal tract of Asian carp offer a novel source due to their invasive presence in the Illinois River, their abundance, and non-exploitation, potentially promoting the development of antimicrobial compounds to protect against pathogens. A promising intestinal bacterial isolate derived from Asian carp, termed NB 2-1, was previously identified as *Bacillus velezensis*. The bacteria produces an unknown antimicrobial compound that is effective against 6 of 10 tested ESKAPE-like bacterial strains. The antimicrobial compound has been shown to be more effective on TSA and NB media in the absence of glucose. Genomic information regarding *Bacillus velezensis* will be presented in addition to solubility and composition of the compound.

2:30pm **56** UG **In Pursuit of Novel Bacteriophages**

*Davide Giambagli, Joanna Corduan, Isabel Brazawskis, Grace Kaiser, Leslie Corona Martinez, Brenton Bishop, Daniel Likins, & Cathleen M. Dobbs [Joliet Junior College]

Bacteriophages are viruses that infect and kill bacteria. They are among the most abundant biological entities on Earth, with an estimated 1031 present. However, only a small portion have been discovered (only 13,571 genomic sequences have been deposited in NCBI as of December 2025). The goal of our project, part of the Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science (SEA-PHAGES) discovery program, was to isolate and characterize bacteriophages from the soil that target the bacterium Arthrobacter globiformis, an important member of many soil microbiomes. Isolating and characterizing such bacteriophages not only contributes to our general

understanding of biodiversity and bacteriophage biology but to our understanding of the soil ecosystem. Furthermore, though the clinical significance of *Arthrobacter* infection is limited, the occurrence of infection with members of the *Arthrobacter* genus in immunocompromised individuals has been reported. Thus, bacteriophage capable of killing *Arthrobacter* species have potential as alternatives to conventional antimicrobials. We isolated 4 bacteriophage and added them to PhagesDB. Elsanna, Moseby, Tipton, and WileyJr. Elsanna was harvested from soil of the Charlotte Codo Prairie in Frankfort, Illinois. Moseby, Tipton and WileyJr were isolated from the soil of a retired urban garden plot in Joliet, IL. Biologically, all four bacteriophage produced clear plaques indicating a lytic life cycle. All four phage displayed siphovirus morphology with two (Elsanna and WileyJr) having a prolate capsid and two (Moseby and Tipton) an icosahedral capsid, as evidenced by electron microscopy. Moseby and Tipton were sequenced (Illumina), revealing that they were the same bacteriophage. Gene annotation of Tipton is currently being undertaken. Once completed, it will be added to NCBI for comparative analysis of novelty, gene content, and evolutionary relationships. Supported by NSF Grant 2516066.

1:00pm **57** Grad **Investigation of Bacterial Biofilm Formation Mechanisms**

*Hansini Gamage Don & Gopal Periyannan [Eastern Illinois University]

The rapid increase of bacterial antibiotic resistance, primarily driven by biofilm formation, underscores the urgent need to understand biofilm-associated survival strategies of bacterial species. Biofilms act as protective matrices that enhance bacterial tolerance to antibiotics and adverse conditions. In this study, *Caulobacter crescentus*, a non-pathogenic and highly adaptable alpha-proteobacterium, was employed as a model to investigate the molecular and physiological basis of biofilm formation under chemical stress induced by toxic aromatic hydrocarbons. The objective was to evaluate the biofilm-forming capacity of *C. crescentus* in the presence of benzaldehyde, protocatechuate, and phthalate as carbon sources and to characterize the nature of the biofilms formed. *C. crescentus* efficiently utilizes diverse carbon compounds, including complex polysaccharides such as xylan, and withstands toxic aromatic compounds through specialized metabolic and structural adaptations. *C. crescentus'* growth was quantified using optical density measurements and colony-forming unit (CFU) analysis, and microscopic observations provided insights into biofilm structure. HPLC analysis of carbon compound utilization indicates differential uptake of carbon sources. The extracellular polymeric substance (EPS) matrix of formed biofilms was comprehensively characterized through Fourier-transform infrared (FTIR) spectroscopy, along with quantitative analyses of uronic acids, proteins, and carbohydrates. These chemical analyses indicate that composition changes depending on the carbon source used for growth. Additionally, alterations in cellular characteristics were examined by isolating and analysing lipopolysaccharides (LPS) and outer membrane protein composition from cells. Aromatic hydrocarbon–induced cellular stress and biofilm formation were monitored through extra cytoplasmic function (ECF) sigma factor activation, as analysed by RT-PCR analysis. Collectively, this integrative approach reveals key molecular adaptations and resilience strategies that enable biofilm formation under aromatic hydrocarbon stress. The findings improve our understanding of bacterial survival, biofilm-associated antibiotic tolerance, and metabolic flexibility, highlighting *C. crescentus* as a powerful model organism for studying biofilm-driven resistance and microbial adaptation in toxic and nutrient-limited environments.

2:30pm **58** UG **Exploring Hydrogen Peroxide's Role in Inducing bcp Gene Expression in *Bacillus subtilis***

*Marius Stancu & Melinda Faulkner [Bradley University]

Bacteria produce reactive oxygen species (ROS) during aerobic respiration, leading to cellular damage. To prevent this damage, bacteria produce ROS-scavenging enzymes. *Bacillus subtilis* produces several of these enzymes, including bacterioferritin comigratory protein (Bcp); however, the factors responsible for controlling the expression of the *bcp* gene are still unknown. This project aims to identify hydrogen peroxide's potential role in inducing the expression of *bcp*, as well as the concentration of hydrogen peroxide that is most effective at inducing its expression. Throughout the span of the project, we used a transcriptional fusion to monitor the expression of *bcp*. This fusion contained the promoter of *bcp* attached to a chloramphenicol resistance gene and β-galactosidase (*bcp'-cat-lacZ*). We exposed *B. subtilis*strains with this *bcp'-cat-lacZ* fusion to various concentrations of different oxidants, including hydrogen peroxide, diamide, paraquat, and cumene hydroperoxide, and monitored *bcp* gene expression through their ability to survive on chloramphenicol. We found that cells exposed to 20-60 μM hydrogen peroxide survived at higher chloramphenicol concentrations than either unexposed cells or cells exposed to other oxidants, suggesting that hydrogen peroxide may induce the expression of *bcp*. These results remained consistent throughout experiments conducted both on LB agar plates and in LB broth in multi-well plates. Current studies seek to quantify the induction of *bcp* by hydrogen peroxide using β-galactosidase assays. Through these studies, we hope to better understand the conditions that promote the expression of *bcp*, providing insight into the role of Bcp in the overall oxidative stress response in *Bacillus subtilis*.

1:00pm **59** UG **Characterization of Communities in Experimentally Reduced Microbiomes of *Daphnia dentifera***

*Maryam Sohail Warraich, Jerry Kavouras, & Ashley Miller [Lewis University]

When the microbiome of *Daphnia dentifera*—a model organism used to study disease dynamics—is reduced, it is less likely to be infected by the fungus *Metschkinowia bicuspidata*. Microbiomes are the community of microorganisms living on or within an organism. Studying reduced daphnia microbiomes provides insight on how pathogens impact their hosts. The purpose of this project is to determine if the functional diversity of the daphnia microbiome changes when its species diversity is reduced by treatment with antibiotics. Species diversity is the number of species present in a community,

whereas functional diversity is the number of roles species in a community can serve. To investigate this, microbially reduced (MR) daphnia were cultivated. MR daphnia were cultured under antibiotic pressure and fed an algae inoculum treated with antibiotics; control daphnia were fed algae without antibiotic treatment. EcoPlate (BIOLOG) was used to assess functional diversity (i.e., community's utilization of carbon substrates) between MR daphnia and control daphnia. In two separate trials, the carbon richness and AWCD differed among the control and MR daphnia. In both experiments, the Shannon Diversity Index indicated MR daphnia had greater community diversity, or in this case greater functional diversity, than the control daphnia. So, it is clear that microbiome reduction did influence functional diversity. This may explain the differences observed when MR daphnia are infected by *M. bicuspidata*. The next step is to extract DNA from daphnia samples and perform ribosomal RNA intergenic spacer analysis to compare species diversity among the communities.

2:30pm **60** Grad **Exploration of Bacteriophage defense mechanisms in *Paraburkholderia* sp. – A *Dictyostelium discoideum* Symbiont**

*Reid Kleeman, Eli Scoles, & Susanne DiSalvo [Southern Illinois University Edwardsville]

Bacteria have existed in a perpetual evolutionary arms race against their primordial counterpart, a dynamic that has driven the development of a vast arsenal of anti-viral defense systems. Due to this constant pressure, bacteria have developed an extensive repertoire of tools to combat phage predation, including Crispr/Cas9 and abortive infection (Abi) mechanisms. Although a vast number of mechanisms have been identified, they remain predominantly unexplored. The purpose of this research is to explore unknown defense mechanisms that may persist in *Paraburkholderia* sp. With limited knowledge about how this genus of bacteria combats phage infection, we explored the possibilities of it containing a diffusible molecular signal that initiates defense. With initial observations showing a lack of defense in *Paraburkholderia hayleyella*, we experimented with other species and noticed a quantifiable change in growth post infection. This led to the exploration of filtrate testing, that when inoculated, certain *Paraburkholderia* sp. exhibited an amplification in growth. We noted this observation and discussed possible evolutionary indications for why this may occur. This has led to the exploration other genera where we explored the possibility of a similar defense mechanism.

1:00pm **61** Grad **Temperate Phages as Drivers of Strain-Level Variation in *Paraburkholderia–Dictyostelium* Symbiosis**

*Sara Shafii & Susanne DiSalvo [Southern Illinois University Edwardsville]

Bacteriophages are viruses that infect bacteria. They are key drivers of microbial evolution. Temperate phages can switch between lytic and lysogenic cycles, enabling them to potentially modify bacterial physiology, transfer genes, and influence ecological outcomes. Although temperate phages shape bacterial traits and community dynamics, their effects on interactions between bacteria and eukaryotic hosts remain poorly understood. The role of temperate phages in facultative symbioses, where bacteria alternate between free-living and host-associated lifestyles, remains unclear. Temperate phages influence bacteria by integrating into the host chromosome as prophages, where they can alter bacterial traits and ecological persistence. This project investigates the function of prophages in the symbiosis between facultative *Paraburkholderia* symbionts and their amoeba hosts, *Dictyostelium discoideum*. Phage activity was assessed using filtrate-spot assays and in vitro bacterial competition assays among Pa70, Pa317, and Pa159. Preliminary results show that Pa70 releases phage particles capable of lysing Pa317, and that Pa317 exhibits variable suppression in competition with Pa70, suggesting possible prophage-associated effects. These findings support the broader goal of determining whether prophage carriage contributes to strain-level differences in bacterial fitness and host outcomes.

2:30pm **62** UG **Influence of Photodynamic Inactivation on Phage-Mediated Lysis of *Paraburkholderia bonniea* 859**

*Yusra Amena, Andres Durantini, & Susanne DiSalvo [Southern Illinois University Edwardsville]

The rise of antibiotic-resistant bacteria highlights the need for alternative antimicrobial strategies. This study explores the combined effects of bacteriophage therapy and photodynamic inactivation (PDI) against *Paraburkholderia bonniea* strain 859 using the lytic bacteriophage Bonzo8 and the photosensitizer Rose Bengal (RB). Photodynamic inactivation relies on light-activated photosensitizers to generate reactive oxygen species (ROS), which can induce oxidative damage in bacterial cells and potentially alter susceptibility to phage infection. Bacterial growth dynamics were monitored using optical density (OD600) measurements under multiple treatment conditions, including bacteria alone, RB alone (1, 5, and 10 μM), phage alone, and combined RB–phage treatments. Control cultures exhibited typical exponential growth, reaching an OD600 of approximately 0.8. RB alone produced minimal growth inhibition across the tested concentrations. In contrast, phage-only treatments resulted in rapid bacterial lysis after approximately five hours. Combined RB–phage treatments demonstrated concentration-dependent effects on bacterial decline, suggesting that oxidative stress induced by PDI may influence phage infection dynamics. These findings indicate that integrating photodynamic inactivation with phage therapy may provide a promising approach for controlling bacterial populations. Ongoing experiments are evaluating methylene blue as an alternative photosensitizer to further investigate how different ROS-generating compounds influence phage–host interactions.

1:00pm 63 UG **Determining the Ability of *Pseudomonas* sp. to Inhibit the Growth of Various Bacterial Strains in the Presence of Naphthalene**

*Zahra Haji & Jenna Smith (Millikin University]

Antibiotic resistance has become a growing concern. A group of pathogens, abbreviated as ESKAPE, is the most likely to display antibiotic resistance. The Tiny Earth initiative educates researchers that non-pathogenic bacteria found in soil can produce antibiotic chemicals as a competitive advantage. My research utilized a *Pseudomonas* strain isolated from soil in the Decatur area, which had previously demonstrated antibiotic activity against ESKAPE safe relatives. Another aspect related to *Pseudomonas* that I decided to research was its ability to inhibit the growth of ESKAPE safe relatives in the presence of naphthalene. I had hypothesized that in the presence of naphthalene, my *Pseudomonas* strain would not only be able to grow but would also display inhibitory behavior against various ESKAPE safe relatives. Inhibitory behavior was assessed using spread patch assays. Based on the results of this experiment, my hypothesis was supported. The *Pseudomonas* strain was able to inhibit the growth of ESKAPE safe relatives *Enterobacter aerogenes* and *Pseudomonas putida* in the presence of naphthalene. When naphthalene was supplemented with an additional carbon source, glucose, it was observed that ESKAPE strains *Acinetobacter baylyi* and *Escherichia coli,* which previously were unable to grow on just naphthalene media, were able to grow, and the *Pseudomonas* strain was also able to inhibit the growth of these bacteria. When varying the pH of the naphthalene plates, it was observed that the *Pseudomonas* strain was able to inhibit the growth of ESKAPE safe relatives *Enterobacter aerogenes* at pH 6 and 7, and *Pseudomonas* putida at pH 7. These results support the potential for soil-derived *Pseudomonas* isolates in antimicrobial production and bioremediation related to naphthalene.

PHYSICS, MATHEMATICS, & ASTRONOMY

2:30pm 64 HS **Physics-Informed Reduced-Order Model for Active Aerodynamics Prediction and Dynamic Wing Control**

*Anuj Subramanian [Adlai E. Stevenson High School]

Active aerodynamics is an emerging technology that alters vehicle subsystems in real time to optimize as track conditions change. Repeated solver or computational fluid dynamics (CFD) evaluations inside a control loop is too slow for continuous optimization, often forcing fixed geometries and limited performance. This project proposes a physics-informed reduced-order model (PI-ROM) that replaces inefficient aerodynamic evaluations with fast, accurate coefficient predictions for reliable active aero rear wing control, thus reducing the risk of incorrect, delayed wing commands that could endanger the driver. A training/testing dataset was generated using XFOIL CFD sweeps for NACA airfoils. The PI-ROM combines thin-airfoil and drag-polar physics as baselines with a neural network residual to improve accuracy for non-ideal conditions. The framework underwent three iterations: calibrating the weights and preventing negative drag, improving drag prediction by leveraging the predicted lift within the residual, and revising the controller from curvature-only changes to an objective-driven strategy that prioritizes drag minimization on straights and downforce maximization in corners. The PI-ROM informed a closed-loop controller which was evaluated against a fixed-wing baseline in a vehicle dynamics track simulation described by ordinary differential equations. The PI-ROM achieved a 26.58x speedup relative to XFOIL prediction time while maintaining accuracy (Mean Absolute Error: 0.0298 for CL, 0.0034 for CD; Normalized Mean Absolute Percentage Error: 1.37% for CL and 8.73% for CD). In simulation, active control reduced lap time by 1.2s and saved 5.61 kJ more energy versus a fixed wing on the same track. Future work would involve 3D wing implementation and hyper-realistic vehicle dynamics to match real-world motorsports.

1:00pm 65 UG **Studying the Formation of Persistent Holographic Grating in Europium-Doped Barium-Tellurite Glass**

*Benjamin Cole, Abdullatif Hamad, & Eric Voss [Southern Illinois University Edwardsville]

In this project, we studied the formation of persistent holographic gratings in europium doped tellurite-barium glass samples using the four-wave mixing technique. We synthesized and polished four glass samples with compositions of $(80 - x)\ TeO_2 + 20BaO + xEu_2O_3$ where x = 1.0, 2.0, 3.0, 4.0 mol %. For each sample, we measured the diffracted power as a function of time, found the index of refraction using Fresnel equations by measuring the reflectance near normal incidence, and using a Lambda 1050+ NIR-VIS-UV spectrometer to obtain absorption spectra. The gratings were written using two crossed beams from an argon laser operating at 476.5 nm. The formed grating was monitored using a He-Ne laser operating at 632.8nm. From the FWM data, we found that the holographic grating strength was generally higher for the higher Eu concentrations. We also saw that an increase in europium concentration resulted in higher index of refraction and faster grating growth.

2:30pm 66 UG **Variations in Refractive Index and Sm-Fluorescence in Cadmium Bismuth Borate Glasses**

*Chelsie Hadley, PK Babu, & Saisudha Mallur [Western Illinois University]

Bismuth borate glasses have been previously used to study the optical properties of rare earth ions. We investigated samarium-doped cadmium bismuth borate glasses to study the refractive index and the fluorescence spectra of Sm^{3+} ions as a function of glass composition. Four glasses were prepared with the formula $xCdO:40Bi_2O_3:59.5\text{-}xB_2O_3:0.5Sm_2O_3$

where x is equal to 0, 5, 10, and 15 mol%. The glasses were prepared using the melt-quench method and they were then annealed, ground, and polished. The refractive index was determined by finding Brewster's Angle, and the fluorescence spectra were recorded using a double grating spectrometer with a laser excitation at 405 nm. The refractive index values lie within the range of 1.81 – 1.92. The fluorescence spectrum shows that the ratio between the intensities of the electric-dipole transition and the magnetic dipole transition decreases with increasing CdO concentration, resulting in increased symmetry around the Sm^{3+} site in the bismuth borate network.

1:00pm **67** UG **Variation of Refractive Index and Optical Band Gap in Tellurium-Zinc-Bismuth-Borate Glasses**

*John Reed IV, P.K. Babu, & Saisudha B. Mallur [Western Illinois University]

The optical properties of bismuth-borate glasses are expected to change under variation of zinc concentration differently with and without the presence of tellurium. A series of zinc-bismuth-borate glasses with compositions $xZnO:35Bi_2O_3:(65-x)B_2O_3$ (x = 0, 5, 10, 15 mol%) and a series of tellurium-zinc-bismuth-borate glasses with compositions $xZnO:35Bi_2O_3:10TeO_2:(55-x)B_2O_3$ (x = 0, 5, 10, 15 mol%) were prepared using a melt-quench technique followed by annealing, grinding, and polishing. The refractive indices of the samples were measured using a Brewster's Angle setup with refractive index values of the zinc-bismuth-borate series ranging from 2.03 to 2.11 and the tellurium-zinc-bismuth-borate series ranging from 1.96 to 2.19, and these values were compared to theoretical predictions of refractive index based on composition. Optical band gap was measured using a UV-VIS Spectrometer, with values ranging from 2.870 eV to 3.015 eV for the zinc-bismuth-borate series and 2.706 eV to 2.913 eV for the tellurium-zinc-bismuth-borate series. This data was analyzed to determine the impacts of increasing Zn^{2+} concentrations with and without the presence of tellurium. With tellurium present, the optical band gap increased linearly with increasing Zn^{2+} concentration and no such relationship was observed without tellurium present.

2:30pm **68** UG **Studying the Formation of Persistent Holographic Grating in Praseodymium-Doped Barium-Tellurite Glass**

*Nathan Oliveira, Abdullatif Hamad, & Eric Vos [Southern Illinois University Edwardsville]

For this project we studied the formation of persistent holographic gratings in praseodymium doped barium-tellurite glasses using the four-wave mixing technique. We made five samples of composition(100-x) TeO2 + 20 BaO + X Pr2O3 where X=0, 0.25, 0.50, 0.75, 1.00, 1.25 mol %. The gratings were written using two laser beams from an Argon laser operating at 476.5 nm with a crossing angle of 3.84°. A He-Ne laser operating at 632.8nm was used to read the grating at the Bragg angle. We also measured the absorption spectra using a Lamba1050+. In addition, we measured indices of a refraction at three wavelengths (450nm, 532nm, and 635nm) using Fresnel reflection near normal incidence. We found similar diffracted signals for each praseodymium doped sample but with significantly longer writing times to achieve the same maximum.

1:00pm **69** HS **Examining the Effects of Auction Format and Sector-Specific Valuation Distributions on Reserve Price Maximization Using Order-Statistic Theory, Expected Revenue Modeling, and FAucS Simulation Analysis**

*Srinithi Kambhampati [Adlai E. Stevenson High School]

The goal of this study was to determine how reserve prices in various economic sectors are impacted by different auction formats, including English, First-Price, and Second-Price auctions. Resources are devalued when reserve prices are not met, particularly in markets for real estate, telecommunications licenses, online advertising, and collectibles distributed via auctions. This causes inefficiency and lost revenue. In order to determine which auction format performs optimally across various sectors, this study measured the yield of each format regarding reserve price maximization. Computer simulations and human trials were conducted for efficiency testing. Using FAucS and JADE, 1,000 auctions in each sector were simulated with set reserve prices and asymmetric bidder behavior, later recording the percentage of the reserve price attained. Next, volunteers participated in a human simulation and placed bids in the same sectors, using identical auction rules as well as realistic reserve values. Data was analyzed to compare how each auction format performed across each sector. With a mean reserve price of 96.8% achieved, English auctions consistently attained high values in all sectors, followed by Second-Price auctions at 81.0% and First-Price auctions at 73.6%. Highlighting identical trends in both the human and computer simulations, the results supported the hypothesis that live auctions increase competition and reduce underbidding. High-value sectors, including telecommunications and real estate, benefited greatly from English auctions, while lower-margin sectors showed smaller but consistent gains. Statistical analysis confirmed significant differences between formats ($p < 0.001$), demonstrating that auction formats directly impact market profitability.

PLANT BIOLOGY

2:30pm **70** UG **Spatial Distribution of Horned Oak Galls Produced by *Callirhythis cornigera* on Pin Oaks (*Quercus palustris*) and Their Correlation with the Local Environment**

*Aidan Bein, Brett Frederickson, Atticus Whitten, Evan Meuth, Jason Williams, & Shannon McCarragher [Southern Illinois University Edwardsville]

Callirhythis cornigera, also known as the horned oak gall Wasp, are pests known to produce large stem galls, which are masses of plant tissue on various parts of the southern pin oak or Spanish swamp oak (*Quercus palustris*). In Illinois, pin oaks are some of the most common trees planted in urban and suburban neighborhoods, causing them to be subject to potential factors affecting their growth patterns. The wasp that produces these galls seems to be specific to the pin oak, and the gall formation seems to vary from tree to tree. Gall infestation can be detrimental to the tree's health, blocking nutrients from reaching the stems and leaves on the branches with galls. These galls are also heavier than most trees' natural parts, leading to branches falling more easily. In urban environments, the wasp are able to spread from tree to tree leading to an increased amount of infestation. Not much information is readily available involving the distribution of galls as well as their potential growth conditions and patterns. A potential connection between gall distribution and tree location can be theorized by observing spatial patterns on a heat map. This project is focused on discussing the potential relationship between the overall health and local environment of a tree compared to the number of galls found on the tree. We hypothesize that due to nutrient availability, urban grown pin oak trees will have more gall growth than those found in more natural environments. To test this, we will be observing potential variables such as diameter at breast height (DBH), number of galls, presence of horns, and mapping it using geographical software. Doing so, we can observe the potential trends in the development of oak galls on pin oaks in the Edwardsville, Illinois area. Our team is planning on mapping out the pin oaks in the Edwardsville area based on what trees are managed by the city of Edwardsville. So far, we have mapped out 60% of the municipally managed pin oak trees in the city and are planning on surveying the rest by April 2026. As of March 2026, out of 116 of the trees we have observed, 8% have been found to be free of galls, 20% have been removed, and 60% had horns on the galls. We also found that the DBH seems to have some relationship with gall infestation, showing higher amounts of galls on trees found near the mean of DBH. We also found that trees that are in the lower 30% of DBH's seem to show less galls, same as those in the upper 30%. After data collection, we are planning on creating a heat map marking potential trends in the distribution of gall formation on pin oaks. The horned oak galls created by the wasp can be very detrimental to communities and by creating a heat map and finding growth patterns, we will be able to provide potential methods for land managers to control their gall infestations in their communities without having to remove all the affected pin oaks.

1:00pm **71** UG **Isolation of a Nitrogen-Fixing Bacterium from the Roots and Soils of *Platanthera leucophaea* and *Epipactis helleborine***

*Michaela Barter, Noah Pyles, & Elizabeth Esselman [Southern Illinois University Edwardsville]

The soil microbiome is a critical component of terrestrial ecosystems, harboring millions of diverse organisms, including fungi, bacteria, viruses, and protozoa. These microbes facilitate a wide range of interactions that promote plant growth and productivity. Since their terrestrialization nearly 400 million years ago, many plants have relied on symbiotic relationships with bacteria and fungi for survival. *Platanthera leucophaea*, the Eastern Prairie Fringed Orchid, is a federally threatened terrestrial orchid restricted to fragmented wetlands and grasslands. In contrast, *Epipactis helleborine*, the Broad-leaved Helleborine, is an invasive orchid rapidly spreading across the United States and Canada. Comparing the microbiomes associated with these two species may provide insight into which microbes *P. leucophaea* may lack, allowing *E. helleborine* to spread rapidly. Recent metagenomic analyses identified a nitrogen-fixing bacterium associated with the roots and surrounding soils of both species. Because nitrogen availability can influence plant growth in nutrient-limited wetland systems, this bacterium may represent an important symbiont to these orchids. This study aims to isolate this nitrogen-fixing bacterium from the roots and soils of *P. leucophaea* and *E. helleborine* to better understand whether bacterial associations may influence the reintroduction success of *P. leucophaea*.

STEM EDUCATION

2:30pm **72** UG **Infanticide or Genetics: Calmodulin Mutations and Kathleen Folbigg**

*Cody Clayton & Keith Johnson [Bradley University]

Connecting DNA mutations and an understanding of protein structure and function is challenging using 2D images in textbooks or on slides. Using freely-available internet resources, students can explore the importance of mutations for protein structure and function and implications for disease. The case explores literature that illuminates the role of calmodulin in human heart health. The story involves the incarceration of an Australian mother for infanticide, but science exonerated her after revealing the presence of a mutation in calmodulin for the mother and at least two children who died. The case is delivered in multiple parts, involving readings, assessments, bioinformatics, exploration of 3D protein structures and mutations, and ethics questions. The case will be part of the Biomolecular Structure and Function collection on Qubeshub after it has been pilot tested in the classroom. The case will consist of pre-made 3D structures that can be used

without significant knowledge of the program and would be suitable for high school seniors as well as introductory biology courses.

1:00pm **73** UG **Comparison of Floating Wetland Treatment (FTW) Model for Secondary Classroom Use**

*Paige Kern & Dara Wegman-Geedey [Augustana College]

The need for projects and assignments that help US students develop scientific literacy is becoming more apparent in the current generation. It is critical that they not only learn fundamental science concepts, but also have a chance to see how these concepts apply to the everyday world. The ecological sciences encompass all that is the natural world, and the need for students to understand ecological processes is becoming increasingly important due to the impacts of climate change. Within the realm of education, a hands-on approach to learning has repeatedly shown better levels of comprehension and further use of knowledge by students. When students physically interact with materials in a laboratory or field setting, they often develop better critical thinking and questioning skills. We used three approaches to develop a hands-on experience with Floating Treatment Wetlands (FTW) for use in junior high and high school science classes. FTWs are artificial islands constructed to allow plants to grow hydroponically in water that is typically too deep for their roots to develop. The addition of native wetland plants to an aquatic ecosystem enables the plants to uptake/use of nutrients like nitrogen and phosphorus, which are common nutrients in run-off from croplands that can cause eutrophication of natural ponds, lakes, streams, and rivers. We created and assessed three systems over a two-month period: an in situ set of FTWs in the campus pond, an ex situ set of FTWs in large troughs in the campus greenhouse, and a scaled-down tabletop model on a lab bench. Each system had its pros and cons, depending on the budget, space, and desired learning goals for specific classroom use.

ZOOLOGY

2:30pm **74** UG **Trematode Communities in Wetlands at Two Restored Sites in Central Illinois during Fall**

*Helen Ratchford & David Estrada [Bradley University]

Parasites, though understudied, play a crucial role in shaping community structure by regulating populations, mediating competition, and comprising a significant portion of food webs. One common group of parasites are trematodes, which are flatworms with complex life cycles involving multiple hosts. This study examined the trematode communities in wetlands at two sites in central Illinois, Banner Marsh State Fish and Wildlife Area and Emiquon Nature Preserve, which were previously used for agriculture and mining. Previous studies have examined parasite communities at these sites during summer; this study focuses on communities in fall, for which parasite communities are less understood. To characterize these communities, six snail surveys were conducted between September and November in 2024 and 2025. Two snail species, *Physa gyrina* and *Planerbella trivolvis*, that are known to be hosts to trematodes were collected; corresponding data were also collected for weather conditions and water quality. Snails were screened for parasite infection in the laboratory using microscopy and a total of 53 infections were found. To aid identification, parasites from 7 snails were further analyzed using DNA extraction, PCR, and sequencing. In Banner Marsh, prevalence (the proportion of snails that were infected) peaked at approximately 17% in November. At Emiquon, prevalence peaked at 10% in late September before falling to 7% in November. Morphological and molecular analyses revealed echinostomes as the dominant parasite group (78.15% of infections), which is notable as this group includes important parasites of amphibians and other vertebrates. These findings indicate a significant presence of trematodes at these sites in fall and support the value of monitoring parasites as indicators of ecosystem health at different times of year. Future research should examine infection in other hosts (e.g., amphibians, waterfowl) to more fully understand seasonal dynamics and trematode transmission within these restored habitats.

1:00pm **75** UG **Increasing Evidence of Zika Virus Exposure in Neotropical Migratory Songbirds Arriving in Macon County, Illinois**

*Addison Oyer & Travis Wilcoxen [Millikin University]

Migratory songbirds are exposed to a wide range of mosquito-borne viruses, including flaviviruses such as Zika virus. Although birds are not considered primary reservoirs for Zika virus, increasing evidence suggests that their long-distance migratory behavior may allow for the transport of viral pathogens into new regions. We hypothesized that migratory songbirds would have IgM antibodies reactive to Zika virus upon arrival in Illinois, indicating recent exposure. We collected blood samples from 144 songbirds of 34 different species during spring migration in Macon County, Illinois. We completed enzyme-linked immunosorbent assays to determine if IgM antibodies specific to Zika virus were present. 30 birds out of the 144 collected (20.8%) had IgM antibodies reactive to Zika virus, with most positives occurring in Neotropical migrant species. To distinguish true Zika virus exposure from cross-reactivity, Zika-reactive samples were further evaluated using blockade-of-binding ELISA. 11 birds (7.6% of all individuals sampled) demonstrated ≥40% blockade and were considered truly Zika-positive upon arrival at the study site. Compared to a similar study conducted in 2020-2021, these results suggest an increase in recent Zika virus exposure among migratory songbirds. While risk of local transmission in Illinois remains low, these findings show potential for migratory birds to carry evidence of arbovirus exposure across long distances.

2:30pm **76** UG **How Small Mammal Foraging Activity Contributes to Seed Dispersal**

*Adrian Davis & Danielle Lee [Southern Illinois University Edwardsville]

Granivorous animals are key to the dispersal of seeds in the wild. In many species, this is done through defecation, where undigested seeds are released back into the environment. Alternatively, some animals engage in caching, where they will carry seeds away and store them to be consumed at a later date. If viable seeds are left undisturbed, through either process, they can potentially sprout into plants of their own. To better understand the trends in this type of dispersal, and to determine the type of caching (scatter-hoarding or larder hoarding) we set up four foraging stations with motion-activated game cameras, each baited with sunflower seeds coated with UV-reactive powder. Two stations were placed on the edge of a wooded canopy, and the other two were placed in a waist high grassland. By measuring and following the tracks left by the animals and using the camera data, we look to find differences in dispersal behavior between species and habitat.

1:00pm **77** UG **Sex-Specific Behavioral Responses of *Drosophila melanogaster* (Diptera: Drosophilidae) to Odorant Stimuli: Examining Response to Acetic Acid, Ethyl Acetate, and Ethanol**

*Amari Terrell & Marianne Robertson [Millikin University]

The olfactory system of *Drosophila melanogaster* has a critical role in survival and reproduction by detecting ecologically relevant odorants. This study explores sex-specific behavioral responses to acetic acid (AA), ethyl acetate (EA), and ethanol, three compounds associated with fruit fermentation. We conducted six odorant tests: AA vs. water, EA vs. water, ethanol vs. water, AA vs. EA, AA vs. ethanol, and EA. vs. ethanol, using 30 males and 30 females per test. Flies were given 5 minutes to explore two odor sources, while the time spent on each source, and the number of returns to each odorant was recorded. A two-way ANOVA was used to determine the interaction between sex and odorant preference. Both sexes spent more time on AA than water, supporting its established role as a strong ecological attractant and oviposition cue. EA elicited sex-specific responses: males preferred water, and females preferred EA, consistent with evidence that specific volatile odorants influence behavior across sexes. In the direct AA vs. EA comparison, there was a sex-specific odorant interaction detected; males spent more time on AA, where females spent more time on EA, but there wasn't a statistically significant difference. Ethanol produced no significant sex-specific differences in any comparison, supporting studies suggesting it acts as a weaker olfactory cue due to its widespread environmental presence. No considerable sex effects were observed for visit counts across any odorant pair. These findings reveal that sex-specific olfactory responses in *D. melanogaster* are odorant-dependent and not uniform across tested chemicals, contributing to a deeper understanding of how ecological context and neural processing structure odor-guided behavior.

2:30pm **78** Grad **Effects of Elevated CO_2 and Body Size on American Bullfrog Tadpole Growth, Survival, and Susceptibility to Trematode Parasites**

*Avril Enciso & John Marino [Bradley University]

Amphibian populations are declining globally due to multiple factors, including anthropogenic stressors like climate change and infectious disease. Elevated atmospheric carbon dioxide (CO_2), a driver of freshwater acidification, may influence host-parasite interactions by altering host physiology and immune function, although such effects may depend on individual traits (e.g., body size). This study examines how elevated CO_2 affects survival, growth and susceptibility to trematode parasites (*Echinostoma revolutum*) in American bullfrog (*Rana catesbeiana*) tadpoles, while also evaluating the role of host body size in mediating these effects. Two experiments were conducted to investigate the interaction between CO_2 exposure and host body size. In the first experiment, tadpoles of different size classes were exposed to parasite cercariae under ambient and elevated CO_2 conditions to measure infection, survival and growth. In the second experiment, immune defenses are being assessed using white blood cell counts and a natural antibody ELISA (enzyme-linked immunosorbent assay) to determine how immune defenses are influenced by CO_2 and thereby might mediate infection risk. Preliminary findings indicate that body size influences susceptibility to infection, with larger tadpoles tending to harbor higher numbers of parasite cysts than smaller individuals, while no clear effect of elevated CO_2 on infection levels has been detected. Data collection and analysis is still ongoing for other variables. Overall, this study highlights the importance of considering CO_2 driven environmental change and host traits in disease ecology and potential conservation concerns for amphibian populations that face multiple stressors.

1:00pm **79** Grad **Adaptive Tool Use in Response to Resource Viscosity: A Study of *Aphaenogaster rudis***

*Dylan Krohe & Paul Brunkow [Southern Illinois University Edwardsville]

Tool use is a well-documented behavior, yet the underlying morphological and ecological constraints that promote it vary across taxa. Among these, the woodland ant *Aphaenogaster rudis* is of particular interest due to its non-expandable gaster, which limits direct ingestion and promotes tool use as the primary foraging strategy. This study investigated how viscosity and food reward influence tool-use behavior in *A. rudis*, and contrasted these behaviors with the foraging strategies of a competitor species, *Prenolepis imparis*. Colonies of *A. rudis* were presented with six liquid resources varying in honey concentration and viscosity, with viscosity being modified with polyvinylpyrrolidone (PVP) to simulate higher honey equivalents. Foraging behavior was recorded in field-based hexagonal arenas using Arduino-controlled overhead cameras that captured images every three minutes over a three-hour period. From these images, two primary metrics were quantified:

maximum tool deposition and tool-recovery (harvest) rate. In parallel, *P. imparis* colonies were exposed to the same experimental solutions but observed for a shorter duration, as this species directly harvested the liquid resources without employing tools. For *P. imparis*, relative foraging effort and duration at each well were measured to assess resource preference and feeding behavior. Data were analyzed using a Type III ANOVA to evaluate the independent and interactive effects of food reward and viscosity. Results indicate that *A. rudis* deposited tools across all solution types but recovered more from wells with higher food rewards, suggesting sensitivity to reward and viscosity. Adjustments in tool-recovery intensity, rather than initial deposition, reflected behavioral flexibility in response to food reward.

2:30pm **80** UG **Foraging Behavior of Field Mice in Disturbed Natural Habitats**

*Grace Witsken & Danielle Lee [Southern Illinois University Edwardsville]

Field mice (*Peromyscus spp.* and *Microtus spp*.) critically shape the vegetative makeup of their ecosystems through their foraging behaviors by consuming and caching seeds. Preferentially removing and consuming some seeds while leaving others alone in the seed bank can alter the vegetative makeup of a habitat. This study examined how habitat disturbance and food item familiarity affect field mouse foraging behaviors. Trials were conducted where bucket enclosures fitted with trail cameras and modified for mesopredator (such as raccoons and skunks) exclusion were placed in study grids spanning three habitat treatment groups: undisturbed, semi-disturbed, and disturbed. Within the buckets, a familiar food item (black oil sunflower seeds) and an unfamiliar food item (American plum seeds) were placed side-by-side in a divided dish. Over 28 trials, only two field mouse visits were recorded, limiting statistical evaluation of disturbance and familiarity effects. However, the modified feeding station design successfully excluded mesopredators such as raccoons and skunks, which have interfered with previous foraging behavior observation trials. Although hypotheses could not be formally tested due to low field mouse activity, this study demonstrates an effective methodological framework for isolating target small mammal species that can be applied to future studies.

1:00pm **81** Grad **Behavioral Flexibility in Tool Use of *Aphaenogaster rudis*: Forced Choice Trials**

*Isabell Walker& Paul Brunkow [Southern Illinois University Edwardsville]

Tool use in animals is a prevalent behavioral phenomenon. Tool use is generally defined as manipulation of objects in the environment to achieve specific goals, such as obtaining food. Examples of tool use span across a wide array of animal taxa, ranging from primates extracting termites and cracking nuts to birds extracting insect larvae and fishes cracking clams. *Aphaenogaster rudis* is the most common ant in North American hardwood forests and is the most important disperser of understory wildflowers. *A. rudis* belongs to the subfamily Myrmicinae which contains species characterized by a chitinous gaster and lack of a distensible crop. These anatomical features make *A. rudis* poor transporters of liquid carbohydrates compared to sympatric competing species. Lacking this distensible crop has driven the evolution of tool-using behavior in the form of dropping absorbent debris for retrieval of liquid carbohydrate food sources. Debris items are then returned to the nest after they have soaked up the liquid food. *A. subterranea,* a closely related species, uses a wide variety of natural and synthetic objects as tools including sponge, leaves, soil, mulch and pine needles. *A. subterranea* have an observable preference towards tools with higher absorbative properties. The purpose of the present research was to examine the degree of flexibility in *A. rudis* tool use by trying to force selection of a tool known to be less preferred. We observed that *A. rudis* exhibits the same preference for higher absorbency tools as *A. subterranea.* Our results however suggest that *A. rudis* will use less absorbent tool when it is closer to a food reward. This suggests that *A. rudis* may actively be making economic decisions about tool use that further nuance our understanding about the evolution of this behavior.

2:30pm **82** UG **Microplastic Accumulation in Fish with Different Feeding Strategies**

*Kortney Stage & Paul Brunkow [Southern Illinois University Edwardsville]

Microplastic pollution is an increasing concern in freshwater ecosystems due to its persistence and potential impacts on aquatic organisms. This study investigates whether microplastic accumulation differs among fish species with distinct feeding strategies collected from two separate sites in east-central Missouri. Fish were sampled in groups of five individuals per species, for 7 different species. For each specimen, stomach and gills were dissected and processed separately. Stomach contents and gill tissues (all gill arches) were filtered using vacuum filtration and then submerged in 10% potassium hydroxide at 35 °C to digest remaining organic material. After several days of digestion, samples were examined under a microscope to identify and quantify microplastic particles. Species examined included pelagic feeders, such as striped shiners, which primarily consume prey within the water column, and benthic feeders, such as stonerollers, which graze on algae and organic matter scraped from gravel substrates. By comparing microplastic prevalence across species and tissue types, this study aims to determine whether feeding location within the water column and role in a food web influences microplastic ingestion and accumulation. Findings from this research will contribute to understanding how ecological niche and feeding behavior affect microplastic exposure in freshwater fish communities.

1:00pm **83** UG **Social Calls as Indicators of Foraging Activity in Big Brown Bats (*Eptesicus fuscus*)**

*Melvin Hodge & Bryan Arnold [Illinois College]

Bats produce a variety of high frequency sounds, including echolocation calls to identify potential prey items and navigate in their environment, and social calls which may have various functions. Recently, research has focussed on examining

social calls present in audio files recorded from automated recorders, as this can be a powerful tool to infer the behavior of bat species by linking the context of the recording to different call types. Big brown bats (*Eptesicus fuscus*) produce different types of social calls including frequency modulated bout (FMB) calls which are unique because of the role they play in foraging, functioning as a territorial signal to ward off conspecifics also foraging in the area. To examine the presence of FMB calls in different ecological contexts, we used data collected from automated recorders installed at Siloam Springs State Park in Clayton, Illinois focusing on recorders installed outside artificially constructed bat boxes. We observed two periods of time in the summer comparing FMB call density at various points in the night. Our results show that earlier in the summer FMB calls were equally common throughout the night, while later in the summer FMB calls were more frequent in earlier periods, indicating a shift in foraging behavior to earlier vs. later periods. While this study is ongoing, our preliminary results suggest that biologists can identify foraging patterns from audio recordings, allowing for a powerful method to assess behavior in a nocturnal setting.

2:30pm **84** UG **Population Differences in Corticosterone During Molt in a Wild Songbirds**

*Milla Helton, Jalyne Long, & Amberleigh Henschen [Eastern Illinois University]

Birds experience a number of energetically demanding events throughout their annual cycle. Energetic needs are partially balanced by the hormone corticosterone, which increases to release stored energy and help birds respond to short-term threats. However, this reduces energy for long-term processes such as molt. Migratory birds typically have a prebasic molt in the fall after the breeding season but before migration. Resident birds do not have the time pressure of migration and can therefore complete this prebasic molt at any time in the fall when it is most advantageous. Thus, we hypothesized that migrating birds would have a higher amount of corticosterone deposited in their feathers compared to non-migratory birds. We tested this hypothesis by measuring corticosterone levels in the tail feathers of common yellowthroats (*Geothlypis trichs*) from a population that doesn't migrate (Florida) and a population that does migrate (Wisconsin). Our initial research focused on optimizing a method to extract corticosterone from the feathers of common yellowthroats. We then found that there is a greater range of corticosterone levels in the Florida population, compared to the Wisconsin population. This might be due to the greater variability in the timing of molt in the non-migratory Florida population compared to the migratory Wisconsin population. This work is important for understanding life history evolution in wild birds.

1:00pm **85** UG **The Structure and Context of Social Calls Produced by Tree Roosting Bats *Lasiurus* and *Lasionycteris***

*Miranda Araujo, Laney Goddard, & Bryan Arnold [Illinois College]

As highly social mammals, bats produce a variety of social calls that extend beyond search phase and typical echolocation. Social calls are highly variable among species as they can communicate a broad range of information that includes individual identification, food location, and predator warnings. The goal of this research is to further understand and analyze how ecological context shapes the frequency and complexity of social calls in the hoary bat (*Lasiurus cinereus*), the eastern red bat (*Lasiurus borealis*), and the silver haired bat (*Lasionycteris noctivagans*) using automated recorders. Automated recorders were placed at Siloam Springs State Park in Clayton, Illinois, from mid May through mid August in three different ecological contexts: 1) open habitats with limited tree cover; 2) forested flight corridors; and 3) outside artificially constructed bat boxes built specifically for tree roosting bats. Recordings collected were analyzed using the bioacoustic program Kaleidoscope, which identified calls to species based on frequency and duration in comparison to a call library. After species identification, spectrograms were visually inspected and categorized as echolocation or social calls and placed into a social call type category based on shape and structure. The project is ongoing, but as of right now, at least seven different social call types have been identified among different bat species including a song-like call from the silver haired bat (*Lasionycterius noctivagans*).