

**TRANSACTIONS OF THE
ILLINOIS STATE ACADEMY OF SCIENCE**

SUPPLEMENT TO VOLUME 116



**115TH ANNUAL MEETING
APRIL 15, 2023**

WITH ILLINOIS JUNIOR ACADEMY OF SCIENCE REGIONAL WINNERS

IN PERSON ALL-DAY EVENT HOSTED BY



ILLINOIS STATE ACADEMY OF SCIENCE

FOUNDED 1907

**AFFILIATED WITH THE ILLINOIS STATE MUSEUM
SPRINGFIELD, IL**

TABLE OF CONTENTS

MEETING SCHEDULE.....	4
ABBREVIATIONS USED IN PROGRAM.....	4
CAMPUS MAP.....	5
ORAL PRESENTATIONS OVERVIEW	6
POSTER PRESENTATIONS OVERVIEW	7
ILLINOIS JUNIOR ACADEMY OF SCIENCE POSTER PRESENTATIONS OVERVIEW	8
ORAL PRESENTATIONS SCHEDULE – 9AM-12NOON WESTLAKE HALL	9
<i>Anthropology & Archeology – Rm 110A</i>	9
<i>Botany – Rm 026</i>	9
<i>Cell, Molecular, & Developmental Biology – Rm 212A</i>	9
<i>Chemistry – Rm 110A</i>	9
<i>Computer Science – Rm 026</i>	9
<i>Engineering & Technology – Rm 214A</i>	9
<i>Environmental Science – Rm 214A</i>	10
<i>Health Sciences – Rm 026</i>	10
<i>Microbiology – Rm 212A</i>	10
<i>Physics, Mathematics, & Astronomy – Rm 130</i>	10
<i>STEM Education – Rm 212A</i>	10
<i>Zoology – Rm 110A</i>	10
POSTER PRESENTATIONS SCHEDULE – 1:15PM-3:30PM RENAISSANCE COLISEUM.....	11
<i>Anthropology & Archeology</i>	11
<i>Botany</i>	11
<i>Cell, Molecular, & Developmental Biology</i>	11
<i>Chemistry</i>	12
<i>Computer Science</i>	12
<i>Environmental Science</i>	12
<i>Health Sciences</i>	13
<i>Microbiology</i>	13
<i>STEM Education</i>	13
<i>Zoology</i>	13
ILLINOIS JUNIOR ACADEMY OF SCIENCE POSTER PRESENTATIONS SCHEDULE – 1:15PM-3:30PM RENAISSANCE COLISEUM.....	15
KEYNOTE ADDRESS – DR LUKE HAVERHALS 4:30PM RENAISSANCE COLISEUM	17
MESSAGE FROM THE VICE PRESIDENTS	18
ORAL PRESENTATION ABSTRACTS.....	19
ANTHROPOLOGY & ARCHEOLOGY – RM 110A	19
BOTANY – RM 026	19
CELLULAR, MOLECULAR, & DEVELOPMENTAL BIOLOGY – RM 212A.....	21
CHEMISTRY – RM 110A	23
COMPUTER SCIENCE – RM 026	25
ENGINEERING & TECHNOLOGY – RM 214A	26
ENVIRONMENTAL SCIENCE – RM 214A	28
HEALTH SCIENCES – RM 026	29
MICROBIOLOGY – RM 212A	30
PHYSICS, MATHEMATICS, & ASTRONOMY – RM 130	30
STEM EDUCATION – RM 212A	33
ZOOLOGY – RM 110A.....	34

POSTER PRESENTATION ABSTRACTS.....	36
ANTHROPOLOGY & ARCHEOLOGY	36
BOTANY	36
CELLULAR, MOLECULAR, & DEVELOPMENTAL BIOLOGY	37
CHEMISTRY	45
COMPUTER SCIENCE	50
ENVIRONMENTAL SCIENCE	51
HEALTH SCIENCES	54
MICROBIOLOGY	55
STEM EDUCATION	58
ZOOLOGY	59
ILLINOIS JUNIOR ACADEMY OF SCIENCE REGIONAL WINNERS PRESENTATION ABSTRACTS.....	67

115TH ISAS ANNUAL MEETING

April 15, 2023

Bradley University

Hosts: Dr. Jennifer Jost & Dr. John Marino

MEETING SCHEDULE

SATURDAY, APRIL 15TH

MORNING EVENTS ARE IN WESTLAKE HALL

- 8:00am – 12:00noon Rm 116 – Check-in, On-Site Registration if Needed, Break Room
- 8:15am – 9:00am Rm 116 – Continental Breakfast
- 8:45am – 9:00am Rm 116 – Welcome
- 9:00am – 12:00noon Oral Presentations, Rms 026, 130, 110A, 212A, 214A

AFTERNOON EVENTS ARE IN RENAISSANCE COLISEUM

- 12:00noon – 4:00pm Main Entry – Check-in, On-Site Registration if Needed, Break Room
- 12noon – 1:00pm Lunch Buffet (tickets required)
- 1:15pm – 2:15pm Group A Poster Presentations (odd numbers)
- 2:30pm – 3:30pm Group B Poster Presentations (even numbers)
- 3:30pm – 4:30pm Roundtables, Tours
- 4:30pm – 5:30pm Keynote Address
- 5:30pm – 6:30pm Dinner (tickets required)
- 6:30pm – 7:00pm Award Presentations

Future Meeting Sites

2024 – Millikin University

ABBREVIATIONS USED IN PROGRAM

Division Abbreviations

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

Participant Abbreviations

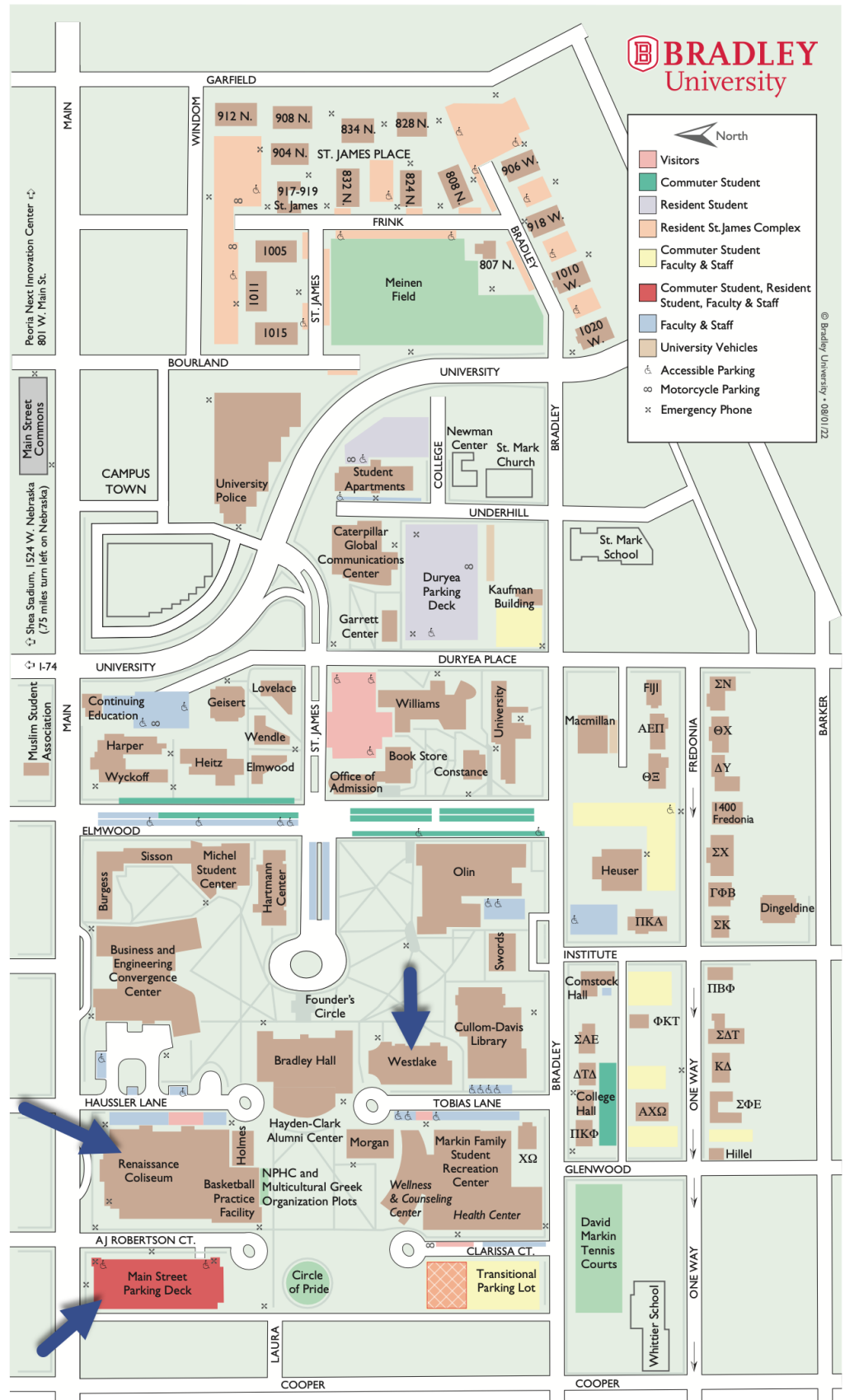
UG	Undergraduate Student
Grad	Graduate Student
None	Regular/Faculty Member

Participating School and Organization Abbreviations

Bradley	Bradley University
EIU	Eastern Illinois University
IC	Illinois College
INHS	Illinois Natural History Survey
ISU	Illinois State University
Lewis	Lewis University
Millikin	Millikin University

Moraine	Moraine Valley Community College
NIU	Northern Illinois University
SIUC	Southern Illinois University Carbondale
SIUe	Southern Illinois University Edwardsville
Southwestern	Southwestern Illinois College
WIU	Western Illinois University

CAMPUS MAP



See Arrows

- **Main Street Parking Deck** is the recommended parking location.
- **Westlake Hall** is where the Oral Presentations will take place.
- **Renaissance Coliseum** is where the Poster Presentations, Lunch and Dinner, and the Keynote Address will occur.

ORAL PRESENTATIONS OVERVIEW

WESTLAKE HALL

Time	Rm 130	Rm 026	Rm 110A	Rm 212A	Rm 214A
9:00am	Harsha Iduruwage Physics, Math, & Astro	Noah Pyles Botany	Joyce Ayodeji Chemistry	Emma Chilcoat Microbiology	Mohammad Faghani Engineering & Tech
9:15am	A K M Ashiqur Rahman Physics, Math, & Astro	Ally Wiseman Botany	Gbenga Dairo Chemistry	Devan Morgan Microbiology	Samson Olorunsiwa Engineering & Tech
9:30am	Al-Maliq Adetunji Physics, Math, & Astro	Antonio Ruiz Botany	Samuel Knebe Chemistry	Maede Shahin Cell Biology	Seth Seaba Engineering & Tech
9:45am	Md Hasibul Hasan Hasib Physics, Math, & Astro	Isaac Phillips Botany	Funmilola Anjorin Chemistry	Hannah Bowers Cell Biology	Mayank Hegde Engineering & Tech
10:00am	Amisha Rane Physics, Math, & Astro	Kurt Schulz Botany	Corbin Preston Chemistry	Riley Martin Cell Biology	Laveena Pareek Engineering & Tech
10:15am	Punya Paudel Physics, Math, & Astro	David Shepard Botany	Emma Green Chemistry	Suzanne Green Cell Biology	Chijioke Nzelu Engineering & Tech
10:30am	<i>BREAK</i>				
10:45am	A K M Ashiqur Rahman Physics, Math, & Astro	Laurence Leff Computer Science	Mariah Mack Zoology	Lucia Thompson Cell Biology	Sayed Uddin Shoaib Environmental Science
11:00am	Hamed Karami Physics, Math, & Astro	Mohamed Salem Computer Science	Emily Kemp Zoology	Victoria Stuart Cell Biology	Tyler McMahon Environmental Science
11:15am	Caleb Engebrecht Physics, Math, & Astro	Laurence Leff Computer Science	Delaney Haubner Zoology	Lucas Schultz STEM Education	Brianna Cook Environmental Science
11:30am	Gabriel Sojka Physics, Math, & Astro	Laurence Leff Computer Science	Richard Essner Zoology	Keith Johnson STEM Education	Autumn Belt Environmental Science
11:45am		Lei Guo Health Sciences	Abraham Packard Anthro & Archeology		Zhi-Qing Lin Environmental Science

POSTER PRESENTATIONS OVERVIEW

RENAISSANCE COLISEUM

Group A [1:15pm – 2:15pm] – Odd Numbers				Group A [2:30pm – 3:30pm] – Even Numbers			
1	Anjum Razzaque Computer Science	51	Samjhana Wagle Environmental Science	2	Anjum Razzaque Computer Science	52	Blake Rentz Environmental Science
3	Ibrahim Bello Cell Biology	53	Dalton Steinkamp Environmental Science	4	Keila Coria Tinoco Cell Biology	54	Emily Beiler Environmental Science
5	Oluwaseun Adeleke Cell Biology	55	Karli Rose Environmental Science	6	Eric Lenzi Cell Biology	56	Jessica Guyton Environmental Science
7	Kortney Lucius Cell Biology	57	Maddie Walsh Health Sciences	8	Rachel Watson Cell Biology	58	Jenna Staszewski Environmental Science
9	Femi Egbeleke Cell Biology	59	Kailynn Bobbett Health Sciences	10	Brooklynn Kelley Cell Biology	60	Trevor Rallo Environmental Science
11	Merve Diler Cell Biology	61	Sahar Rashid Health Sciences	12	Taylor Pierce Cell Biology	62	Gia-Maria Calbaza Microbiology
13	Emily Stidham Cell Biology	63	Elise Murphy Health Sciences	14	Jill Lambrechts Cell Biology	64	Rachel May Microbiology
15	Marjori Russo Cell Biology	65	Andrew Hofferkamp Microbiology	16	Nathan Budde Cell Biology	66	Brailey Coulter Microbiology
17	Ronnautica Dixon Cell Biology	67	Caitlin Martin Microbiology	18	Lauren Lucykow Cell Biology	68	Jenna Grabowski Microbiology
19	Riley Martin Cell Biology	69	Kendra LaMarsh Microbiology	20	Jaelyn Boone Cell Biology	70	Scott Holt Microbiology
21	Keagan Fox Cell Biology	71	Haylee Simmons Anthro & Archeology	22	Chloe La Prairie Cell Biology	72	Jana Wollesen STEM Education
23	Cherise Anderson Cell Biology	73	Isabella Aguirre Anthro & Archeology	24	Melina Hall Cell Biology	74	Fabiola Perez STEM Education
25	Ethan Monroe Cell Biology	75	Samantha Roberts Botany	26	Anna Sipes Cell Biology	76	Rhiannon Davids STEM Education
27	Gbemisola Akindeji Chemistry	77	Kurt Schulz Botany	28	Katie Kanaan Chemistry	78	Sarah Lyons Zoology
29	Grant Meyer Chemistry	79	Natalie Nicole Lopez Zoology	30	Lillie Purcell Chemistry	80	Patrick Menke Zoology
31	Zachary Dodson Chemistry	81	Kehinde Adeniyi Zoology	32	Aysha Kirkwood Chemistry	82	Carter Grieco Zoology
33	Okiki Quadri Chemistry	83	Amy Docter Zoology	34	Zaman Shah Chemistry	84	Katelyn Baker Zoology
35	Grace Brownlee Chemistry	85	Garima Ranabhat Zoology	36	Kaitlyn Walls Chemistry	86	Justin Caldwell Zoology
37	Ogheneruno Theodora Ideh Chemistry	87	Carolyn Kinnunen Zoology	38	Scott Huckabay Chemistry	88	Emma Antonelli Zoology
39	Keszia Fabien Chemistry	89	Efe Oniovokukor Zoology	40	Briar Hilsabeck Chemistry	90	Alexander Crickman Zoology
41	Emmanuel Adejumo Chemistry	91	John Moore Zoology	42	Aaron Weseloh Chemistry	92	Sophie Dorgan Zoology
43	Olivia Brinker Chemistry	93	Jessica Sandoval Zoology	44	Emily Jovanovich Chemistry	94	Elizabeth Hrycyna Zoology
45	ABSENT	95	Noah Wright Zoology	46	Lindsey LeBlanc Chemistry	96	Robert Weck Zoology
47	Quentin Ott Chemistry	97	Ainslee Stroup Zoology	48	Jake Provis Chemistry	98	Jordan Morgan Zoology
49	Katie Cutler Environmental Science			50	Eduardo Fulgencio Chemistry		

ILLINOIS JUNIOR ACADEMY OF SCIENCE POSTER PRESENTATIONS OVERVIEW

RENAISSANCE COLISEUM

Group A [1:15pm – 2:15pm] – Odd Numbers				Group A [2:30pm – 3:30pm] – Even Numbers			
101	Harmin Patel	9 th	Dunlap High School	102	Agrini Neekhara	9 th	Dunlap High School
103	Gloria Monteen	10 th	Trinity Academy	104	Patrick Swider	7 th	St. Athanasius
105	Jordon Gully	10 th	Governors French Academy	106	Jack Snizek & Michael O'Malley	8 th	Ebinger School
107	Sofia Weber	11 th	Northside College Prep	108	Ellynne Clover-Crowden	12 th	Agape Christian High School
109	Sahana Garapati	9 th	RISE STEM Research Institute	110	Aditya Prashanth	11 th	Illinois STEM Society
111	Anika Sudhir	11 th	RISE STEM Research Institute	112	Vibha Srikanth	12 th	Illinois STEM Society
113	Vignesh Tiruvannamalai	11 th	Illinois STEM Society	114	Aditya Sundar	11 th	Illinois STEM Society
115	May Sughayar	10 th	AQSA School	116	Macy Putnam	12 th	Southeastern High School
117	Eman Abedelal	10 th	AQSA School	118	Clare Blasgen & Maria Diagiantis	7 th	St. Mary Immaculate – Plainfield
119	Grace Stevens & Morgan Wilcox	8 th	Southeastern Junior High School	120	Aidan Piper	12 th	Althoff Catholic High School
121	Colin Gerlock	10 th	St. Jude Catholic School – New Lenox	122	Alex Hampton	12 th	Althoff Catholic High School
123	Alexander DiGiovanni	12 th	Althoff Catholic High School	124	Jad Dibs	11 th	Niles West High School
125	John Almos & Drew Wang	9 th	Edwardsville High School	126	Akosua Hayne	10 th	Walter Payton College Prep
127	Henry Bao	11 th	Walter Payton College Prep				

ORAL PRESENTATIONS SCHEDULE – 9AM-12NOON WESTLAKE HALL

Time	Presenter	Title of Presentation
Anthropology & Archeology – Rm 110A		
11:45am	Abraham Packard (SIUC, Grad)	Bones, Bugs & Bioerosion: Dermestid Beetle Substrate Preference, Substrate Survivorship, and Their Taphonomic Effect on Bone
Botany – Rm 026		
9:00am	Noah Pyles (SIUe, Grad)	Root Microbial Communities in Illinois <i>Spiranthes</i> Orchids
9:15am	Ally Wiseman (IC, UG)	Isolation and Provisional Identification of Mycorrhizal Fungi from Roots of Orchids Native to the Republic of Palau in the Western Pacific
9:30am	Antonio Ruiz (IC, UG)	Chemical Composition of Ghost Orchid (<i>Dendrophylax Lindenii</i>) Floral Nectar from Florida
9:45am	Isaac Phillips (IC, UG)	When Weeds Collide: Natural Colonization of Chicory (<i>Cichorium intybus</i>) by Dandelion (<i>Taraxacum officinale</i>) in a Frequently Mowed Lawn
10:00am	Kurt Schulz (SIUe)	Spring, Summer, Fall: When is Photosynthesis Best of All?
10:15am	David Shepard (Moraine)	Oaks of the Chicago Region
Cell, Molecular, & Developmental Biology – Rm 212A		
9:30am	Maede Shahin (SIUe, Grad)	Studying SLC12 Family Ion Channels in Planarians
9:45am	Hannah Bowers (SIUe, UG)	Investigating the Function of Novel Planarian Genes
10:00am	Riley Martin (Bradley, UG)	Localization of Estrogen Receptor Alpha in Chick Embryonic Spinal Cord Neurons
10:15am	Suzanne Green (IC, UG)	Cell Proliferation and Lung Tissue Regrowth in <i>X. laevis</i>
10:45 am	Lucia Thompson (SIUe, UG)	Antibiotic Induced Microbiome Depletion (AIMD) in Mice and its Effect on Thyroid Hormone Levels
11:00am	Victoria Stuart (Millikin, UG)	Innate Immunity in the Red-Eared Slider Turtle: Presence and Evolution of the Inflammatory Protein Serum Amyloid A
Chemistry – Rm 110A		
9:00am	Joyce Ayodeji (WIU, Grad)	The Flavonoid Content of <i>Morchella esculenta</i> (Morel) Extracts
9:15am	Gbenga Dairo (WIU, Grad)	Compounds from <i>Morchella esculenta</i> as Potential Inhibitors of RNA-Binding Protein La in Ovarian Cancer: A Molecular Modeling and Quantum Mechanics Approach
9:30am	Samuel Knebe (EIU, Grad)	Chemical Biology Approach to Uncover Influence of Sequence Variations on CES1 Activity in Live Cells
9:45am	Funmilola Anjorin (WIU, Grad)	Pancreatic Cancer Specificity of Phage Display-Selected Peptide MCA1
10:00am	Corbin Preston (EIU, UG)	Carbon Compound Metabolism of <i>Caulobacter crescentus</i> and Potential for Antibiotic Development
10:15am	Emma Green (IC, UG)	Comparing Copper Catalysts in the Synthesis of 1,2,3-Triazoles via Click Chemistry
Computer Science – Rm 026		
10:45am	Laurence Leff (WIU)	Announcing: Participatory Democracy Back End
11:00am	Mohamed Salem (WIU, Grad)	Sybilsoenet: An Algorithm for the Detection of Sybil Entities and Sybil Attacks
11:15am	Laurence Leff (WIU)	Announcing TwoLMS2IGS
11:30am	Laurence Leff (WIU)	Announcing: Multiple Choice Question Generator (Rx and Rt)
Engineering & Technology – Rm 214A		
9:00am	Mohammad Faghani (NIU, Grad)	Manufacturing Bio-plastics from Hemp Residues
9:15am	Samson Olorunsiwa (ISU, Grad)	Agile Software Quality Assurance using Scrum Theory
9:30am	Seth Seaba (ISU, Grad)	The Application of Lean in Software Development Lifecycle
9:45am	Mayank Hegde (ISU, Grad)	Smart Supply Chain Risk Management
10:00am	Laveena Pareek (ISU, Grad)	Role of Artificial Intelligence in Smart Supply Chain Management
10:15am	Chijioke Nzelu (ISU, Grad)	UX Designing for Process Improvement: Implementing Six Sigma Methodologies

Time	Presenter	Title of Presentation
Environmental Science – Rm 214A		
10:45am	Sayed Uddin Shoaib (NIU, Grad)	Municipal Solid Waste: A Prediction Methodology for the Generation Rate in the United States Counties
11:00am	Tyler McMahon (Bradley, UG)	Effects of Burning and Grazing on Lepidoptera Diversity in Illinois Tall Grass Prairies
11:15am	Brianna Cook (Bradley, UG)	Landscape of Fear in Response to Anthropogenic Hunting Patterns
11:30am	Autumn Belt (SIUe, UG)	Mortality Bioassay of <i>Drosophila melanogaster</i> Following Exposure to Perfluorooctane Sulfonate Along with Ivermectin
11:45am	Zhi-Qing Lin (SIUe)	Toxic Metal Accumulation in Shellfish Commercially Available in the US Market
Health Sciences – Rm 026		
11:45am	Lei Guo (NIU, Grad)	Novel Risk Indices for Analyzing County-level Cancer Disparities in Illinois: Development and Validation
Microbiology – Rm 212A		
9:00am	Emma Chilcoat (SIUe, Grad)	The Type VI Secretion System: A Defense Mechanism by a Termite Gut Symbiont
9:15am	Devan Morgan (IC, UG)	Identifying Potential Novel Antibiotics for Future Use
Physics, Mathematics, & Astronomy – Rm 130		
9:00am	Harsha Iduruwage (WIU, Grad)	Estimating Transmission Parameters for Covid-19 in Sri Lanka
9:15am	A K M Ashiqur Rahman (WIU, Grad)	Measurement Error Mitigation Techniques used in a Single Qubit Encoded into 3(GHZ) Code
9:30am	Al-Maliq Adetunji (WIU, Grad)	An Investigation into Extending Capabilities of Standard Quantum Error Correcting Codes to Handle Amplitude Damping Errors
9:45am	Md Hasibul Hasan Hasib (WIU, Grad)	Influence of Host Glass Composition on Optical Absorption of Pr ³⁺ and Dy ³⁺ Co-Doped in Bismuth Boro-Tellurite Glasses
10:00am	Amisha Rane (WIU, Grad)	Finding the Optimal Spectral Resolution for Analysis of Molecular Line Observations of a Sample of High-Mass Star Forming Regions
10:15am	Punya Paudel (WIU, Grad)	Continuum Imaging of Three High-Mass Star Forming Regions
10:45am	A K M Ashiqur Rahman (WIU, Grad)	Analysis of Stimulated Emission Cross-Section of Praseodymium (Pr ³⁺) and Dysprosium (Dy ³⁺) Ions Co-Doped in Bismuth Boro-Tellurite Glasses
11:00am	Hamed Karami (WIU, Grad)	Perfect Colorings of Generalized Petersen Graphs
11:15am	Caleb Engebrecht (WIU, UG)	A Mathematical Model of Losses in Multistranded Reinforced Cables
11:30am	Gabriel Sojka (WIU, UG)	Molecular Masers in the Orion Nebula
STEM Education – Rm 212A		
11:15am	Lucas Schultz (IC, UG)	Special Relativity 2D Pedagogical Video Game
11:30am	Keith Johnson (Bradley)	Teaching Macromolecular Structure with Computer Models
Zoology – Rm 110A		
10:45am	Mariah Mack (SIUe, Grad)	Developmental Plasticity of <i>Ambystoma texanum</i> Under Various Hydroperiod and Predation Risk Conditions
11:00am	Emily Kemp (Millikin, UG)	Sertraline Exposure Influences Learning in Developing Tadpoles
11:15am	Delaney Haubner (Millikin, UG)	Surveillance of West Nile Virus in Migratory Warblers in Central Illinois
11:30am	Richard Essner (SIUe)	Semicircular Canal Size Constrains Vestibular Function in Miniaturized Frogs

POSTER PRESENTATIONS SCHEDULE – 1:15PM-3:30PM

RENAISSANCE COLISEUM

Time	#	Presenter	Title of Presentation
Anthropology & Archeology			
1:15pm	71	Haylee Simmons (IC, UG)	Development and Sexual Dimorphism in Human Chins
1:15pm	73	Isabella Aguirre (IC, UG)	Human Orbital Index Development and Sexual Dimorphism
Botany			
1:15pm	75	Samantha Roberts (SIUe, Grad)	Variation in Insect Visitation and Seed Viability for Three Species of <i>Spiranthes</i> Orchids
1:15pm	77	Kurt Schulz (SIUe)	Tracking Invasive <i>Lespedeza cuneata</i> Using Remote Sensing
Cell, Molecular, & Developmental Biology			
1:15pm	3	Ibrahim Bello (SIUe, Grad)	Investigating the Genetic Locus of mnd Gene in a Basidiomycete Fungus <i>Schizophyllum commune</i>
2:30pm	4	Keila Coria Tinoco (Bradley, UG)	Effects of Ketoconazole on Vac8-GFP Localization in <i>Komagataella pastoris</i>
1:15pm	5	Oluwaseun Adeleke (SIUe, Grad)	The Immediate Effect of Bite Blocks on Brux-Like Motor Patterns and Long-Term Expression of Myogenic Cell Lineage Markers, Pax7 and Myogenin
2:30pm	6	Eric Lenzi (Bradley, UG)	Antimicrobial Production from Soil Pseudomonads
1:15pm	7	Kortney Lucius (EIU, Grad)	Exploring the Fungus-Derived Health Supplement PSK as a Biofuels Co-Product
2:30pm	8	Rachel Watson (Bradley, UG)	Investigation of the Relationship between Trehalose Synthesis and Fumonisin Production Using qRT-PCR
1:15pm	9	Femi Egbeleke (WIU, Grad)	The Anti-Cancer Effect of <i>Acmella</i> extracts in Ovarian Cancer
2:30pm	10	Brooklynn Kelley (SIUe, UG)	Rescue of the ggpps11 Variegated Phenotype Using Meristem Specific Promoters
1:15pm	11	Merve Diler (EIU, Grad)	The Role of Msx1 And Pura in Fibroblast and Liver Cell Identity
2:30pm	12	Taylor Pierce (SIUe, UG)	Classical Conditioning of <i>Schmidtea mediterranea</i> Using Common Flavor Extracts
1:15pm	13	Emily Stidham (Bradley, UG)	The Effect of Chemotherapy on Cancer Cell Aggression in Ovarian Cancer Stem Cells and Bulk Ovarian Cancer Cells
2:30pm	14	Jill Lambrechts (SIUe, UG)	Leaf Morphology in Arabidopsis Berberine Bridge Enzyme-Like Mutants
1:15pm	15	Marjori Russo (IC, UG)	Treating <i>Xenopus laevis</i> Corneas with Amylase and Collagenase to Disrupt Stromal Integrity
2:30pm	16	Nathan Budde (SIUe, UG)	Developing a Circumnutation Analysis Pipeline for Arabidopsis Floral Meristems
1:15pm	17	Ronnautica Dixon (IC, UG)	Evaluating Hair Cell Damage in Neuromasts of <i>Xenopus laevis</i>
2:30pm	18	Lauren Lucykow (SIUe, UG)	Identifying a Potential Mating Pheromone Gene in <i>Schizophyllum commune</i>
1:15pm	19	Riley Martin (Bradley, UG)	Effect of Oxidative Stress on Expression of Methionine Sulfoxide Reductase Genes in <i>Tetrahymena thermophila</i>
2:30pm	20	Jaelyn Boone (SIUe, UG)	Identifying and Evaluating a Potential Full-Length Receptor Gene in <i>Schizophyllum commune</i> Matb $\alpha 9$ - $\beta 6$
1:15pm	21	Keagan Fox (EIU, UG)	An Investigation of Uncharacterized Proteins from <i>Trametes versicolor</i> (Turkey Tail Fungus) Involved in the Degradation of Lignocellulosic Biomass
2:30pm	22	Chloe La Prairie (Millikin, UG)	The Cytotoxicity Effects of Punicalagin on the Follicular Variant of Papillary Thyroid Carcinoma
1:15pm	23	Cherise Anderson (Bradley, UG)	Production of Dopaminergic iPSC-Derived Neurons on Polycaprolactone Nanofiber
2:30pm	24	Melina Hall (Millikin, UG)	Characterizing T ₃ and T ₄ Influence on the Efficacy of Two Pro-Apoptotic Cytotoxins
1:15pm	25	Ethan Monroe (SIUe, UG)	Antibiotic Resistance of Two Periodontal Pathogens for Development of an Antibiotic Cocktail

Time	#	Presenter	Title of Presentation
2:30pm	26	Anna Sipes (EIU, UG)	The Effects of Snai2 on Neuronal and Fibroblast Gene Expression
Chemistry			
1:15pm	27	Gbemisola Akindeji (WIU, Grad)	Anti-carcinogenic Activity of <i>Acmella</i> Extracts in Pancreatic Cancer
2:30pm	28	Katie Kanaan (WIU, UG)	Creating a Standard of Comparison for Nymph and Larval Tick Identification Utilizing Glutaraldehyde Fixation and Scanning Electron Microscopy
1:15pm	29	Grant Meyer (WIU, Grad)	Potency Testing of Cannabidiol in Hemp-infused Gummies among Nineteen Cannabinoids by Liquid Chromatography Ultraviolet Detection
2:30pm	30	Lillie Purcell (WIU, UG)	Analyzing Illicit Drugs Using Silver Nanoparticles
1:15pm	31	Zachary Dodson (WIU, Grad)	Quantification of Cannabidiol in Hemp-infused Water by Ultra High Performance Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry
2:30pm	32	Aysha Kirkwood (Bradley, UG)	Oscillating Behavior of Iron in Acidic Media
1:15pm	33	Okiki Quadri (WIU, Grad)	Towards the Synthesis of o-Iodoxybenzoic Acid Derivatives with Biphenyl and Triphenyl Scaffolds
2:30pm	34	Zaman Shah (Bradley, UG)	Copper-Catalyzed Alkyne-Azide Cycloaddition Reactions Utilizing Copper-Based Nanoparticles Trapped within a Polydimethylsiloxane Matrix
1:15pm	35	Grace Brownlee (WIU, Grad)	Quantification of Cannabichromene in Cannabichromene Isolates of Hemp among Nineteen Cannabinoids by Liquid Chromatography Ultraviolet Detection
2:30pm	36	Kaitlyn Walls (Bradley, UG)	Measuring Varying Levels of Sugars in Soft-Drinks Utilizing RI and Raman Spectroscopy
1:15pm	37	Ogheneruno Theodora Ideh (WIU, Grad)	Toxicity Evaluation of <i>Acmella alba</i> Crude Extracts on Zebrafish (<i>Danio rerio</i>) Embryos
2:30pm	38	Scott Huckabay (IC, UG)	Exploring New Nickel-Based Catalysts or Suzuki-Miyaura Reactions
1:15pm	39	Keszia Fabien (WIU, Grad)	Potency Testing of Cannabinol in Cannabinol Isolates of Hemp among Nineteen Cannabinoids by Liquid Chromatography Ultraviolet Detection
2:30pm	40	Briar Hilsabeck (WIU, UG)	Functionalization of Humic Acid for Metal Extraction Using Iron Nanoparticles
1:15pm	41	Emmanuel Adejumo (WIU, Grad)	Quantification of Cannabigerol among Nineteen Cannabinoids in Hemp-infused Gummies by Liquid Chromatography Ultraviolet Detection
2:30pm	42	Aaron Weseloh (WIU, UG)	Potency Testing of Cannabidiolic Acid in Dried Hemp Flowers among Sixteen Cannabinoids by Liquid Chromatography Ultraviolet Detection
1:15pm	43	Olivia Brinker (WIU, UG)	Antioxidants in Hot-Brewed and Cold-Brewed Teas (FRAP Method)
2:30pm	44	Emily Jovanovich (WIU, UG)	Potency Testing of $\Delta 8$ -Tetrahydrocannabinol in Delta 8 Concentrate among Nineteen Cannabinoids by Liquid Chromatography Ultraviolet Detection
1:15pm	45	ABSENT	ABSENT
2:30pm	46	Lindsey LeBlanc (WIU, UG)	Quantification of Cannabigerolic Acid among Sixteen Cannabinoids in Dried Hemp Flowers by Liquid Chromatography Ultraviolet Detection
1:15pm	47	Quentin Ott (WIU, UG)	Shrinking Sticks in Liquid Nitrogen
2:30pm	48	Jake Provis (WIU, UG)	Quantification of $\Delta 9$ -Tetrahydrocannabinol among Nineteen Cannabinoids in Delta 8 Concentrate by Liquid Chromatography Ultraviolet Detection
2:30pm	50	Eduardo Fulgencio (IC)	Preparation and Preliminary Application of Imidazolium Ionic Liquids of Varying Carbon-Chain Length
Computer Science			
1:15pm	1	Anjum Razzaque (WIU)	Internet of Things (IoT) in Optimizing Supply Chains to Improve Organizational Performance
2:30pm	2	Anjum Razzaque (WIU)	Changing Teaching and Learning to Improve Learning Outcomes when Moderated by Students' Culture and Mode of Learning
Environmental Science			
1:15pm	49	Katie Cutler (SIUe, Grad)	Assessing Seismic Pollution from Bridges Over Streams and Rivers
1:15pm	51	Samjhana Wagle (SIUe, Grad)	Spatial Variation of Selenium in Lake Erie Sediments
2:30pm	52	Blake Rentz (SIUe, UG)	Establishment and Bioassay of an Isogenic Strain of the DDT-Resistant <i>Drosophila melanogaster</i>

Time	#	Presenter	Title of Presentation
1:15pm	53	Dalton Steinkamp (SIUe, UG)	Selenium Accumulation in Different Cultivars of Garlic (<i>Allium sativum</i>) in Southern Illinois
2:30pm	54	Emily Beiler (SIUe, UG)	The Determination of Altered Perfluorooctane Sulfonate Toxicity in Male <i>Drosophila melanogaster</i> Following Co-exposure of Ion Channel Modifiers
1:15pm	55	Karli Rose (SIUe, UG)	A Comparison of Arboreal Vertebrate Diversity in Forest Edge and Forest Interior Habitats
2:30pm	56	Jessica Guyton (Bradley, UG)	The Impacts of Ammonium Nitrate on the Growth, Survival, and Behavior of <i>Planorbella trivolvis</i> and <i>Physa gyrina</i> Snails
2:30pm	58	Jenna Staszewski (Lewis, UG)	The Filtering Effects of <i>Dreissena polymorpha</i> on <i>Metschnikowia bicuspidata</i> Parasitism in <i>Daphnia dentifera</i>
2:30pm	60	Trevor Rallo (SIUe, UG)	Analyzing Decomposition in a Temperate Lotic System
Health Sciences			
1:15pm	57	Maddie Walsh (SIUe, Grad)	The Effects of Smoking and Vaping on the Oral Microbiome: A Comparative Study
1:15pm	59	Kailynn Bobbett (SIUe, UG)	Does Cigarette Smoke or E-Cigarette Vapors with or without Nicotine Affect Growth of <i>Actinomyces viscosus</i> , an Endodontic Pathogen?
1:15pm	61	Sahar Rashid (SIUe, UG)	Does Cigarette Smoke or E-Cigarette Vapors with or without Nicotine Affect Growth of <i>Aggregatibacter actinomycetemcomitans</i> , a Periodontal Pathogen?
1:15pm	63	Elise Murphy (SIUe, UG)	Survivability of Opportunistic Oral <i>Candida albicans</i> After Exposure to SmartMouth and Other Mouth Rinses
Microbiology			
2:30pm	62	Gia-Maria Calbaza (Bradley, UG)	Implementing Transposon Mutagenesis to Investigate Proteins that Alter the Expression of Bacterioferritin Comigratory Protein in <i>Bacillus subtilis</i>
2:30pm	64	Rachel May (Lewis, UG)	Antibacterial Properties of Extracts from the Osage Orange, <i>Maclura pomifera</i>
1:15pm	65	Andrew Hofferkamp (SIUe, Grad)	The Enemy of My Enemy ss My Friend: Identifying Prophages in <i>Paraburkholderia</i> Symbionts of <i>Dictyostelium discoideum</i> and Investigating Their Role in Host Colonization Competition
2:30pm	66	Brailey Coulter (SIUe, UG)	Microbiome Analysis After AIMD in Mice
1:15pm	67	Caitlin Martin (SIUe, Grad)	Investigating the Role of Lysozymes and Other Host Factors in Mediating Amoeba Resilience to <i>Paraburkholderia</i> Infections
2:30pm	68	Jenna Grabowski (SIUe, UG)	Exploring the Role of Antimicrobial Lysozyme Genes in the Susceptibility of Amoeba Host Cells to <i>Paraburkholderia</i> Symbiont Infections
1:15pm	69	Kendra LaMarsh (IC, UG)	Testing for Drug Resistant Bacteria in Central Illinois Soil
2:30pm	70	Scott Holt (WIU)	Beneficial Bacteria Isolated From Yard-Long Bean (<i>Vigna unguiculata</i> (L.) Walp. Ssp. <i>sesquipedalis</i> (L.) Verde)
STEM Education			
2:30pm	72	Jana Wollesen (SIUe, Grad)	Investigating Metacognition in Introductory Biology Students at a Public University in Illinois
2:30pm	74	Fabiola Perez (SIUe, UG)	Illinois High School Students' Perceptions and Relatability to Scientists Before and After Authoring or Completing Scientist Spotlights
2:30pm	76	Rhiannon Davids (Bradley, UG)	Incorporating Themes into STEM Education Outreach
Zoology			
2:30pm	78	Sarah Lyons (Bradley, UG)	The Long Term Effects of Aerial Exposure on the Invasive Zebra Mussel, <i>Dreissena polymorpha</i>
1:15pm	79	Natalie Nicole Lopez (Bradley, Grad)	Using DNA Sequencing to Reveal the Diversity of Echinostome Trematode Parasites in Central Illinois
2:30pm	80	Patrick Menke (Bradley, UG)	Exploring the Effects of Potassium Chloride during Aerial Exposure on Zebra Mussel Survival
1:15pm	81	Kehinde Adeniyi (SIUe, Grad)	Microhabitat Characteristics of Calling Sites in the Illinois Chorus Frog, <i>Pseudacris streckeri illinoensis</i>
2:30pm	82	Carter Grieco (Bradley, UG)	Long-Term Field Growth Following Aerial Lab Exposure in Zebra Mussels <i>Dreissena polymorpha</i>

Time	#	Presenter	Title of Presentation
1:15pm	83	Amy Docter (SIUe, Grad)	Behavior and Activity Patterns of the Illinois Chorus Frog (<i>Pseudacris streckeri illinoensis</i>)
2:30pm	84	Katelyn Baker (SIUe, UG)	Effects of Maternal Age on Offspring Development in Rhesus Macaques at Cayo Santiago
1:15pm	85	Garima Ranabhat (SIUe, Grad)	Microhabitat Characteristics of Oviposition Sites of the State-Threatened Illinois Chorus Frog (<i>Pseudacris streckeri illinois</i>)
2:30pm	86	Justin Caldwell (Millikin, UG)	Relationship Between Starvation Intervals and Longevity in <i>Drosophila melanogaster</i>
1:15pm	87	Carolyn Kinnunen (SIUe, Grad)	Prevalence of Infection by <i>Batrachochytrium dendrobatidis</i> and Ranavirus in a Sand Prairie Amphibian Community in Southwestern Illinois
2:30pm	88	Emma Antonelli (Millikin, UG)	Kin Discrimination in Female <i>Drosophila melanogaster</i> (Diptera: Drosophilidae): Signs of Aggression Between Related and Unrelated Females
1:15pm	89	Efe Oniovokukor (SIUe, Grad)	Investigating the Impact of Predator Odor Cue on Field Mice
2:30pm	90	Alexander Crickman (Lewis, UG)	The Effect of Competition-Induced Stress in <i>Daphnia dentifera</i> by <i>Dreissena polymorpha</i> and its Susceptibility to Infection by <i>Metschnikowia bicuspidata</i>
1:15pm	91	John Moore (SIUe, Grad)	The Effect of Sexual Dimorphism in Mosquitofish on Predation of Amphibian Larvae
2:30pm	92	Sophie Dorgan (Millikin, UG)	Repeatability of Peak Corticosterone Response in Recaptured Songbirds
1:15pm	93	Jessica Sandoval (SIUe, Grad)	Drivers of Life History Variation in a Paedomorphic Salamander
2:30pm	94	Elizabeth Hrycyna (INHS)	Population Trends of Introduced Beetles in Forests, Wetlands, and Grasslands Across Illinois Over 20 Years
1:15pm	95	Noah Wright (EIU, Grad)	Thermal Acclimation of the Green Sunfish, <i>Lepomis cyanellus</i> , Induce Changes in Whole-Organism Thermal Thresholds and Mitochondrial Bioenergetics
2:30pm	96	Robert Weck (Southwestern)	A Test of Reproductive Isolation Between Two Populations of Cave-Dwelling Snails
1:15pm	97	Ainslee Stroup (IC, UG)	Using Automated Recorders to Study Social Calls of Insectivorous Bats in Siloam Springs State Park
2:30pm	98	Jordan Morgan (IC, UG)	Acoustic Structure and Variability of Distress Calls in Evening Bats (<i>Nycticeius humeralis</i>)

ILLINOIS JUNIOR ACADEMY OF SCIENCE
POSTER PRESENTATIONS SCHEDULE – 1:15PM-3:30PM
RENAISSANCE COLISEUM

Time	#	Presenter	Title of Presentation
1:15pm	101	Harmin Patel (9 th) [Dunlap High School]	The Effects of a Full Vs. Empty Stomach in Iron Absorption
2:30pm	102	Agrini Neekhara (9 th) [Dunlap High School]	Commercially Labeled Sports and Energy Drinks: Do They Work?
1:15pm	103	Gloria Monteen (10 th) [Trinity Academy]	Let Down Your Hair
2:30pm	104	Patrick Swider (7 th) [St. Athanasius]	Where the Rubber Meets the Road
1:15pm	105	Jordon Gully (10 th) [Governors French Academy]	Advancing Agriculture: Using Leaf Architecture To Improve Crop Production
2:30pm	106	Jack Sniezek & Michael O'Malley (8 th) [Ebinger School]	The Effect of Different Materials on Sound
1:15pm	107	Sofia Weber (11 th) [Northside College Prep]	Regional Variation in Wind Impact on Sea Ice
2:30pm	108	Ellynn Clover-Crowden (12 th) [Agape Christian High School]	The Point Is...
1:15pm	109	Sahana Garapati (9 th) [RISE STEM Research Institute]	<i>C. elegans</i> APL-1 Protein Response to Caffeine as a Model for Human β -AMYLOID Peptide for Alzheimer's Disease
2:30pm	110	Aditya Prashanth (11 th) [Illinois STEM Society]	Human Body Detection with Occlusion
1:15pm	111	Anika Sudhir (11 th) [RISE STEM Research Institute]	The Impact of Cyanobacteria on the Rate of Regeneration of Planaria to Determine Novel Antiproliferative and Cytotoxic Compounds for Development of a Novel Cancer Treatment
2:30pm	112	Vibha Srikanth (12 th) [Illinois STEM Society]	Smarter Farming Through Programming
1:15pm	113	Vignesh Tiruvannamalai (11 th) [Illinois STEM Society]	Conventional Paint vs Natural Alternative: Impact on Water Quality Over Time
2:30pm	114	Aditya Sundar (11 th) [Illinois STEM Society]	Impact of Airfoil Design on Lift
1:15pm	115	May Sughayar (10 th) [AQSA School]	Does Fish Type Impact the Effectiveness of the Aquaponics System
2:30pm	116	Macy Putnam (12 th) [Southeastern High School]	The Development of a Mobile, Arduino-Based Water Quality Testing Apparatus
1:15pm	117	Eman Abedelal (10 th) [AQSA School]	Preventing Soil Erosion
2:30pm	118	Clare Blasgen & Maria Diagianis (7 th) [St. Mary Immaculate – Plainfield]	How Does Color Absorb Heat?
1:15pm	119	Grace Stevens & Morgan Wilcox (8 th) [Southeastern Junior High School]	Mycelium: Powerhouse or Parasite? Testing the Effects of Mycelium on <i>Zea mays</i> and <i>Raphanus sativus</i>
2:30pm	120	Aidan Piper (12 th) [Althoff Catholic High School]	The Comparison of the Force Generated by Four Different Iterations of 3D-Printed Aerospike Nozzles Using Water Pressure
1:15pm	121	Colin Gerlock (10 th) [St. Jude Catholic School – New Lenox]	3D Printed Rubics Cube Solver
2:30pm	122	Alex Hampton (12 th) [Althoff Catholic High School]	Where did the Disc-Go?
1:15pm	123	Alexander DiGiovanni (12 th) [Althoff Catholic High School]	Efficient Generation of Arbitrarily Bounded Random Integers
2:30pm	124	Jad Dibs (11 th) [Niles West High School]	Comparing Importance of Dopamine Receptor Types in PD Treatments

Time	#	Presenter	Title of Presentation
1:15pm	125	John Almos & Drew Wang (9 th) [Edwardsville High School]	Detection and Evaluation of Skin Cancer with Image Processing
2:30pm	126	Akosua Haynes (10 th) [Walter Payton College Prep]	The Effects of Salinization on Plant Growth
1:15pm	127	Henry Bao (11 th) [Walter Payton College Prep]	Airfoil Design with Computational Fluid Dynamics

KEYNOTE ADDRESS – DR LUKE HAVERHALS 4:30PM
RENAISSANCE COLISEUM

Dr. Luke Haverhals, *CEO and Founder, Natural Fiber Welding, Inc.*



Luke earned a Ph.D. in Chemistry at the University of Iowa before going on to explore all-natural alternatives to petroleum-derived synthetic plastics as an Assistant Research Professor at the US Naval Academy. His vision to develop bioneutral, high-performance materials from renewable natural nutrient inputs has become the foundation for NFW's ecosystem of patented, paradigm-shifting material technologies. Luke has given dozens of invited international presentations on the intersection of materials science with fashion, footwear, and other related trillion-dollar consumer industries.

In an industry awash with incremental solutions, Luke is leading NFW to drive a moonshot systems-level shift away from petroleum-derived products and toxic chemistries. Luke was named IPOEF Inventor of the Year in 2022. Luke is an Unreasonable Group Fellow, Forbes Council Member, and World Economic Forum (WEF) Technology Pioneer, and graduate of The Circulars Accelerator, Fashion for Good Scaling Programme, and the Nation Science Foundation I-Corps Program.

MESSAGE FROM THE VICE PRESIDENTS

Greetings and welcome to the 2023 Annual Meeting of the Illinois State Academy of Science hosted at Bradley University! We are so pleased for you to join us in sharing and celebrating the exciting work performed by student and professional researchers from across our state. We are pleased to welcome presenters from at least 11 different institutions, with over 200 oral and poster presentations across the Academy's divisions.

We are especially happy to welcome you to Bradley for our first in person meeting since 2019. Hosting this meeting aligns with one of the central values of Bradley University to advance scientific knowledge and understanding, going back to Bradley's founding in 1897 by Lydia Moss Bradley. While you are here for the meeting, we hope you have the chance to also spend a little bit of time exploring campus and see what Peoria has to offer.

We also want to take this opportunity to thank the many partners who contributed to make this meeting possible. In particular, we would like to thank the student volunteers, university staff, and all of the students and faculty members and other attendees. We also want to thank the Bradley University Center for STEM Education, the College of Liberal Arts and Sciences Dean's office, and the Provost's office for their help in planning and scheduling this event. Finally, we especially want to thank Executive Secretary Robyn Myers and Director of Communications & Program Planning Tere North for their essential work in helping with meeting organization and preparing the program and schedule for the meeting. This meeting would not have been possible without their contributions.

We hope you have a fantastic meeting and enjoy your time visiting our campus! Finally, we hope you will join us next year for the 2024 meeting at Millikin University!

Sincerely,
Drs. Jennifer Jost and John Marino
Co-VPs for the 2023 Meeting



ORAL PRESENTATION ABSTRACTS

9:00am – 12noon, Saturday, April 15, 2023, in Westlake Hall

*presenter, [school] with differences noted by superscript

ANTHROPOLOGY & ARCHEOLOGY – RM 110A

11:45am Grad **Bones, Bugs & Bioerosion: Dermestid Beetle Substrate Preference, Substrate Survivorship, and Their Taphonomic Effect on Bone**

*Abraham Packard, Gretchen R. Dabbs [Southern Illinois University Carbondale]

The dermestid beetle (*Dermestes maculatus*), generally known as a pest species, has become renowned in the laboratory as an aid to skeletonization of remains, both for the zoologist and the anthropologist. However, little attention has been paid to the potential effect these insects might have on skeletal materials themselves and whether their traces may be mistaken for trauma or the effects of other trace-leaving processes. The use of dermestid beetles in the anthropology laboratory was tested by a choice experiment based on ASTM D3345-17, examining the behavior of *D. maculatus* regarding Styrofoam, wood, and two types of bone. Specifically, this project tested 1.) whether the beetles showed preference for a particular material (of wood, Styrofoam, dry bone, or green bone) for pupal chamber formation, 2.) whether material(s) had an impact on survivorship from the larval to adult stages, and 3.) what traces dermestids leave on skeletal remains and the variation in form of those traces. Results suggest dermestid beetles will preferentially bore pupal chambers in softer materials (Styrofoam > wood > dry bone > green bone), but preference is not absolute, as pits appear in bone even when softer materials are present. Preference did not appear to impact survivorship. Information on the “typical” form of dermestid traces on materials will be presented, as an aid to identifying these features as resulting from insect-mediated postmortem processes, as opposed to ante- or perimortem processes/events. Where laboratory work requires that traces from tissue removal not be left on skeletal remains, *D. maculatus* is a viable aid if procedure is followed.

BOTANY – RM 026

9:00am Grad **Root Microbial Communities in Illinois *Spiranthes* Orchids**

*Noah Pyles, Eric Parperides, Darron Luesse, Elizabeth Esselman [Southern Illinois University Edwardsville]

Root associated microbes play a prevalent role in orchid development and germination and are often utilized to enhance the cultivation of orchids for conservation purposes. Terrestrial orchids are most notable for forming relationships with endophytic fungal symbionts to obtain carbohydrates and nitrogen because seeds lack endosperm. More recently, terrestrial orchids have been shown to have a diverse root microbiome and endophytic bacteria that produce auxin to promote germination and development. In this study, the root microbiome of three different species of *Spiranthes* orchids were characterized and auxin-producing root bacteria were isolated. Metagenomic analysis using the 16Sv3v4 and ITS2 sequences were used to identify the alpha and beta diversity of *Spiranthes* root samples and colorimetric analysis was used to detect and quantify auxin production by endophytic bacteria. NMDS analysis showed that individual species of *Spiranthes* orchids were most closely related to each other as opposed to other species. Sample composition showed varying degrees of family and genera relative abundance. *Pantoea* and *Enterobacter* were discovered to be the most prominent genera in *Spiranthes* orchids that produced the highest concentration of auxin. Overall, these findings indicate that the root microbiome of *Spiranthes* orchids are diverse and may be a promising avenue of research to further conservation efforts for threatened orchids.

9:15am UG **Isolation and Provisional Identification of Mycorrhizal Fungi from Roots of Orchids Native to the Republic of Palau in the Western Pacific**

*¹Ally Wiseman, ¹Courtney R. Lercher, ²Benjamin J. Crain, ¹Lawrence W. Zettler [¹Illinois College, ²Smithsonian Environmental Research Center]

Located ca. 1,000 km from the Philippines at the eastern edge of Wallace’s Line lies the Republic of Palau, a small (535 km²) archipelago with ca. 100 known orchid species, including 32 endemics. In 2017, the Palau Orchid Conservation Initiative, spearheaded by the North American Orchid Conservation Center (NAOCC), was established to study the mechanisms contributing to an unusually large number of endemic species, and to develop protocols for conservation. Among the project collaborators include the U.S. Forest Service, Palau Division of Forestry, and Ngardok Nature Reserve. Illinois College’s role in this ongoing collaboration involves

the isolation and storage (cryopreservation) of putative mycorrhizal fungi for use in seed germination experiments. Considering that all orchids rely on specific fungi for seed germination and survival in situ, more information about their mycorrhizal fungi is needed in this age of extinction, especially in Pacific islands vulnerable to sea level rise imposed by climate change. In January 2023, live root samples harboring fungi from 23 orchid species were transported to Illinois College's SDA-certified quarantine facility under permit (e.g., CITES, phytosanitation). Of 194 root segments, each measuring 1 cm in length, only 19 (9.8%) contained pelotons. Thus far, seven putative mycorrhizal fungi, assignable to all three primary genera associating with photosynthetic orchids worldwide, have been isolated in pure culture. *Tulasnella* was isolated from *Bulbophyllum betchei*, *Crepidium setipes*, *Corymborkis veratrifolia*, and *Sarcanthopsis woraqueana*, whereas *Ceratobasidium* was present in *Peristylus palawensis* and *Taeniophyllum palawense*. *Moerhousia laxa* (probably now *Platyplepis laxa*) probably also harbored *Serendipita* – a genus infrequently isolated from orchids worldwide.

9:30am UG Chemical Composition of Ghost Orchid (*Dendrophylax Lindenii*) Floral Nectar from Florida
 *¹Antonio Ruiz, ¹Brent Chandler, ²Mark Danaher, ¹Lawrence Zettler [¹Illinois College, ²Florida Panther National Wildlife Refuge]

Numerous studies have confirmed the importance of nectar for effective pollination and reproductive success in orchids, but the chemical composition of floral nectar has received surprisingly little attention. We report the chemical compounds present in the nectar of the well-known ghost orchid, *Dendrophylax lindenii* (Lindl.) Bentham ex Rolfe, using gas chromatography and mass spectrometry (GC/MS) analysis. This rare species exists as a leafless epiphyte in forests of south Florida and western Cuba and yields a striking floral display consisting of fragrant white flowers with long (11-17 cm) nectar spurs. Nectar samples were obtained from naturally occurring populations within the Florida Panther National Wildlife Refuge during July 2021 and analyzed in the laboratory 1 week later. Results revealed the presence of 3 sugars (glucose, fructose, sucrose), three acids (lactic, malic, threonic), as well as 4-hydroxyl benzyl alcohol. In addition, all three sugars were detected on the upper surface of flower's labellum where moisture is known to collect due to its concave shape. This study supports the contention that sugars are a ubiquitous component of orchid floral nectar, but the presence of the other compounds (acids) deserves further inquiry. Knowing more about the compounds in *D. lindenii* nectar will provide more insight into how and why hawk moths visit and pollinate the flowers of this rare orchid in the natural setting.

9:45am UG When Weeds Collide: Natural Colonization of Chicory (*Cichorium intybus*) by Dandelion (*Taraxacum officinale*) in a Frequently Mowed Lawn

*Isaac Phillips, Lawrence Zettler [Illinois College]

In Illinois and throughout the world, exotic weeds continue to pose a serious threat to natural ecosystems by displacing or outcompeting native plant species. One well-known example is the dandelion, *Taraxacum officinale* Weber (Asteraceae), originally native to Europe and Asia. The tenacity of this species to colonize open spaces (e.g., lawns) is noteworthy. Even uprooted specimens in the act of anthesis are capable of releasing wind-borne, single-seeded fruits (achenes) before dying, exemplifying this weed's ability to survive and prosper. We report the presence of a dandelion specimen growing from the base of an inflorescence stem of chicory (*Cichorium intybus* L.) rooted in the lawn of a church in Jacksonville, Illinois. The region of the stem where the dandelion was attached appeared as a swollen knot suggesting that the dandelion may have sprouted as a wind-born seed shortly after the lawn was mowed. It is conceivable that severing of the chicory stem from mowing may have provided the dandelion with a source of water exuded by the host's xylem resulting in a graft between these two weedy species. Given that both weeds belong to the same family (Asteraceae), subfamily (Cichorioideae), and tribe (Cichorieae) and are therefore closely related, this explanation cannot be ruled out. Efforts are being planned to carry out experiments in the laboratory to verify dandelion's ability to colonize chicory and other plant species through wind-born seeds.

10:00am Spring, Summer, Fall: When is Photosynthesis Best of All?

*Kurt Schulz [Southern Illinois University Edwardsville]

Amur honeysuckle (*Lonicera maackii* (Rupr.) Maxim) and other Asian bush honeysuckles are aggressive and damaging invaders of forests in eastern North America. In southern Illinois Amur honeysuckle produces leaves earlier spring and holds them later in fall than native woody understory species. This is presumably an advantage because more light penetrates the tree canopy at these times. Unfortunately, we lack systematic measurements of photosynthetic light response through the growing season to place this possible advantage in context with the much longer photosynthetic period spent under a closed canopy. I measured photosynthesis and leaf characteristics on detached shoots April-November 2019, and April and October-December 2021. Maximum rates of photosynthesis in April were ca. 20-30% higher than in summer, but this effect disappeared by early May.

Photosynthetic rates sharply declined in mid-October (the time of canopy senescence) and crashed by the first heavy frost in November. Steep leaf angles and low leaf area limits the benefit of better photosynthetic opportunities in spring. The variable onset of frost limits the duration of better photosynthetic opportunities in fall. Under the most optimistic conditions (30% of each day at light saturation) the spring and fall light windows might account for 30% of carbon gain.

10:15am

Oaks of the Chicago Region

*David Shepard [Moraine Valley Community College]

An analysis of 17 taxa of the genus *Quercus* indigenous to the Chicago region was conducted. The study area included thirty counties representing the states of Illinois, Indiana, Michigan and Wisconsin. The identification and ecology of each species is presented representing the diversity richness of the Great Lake region. Varieties and hybrids were also included in the study of which ten had more southerly disjunct ranges and seven with more northern/widespread distribution. The *Leucobalanus* subgenus group was represented by seven species with additionally six having hybrid origin. The *Erythrobalanus* subgenus group was represented by 10 species with three varieties and additionally five with hybrid origin. Three with more southerly distribution were of introgressed forms. Previously reported state endangered *Quercus texana* (Nuttall's Oak) along with state threatened *Quercus montana* (Chestnut Oak) occur in the area. Newly discovered *Quercus acerifolia* (Maple leafed Oak) was recently found growing in the Tinley Creek Forest Preserve located in southern Cook County.

CELLULAR, MOLECULAR, & DEVELOPMENTAL BIOLOGY – RM 212A

9:30am

Grad Studying SLC12 Family Ion Channels in Planarians

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

The basis of neuronal communication is rapid and large changes in the electrical potential across neuron cell membranes, called action potentials. This act of signaling is done with the help of ion channels, and the role of these proteins, including members of the solute carrier family 12 subgroup (SLC12), in cell communication and organ development has been investigated in multiple organisms. These data show that some family members such as K-Cl co-transporter SLC12A5 play an important role in transferring chloride in mature neurons, enabling them to regulate the synaptic transmission and morphology of these cells. We seek to further investigate the role of SLC12 family ion channels in neuronal development using the freshwater planarian *Schmidtea mediterranea* as a model organism. Planarians are able to regenerate their body parts after injury, by the means of their pluripotent cells, and this feat even applies to their nervous system. Thus, they serve as an interesting model for studies of neuron development and regeneration. We performed BLAST searches using human SLC12A5 and its *C. elegans* counterpart KCC-2 against the *S. mediterranea* transcriptome database and identified five planarian homologs with e-values ranging from 0 to 2-17. Reciprocal BLAST searches of these planarian proteins against the human database confirmed all five as members of the SLC12 family, although some were more closely related to other SLC12 family members than they were to SLC12A5. We are currently preparing to knock down these genes in planarians to further investigate their function.

9:45am

UG Investigating the Function of Novel Planarian Genes

*Hannah Bowers, Kailynne Cruthis, Amy Winn [Southern Illinois University Edwardsville]

The capacity of a species to undergo regeneration varies widely across the animal kingdom, and the planarian *Schmidtea mediterranea* falls on the higher end of this spectrum, having the ability to regenerate any part of the body from a small fragment. Planarians rely on a pool of pluripotent adult stem cells, called neoblasts, for this regenerative ability, and many of the pathways that control neoblast maintenance and differentiation were discovered based on their similarity to known stem cell regulators in humans and non-planarian model species. However, the planarian genome contains many other expressed sequences that are currently unannotated. These genes have not been directly characterized in planarians, and homology-based annotation has failed because they are not conserved beyond closely-related species or because their counterparts in other model species are also uncharacterized. We compiled a list of such genes from the *Schmidtea mediterranea* Genome Database (SmedGD), filtering for genes with a transcript length greater than 1000nt and an annotated function listed as "cannot determine. We then performed Blast2GO analysis to further narrow the list to genes with no hits in a BLAST search with an e-value cutoff of 0.001 (905 genes) and those where the top homologs were described using terms such as "hypothetical", "expressed conserved protein", or "predicted uncharacterized protein" (260 genes). We are currently knocking down genes from these lists by RNA interference with the goal of identifying novel stem cell regulators and other genes required for planarian regeneration.

10:00am UG

Localization of Estrogen Receptor Alpha in Chick Embryonic Spinal Cord Neurons

*Riley Martin, Craig Cady [Bradley University]

Estrogens are commonly associated with the female reproductive system; however, their role in the central nervous system is just as important. Recent studies have shown that estrogens can have a neuroprotective effect in the brain against stressors such as glutamate or amyloid- β . These functions are regulated through two nuclear estrogen receptors: ER α and ER β . Targeting these receptors to increase the neuroprotective effects has been a new method to treat various neurodegenerative diseases such as Alzheimer's and the symptoms associated with menopause. Thus, the localization of estrogen receptors in the brain is essential to understand its therapeutic effects.

Immunocytochemistry was used to determine the location of ER α on neurons or glial cells in a primary, mixed culture of chick embryonic spinal cord neurons (CESCNs). When simultaneously using an anti-ER α antibody and anti-GFAP (a marker for glial cells) it was determined that ER α is found on glial cells of CESCNs. This supports previous research suggesting estrogen functions in the brain involve glial-specific mechanisms. Future experiments with an antibody against a neuronal-specific protein, NeuN, and anti-ER α will identify if the receptor is also expressed on neurons with other studies investigating receptor expression in the adult brain of mice. In addition, immunocytochemistry will be performed to compare the expression of ER α after exposure to neuro stressors such as glutamate or amyloid- β to determine if the expression of the receptor changes during stress.

10:15am UG

Cell Proliferation and Lung Tissue Regrowth in *X. laevis*

*Suzanne Green, Paul Hamilton [Illinois College]

The respiratory system in *Xenopus laevis* is diverse and distinct from mammalian systems, given that respiration is not located in a single organ system, and the lungs are available to access externally. Because of the plasticity of many tissues within the *Xenopus* organism and the lack of complete reliance on the lungs for respiration, it was speculated that the lungs of the tadpoles might be capable of regenerating after mechanical injury. The distal tip of the lungs of stage 37-42 tadpoles was removed through pneumonectomies, and the animals were allowed to recover for time points varying from 24 hours to 21 days. After the recovery time was complete, the lungs were evaluated on a macroscopic scale by measuring the area of the distal tip, and a microscopic scale with antibody staining targeting the nuclei of dividing cells. Cell counts showed that the injured lung was not significantly more mitotically active than the control lungs at any point. Calculations of area showed that the injured lung was being outgrown by the control lung, indicating that the lung tissue is not regenerating. Although the tissue is not regenerating like initially proposed, there was some wound healing observed, providing a basis for future research.

10:45am UG

Antibiotic Induced Microbiome Depletion (AIMD) in Mice and its Effect on Thyroid Hormone Levels*¹Lucia Thompson, ²Cinnamon VanPutte [¹Southern Illinois University Edwardsville, ²Southern Illinois University School of Dental Medicine]

The importance of the microbiome in the body's homeostasis is still not yet fully understood. There is growing evidence suggesting the involvement of the microbiome in many facets of metabolism, including the thyroid system. Thyroid hormones play a critical role in regulating bodily processes such as growth, metabolism, and the development of bone. To address the paucity of studies linking thyroid hormones and the gut microbiome, mice were given antibiotics in their drinking water for six weeks to induce microbiome depletion (AIMD). After six weeks, terminal blood samples were collected to be analyzed. Levels of thyroxine, T4, were lower in AIMD animals (n=4) than in control animals, although there was no statistical significance between them. A major impediment throughout this approach was the amount of blood acquired from each animal. Sufficient biological sample must be collected, and validated techniques must be utilized to accurately measure hormone levels. Due to the limitations of blood collection and to reduce added stressors, we have developed and validated an ELISA to measure triiodothyronine, T3, from fecal samples. This method of noninvasive sample collection will promote a less stressful environment for biological models and allow for more frequent and reliable sampling. Future experiments will utilize this ELISA protocol for the hormonal analysis.

11:00pm UG

Innate Immunity in the Red-Eared Slider Turtle: Presence and Evolution of the Inflammatory Protein Serum Amyloid A

*Victoria Stuart, Travis Wilcoxon, Laura Zimmerman [Millikin University]

Turtles, like humans, are long-lived vertebrates with innate and adaptive immune pathways and thus provide an interesting model system for the effects of aging on the immune system. In humans, part of the innate immune response to an antigen is inflammation which includes the release of many proteins such as serum amyloid A (SAA). Typically, this inflammatory pathway aids the individual in combating the antigen. However, often as individuals age they experience a constant upregulation of proteins like SAA, which leads to a damaging condition known as chronic inflammation or "inflamm-aging." However, turtles and other reptiles have a unique immune

system with many features less understood than mammalian species. SAA has never been studied in turtles, but is a highly conserved protein across many taxa. We collected blood samples from red-eared slider turtles to measure levels of SAA using a chicken SAA ELISA. Plastron length was measured as a proxy for age. We found variation in SAA levels. We did not find a significant relationship between SAA and age, indicating that red-eared slider turtles do not experience chronic inflammation. We then ran a second SAA assay with samples from a population of red-eared slider turtles that had been tested for parasitic infections via a fecal float. We found a significant relationship between parasitic infection status and SAA, demonstrating that the protein functions similarly to the mammalian inflammatory response.

CHEMISTRY – RM 110A

9:00am Grad **The Flavonoid Content of *Morchella esculenta* (Morel) Extracts**

*Joyce Ayodeji [Western Illinois University]

One of the factors that influences cancer development is the presence of reactive oxygen species (ROS) within cells, causing genomic instability. ROS can be scavenged by the binding action of antioxidants thus preventing further oxidation of biomolecules. Flavonoids are powerful antioxidants found in natural products such as plants and fungi and they have been utilized in pharmaceutical industries due to their health benefits. Previous research shows that extract from *Morchella esculenta* has an anti-proliferative effect on an ovarian cancer cell (SKOV 3), however, its flavonoid content is unknown. This study aims to determine the total flavonoid content of grey and yellow morel methanolic extracts using the Aluminum Chloride Colorimetric Assay (ACCA).

Each extract was prepared by weighing 100 mg of powdered morels into 1 ml of extract solution (200 μ L 12 M HCl, 16.8 mL 90% methanol, 3 mL dd H₂O). The ACCA was done by using several concentrations of quercetin (100, 50, 25, 10, 5, 2, 1, and 0 μ g/mL) as the standard solution. 25 μ L of each standard solution, 75 μ L 95% ethanol, 5 μ L 10% aluminum chloride, 5 μ L 1M potassium acetate, and 140 μ L ddH₂O were mixed in a 96-well plate, incubated in the dark for 30 mins and the absorbance was read spectrophotometrically at 415 nm. A standard calibration curve of absorbance against the known concentration of quercetin was plotted. This was used to calculate the flavonoid concentration in each morel extract after measuring their absorbance using the same method as described above.

The flavonoid concentration in the methanolic extract was expressed as quercetin equivalent (QE) for both yellow and grey morels with resulting values of 0.1089 ± 0.0081 and 0.1277 ± 0.0067 mol (QE)/g dried weight respectively. This study indicates a high amount of flavonoid in both yellow and grey morels, with grey morels showing the highest concentration.

9:15am Grad **Compounds from *Morchella esculenta* as Potential Inhibitors of RNA-Binding Protein La in Ovarian Cancer: A Molecular Modeling and Quantum Mechanics Approach**

*Gbenga Dairo, Matthew Ward, John Determan, Mette Soendergaard [Western Illinois University]

Ovarian cancer (OC) is implicated in most gynecological cancer-related deaths. Currently, the primary treatments for ovarian cancer are surgery and chemotherapy using platinum-based drugs to induce remission. However, OC recurs in 70-80% of patients within two years, which usually results in the death of most ovarian cancer patients. La protein is significantly expressed in various malignant tumors, including ovarian cancer. Previous studies reported that ovarian cancer patients have significantly higher levels of La protein expression in their serum than healthy individuals, which is related to the poor response to platinum-based chemotherapy. Inhibiting La protein could control the expression of the potential downstream genes involved in promoting proliferation and chemotherapy resistance to ovarian cancer, which could serve as a therapeutic intervention in treating ovarian cancer.

Extract from *Morchella esculenta* has been reported to contain anti-cancer properties, but no study has reported the interaction of its bioactive compounds with La protein in ovarian cancer.

This study examines the interaction of La protein with some bioactive compounds of *Morchella esculenta*, as well as their pharmacokinetics and thermochemical properties using structural bioinformatics and advanced theoretical chemistry techniques. This study gives insight into Morel mushroom's bioactive compound's therapeutic potential in treating ovarian cancer.

The four lead compounds, including beta-carotene, p-hydroxybenzoic acid, gamma-tocopherol, and alpha-tocopherol, showed a higher binding affinity of -10.7, -8.1, -7.9, and -7.6 Kcal/mol respectively than pyridine-2-carboxylate (control), which showed a binding affinity of -5.2 Kcal/mol following molecular docking. MM/GBSA calculation also showed the highest binding affinity for the selected lead compounds, which validates their

inhibitory potential. Furthermore, results from molecular dynamics simulation for 100 ns, pharmacokinetic analysis, and LRC-DFA showed that lead compounds of *Morchella esculenta* have good stability to the target receptor, orally absorbable, and good physicochemical properties, which could serve as a therapeutic intervention in treating drug-resistant ovarian cancer.

9:30am Grad Chemical Biology Approach to Uncover Influence of Sequence Variations on CES1 Activity in Live Cells

*Samuel Knebe, Michael Beck [Eastern Illinois University]

Human carboxylesterases (CESs) catalyze the hydrolysis of esters, amides, thioesters, and carbamates. CES-mediated hydrolysis plays an important role in the metabolism of many drugs including the first FDA approved antiviral treatment for COVID-19, remdesivir (Veklury), the seizure control medication rufinamide (Banzel), and the flu antiviral drug oseltamivir (Tamiflu). CES activity is known to be influenced by a variety of factors including those that vary CES's amino acid sequence including single nucleotide polymorphisms (SNPs), alternative RNA splicing, and alternative translation start sites. This is best reported for one of the two predominant CESs, CES1, where some of these factors have been linked to adverse clinical outcomes when patients are treated with CES1-substrate therapeutics. Despite the importance of CES1 in drug metabolism, the factors that influence the activity of CES1 remain understudied compared to other enzymes involved in drug metabolism. To address the need to study CES1, we have developed a live cell fluorescence microscopy-based assay that can measure the activity of CES1 sequence variants. We expect the approach reported here will prove to be valuable in annotating the activity of CES1 sequence variants leading to discovery of additional sequences that could result in abnormally low metabolism of CES1-substrate drugs.

9:45am Grad Pancreatic Cancer Specificity of Phage Display-Selected Peptide MCA1

*Funmilola Anjorin [Western Illinois University]

Pancreatic cancer accounts for about 7% of all cancer deaths. The ability for aggressive metastatic progression as well as the asymptomatic disease development and a lack of inadequate detection methods result in a low survival rate of about 3%. However, peptides with high affinity and specificity show promise as radiolabeled imaging agents for both detection and therapy.

Previously, we used phage display technology to identify a peptide, MCA1, that binds to the human ductal adenocarcinoma pancreatic cell line, Mia Paca-2 while showing no binding to other cancerous and non-cancerous cell lines (LNCaP, HEK293, hTERT-HPNE, and SKOV-3). Here, the pancreatic cancer cell line specificity of MCA1 was further elucidated. A dose-response assay using a modified ELISA was used to determine the EC₅₀-values of MCA1 to Mia Paca-2, metastatic ductal adenocarcinoma (CFPAC-1), primary adenocarcinoma (Panc 10.05), and ascitic adenocarcinoma (HPAF-II) cells. The EC₅₀-values were calculated to be 299.0 nM (248.3-359.7 nM; 95% confidence interval; CI), 1.24 μ M (0.167-73.93 μ M 95% CI), 51.69 μ M (1.28 μ M -undetermined 95% CI), and 24.22 μ M (3.00-275 μ M 95% CI), respectively. The R²-values for the sigmoidal dose-response curves were 0.9376, 0.2172, 0.5663, and 0.3096 for Mia pacac-2, CFPAC-1, Panc 10.05, and HPAF-II cells, respectively.

These results show that MCA1 exhibits the highest affinity to the original target cell line (Mia Paca-2) and shows comparatively low binding with wide 95% CI and low R₂-values to the other cell lines. This indicates that the peptide is specific for the Mia Paca-2 cells and may target a biomarker that is not expressed in CFPAC-1, Panc 10.05, and HPAF-II cells. Thus, MCA1 may be further developed as a specific ligand of subtypes of pancreatic ductal adenocarcinoma.

10:00am UG Carbon Compound Metabolism of *Caulobacter crescentus* and Potential for Antibiotic Development

*Corbin Preston, Gopal Periyannan, Deep Patel [Eastern Illinois University]

Caulobacter crescentus is a gram-negative, freshwater bacterium that has evolved to thrive in nutrient-poor (oligotrophic) environments by utilizing a diverse array of carbon compounds. This study aims to investigate the metabolic properties of *C. crescentus* in relation to aromatic hydrocarbons and select carbohydrates to gain insight into its general metabolic characteristics and variations. In the growth survey of aromatic hydrocarbons, *C. crescentus* was found to be capable of utilizing 11 different compounds, including benzene derivatives such as protocatechuic acid, benzaldehyde, and phthalic acid, as a carbon source for growth. Additionally, *C. crescentus* demonstrated growth in polymeric xylan. Interestingly, in the presence of glucose, ferulic acid and glucuronic acid exhibited growth-inhibiting properties, despite sharing a common aromatic ring structure with protocatechuic acid. The chemical substituents on the ring appear to play a critical role in determining whether a compound promotes or inhibits growth. The absence of growth in glucuronic acid suggests that polyhydroxy compounds may act as antibacterial agents. Ongoing growth inhibition studies of strategically chosen polyhydroxy compounds, aided by

microscopic and metabolite analysis, aim to further elucidate the mechanisms underlying bacterial growth. These findings on *C. crescentus*' growth properties in structurally distinct carbon compounds provide an opportunity to explore bacterial carbon compound sensing, unique metabolic transformations, and associated gene regulation. Ultimately, this knowledge could be applied to the development of novel antibiotics that target gram-negative bacterial mechanisms. Furthermore, *C. crescentus*' tendency to form biofilms in aromatic hydrocarbons highlights its potential utility in bioremediation efforts.

10:15am UG

Comparing Copper Catalysts in the Synthesis of 1,2,3-Triazoles via Click Chemistry

*Emma Green, Jocelyn P. Lanorio, Ethan A. Leitschuh [Illinois College]

1,2,3-Triazoles have several biopharmaceutical functions such as antiviral and antiallergic behaviors. The process to create these molecules involves the cycloaddition of an azide, an alkyne, and a catalyst. However, many catalysts contain rare metals that are costly and dangerous. The purpose of this research was to determine if copper is a viable replacement for these metals, and if so what reaction conditions are the most favorable.

The copper catalysts were examined under a few different conditions. These were reactions containing solvent, neat (no solvent), with heat, and at room temperature. Additionally, the effect of the charge of copper was investigated. The importance of these variables was to find the most green combination of conditions; for example, a reaction not requiring solvent or heat would be considered ideal. The products were characterized by melting point, TLC, IR, and GCMS.

The results indicated that copper catalysts provide a high yield of pure product, with neat conditions being the most efficient reactions. Furthermore, it was observed that the cycloaddition reactions can also be run at room temperature. The charge of copper does not appear to affect the reaction, although the stability and sterics of the anion attached to the copper do.

COMPUTER SCIENCE – RM 026

10:45am

Announcing: Participatory Democracy Back End

*Laurence Leff, Sean Cordes, Sai Dasari, Kyle Smith, Greg Sabo, Anjum Razzaque [Western Illinois University]

The participatory democracy literature emphasizes empowering ordinary citizens doing more than voting for a few candidates. This is a software framework to allow a large group of citizens to collectively form and achieve a consensus on a complicated and legal structure such as a budget and tax code for a country, a constitution, or a penal code. Participatory Democracy Back End (PDBE) is that framework. It implements the following paradigms: (1) participants choose an initial budget. (2) participants rate the budgets. (3) PDBE combines the budgets based on the rating to achieve a consensus budget. (4) PDBE communicates back to each participant's client program the consensus budget. (5) The participants indicate their changes, and the client communicates that back to PDBE. (6) PDBE combines them into a consensus budget. (7) PDBE returns that to the clients. The process returns to 3. A custom protocol got implemented on top of sockets. Also, all the materials for the participants (videos, voice-animated PowerPoints, tax model, etc.) to do this with the US federal budget got created. The further plans is to create alternate client types: web veneer and mobile, and voting types, e.g. Pivato's Groves-Clarke pivotal voting using political points. Also, PDBE will serve as the backend in other PD settings where participants can create an extensive complicated structure including the Supreme Court game, for which the primary investigator of this study designed and commissioned implementation. However, like the alternative zTree, PDBE supports multiple experimental arms, pre and post-experiment questionnaires. Also, PDBE supports a "tax model" so participant get the budget deficit and tables for their trial budget, as well as a protocol with the experimenter. In contrast to the zTree, the PDBE is intended for more complicated data structures and real-world calculations. Thus, this JAVA-based system supports UROp.

11:00am Grad

Sybilsoctnet: An Algorithm for the Detection of Sybil Entities and Sybil Attacks

*Mohamed Salem, Antonio Cardenas [Western Illinois University]

P2P networks are left vulnerable to Sybil attacks if proper controls are not met. Different social media platforms including Facebook and Twitter are prone to Sybil attacks in the form of fake identities and posts. These attacks can be used to influence the public on forming a public opinions at the time of elections. In my thesis we reviewed the different types of Sybil detecting and preventing algorithms. A machine learning approach was being used to generate a model that detects Sybil nodes in a social media platform.

11:15am

Announcing TwoLMS2IGS

*Laurence Leff, Anjum Razzaque [Western Illinois University]

A Faculty Member (AFM) is teaching a course where some assignments are on one Learning Management System, and some assignments are on another Learning Management System (LMS). The most likely use case is that one system is from the publisher, and their institution uses the other. AFM downloads the grade sheet for their courses from each LMS (the DGS); AFM also prepares a spreadsheet with information common to each student's IGS, including the formula to calculate totals and grades. TwoLMS2IGS Updates each student's Individual Grade Sheet (IGS) by putting the grades from the DGS. In addition, TwoLMS2IGS utilities process a set of files downloaded from an assignment dropbox; if most assignments receive full credit (the usual case in the author's current courses), it will enter the grades into each student's IGS. The system is configurable for different LMS grade sheet downloads, different ways each LMS may prepare the files received for an assignment, and different locations of the cells to receive grades in the IGS. Utilities are implemented for expected use cases, such as AFM needing to add an assignment or change the spreadsheet formulae after the IGS has been populated. This system was implemented for ease of use by an experienced user by having all tasks implemented at the command line having minimal keystrokes to perform each task and facilitating AGM setting up shell or batch command files to perform common tasks in their classes. The system is in production and used in the course sections assigned to the author.

11:30am

Announcing: Multiple Choice Question Generator (Rx and Rt)

*Laurence Leff, Anjum Razzaque [Western Illinois University]

A Faculty Member (AFM) wishes to test online students over a body of knowledge using multiple-choice, multiple-response, and matching questions. They wish each student to get a different examination, but each is in the same style and over the same material. (And they may wish to provide a student with multiple attempts.) AFM prepares a "*concept file*," which is a list of pairs of sets of phrases; for an American History test, one such pair might be "Abraham Lincoln," "President Lincoln," or "Abe Lincoln; the other settings might be "president during civil war" "signed emancipation proclamation" and "assassinated." Rx generates all combinatorially possible test questions. When the combinatorial explosion becomes too great, random selection is also available, particularly for matching questions. We also implemented a program, Rt, to search Respondus input files. Rt was used to test Rx under an IEEE- 829-standard test plan which included combinatorial calculations to ensure that all questions that should be generated were (and vice versa). We then use Respondus to load these into test banks onto Western Online Learning Management System; Respondus can load the files into many different LMS. This has been in production use in CS101 sections taught by this faculty member for three semesters. Combinatorial calculations show that for reasonable scenarios, there is a small chance that two students taking the same exam or the same student given multiple attempts will get even one identical question; there is an infinitesimal chance that they will get two identical examinations.

ENGINEERING & TECHNOLOGY – RM 214A

9:00am

Grad

Manufacturing Bio-plastics from Hemp Residues

*Mohammad Faghani, Mahdi Vaezi, Robert Tatara, Sahar Vahabzadeh [Northern Illinois University]

Plastic waste management has become a major environmental challenge worldwide due to the long degradation period of petroleum-based polymers, which are widely used in everyday life. To address this concern, biodegradable composites have been developed as an eco-friendly alternative. The current study focuses on investigating the feasibility and mechanical properties of biocomposites, which are composed of polymeric matrices and natural fibers. Natural fiber polymer composites (NFCs), also known as biocomposites, have emerged as promising replacements for non-biodegradable plastics due to their environmental friendliness, low cost, biodegradability, and excellent mechanical properties. Among the various natural fibers, industrial hemp (*Cannabis Sativa*) has been found to possess a high cellulose content, making it an ideal reinforcing material for polymers. In contrast to other crops like corn, kenaf, and sugar cane, hemp is distinguished by having a high cellulose content of 70–74% (including the one with a high degree of crystallinity), 15–20% hemicellulose, and only a little quantity of lignin (3.5–5.7%), pectin (0.8%), and waxes (1.2–6.2%). The current study investigates the mechanical and physical properties of biocomposites produced using hemp bast fibers as a reinforcement material for a different type of polymer. Biocomposite materials produced here are constructed of two or more constituent materials, including the matrix (resin) and reinforcing phase. Both thermoplastic and thermoset polymers will be used as matrix with hemp fibers. Biodegradable polymers will also be employed as a matrix for natural fibers to create "green" biocomposites. The results indicate that biocomposites produced with hemp bast fibers as a reinforcement material exhibit significantly higher tensile strength and modulus than those without reinforcement.

In some cases, the result indicated that the ultimate tensile strength of the composites increased by more than 200% when hemp fibers are used as reinforcement in polymers.

- 9:15am Grad Agile Software Quality Assurance using Scrum Theory**
 *Samson Olorunsiwa, Jaby Mohammed [Illinois State University]
 The Agile-Scrum framework provides an avenue of advancing software quality assurance through the context of continuous improvements that is made possible by the Agile framework. The scrum theory implements the use of the expertise of software testers who are responsible for the STLC process that is a subset of SDLC and other programmers who work towards the development of the software. Evidently, using both Agile and scrum theory, it is predictable that SQA will be achieved both before and after the deployment of the program or software in question. The study in this perspective conducts a literature review to shed more insight into the scrum theory, Agile methodology, software quality assessment and the benefits and challenges of using scrum in Agile software quality assessment. The study employs a qualitative research design thus rendering it to be reliant on past articles and journals on the topic that have been peer-reviewed. The findings derived from the study include the 12 principles of Agile, the significant differences between Agile and scrum methods, and the scrum roles that are implemented throughout the SDLC process. Overall, the study reveals that the scrum theory is among the most utilized approaches today when using Agile for quality assessment. The efficiency of the Agile methodology thus establishes grounds that support the use of scrum theory in software quality assessment.
- 9:30am Grad The Application of Lean in Software Development Lifecycle**
 *Seth Seaba, Jaby Mohammed [Illinois State University]
 The presentation aims to provide valuable insights into the application of lean software development throughout the software development lifecycle, which could ultimately lead to a more efficient and productive development process. Lean philosophy involves identifying and eliminating any waste in the development process, streamlining tasks to improve efficiency, and maintaining a focus on high-quality outputs. By applying lean principles, organizations can significantly reduce development costs, increase productivity, and ultimately deliver better products to their customers.
- The presentation highlights the gap in literature in terms of applying lean principles to the software development lifecycle, and aims to bridge that gap by providing a better understanding of waste management and team leadership strategies in software development. The focus on core elements of lean software development such as waste management, efficiency, and quality helps to provide a comprehensive view of the benefits of implementing lean philosophy in software development.
- 9:45am Grad Smart Supply Chain Risk Management**
 *Mayank Hegde, Jaby Mohammed [Illinois State University]
 The adoption of new technologies such as the Internet of Things, cyber-physical systems, big data, and cloud computing are transforming traditional supply chain and logistics processes into Logistics 4.0. This transition offers the potential for businesses to reduce costs and improve efficiency by utilizing these technologies in their logistics operations. Smart supply chain risk management has become an integral part of the supply network after COVID-19 outbreak. Globalization and economic policies have created an unpredictable situation, leading to difficulties for supply chain organizations. These have a significant effect on a nation's economy and the financial well-being of companies. In the years to come, risk management in the smart supply chain is set to have a considerable effect on the global economy, allowing businesses to take their operations to a higher level of efficiency. As a result, supply chain risk management is evolving to meet customer needs, and new digital supply chain models are being developed. Having a clear understanding of the risks associated with your supply chain is essential for effective risk management. Companies of all sizes can benefit from implementing tried-and-true tactics to reduce risk and set themselves up for success. Supply Chain Risk Management is the process by which companies take deliberate steps to identify, assess, and reduce risks within their supply chain and improve efficiency and revenue. Risks to the supply chain may come from both internal and external sources. The purpose of this presentation is to investigate the condition of smart supply chain risk management right now and any potential issues that may still be there in the industry.
- 10:00 Grad Role of Artificial Intelligence in Smart Supply Chain Management**
 *Laveena Pareek, Jaby Mohammed [Illinois State University]
 The purpose of this presentation is to demonstrate how AI-based tools and techniques can enhance the performance of supply chain operations by analyzing past studies. Additionally, this research will also propose new developments that can be made through the use of AI. However, a majority of the studies are based on

simulated data instead of actual operational data, which may not accurately reflect the complexities of real-world supply chains

10:15am Grad UX Designing for Process Improvement: Implementing Six Sigma Methodologies

***Chijioke Nzelu, Jaby Mohammed [Illinois State University]**

The integration of User Experience (UX) design principles into the implementation of Six Sigma methodologies could have a significant impact on the success of process improvement initiatives. UX design is the process of developing a user-centered design that aligns with the needs, goals, and preferences of users. Six Sigma methodologies are used to improve the quality and efficiency of processes by identifying and eliminating defects while reducing process variability. When UX design is combined with Six Sigma, a data-driven methodology for process improvement, organizations should achieve a more holistic and effective approach to process improvement. This research explores the impact of incorporating UX design principles in implementing Six Sigma methodologies for process improvement. The study aims to determine the effectiveness of UX design in enhancing the user adoption and overall success of Six Sigma projects by examining the literature on UX design, Six Sigma methodologies, and the integration of the two. Through a review of the literature and case studies, this paper provides insights into the best practices for UX design in process implementation. It offers recommendations for organizations seeking to optimize their processes through the incorporation of UX design principles and Six Sigma methodologies. The findings will provide insight into the key principles, best practices, and potential benefits of integrating UX design with Six Sigma methodologies, including increased user engagement and adoption, improved process efficiency, and enhanced customer satisfaction. The paper also includes case studies of successful implementation of UX design in Six Sigma projects. The results of this research will have important implications for organizations looking to adopt a more comprehensive approach to process improvement and user-centered design

ENVIRONMENTAL SCIENCE – RM 214A

10:45am Grad Municipal Solid Waste: A Prediction Methodology for the Generation Rate in the United States Counties

***Sayeed Uddin Shoaib, Mohammed Sohaib Uddin, Mahdi Vaezi [Northern Illinois University]**

Municipal solid waste (MSW) generation has become a significant environmental and economic concern worldwide. In the United States, MSW generation has increased significantly over the past few decades, and it is essential to understand the factors that contribute to this trend. This project aims to predict MSW generation using socio-economic factors for different states in the US. The need for this project arises from the critical need to devise efficient waste management policies, reduce waste generation, and increase recycling rates.

The project will analyze the correlation between solid waste generation and various socio-economic factors, such as population, gross domestic product, number of housing units, school enrollment, labor force, poverty estimates, and unemployment rates for multiple states. We will use multiple data sources, including US Census Bureau data, to gather the necessary socio-economic data. Additionally, we will investigate the factors that caused spikes in MSW generation using time series plots for each of these states, with county as the unit of analysis. The time series analysis will allow us to identify the primary factors that contributed to the increase in MSW generation over time. We will also compare our analysis for different states to identify patterns and differences.

To achieve our goal of predicting MSW generation accurately, we will use deep learning methods such as artificial neural networks. The neural network models will enable us to identify the significant contributors to MSW generation accurately. We will also use feature selection techniques to identify the most influential socio-economic factors that affect MSW generation. The final goal of this project is to identify the factors directly responsible for the critical increments in solid waste generation, enabling planning agencies to make better waste management plans and improve the recycling rate.

11:00am UG Effects of Burning and Grazing on Lepidoptera Diversity in Illinois Tall Grass Prairies

***Tyler McMahon, Anant Deshwal [Bradley University]**

Globally, invertebrates have seen a decline in species diversity and abundance. Pre-agriculture Illinois was 80% tallgrass prairie that supported the majority of arthropod diversity. Insects such as moths (*Lepidoptera*) are critical to food chains, soil formation, pollination, and nutrient cycling. Restoration efforts have been attempted to restore the Illinois Tallgrass Prairie such as protected areas, urban parks, and wildlife preserves. To maintain prairies and promote high species diversity, controlled burns and grazing of herbivores are implemented. This study shows the

effects of grazing from American Bison and controlled burning of prairies on *Lepidoptera* diversity. To capture moths in prairies, blacklight traps were placed in various prairie management types. The captured specimen were identified and compared to calculate diversity and abundance between sites. The results show significant differences between grazed and burning areas hosting the most species diversity. Understanding prairie management can create effective protected areas and offset the Arthropod decline.

11:15am UG Landscape of Fear in Response to Anthropogenic Hunting Patterns

*Brianna Cook, Anant Deshwal [Bradley University]

Urbanization, agriculture and hunting have impacted abundances, behavior, and movement patterns among mammals in Central Illinois, and hunting seasons are no exception. Game species such as White-Tailed Deer have received much higher attention for conservation purposes but relatively fewer studies have studied the impact anthropogenic activities have on nongame species. This study aimed to answer the question of if nongame mammals exhibit a landscape of fear in response to hunting activity. Using the REM model, we are studied the influence of anthropogenic activities on mammal behavior in Central Illinois. In this study, we used camera traps to quantify movement behavior of nongame mammals during hunting and non-hunting periods in both urban and protected areas. Mammals spent significantly more time in non hunting areas and shifted in their diurnal activity patterns during hunting season. The apex predators of the area were found to have the most drastic change in behavior and range from hunting to non-hunting areas. Smaller mammals were also shown to be more relaxed when unaware of the presence of the cameras.

11:30am UG Mortality Bioassay of *Drosophila melanogaster* Following Exposure to Perfluorooctane Sulfonate Along with Ivermectin

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

Perfluorooctane Sulfonate (PFOS) is a synthetic chemical widely used in everyday life that has become a global pollutant. Research has shown that PFOS is acutely neurotoxic to *Drosophila melanogaster*. This research aims to identify if drugs that act as an agonist for chloride channels, such as ivermectin, may counteract and help decrease PFOS mortality. We exposed male flies to PFOS only, ivermectin only, then the two combined for various increments of time. The mortality rate concluded to be significantly high with just exposure to different concentrations of PFOS compared to the PFOS plus sublethal ivermectin treatments (t-test, $p < 0.05$).

11:45am Toxic Metal Accumulation in Shellfish Commercially Available in the US Market

*Zhi-Qing Lin, Wilson Gao, Skylar Bone [Southern Illinois University Edwardsville]

Seafood has become increasingly prevalent in people's daily lives, and approximately a quarter of the seafood harvested consisted of shellfish. Shellfish provide high dietary intake of protein and other essential nutrients, but there are also concerns about toxic metals accumulated in shellfish tissues because some shellfish such as mussels, oysters, and clams are benthopelagic. Thus, the objectives of this study were to investigate toxic metal concentrations in shellfish of 16 species that are commercially available in the US supermarket. To investigate the spatial variations of metal accumulation in shellfish, shrimp samples of *Litopenaeus vannamei* were collected from four different ocean regions. Preliminary results showed that concentrations of Cd and Hg varied significantly among 16 species, showing relatively high Cd concentrations of 13.1 ± 5.3 mg/kg in snail (*Babylonia lutosa*) and high Hg concentrations of 0.166 ± 0.074 mg/kg in squid (*Dosidicus gigas*). Comparable concentrations of Cd and Hg were observed in the shrimp harvested from four different parts of the world.

HEALTH SCIENCES – RM 026

11:45am Grad Novel Risk Indices for Analyzing County-level Cancer Disparities in Illinois: Development and Validation

*¹Lei Guo, ¹M. Courtney Hughes, ²Margaret E. Wright, ¹Ali Faghani, ¹Meredith C. Osias, ¹Mahdi Vaezi [Northern Illinois University, ²University of Illinois Cancer Center]

Cancer is the second leading cause of death in Illinois (IL), responsible for 20% of all annual deaths. In 2022, nearly half of all cancer-related deaths in the state were caused by four common cancers: lung, colorectal, breast, and prostate. Among these, lung cancer (LC) had the highest mortality rate, with 39.2 deaths per 100,000 people. Using publicly available data, we created two indices to assess cancer risk and disparities across Illinois counties. First, the Lung Cancer Risk Index (LCRI) combined meta-analysis and Analytic Hierarchy Process (Meta-AHP) methods to incorporate modifiable risk factors into a summary measure, with smoking being the primary contributor. Our LCRI_{IL} case study found a positive correlation between the index and LC incidence rate ($r = 0.45$,

$P < .001$) and mortality rate ($r = 0.50$, $P < .001$) across IL counties. Second, the Illinois Cancer Risk Index (ICRI) utilized factor analysis to reduce 90 predictors for the four common cancers into a simple measure that represented the most significant contributors. The index was positively correlated with the average mortality rate of the four common cancers combined ($r = 0.59$, $P < .001$).

We demonstrated the geographic distribution of both the LCRI_{IL} and ICRI by county across IL. The LCRI_{IL} shows that high LC risk areas are concentrated in the East-Central and southern portions of the state, as well as Cook County. The ICRI map demonstrates that the counties in East-Central, far northern, and southern IL have the highest risk of mortality from the four most common cancers. These indices can help identify counties that may be in need of additional resources and interventions to address multiple cancer risk factors. They can be used in any location where data is available and aid interdisciplinary professionals and researchers in identifying geospatial disparities and gaps.

MICROBIOLOGY – RM 212A

9:00am Grad **The Type VI Secretion System: A Defense Mechanism by a Termite Gut Symbiont**

*Emma Chilcoat, Brittany Peterson [Southern Illinois University Edwardsville]

The eastern subterranean termite, *Reticulitermes flavipes*, is a valuable model to study symbiotic functions that help provide defense against invading microbes. The symbionts of the eastern subterranean termite, *Reticulitermes flavipes*, have been associated with digestion, pathogen protection, and mediating other host physiologies.

Recently, our lab discovered the presence of a type VI secretion system (T6SS) in a native isolate from the termite gut (Rf20). T6SSs are molecular machines embedded in the cell wall of some bacteria that target nearby cells.

Upon contact, the T6SS delivers effector proteins, like toxins and cell manipulators, into the target cell resulting in cell death. Preliminary data in our lab suggests that symbionts with this secretion system outcompete one termite pathogen, *Serratia marcescens*, in vitro. We hypothesize that the type VI secretion system found in Rf20 is necessary for *R. flavipes* to outcompete opportunistic bacterial pathogen, *Serratia marcescens*, in vitro. To test this hypothesis, we targeted the main structural component of the T6SS, the hcp gene, using site-directed mutagenesis within the Rf20 genome via suicide plasmid pCVD442. We then repeated our co-culture competitions assay with the mutagenized Rf20 hcp clones to determine if the T6SS is necessary to outcompete the termite pathogen in vitro. The co-culture results with Rf20 hcp mutants resulted in a 50:50 ratio with the pathogen, *Serratia marcescens*. Our results support our hypothesis that the type VI secretion system found in Rf20 is necessary for *R. flavipes* to outcompete opportunistic bacterial pathogen, *Serratia marcescens*, in vitro.

Sigma Xi G03152021108419820, 2021 ISAS-SRG, and 2022 SIUE Research Grants for Graduate Students provided funding this research.

9:15am UG **Identifying Potential Novel Antibiotics for Future Use**

*Devan Morgan, Nik Wollenhaupt, Brent D. Chandler, Gwendolyn S. Knapp [Illinois College]

The overuse of antibiotics in both clinical and agricultural settings has contributed to the global spread of multidrug-resistant (MDR) bacterial pathogens, resulting in over \$2 billion a year in healthcare costs, and 70,000 excess global deaths. MDR bacteria are widespread and are found in populated areas, as well as isolated and remote areas such as the high arctic. Moreover, ESKAPE strains, which include six common pathogens with growing MDR issues, pose a threat to the human population because of the lack of effectiveness of antibiotics over time due to overuse and exposure. Developing new treatments to combat infections caused by these bacteria is important to tackling the MDR problem.

To identify potential new sources of antibiotics, bacteria were isolated from environmental samples and tested for their ability to inhibit growth against the ESKAPE pathogens, and several antimicrobial-producing strains were isolated. These strains are being identified using classical microbiological techniques, as well as 16s rRNA sequencing. Further, the compounds that cause the disruption of microbial life are being isolated using liquid chromatography. We have begun to characterize these isolated compounds against the various ESKAPE strains.

PHYSICS, MATHEMATICS, & ASTRONOMY – RM 130

9:00am Grad **Estimating Transmission Parameters for Covid-19 in Sri Lanka**

*Harsha Iduruwage, Dinesh Ekanayake [Western Illinois University]

COVID-19 pandemic has had a devastating impact on many societies during the past few years. As a zoonotic disease, the study of its transmission is fundamental to understanding its community spread. The basic

reproduction number (R_0) is an epidemiological metric used to measure the transmissibility of infectious disease. R_0 is usually estimated from a time series of epidemiological data or using ordinary differential equation models. However, imperfect data and many uncertainties lead to inaccurate estimations. This is particularly true in third world countries, where a greater proportion of people with a mild COVID may not seek medical treatments. In this research, we investigate the community transmissibility of COVID in Sri Lanka. Assuming that the uncertainty can be modeled by a Wiener process, we use Itô stochastic differential equations to model the disease transmission. We evaluate the transmission rate, the recovery rate, and R_0 for the disease. We compare the results with the existing methods and estimates for Sri Lanka. We demonstrate that the proposed method indeed produces a better estimate using several model selection criteria.

- 9:15am Grad Measurement Error Mitigation Techniques used in a Single Qubit Encoded into 3(GHZ) Code**
 *A K M Ashiqur Rahman, Kishor T. Kapale [Western Illinois University]
 Quantum computers are prone to errors due to their fragile nature and the effects of noise in the system. Measurement errors are a common source of error in quantum computing that can lead to inaccuracies in the measured results. To address this issue, measurement error mitigation (MEM) is used to correct errors in the measurement process. One approach used in MEM is the correction matrix approach, which involves constructing a correction matrix that adjusts the probabilities of the measured states based on the estimated error rate. This correction matrix is then applied to the measurement data to correct the measurement errors, improving the accuracy of quantum computations. In this study, we used this technique on a single qubit encoded into 3(GHZ) codes to see what the effect is. To do this we used Qiskit a python-based platform and run it in the real quantum computer(ibmq_belem) and we got a satisfactory mitigated result. But when the circuitry becomes large, whether this approach is helpful in general, it still needs to be searched. However, MEM is a helpful technique for mitigating errors in the measurement process, which can be a significant source of noise in quantum computing. By estimating the error rate and applying appropriate post-processing techniques, such as the correction matrix approach, it is possible to correct these errors and improve the accuracy of quantum computations.
- 9:30am Grad An Investigation into Extending Capabilities of Standard Quantum Error Correcting Codes to Handle Amplitude Damping Errors**
 *Al-Maliq Adetunji, Kishor Kapale [Western Illinois University]
 Quantum states of qubits are used to hold information on quantum computers. Through the operation of quantum gates on qubits, embedded information can be manipulated. Unfortunately, the microscopic nature of qubits makes them susceptible to unwanted interactions with their environment. In addition, the gate operations to which qubits are subjected can be erroneous. These noise-inducing factors perturb the quantum states of qubits and diminish the possibility of performing accurate calculations using actual quantum hardware. Nevertheless, fault-tolerant quantum computing has been mathematically demonstrated. Fault-tolerant quantum computing employs qubit-controlling protocols with underlying quantum error-correcting (QEC) codes to consistently correct errors that arise during computation due to the aforementioned factors. Predominantly, fault-tolerant protocols have been developed around QEC codes that correct a popular range of errors, namely, Pauli errors. However, the performance of these codes is impaired by their inefficiency in correcting other types of errors, such as the amplitude-damping error. In this work, we investigate the development of a framework that incorporates amplitude-damping and Pauli-error error-correcting capabilities. With this framework, we seek a higher-accuracy fault-tolerance scheme against standard Pauli errors as well as amplitude-damping errors.
- 9:45am Grad Influence of Host Glass Composition on Optical Absorption of Pr^{3+} and Dy^{3+} Co-Doped in Bismuth Boro-Tellurite Glasses**
 Md Hasibul Hasan Hasib, Saisudha B. Mallur, P. K. Babu [Western Illinois University]
 In this work we have analyzed the effect of compositional changes in bismuth boro-tellurite glasses on the optical properties of co-doped Praseodymium (Pr^{3+}) and Dysprosium (Dy^{3+}) ions. For preparing the glass samples, we mixed the raw materials of highly pure (99.9%) Bi_2O_3 , H_3BO_3 , TeO_2 , Pr_2O_3 , and Dy_2O_3 homogeneously to make a 20g batch for each glass samples. Bi_2O_3 content was varied with fixed 10 mol% and 20 mol% TeO_2 content. The raw materials were melted in the temperature range of 800-1000°C by using a high temperature furnace and air quenched on a metal plate. Glass samples were annealed at 350°C for 2-3 hours to reduce thermal strains. Finally, samples were polished to get proper reflecting surfaces. Refractive index measurements were carried out using a Brewster angle set up and optical absorption spectra were recorded in the wavelength range 200–2400 nm using a Varian (Cary 5G) absorption spectrometer with a resolution of ± 0.2 nm. Using modified Judd-Ofelt theory, oscillator strength (area under the band) of each absorption transitions were determined. One of the absorption transitions in Pr^{3+} and Dy^{3+} is very sensitive to the environment. This is called the hypersensitive transition (HST). The variation of the peak wavelength and oscillator strength of this HST with Bi_2O_3 and TeO_2

content is discussed. Considering all the absorption transitions, intensity parameters which depend on the symmetry of the rare earth (Pr^{3+} and Dy^{3+}) sites and Pr-O and Dy-O covalency are calculated by least squares analysis method. The variation in these optical parameters with changes in the base glass indicates that there are structural changes in the vicinity of Pr^{3+} and Dy^{3+} ions, and an increase in the Pr-O and Dy-O covalency.

10:00am Grad Finding the Optimal Spectral Resolution for Analysis of Molecular Line Observations of a Sample of High-Mass Star Forming Regions

*Amisha Rane, Esteban Araya [Western Illinois University]

Sanchez-Tovar et al. (submitted) reported detection of CH_3OH and NH_3 in a sample of young high-mass stellar objects based on broadband VLA continuum observations. We present results of follow-up observations of three regions in their sample (IRAS 20126+4104, IRAS 18089-1732 and G34.43+00.24) to study the nature of the lines, focusing in particular on the CH_3OH 8(2)-8(1) transition. A main component of the work was to optimize the velocity resolution to maximize the signal-to-noise ratio while keeping the velocity information of the spectral profiles. We confirmed the detection and found that the optimal channel widths are between 1 and 3 km/s for the sources in the sample. We found that the CH_3OH emission is extended (larger than $\sim 0.5''$) and has line-widths greater than ~ 5 km/s, consistent with thermal emission.

10:15am Grad Continuum Imaging of Three High-Mass Star Forming Regions

*Punya Paudel, Esteban Araya [Western Illinois University]

High spectral and angular resolution Very Large Array observations at 1.3 cm of three radio continuum sources with methanol and ammonia lines were made by our group to investigate the kinematics of molecular gas associated with the jets and determine the nature of the emission. We imaged the continuum of the three sources using one of the narrow spectral windows (SPWs), and compared it to the continuum from three broadband SPWs as well as with previous continuum measurements reported by Rosero et al. (2016) to check for consistency in the flux density calibration. The radio continuum from the narrow SPWs were in agreement with the continuum measurements from Rosero et al. (2016) for all three sources. However, the continuum from the broad-band SPWs was inconsistent for one of the sources. We are exploring whether calibration errors or the extended nature of the radio emission is responsible for this discrepancy.

10:45am Grad Analysis of Stimulated Emission Cross-Section of Praseodymium (Pr^{3+}) and Dysprosium (Dy^{3+}) Ions Co-Doped in Bismuth Boro-Tellurite Glasses

*A K M Ashiqur Rahman [Western Illinois University]

Glasses doped with rare earth ions show various interesting optical properties, including fluorescence, absorption, and lasing that make them an excellent optical system for practical applications. Therefore, we studied bismuth boro-tellurite glasses ($\text{Bi}_2\text{O}_3:\text{B}_2\text{O}_3:\text{TeO}_2:\text{Pr}_2\text{O}_3:\text{Dy}_2\text{O}_3$) co-doped with praseodymium and dysprosium. These glasses are prepared using the melt-quench method. In this study, we looked into different optical characteristics, fluorescence, and stimulated emission cross-sections, by varying the concentration of dysprosium from 0.5% to 1.5%. We recorded the optical absorption with a Varian (Cary 5G) absorption spectrometer and used those spectra to calculate the oscillation strength, and intensity parameters. Using these results, we calculated the radiative transition probability, lifetime, and branching ratios. Fluorescence spectra are recorded using a LEOI-101 Modular Multifunctional Grating spectrometer using a 445 nm diode laser. Dy^{3+} ions can only be excited in the ultraviolet region, whereas Pr^{3+} ions can be excited at 445 nm in the visible region. In our measurements, Dy^{3+} ions were indirectly excited by exciting Pr^{3+} ions. We observed fluorescence from Dy^{3+} ions as a result of energy transfer from Pr^{3+} ions to Dy^{3+} ions. We finally determined the stimulated emission cross-section using parameters calculated from absorption data and in conjunction with fluorescence data. When we compared these values to those of singly doped bismuth boro-tellurite glasses, we observed enhanced optical parameters which make these glasses useful in optical applications.

11:00am Grad Perfect Colorings of Generalized Petersen Graphs

*Hamed Karami [Western Illinois University]

For a graph G and an integer m , a mapping $T: V(G) \rightarrow \{1, \dots, m\}$ is called a perfect m -coloring with matrix $A = (a_{ij})$; i and j in $\{1, \dots, m\}$, if it is surjective, and for all i and j , for every vertex of color i , the number of its neighbors of color j is equal to a_{ij} . There is another term for this concept in literature as equitable partition. In this talk, some important results about enumerating parameter matrices of all perfect 2-colorings and perfect 3-colorings of generalized Petersen graphs $\text{GP}(n, k)$ are presented.

11:15am UG

A Mathematical Model of Losses in Multistranded Reinforced Cables

*Caleb Engebrecht, Dinesh Ekanayake [Western Illinois University]

Renewable energy sources, such as wind and solar energy, offer significant environmental benefits, as they are naturally replenished. However, wind and solar generation vary with wind speed and solar insolation. If transmission systems have a high penetration of renewable energy sources, the energy variability can produce significant voltage fluctuations. To improve power quality, it is imperative to understand the transmission power losses relevant to the fluctuations. These fluctuations can be viewed as high frequency voltage components.

While transmission power losses are well understood for DC and 60Hz and 50 Hz AC waveforms, there is a need for mathematical models to approximate the losses arising from high frequency components. In this research, we develop a mathematical model for multistranded Aluminum Conductor Steel Reinforced (ACSR) cables. This model uses simplified radially symmetric geometry and a partial differential equation, assuming no hysteresis losses and uniform, isotropic materials. We utilize a radial discretization to characterize the model as arrays of coupled resistor-inductor circuits. This implementation greatly simplifies the analysis of multistranded ACSR cable power losses and is applicable to many waveforms and cable types.

11:30am UG

Molecular Masers in the Orion Nebula

*Gabriel Sojka, Drew Hecox, Esteban Araya [Western Illinois University]

The Orion Nebula is the closest region of high-mass star formation; it is located 1344 light years from Earth in the ‘sword’ region of the Orion constellation. An important tool to study star formation is spectroscopy, particularly, observations of molecular lines. Similarly to how an atom can emit spectral lines due to the electron changing its energy level, molecules can also emit spectral lines due to transitions between energy levels. We are studying Orion as part of the VOLS project (VLA Orion A Large Survey), which is an international project using the Very Large Array in New Mexico surveying the Orion Nebula. VOLS is conducting radio continuum (to detect ionized gas) as well as spectral line observations, including OH and CH₃OH transitions. We report results of a search for 6.7 GHz CH₃OH and 6035 MHz OH lines toward specific sites in the Orion Nebula known to have previous detections of these molecules, based on data from one VOLS observing epoch. We detected a 6.7 GHz CH₃OH maser at a location where a maser was detected in 2003 and 2004. However, the maser is ~5 times brighter than previously reported, which confirms variability of CH₃OH masers in the region. This work is based on observations conducted by the VOLS collaboration (P.I. G. Busquet Rico).

STEM EDUCATION – RM 212A

11:15am UG

Special Relativity 2D Pedagogical Video Game

*Lucas Schultz, Noah Postin, Katelyn Pattillo, Josiah Kunz [Illinois College]

Special relativity is a topic that, while not mathematically cumbersome, can be difficult for students to grasp. One reason is that there are no perfect analogies and very few ways to convey the topic in a laboratory setting. This ongoing project attempts to overcome the experiential problem with special relativity by developing a physics-based special relativity video game. The game utilized simple 2D video game platforming along with basic relativistic equations to engage students of all levels. Data via questionnaire was collected pre- and post-video-game and then analyzed. The results are discussed.

11:30am

Teaching Macromolecular Structure with Computer Models*¹Keith Johnson, ²Brian Gadd [¹Bradley University, ²Los Angeles Mission College]

Protein visualization using computer modeling software is a powerful educational tool to illustrate and explore the connection between protein structure, function, chemistry, and biology. However, using these tools in the classroom requires prerequisite knowledge of macromolecules, small molecules, chemical bonds, and in some cases the use of the tools themselves. The “Box of Lessons” was first envisioned as an introduction to the chemistry of biological molecules, using available Internet resources and 3D visualization on computers, to engage students and educators in the exploration of biological molecules and the interaction between chemistry and biology with a focus towards understanding disease.

The resources of the “Box of Lessons” have been generated to encourage supplementation of textbook and lecture resources for introductory biology and chemistry courses to illustrate the connection between the sciences. The worksheets have been generated to guide the users, both educators and students, through available resources and to provide tools for exploration. Students using the worksheets will be led through resources to gather information using assessment questions. The modular nature of the resources allow educators to use all or part of the resource

to fit the need of their course or the intended use while providing an avenue for adaptation of the resources to fit the desires of the educator.

An introduction to the “Box of Lessons” will be provided. Examples of the use of the RCSB PDB (Research Collaboratory for Structural Bioinformatics PDB) and Mol* protein 3D-visualization tools will also be provided for use at the introductory level. The examples will come from a new resource that illustrates use across an introductory biology course on cell and molecular biology. Additional resources are in development.

ZOOLOGY – RM 110A

10:45am Grad **Developmental Plasticity of *Ambystoma texanum* Under Various Hydroperiod and Predation Risk Conditions**

*Mariah Mack [Southern Illinois University Edwardsville]

The length of time a water body remains inundated is an important environmental factor for developmental stages of aquatic-breeding amphibians. In addition, predation risk has direct and indirect effects on amphibians. Some amphibians exhibit plasticity during development to mitigate these environmental stressors. I conducted a mesocosm experiment with three hydroperiod treatments (short, medium, constant) and two predator treatments (presence or absence of *Lepomis macrochirus* cues) and measured life history traits at metamorphosis to determine the degree of developmental plasticity exhibited by *Ambystoma texanum* (smallmouth salamander). Survival to metamorphosis averaged 56.7% and was consistent across all treatments. Larval period, mass, and body size increased with longer hydroperiods but were not significantly affected by predator cue or the interaction of hydroperiod and predator cue, suggesting a lack of synergistic effects between these stressors for the levels we used. Larval periods ranged from 50 to 100 days, with an overall average of 65.35 days. Compared to the control, salamanders in the short hydroperiod metamorphosed 14.5% earlier, 49% lighter (mass), and 14.8% smaller (SVL) on average. Understanding the effects of environmental stressors on *A. texanum* life history traits is important for predicting their adaptability to climate change-induced shifts in water availability and introduced predators.

11:00am UG **Sertraline Exposure Influences Learning in Developing Tadpoles**

*Emily Kemp, Travis E. Wilcoxon [Millikin University]

Selective serotonin reuptake inhibitors (SSRIs) are common medications prescribed for the treatment of depression, panic attacks, and other anxiety disorders. These pharmaceuticals are capable of crossing the placenta, and the influence on developing fetuses is unknown. Tadpoles serve as a good vertebrate model for factors that influence development because they are free-living at a comparable stage when many vertebrates are *in ovo* or *in utero*. Most studies of the effects of sertraline on learning involve children who are prescribed sertraline and comparatively fewer, correlational studies have examined potential impacts of exposure *in utero*. The purpose of this study was to experimentally examine the impacts of sertraline exposure on learning in tadpoles. Our factorial study included six different groups, with different combinations of sertraline concentrations (control, low, high) and two stimulus groups (pseudoconditioned and conditioned) following a classical conditioning paradigm. Specifically, pheromonal signals from potential predators (fish) and from injured conspecifics (tadpoles) were incorporated into the study, as tadpoles have an innate response to decrease activity in the presence of conspecific injury cues. We found that tadpoles exposed to low and high levels of sertraline were significantly less likely to learn to associate fish odors with the conspecific injury cues, while the true control group significantly reduced activity in response to fish cues following four days of conditioning. Our findings suggest that sertraline may directly, or indirectly, influence learning in vertebrates in early development.

11:15am UG **Surveillance of West Nile Virus in Migratory Warblers in Central Illinois**

*Delaney Haubner, Travis Wilcoxon [Millikin University]

West Nile virus (WNV) is a zoonotic pathogen that utilizes a mosquito-bird-mosquito transmission pathway. *Culex* mosquitoes act as the primary bridge vector and birds act as reservoir and amplification hosts. Many factors can increase a bird's risk of exposure to WNV such as age, climate and preferred habitat type. Through the surveillance of WNV in local bird populations, transmission patterns within an area can be observed. Blood samples were collected from migratory warblers from spring and fall seasons to observe patterns in migration and from various habitat types in order to observe differences in exposure rates and the relationship to the bird's proximity to a water source. An indirect IgY ELISA was used to analyze 192 samples from 18 different warbler species and to detect WNV antibodies in the samples. There was no significant difference in the prevalence of WNV antibodies between spring and fall among the warblers but there are differences in WNV among warblers that use different habitat types. Warblers that inhabit areas near standing water were more likely to test positive for

IgY antibodies for WNV. This relationship can be explained by considering mosquitoes' use of water for oviposition. The results of this study supports and furthers the current understanding of WNV dynamics in small, migratory birds like warblers.

11:30am UG

Semicircular Canal Size Constrains Vestibular Function in Miniaturized Frogs

*¹Richard Essner, ²Rudá Pereira, ³David Blackburn, ³Amber Singh, ³Edward Stanley, ²Mauricio Moura, ²André Confetti, ⁴Marcio Pie [¹Southern Illinois University Edwardsville; ²Universidade Federal do Paraná, Brazil; ³Florida Museum of Natural History/University of Florida; ⁴Edge Hill University, UK] Miniaturization has evolved repeatedly in frogs in the moist leaf litter environments of rainforests worldwide. Miniaturized frogs are among the world's smallest vertebrates and exhibit an array of enigmatic features. One area where miniaturization has predictable consequences is the vestibular system, which acts as a gyroscope, providing sensory information about movement and orientation. We investigated the vestibular system of pumpkin toadlets, *Brachycephalus* (Anura: Brachycephalidae), a clade of miniaturized frogs from Brazil. The semicircular canals of miniaturized frogs are the smallest recorded for adult vertebrates, resulting in low sensitivity to angular acceleration due to insufficient displacement of endolymph. This translates into a lack of postural control during jumping in *Brachycephalus* and represents a physical constraint resulting from Poiseuille's law, which governs movement of fluids within tubes.

POSTER PRESENTATION ABSTRACTS

1:15pm – 3:30pm, Saturday, April 15, 2023, in Renaissance Coliseum

*presenter, [school] with differences noted by superscript

ANTHROPOLOGY & ARCHEOLOGY

#71 UG
1:15pm

Development and Sexual Dimorphism in Human Chins

*Haylee Simmons, Miranda Karban [Illinois College]

This study investigates the development and sexual dimorphism of the human chin. Previous studies have shown chin size differs between males and females, but the timing and patterning of this difference are not well understood. Cephalograms from 30 subjects (15 male, 15 female) sampled from the AAOF Legacy Collection were measured at 4 longitudinal age groups, spanning from 3.0-20.6 years of age. Landmark (n=4) and sliding semilandmark (n=15) points were collected along the lateral profile of the mandible and the mandibular angle was measured from each cephalogram. Statistical analysis, including GPA, RWA, T-tests, and two-block partial least squares analysis was performed using the R software. No clear patterns related to age were found when the entire mandibular profile was assessed. Significant sexual dimorphism was found to covary significantly with the shape of the inferior and posterior mandible. The mandibular angle was found to covary significantly with the anterior chin shape, showing the close developmental ties between these two regions of the mandible. The significant sexual dimorphism in the mandibular angle found here has important impacts on the forensic sex destination of human skeletal remains.

#73 UG
1:15pm

Human Orbital Index Development and Sexual Dimorphism

*Isabella Aguirre, Miranda Karban [Illinois College]

The human eye orbit is comprised of several different bones, yet it is often neglected when discussing patterns of individual growth. Previous research has been conducted to assess the orbital index (OI), which is a ratio of the height and width of each orbit, but this mechanism has often been tied to racial generalizations. This study quantifies the left and right orbits during multiple stages of development and assesses sexual dimorphism of the OI. It was hypothesized that there would be an increase in OI as individuals age and that there would be significant sexual dimorphism present. We also hypothesized that the racial group categorization, which has been commonly studied in previous research, would not change throughout an individual's lifetime. A radiograph sample of 30 subjects (15 males, 15 females) from the University of Toronto Burlington Growth Study were measured at four longitudinal age points (age 1: 4.9-5.3 years, age 2: 6.9-7.2 years, age 3: 8.9-9.2 years, and age 4: 15.9-16.3 years). The OI ratio (orbital height/orbital width*100) was calculated at each age point. The dimensions of the eye orbit were found to significantly change between the ages of 5 to 7 years, with only minimal changes occurring between 7 to 16 years of age. No significant sexual dimorphism was found in any of the sampled age groups. This study did not support the use of OI for racial categorization, opposing the findings of some previous studies. These results can aid in identifying abnormal growth patterns in structures of the eye and can potentially provide a baseline to assess ocular diseases. These results indicate that the orbital index should not be used as a method of sex estimation in forensic anthropology.

BOTANY

#75 Grad
1:15pm

Variation in Insect Visitation and Seed Viability for Three Species of *Spiranthes* Orchids

*Samantha Roberts, Elizabeth Esselman, Jason Williams [Southern Illinois University Edwardsville]

Climate change, habitat loss, pollution and invasive species are just a few challenges facing plants and animals. Best practices for plant management involves not only understanding and providing necessary abiotic requirements but also biotic components needed for seed production, fertilization, germination, and growth. Thus, successful plant conservation may rely on the presences of specific insect pollinators, however, which insects serve as pollinators of many at risk flowering plants are unknown. To determine the likely pollinators of three native orchids in the genus *Spiranthes* (family Orchidaceae), we identified insects visiting flowers during their limited blooming periods (~ two weeks). A total of 145 insects representing 16 different families were collected or observed visiting flowers of *S. vernalis*, *S. magnicamporum* and *S. cernua*. Insect visitations to *S. vernalis* flowers were dominated by true bugs (order Hemiptera) constituting 33.7% of the 83 total animals that were captured or observed. Lepidopterans were the primary insect observed/collected for *S. magnicamporum*

(56.4% of total), and no insect visits were observed for *S. cernua*. Seed viability ranged between for *S. vernalis* to and for *S. magnicamporum* and *S. cernua* respectively.

#77
1:15pm

Tracking Invasive *Lespedeza cuneata* Using Remote Sensing

*Kurt Schulz, Owen Luetkemeyer, Adriana Martinez [Southern Illinois University Edwardsville]

Lespedeza cuneata is an invasive legume found across the midwestern plains, primarily within grassland environments. Due to its rapid reproduction, extensive seedbank, and environmental hardiness, *L. cuneata* quickly outcompetes many native grasses and forbs within sensitive prairie ecosystems. Unfortunately, it is highly resistant to regular extermination techniques. Early detection and mitigation of *L. cuneata* invasion drastically increases the success of prairie restoration efforts. While *L. cuneata* succeeds in tallgrass prairies, it has several unique features that strongly differentiate it from dominant native species, including a woody stem, an oblique angle of growth, and variable seasonal coloration. The focus of this research is to analyze these qualities of *L. cuneata* to determine if they are detectable by remote imaging sensors such as drone RGB cameras and civil multispectral and synthetic aperture radar satellites. An automated or semi-automated detection solution from remote sensing data would be a preferable alternative to traditional detection methods. Such a model promises larger-scale and faster assessment of the presence of *L. cuneata* in protected areas, but also provides the precise locations of invasion and the relative percent of *L. cuneata* biomass present.

CELLULAR, MOLECULAR, & DEVELOPMENTAL BIOLOGY

#3 **Grad**
1:15pm

Investigating the Genetic Locus of *mnd* Gene in a Basidiomycete Fungus *Schizophyllum commune*

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

A recessive mutant phenotype called mound was discovered in mushroom-forming *Schizophyllum commune* about 50 years ago (Leonard, 1975). Mound forms dense, hemispherical indeterminate hyphal growths on fungal colonies following internuclear replacement of wild type *mnd*⁺ allele information with mutant *mnd* allele information. The unusual morphology, and the molecular genetics of mound allele transformation are not fully elucidated. Recent work by Zanker (2021) identified two genetic markers, *GTF* and *pep*, linked to *mnd*, narrowing the region predicted to contain the *mnd* locus from 3.1 Mb to 1.8 Mb. To investigate further, we continued toward the genetic locus of *mnd* with a search for genetic markers that are more tightly linked to *mnd*. To do this, a total genomic library of the mutant strain was screened by PCR with nine primer pairs. Four fosmid clones from two separated central areas of the 1.8 Mb DNA region have been isolated. Polymorphic sites between the reference genome and the mound strain DNA have been difficult to locate for the purpose of molecular marker mapping near *mnd*. Approximately 5 kb from two clones has been sequenced with no SNP detected. One potential deletion in the cloned *mnd* mutant strain DNA is being further analyzed. Two other clones will be sequenced and analyzed in search of polymorphic genetic markers. We will determine a genetic map position of each marker relative to the *mnd* locus. These new genetic markers will be used to identify DNA clones that include the *mnd* locus for its characterization.

#4 **UG**
2:30pm

Effects of Ketoconazole on Vac8-GFP Localization in *Komagataella pastoris*

* Keila Coria Tinoco, Chelsea Smith, Michelle Fry, Asher Stein, Nick Rogers [Bradley University]

The Fry research group has previously demonstrated that an armadillo repeat protein, Vac8p, is required for a selective recycling pathway known as microautophagy in the yeast *Komagataella pastoris* (*K. pastoris*). Association of *K. pastoris* Vac8p with the vacuolar membrane requires the presence of amino-terminal acylation sites in the protein suggesting a lipid-anchoring interaction. Previous attempts to purify *K. pastoris* Vac8p have shown only partial solubilization of the protein using either SDS or Triton X-100, leading us to hypothesize that Vac8p may associate with detergent-resistant membrane domains. To probe this hypothesis, we grow *K. pastoris* strains expressing a fluorescently-tagged Vac8p (Vac8-GFP) in the presence of ketoconazole, a sterol depletion agent, and assess the effect on the vacuolar membrane association of Vac8p. To date, we have demonstrated that growth of *K. pastoris* strain expressing Vac8-GFP is not affected by the presence of ketoconazole at doses up to 2 µg/mL over a time course of 6 hours. In addition, the Vac8-GFP levels in cellular extracts appear to be unaffected by the presence of the sterol depletion agent. In the future, we will use subcellular fractionation and differential extraction methods to probe the association of Vac8-GFP with vacuolar membranes of *K. pastoris* grown in the presence and absence of 2 µg/mL ketoconazole.

- #5 Grad**
1:15pm **The Immediate Effect of Bite Blocks on Brux-Like Motor Patterns and Long-Term Expression of Myogenic Cell Lineage Markers, Pax7 and Myogenin**
*¹Oluwaseun Adeleke, ²Alica DeMaria, ²Achint Utreja, ²Dan Welch [¹Southern Illinois University Edwardsville, ²Southern Illinois University School of Dental Medicine]
Posterior bite blocks are used in orthodontic dentistry to alter the occlusion, which has a secondary effect of stretching the muscles of mastication in the vertical dimension. We are using the laboratory rat as an animal model since the Masseter is the major jaw-closing muscle in both humans and rats. The Masseter is innervated by trigeminal motor neurons that receive inputs from central pattern generators (CPG) in the brainstem. CPGs are neuronal networks that produce rhythmic motor patterns such as mastication and bruxing. In humans, excessive bruxing is characterized by the repetitive act of grinding and clenching the teeth causing tooth wear and breakage. Characterizing the immediate physiological response of bite blocks due to altered proprioceptive feedback has been largely ignored in the orthodontic literature. Electromyography (EMG) is a technique that evaluates the electrical potential of a muscle during contraction. EMGs will be used to characterize brux-like motor patterns before and after 3, and 7 days after placement. We compared the EMG amplitude, cycle period, and burst duration. We also characterized the histological changes in the muscles of mastication after treatment with posterior bite blocks. The histological result showed the number of Pax 7 positive nuclei increased 7 days after posterior bite block placement.
- #6 UG**
2:30pm **Antimicrobial Production from Soil Pseudomonads**
*Eric Lenzi, Keith Johnson, Vivian Lee, Kathryn McNease, Chelse Recendez [Bradley University]
The identification of new antimicrobial compounds has been slow in recent decades. Pharmaceutical companies that are involved in drug development are not pursuing antimicrobial compounds largely due to the expense of identification and the minimal yield in return with the identification and testing of novel antimicrobial compounds. Academic scientists have turned to the creation of synthetic compounds based on existing compounds or exploring environmental bacteria for the identification of new compounds (Tiny Earth project).

Two soil bacteria, tentatively identified by sequencing as Pseudomonads, have been identified that produce an antimicrobial compound that is being further characterized. The compound appears active against *Bacillus* sp. but not against *E. coli*. The compound is synthesized and secreted from the bacteria in liquid tryptic soy broth in the presence of 0.5% glucose (but not in the absence of glucose). The antimicrobial compound has been extracted using ethyl acetate, dried and tested against bacteria on Mueller-Hinton plates. Thin layer chromatography and spectral analysis suggests that the two bacterial isolates produce different antimicrobial compounds. Further characterization is being performed. Additional candidate antimicrobial bacteria have been identified and are being characterized in the laboratory.
- #7 Grad**
1:15pm **Exploring the Fungus-Derived Health Supplement PSK as a Biofuels Co-Product**
*Kortney Lucius, Brook C. Ozier, Deep D. Patel, Gopal R. Periyannan, Thomas Canam [Eastern Illinois University]
White-rot fungi, such as *Trametes versicolor* strain 52J, have been demonstrated to have potential applications as lignocellulosic (non-starch) biomass pretreatment agents for liquid biofuel production. However, lignocellulosic biofuel processes struggle in competitive marketplaces due to high capital and operating costs. One business strategy to overcome thin profit margins is to generate marketable co-products with minimal financial input. To that end, a related strain to *T. versicolor* 52J is *Coriolus versicolor* CM-101, which produces a carbohydrate-protein complex called polysaccharide krestin (PSK) that is sold as a health supplement with clinically-demonstrated positive outcomes. If *T. versicolor* 52J can also produce PSK, and/or *C. versicolor* CM-101 can be used as a pretreatment agent for lignocellulose, PSK could be a potential co-product for lignocellulosic biofuel processes. To explore whether PSK is found in *T. versicolor* 52J under the same growth conditions as *C. versicolor* CM-101, proteins were extracted from liquid cultures of the fungi and fractionated using ammonium sulfate precipitation followed by purification using desalting chromatography. The profiles of the extracted proteins from each fraction will be compared between the two strains of fungus, and the presence or absence of PSK will be explored using an antibody specific for carbohydrate-protein complexes. In a separate experiment, *C. versicolor* CM-101 and *T. versicolor* 52J were applied directly to chopped miscanthus straw (*Miscanthus x giganteus*) under semi-sterile conditions. After several weeks of growth of the fungi and decomposition of the lignocellulose material, the treated biomass was dried, milled to a fine powder, and will be subjected to a variety of chemical analyses, such as lignin composition and extractability of fermentable sugars. Both of these experiments will help to determine whether it is possible to isolate PSK as a potential co-

product during the production of liquid biofuels from lignocellulose, which could improve the economics of that industry.

- #8 UG**
2:30pm **Investigation of the Relationship between Trehalose Synthesis and Fumonisin Production Using qRT-PCR**
*¹Rachel Watson, ¹Ethan Tyner, ¹Carley Steres, ¹Kristi McQuade, ²Daren Brown [¹Bradley University, ²USDA-NCAUR]
Fusarium verticillioides is a filamentous fungus that infects corn, sometimes resulting in the production of fumonisin mycotoxins that cause health issues in livestock and humans. Our lab showed previously that mutant strains lacking the trehalose-6-phosphate synthase encoding gene *TPS1* not only cannot produce the disaccharide trehalose but also produce fumonisins at levels significantly lower than the wild-type strain, suggesting a link between *TPS1* and fumonisin metabolism. In this study, we use quantitative reverse transcription polymerase chain reaction (qRT-PCR) to compare the expression of fumonisin biosynthesis genes in the *TPS1*-deletion strain $\Delta TPS1.7$ to that of wild type *F. verticillioides*. Our preliminary results indicate that expression of *FUM1b*, *FUM3*, and *FUM8a* is significantly lower in $\Delta TPS1.7$ than in the wild type strain, which is consistent with reduced fumonisin production.
- #9 Grad**
1:15pm **The Anti-Cancer Effect of *Acmella* extracts in Ovarian Cancer**
*Femi Egbeleke, Shelby Henning, Mette Soendergaard [Western Illinois University]
Ovarian cancer is a gynecologic cancer that has been reported to be the fifth leading cause of cancer death in females in the United States of America. 19,710 new cases and 13,270 death cases have been estimated by the American Cancer Society to be reported in the year 2023. Just like every other cancer, possible treatment options for ovarian cancer as of date are surgery, chemotherapy, radiotherapy, immunotherapy, and also combination therapy, all of which are not efficient as patients in most cases die of the disease. This study investigated the anti-cancer effect of *Acmella alba*, and *Acmella oleracea* on the SKOV3 cell line of ovarian cancer. Different parts (leaf, stem, root, and flower) of the two species were harvested, freeze dried, and crushed into fine powder, and extracted using water, methanol, and ethanol. The extracts were resuspended in dimethyl sulfoxide (DMSO). SKOV3 cells were grown in McCoy's 5A medium at 37°C, 5% CO₂, and treated with DMSO (vehicle), 0.2 mg/ml water, methanol, or ethanol *Acmella* extracts, and 100 μ M paclitaxel (positive control) for 48 h. The anti-cancer effects of the eyeball plant were investigated by carrying out a cell viability test using 3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT). The results were subjected to one-way ANOVA statistical analysis to compare the viability of cells treated with the plant extracts or paclitaxel to the vehicle control. The leaf, stem and flower of the water, the flower of the methanol, and all the ethanol extracts of *Acmella alba*, as well as the leaf and flower of water, all the methanol and all the ethanol extracts of *Acmellaoleracea* were found to significantly reduce the cell viability (p-value<0.05). These results reveal that *Acmella* extracts exhibit anti-cancer activity, which may be utilized in the development of new treatments of ovarian cancer.
- #10 UG**
2:30pm **Rescue of the GGPPS11 Variegated Phenotype Using Meristem Specific Promoters**
*Brooklynn Kelley, Noah Drewes, Hendrick Hamilton, Tessa England, Darron Luesse [Southern Illinois University Edwardsville]
The synthesis of chlorophyll molecules is a complex process that requires the activity of many enzymes to produce precursor molecules. One of these, Geranylgeranyl Diphosphate (GGPP) is produced by Geranylgeranyl Diphosphate Synthase 11 (GGPPS11). A point mutation in *GGPPS11* (*ggpps11-1*) leads to specifically-patterned variegated leaf phenotype and abnormal leaf morphology. The purpose of this research is to determine if the variegated pattern is set out in the shoot apical meristem, possibly due to small temperature differences present in the meristem cell layers. To test this, *GGPPS11* was driven behind the meristem layer 1-specific promoter ATML1 and meristem layer 3-specific promoter WUS. These constructs were transformed into wild-type and *ggpps11-1* mutant plants using *A.tumefaciens* floral dip. Plants resistant to Basta selection have shown no obvious phenotypic differences to wild type. We are in the process of confirming these through PCR. After true-breeding homozygous insert lines have been identified, more detailed analysis will be performed including chlorophyll quantification and leaf variegation percentage using ImageJ.
- #11 Grad**
1:15pm **The Role of MSX1 and PURA in Fibroblast and Liver Cell Identity**
*Merve Diler, Gary A. Bulla [Eastern Illinois University]
Despite the fact that all cells in an organism share the same genetic information, various types of tissues exist within the same organism. This distinction stems from the differential gene expression and regulation patterns

that control tissue specificity. Whole genome microarray analyses of cultured cells identified several candidate genes that may be important transcription factors in tissue identification. One of these candidate genes, *Msx1*, is involved in embryonic development, particularly limb pattern formation and craniofacial development. Its absence causes a variety of developmental defects, including cleft lip and Wolf Hirschhorn Syndrome. Another candidate gene, *Pura*, plays an important role in DNA replication, gene transcription, RNA transport, and mRNA translation and to be essential for postnatal brain development therefore its absence is lethal. The goal of this project is to determine if *MSX1* and/or *PURA* can act to reprogram hepatoma cells to disrupt liver function in cultured hepatoma cells and activate fibroblast function. Our strategy was to transfect rat Fg14 hepatoma cells with mouse *Msx1* and *Pura* gene expression plasmids, which contains the Neo gene, using lipofection. RT-PCR was used to compare expression of introduced genes as well as liver and fibroblast marker genes to non-transfected parental cells by using gene specific primers. GAPDH was used to normalize signals and the DDCT method to calculate fold differences in expression between samples. Results showed only modest effects of overexpression of *MSX1* and *PURA* on the liver phenotype in transfected cells, suggesting that cellular reprogramming requires more than a single driver.

#12 UG
2:30pm

Classical Conditioning of *Schmidtea mediterranea* Using Common Flavor Extracts

*Taylor Pierce, Amy Winn [Southern Illinois University Edwardsville]

The planarian *Schmidtea mediterranea* is a good model system for testing simple behaviors due to their uncomplicated nervous system that contains cephalic ganglia and ventral nerve cords. They have been used in previous tests of memory involving conditioned response using light and shock or rough and smooth surfaces. Our current study is aimed at developing an assay to test planarians' ability to associate their food with a flavoring, with the goal of using this test in a knockdown screen to find planarian genes in control of memory. We conditioned worms by mixing flavored extracts with their food for several weeks and then tested to see whether the worms learned to associate that flavoring with the presence of food. The expectation was that conditioned worms would move down a choice-maze path to the end where extract was located and that unconditioned worms would distribute randomly to both ends. Our initial round of testing suffered an unexpected setback due to potential toxicity of the 3D-printed maze arenas causing the worms to become sick. Because of this, we switched to a different test model in which we placed conditioned worms in a petri dish and added extract to a "target zone" on one side. The number of worms in the target zone was monitored at one-minute intervals to determine whether they were attracted to the flavoring. Our results failed to show a response, with worms showing no preference for or against the target zone. We are currently revisiting the choice-maze assay, allowing the resin to cure for longer periods before exposing the worms to the arena. If we can demonstrate a response in that assay, we will then move on to knocking down potential memory-related genes to see if that eliminates the conditioned behavior.

#13 UG
1:15pm

The Effect of Chemotherapy on Cancer Cell Aggression in Ovarian Cancer Stem Cells and Bulk Ovarian Cancer Cells

*Emily Stidham, Craig Cady [Bradley University]

Ovarian cancer has the highest mortality rate of all of the gynecologic cancers, primarily due to its late-stage diagnosis and frequent recurrence. The cancer stem cell theory suggests that ovarian cancer stem cells contribute to this process through their ability to self-renew and ability to initiate new tumors. Ovarian cancer stem cells are thought to play a role in the recurrence of this disease. Cancer stem cells are found in most solid tumors and are resistant to chemotherapy and radiation therapy. Chemotherapy exposure has been shown to alter cancer cell aggression, making it an essential avenue for exploration. This project aimed to investigate the impact of 5-fluorouracil chemotherapy exposure on bulk ovarian cancer cells and ovarian cancer stem cells. Cell viability was analyzed using an alamarBlue assay to determine resistance to varying chemotherapy dosages. Additionally, a transwell migration assay was performed to assess the effect of chemotherapy exposure on cancer aggression. The results revealed that both cancer cell types' aggression significantly decreased upon chemotherapy exposure. Future studies will explore the effect of different chemotherapy agents on ovarian cancer stem cells and bulk ovarian cancer cells and their aggression properties.

#14 UG
2:30pm

Leaf Morphology in *Arabidopsis* Berberine Bridge Enzyme-Like Mutants

*Jill Lambrechts, Allison Newton, Jordyn Gawe, Darron Luesse [Southern Illinois University Edwardsville]

GERANYLGERANYL DIPHOSPHATE SYNTHASE 11 (GGPPS11) is an enzyme in the Mevalonate pathway responsible for making Geranylgeranyl Diphosphate, a precursor molecule for chlorophylls, carotenoids and other photosynthesis-related isoprenoids. A point mutation in *Arabidopsis* *GGPPS11* (*ggpps11-1*) results in variegated leaves and abnormal leaf physiology. RNA-seq analysis of white sectors revealed that 12 of the 28

total Berberine Bridge Enzyme-Like (BBEL) gene family members had differential expression in *ggpps11-1*. Although a large family, the function of most BBEL genes is unknown. The goal of this research was to determine the effects of BBE mutants on leaf shape in *A. thaliana*. T-DNA insertion lines were isolated and confirmed for each of the BBEL family members. Shape and size of leaves in all mutant lines were analyzed with the program called Leaf Shape Determination (LAMINA). Compared to wild type, none of the *bbel* mutant lines showed a significant difference in leaf area, perimeter, circularity or serrations. Future work will examine the effect of stress on BBE mutants, as well as the impact of these mutations on chlorophyll synthesis.

#15 UG
1:15pm

Treating *Xenopus laevis* Corneas with Amylase and Collagenase to Disrupt Stromal Integrity

*Marjori Russo, Paul Hamilton [Illinois College]

Xenopus laevis, or the African Clawed Frog, is well known for its regenerative ability of the lens of the eye. *X. laevis* tadpoles are able to regenerate the lens using signals sent from the neural retina and transmitted to cells located in the basal layer of the cornea epithelium. However, these frogs lose this regenerative capability after undergoing metamorphosis. As the tadpole goes through the necessary changes to become a juvenile frog, the once open space between the layers of the cornea is lost as the stroma develops. From this point on, *X. laevis* is unable to regenerate a new lens. Post metamorphic regenerative studies concluded that these frogs still possess the capability to release signals that trigger lens protein formation in cornea cells, indicating that the cornea epithelium is still capable of initiating the regenerative process. Finding a way to disrupt the integrity of the cornea stroma would provide a clear picture of the potential structural role that it plays in limiting the formation of a lens. Recent work done by Kazaili (2020) successfully utilized amylase to degrade the integrity and thickness of pig corneas. This same approach might also be utilized to degrade the stroma of juvenile frog corneas. The ultimate goal of this research is to degrade the stroma of *X. laevis* in order to assess the potential of the mature cornea to regenerate a lens. After treatment with amylase and collagenase, qualitative observations suggested that integrity of the treated corneas was disrupted, as corneas were more delicate overall than control corneas from the same juvenile frogs. Using histological approaches we are working to compare the stroma thickness of treated corneas against untreated corneas.

#16 UG
2:30pm

Developing a Circumnutation Analysis Pipeline for Arabidopsis Floral Meristems

*Nathan Budde, Michael Buzzard, Darron Luesse [Southern Illinois University Edwardsville]

Circumnutation is an endogenous movement in plants that causes them to oscillate in different directions during growth. Though it is possible that circumnutation is the activity from which many other plant movements are derived, the mechanism is unknown. The established approach for studying circumnutation is the use of time-lapse photography to capture the location of the floral meristem over time in different conditions. The most recent and lab-friendly tool available for analyzing plant stem nutations is Circumnutation Tracker (CT). CT appears to collect reproducible and informative data about the period and size of the circumnutation movements, but the method of collection requires manually identifying the location of the floral meristem in each frame of a timelapse video, which is very labor-intensive and less reproducible as it is subject to human error. The goal of this research is to automate this process and develop an image capture and analysis pipeline that utilizes AI to identify the meristem in videos. To begin this project, I spent time going through the literature available on tracking plant movement until I found a method that was replicable in our lab. Having settled on a method, further steps include learning how to use the software to track Arabidopsis circumnutation and produce coordinates for comparison. Once we can reliably compare circumnutation patterns in Arabidopsis mutants, we can discern which gravitropism-related mutations also impact circumnutation.

#17 UG
1:15pm

Evaluating Hair Cell Damage in Neuromasts of *Xenopus laevis*

*Ronnautica Dixon, Paul Hamilton [Illinois College]

The lateral line system is a detection mechanism of tactile sense organs within the water for aquatic vertebrates such as fish and amphibians, including *Xenopus laevis*. Hair cells within the neuromasts of the lateral line system function as mechanoreceptors responding to movement, vibrations, and pressure changes. Our goal is to assess *Xenopus laevis* as a potential model for screening the ototoxicity of drugs, through the visualization of damage to the hair cells of the lateral line system. This is a well-established technique in Zebrafish, but the efficacy of using *Xenopus* tadpoles remains unclear. *Xenopus* hair cell nuclei were visualized using the fluorescent dye YO-PRO-1, highlighting the neuromasts of the lateral lines located around the left and right eyes of the tadpoles. Using *X. laevis* tadpoles at stages 32-45, we assessed the ototoxicity of three drugs: Kanamycin, Chloramphenicol and Spermidine. Hair cell damage was assessed by the failure to incorporate the YO-PRO-1 dye and demonstrated the feasibility of using the *Xenopus* lateral line system as a model of studying drug ototoxicity.

- #18 UG**
2:30pm
- Identifying a Potential Mating Pheromone Gene in *Schizophyllum commune***
*Lauren Lucykow, Jaelyn Boone, Thomas J. Fowler [Southern Illinois University Edwardsville]
Many basidiomycete fungi can reproduce sexually from basidiospore-containing fruiting bodies and have thousands of different mating types. Following hyphal contact, mate signaling can be activated through small lipopeptide pheromones that are recognized by G-protein coupled receptors. One of these fungi, *Schizophyllum commune*, specifies a variety of mating pheromones and receptors in genes at the *matB* locus. Fosmid clones with pheromone and receptor genes have previously been isolated and preliminarily characterized from a developmental mutant with *matB* version *matB a9-b6*. Here, we have tested these potential genes to analyze their product's activity. We have recognized a potential pheromone gene found in the *matB a9* region of the mutant HK28 strain of *S. commune* due to its predicted pheromone-like features. The gene product's activity was tested through transformations. To perform these transformations, we inserted the predicted gene's DNA into a strain of *S. commune* (*B*-null), which contains no mating receptor or pheromone activity. These transformants were confronted with various tester strains, all containing different versions of *matB* mating types. We found that transformants with the predicted pheromone gene signal several tester strain receptors, specifically, the *a4*, *a7*, and *b8* receptors. These receptors have been previously grouped together by other pheromones. We hypothesize that the *a4*, *a7*, and *b8* *matB* receptors may be closely related due to their similar reactivity to this pheromone. An observation that a phenylalanine residue may be in a key position of the predicted pheromone is reinforced as likely to be required for *a4* receptor activation. This additional pheromone shows that pheromones that were previously grouped separately by amino acid sequence may be more functionally related than we originally considered.
- #19 UG**
1:15pm
- Effect of Oxidative Stress on Expression of Methionine Sulfoxide Reductase Genes in *Tetrahymena thermophila***
*Riley Martin, Naomi Stover, Hannah Eichenberger, Jessica Muinos, Melanie Buzzaed [Bradley University]
The Free Radical Theory of Aging proposes that free radicals denature proteins over the lifetime of an individual through oxidative reactions. This can disrupt cellular functions, resulting in common physical signs of aging, from graying of hair to more serious conditions such as Alzheimer's Disease. Chaperones of the methionine sulfoxide reductase (MXR) family specifically repair proteins that have been oxidized at a methionine amino acid. Many eukaryotes utilize two MXR genes in order to reduce both the S and R conformations of oxidized methionine; interestingly, the ciliate *Tetrahymena thermophila* has four MXR genes. Here we show that MXR gene expression increases under oxidative stress. Furthermore, MXR homologs in the plant *Arabidopsis thaliana* localize to different parts of the cell. Future studies will determine the localization of the MXR proteins in *T. thermophila* cells.
- #20 UG**
2:30pm
- Identifying and Evaluating a Potential Full-Length Receptor Gene in *Schizophyllum commune* Matb $\alpha 9$ - $\beta 6$**
*Jaelyn Boone, Lauren Lucykow, Thomas J. Fowler [Southern Illinois University Edwardsville]
Schizophyllum commune is a type of basidiomycete fungus that has thousands of mating types. Its mushrooms develop sexual spores that will generate hyphae. Potential mates may be encountered as the mycelia expand in the search for nutrients. They recognize mates, in part, through small lipopeptide pheromones that are passed between hyphae, and if compatible, a G-protein coupled receptor will recognize the pheromone and begin the mating process. Predicted pheromone and receptor genes have previously been isolated in a 35kb clone from a *matB* $\alpha 9$ - $\beta 6$ individual and identified based on their activity. We have recognized a predicted full-length receptor gene found in the *matB* $\alpha 9$ region of the mutant HK28 strain of *S. commune*. To perform this test, we transformed a strain of *S. commune* (*B*-null), which provides a genetic background with no mating receptor or pheromone activity. We then attempted matings between transformants and an array of tester strains, with different mating types. We found that this DNA does confer receptor activity with most testers, but there was no activity with any strain containing a *matB* $\alpha 9$ region, which is expected. It was also found that it does not react to any strain with the *matB* $\beta 5$ region. We hypothesize that the receptor genes in the *matB* $\beta 5$ region and the *matB* $\alpha 9$ region are very similar in activity and DNA sequence due to their similar reactivity. When their pheromones are sent out, their receptors recognize them as their own and will not signal. Identifying and testing potential full-length receptor genes may tell us a lot about *S. commune*, *matB* $\alpha 9$ - $\beta 6$, we learn about the inter-workings and relationship between pheromones and receptors to develop our understanding of how this type of mating evolved.

#21 UG
1:15pm

An Investigation of Uncharacterized Proteins from *Trametes versicolor* (Turkey Tail Fungus) Involved in the Degradation of Lignocellulosic Biomass

*Keagan Fox, Thomas Canam [Eastern Illinois University]

Although lignocellulosic (non-starch) biomass is an excellent source of fermentable sugars that could be used as substrates for liquid biofuels (e.g. ethanol), the recalcitrance of the material presents a technological barrier. For example, the fractionation of lignocellulose into individual components, such as cellulose, requires resource-intensive thermomechanical and/or thermochemical treatments. These steps add significant cost and reduce the economic viability of the process. Previous studies have suggested that pretreating lignocellulosic biomass with white-rot fungi prior to biofuel production may reduce the severity of the processes, thereby decreasing production costs. We have demonstrated that the white-rot fungus, *Trametes versicolor*, is able to deconstruct a wide variety of lignocellulosic biomass types, including miscanthus straw and poplar wood. Molecular analyses of this fungus while growing on these substrates revealed a suite of highly expressed genes known to be involved in lignocellulose deconstruction, as well as several genes encoding proteins of unknown function. The goal of the present study was to clone the genes of some of these uncharacterized proteins into an expression plasmid for the purposes of production in a yeast system for further analysis. The genes for three hypothetical proteins that were highly expressed by *T. versicolor* while growing on hybrid poplar were cloned into pDONR-221 using Gateway technology for subsequent cloning into the yeast expression plasmid pYES-DEST52. The proteins can then be expressed using the inducible *GAL1* promoter, purified using a nickel-histidine system, and then tested for enzymatic activity against a variety of lignocellulosic substrates (e.g. commercial cellulose preparations). The results of this study will further our understanding of the biochemical mechanisms used by white-rot fungi to degrade biomass, which may contribute to the economic viability of lignocellulose-to-biofuel processes.

#22 UG
2:30pm

The Cytotoxicity Effects of Punicalagin on the Follicular Variant of Papillary Thyroid Carcinoma

*Chloe La Prairie, Jennifer Schroeder [Millikin University]

Papillary Thyroid Carcinoma (PTC) is the most common type of thyroid cancer, with the follicular variant as the most common subtype of PTC. Standard PTC treatment includes thyroidectomy, surgical removal of the thyroid lobe, radioactive iodine therapy (RAI), and long-term suppression of thyroid stimulating hormone (TSH). Standard PTC treatments are not always accessible to patients or successful in treating the cancer. In a search for a more efficient method of killing thyroid cancer cells, we have begun studying punicalagin, a water-soluble ellagitannin found in pomegranate juice with high antioxidant activity. Punicalagin contributes to various pathological and physiological processes, including inflammation, immunity, and cancer. In our study, the MDA-T68 cell line was used as a model cell line to examine the effect of punicalagin in follicular variant papillary thyroid carcinoma. Using colorimetric assays, we tested 24- and 48-hour cytotoxicity after exposure to 0.05 uM - 100 uM punicalagin. Resazurin and MTT assays were used to monitor the cytotoxicity through cellular metabolic activity.

#23 UG
1:15pm

Production of Dopaminergic iPSC-Derived Neurons on Polycaprolactone Nanofiber

*Cherise Anderson [Bradley University]

Parkinson's disease is a neurodegenerative disorder causing symptoms such as tremors and muscle stiffness, with an estimated 90,000 people diagnosed each year in the U.S. Current treatments focus on symptoms rather than the root cause of the problem, which is a decrease in dopaminergic neurons present in the substantia nigra (SN). Our lab is investigating the differentiation of induced pluripotent stem cells (iPSCs) into dopaminergic neurons for transplantation into the SN. iPSCs can be generated from the patient's somatic cell line, reducing the risk of tissue rejection that can occur with foreign tissue transplants. In order to differentiate iPSCs into dopaminergic neurons, the stem cells must first form embryoid bodies (EB). EBs are three-dimensional aggregates from iPSCs grown in suspension, allowing differentiation into cells from any of the three germ layers, producing mature cell types such as neurons or glial cells. EBs are produced in an AggreWell plate containing 50 microwells per well, causing iPSC aggregation to enhance EB formation. EBs will then be plated onto polycaprolactone nanofiber (PCL) coated with neuronal differentiation factors, providing a three dimensional scaffolding for the cells to bind to while differentiation factors are slowly released. In addition to the three-dimensional scaffolding, PCL prevents cells from migrating outside of the scaffold, keeping the new dopaminergic cells localized at the SN. During this process, EBs first form neuronal precursor cells, followed by mature midbrain neurons of which a portion are dopaminergic, to be verified with immunocytochemistry and qrtPCR. Current methods on flat, tissue-culture treated plates result in two-dimensional growth and do not allow for continual and slow exposure to lower dose differentiation factors, as with our coated PCL method.

We hypothesize EBs can be generated using an AggreWell plate and then plated onto differentiation factor coated PCL nanofiber for analysis of neuronal, dopaminergic expression.

#24 UG
2:30pm

Characterizing T₃ and T₄ Influence on the Efficacy of Two Pro-Apoptotic Cytotoxins

*Melina Hall, Jennifer Schroeder [Millikin University]

Accumulating evidence has indicated that thyroid hormones (L-thyroxine, T₄, or 3,5,3'-triiodo-L-thyronine, T₃) affect the oncogenic properties of cancer cells, including apoptotic mechanisms. In the present study, rhabdomyosarcoma (RMS) cells (SJCRH30) were used to evaluate how T₄ and T₃ affect the efficacy of two apoptosis-inducing cytotoxins, cantharidin and resveratrol. RMS is a soft tissue sarcoma of skeletal muscle that primarily affects children under the age of six. Cells were treated with cantharidin (IC₅₀ 2.25 µM) or resveratrol (IC₅₀ 140 µM) and 10⁻¹⁰ to 10⁻⁷ M T₃ or T₄. Cell viability data from MTT and resazurin assays will be used to determine how thyroid hormones influence cytotoxin efficacy in the SJCRH30 cancer cell line.

#25 UG
1:15pm

Antibiotic Resistance of Two Periodontal Pathogens for Development of an Antibiotic Cocktail

*¹Ethan Monroe, ²Cinnamon VanPutte [¹Southern Illinois University Edwardsville, ²Southern Illinois University School of Dentistry]

Two anaerobic bacteria, *Porphyromonas gingivalis* and *Aggregatibacter actinomycetemcomitans* are important in periodontal disease. This is a complex multi-species microbial inflammatory condition, which leads to deterioration of gums and alveolar bone loss. In future studies, an antibiotic cocktail will be used for antibiotic induced microbiome depletion (AIMD) in mice to measure alveolar bone loss. Therefore, it is important to develop an antibiotic cocktail that allows these bacteria to grow. The Kirby-Bauer Test was used to determine susceptibility of these bacteria to certain antibiotics using Cytiva Whatman Antibiotic Assay Discs. Zones of inhibition (ZOI) for each antibiotic for each bacterium were measured. The antibiotics included amoxicillin, vancomycin, metronidazole, neomycin, cefadroxil, cephalixin, ampicillin, and the antifungal agent, amphotericin B. We tested 4 different concentrations of each antibiotic. Next, bacterial cultures were inoculated and plated onto separate 5% blood agar petri dishes. Four discs were then placed onto each plate, containing either *P. gingivalis* or *A. actinomycetemcomitans*. A different concentration of each antibiotic was pipetted (25 µL) onto the discs. After the agar plates were incubated in an anaerobic chamber (37°C) for 48 hours, the ZOI were measured. The results showed that the most effective antibiotic allowing growth of both bacteria is metronidazole, while both bacteria grew in the presence of amphotericin B. The ZOI for both of these agents measured 0 mm. This means that both bacteria are resistant to amphotericin B and metronidazole. The bacteria were completely susceptible to amoxicillin, vancomycin, neomycin, and ampicillin. The bacteria were moderately susceptible to cefadroxil and cephalixin except at lower doses. In conclusion, the best cocktail components to use to induce AIMD in the mice are amphotericin B and metronidazole.

#26 UG
2:30pm

The Effects of Snai2 on Neuronal and Fibroblast Gene Expression

*Anna Sipes, Gary Bulla [Eastern Illinois University]

Several key genes play an important role in the differentiation and proliferation of cell lines during human development. The specific gene or combination of genes directly involved in this process is still unknown at large. Through whole genome microarray analysis, several candidate genes were identified that might play a role in this critical developmental process of cell line maturation. Of these candidate genes, Snai2 was selected for further testing. To test the effect of the overexpression of Snai2, N2A cells from a neuronal-derived mouse cell line were transfected and screened for the presence of the vector through G418 resistance. Clones were isolated from the surviving pool and expanded until RNA could be harvested and converted to cDNA for analysis via quantitative Polymerase Chain Reaction (qPCR). GAPDH levels were tested as a control for the quality of the RNA extracted and cDNA conversion. The expression levels of a panel of three neuronal genes and five fibroblast genes were measured via qPCR. Fibroblast gene expression was of particular interest due to fibroblasts' nature of not being terminally differentiated. Zpf593 and Dkk1 of the neuronal genes tested were found to have increased expression. Three of the fibroblast genes tested (Spp1, Shox2, and c-Fos) showed significant (6 and 16-fold) repression of fibroblast genes. Coll a1 and Bmp3 showed less than 2-fold effects.

CHEMISTRY

- #27** **Grad** **Anti-carcinogenic Activity of *Acmella* Extracts in Pancreatic Cancer**
1:15pm *Gbemisola Akindeji, Mette Soendergaard [Western Illinois University]
 Pancreatic cancer is the third leading cause of cancer deaths worldwide. Despite significant advances in management and treatment, it has a minimal survival rate, with 95% of cases being incurable. A large number of chemotherapeutic drugs used in cancer treatment are molecules isolated from natural products such as plants or their synthetic derivatives. Plants have a vast range of bioactive molecules that have been proven to possess medicinal and therapeutic properties that have been used in the treatment of deadly diseases such as cancer. *Acmella* is used as a medicinal herb with little research documenting the anti-cancer properties of the plants. The research aims to elucidate the anti-cancer activity of *Acmella alba*, *Acmella oleracea*, and *Acmella calirrhiza* on Mia Paca-2 of human pancreatic cancer using the MTT cell viability assay. The stems, roots, leaves, and flowers of the plants were harvested, freeze-dried, and ground into a fine powder. The plant materials were extracted thrice using water and ethanol. All the fractions were resuspended in dimethyl sulfoxide (DMSO) to a final concentration of 0.2 mg/mL. The viability of cells was determined using a 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay. The anti-cancer activity of all the fractions extracted was tested on Mia paca-2 cells by growing the cancer cells in Dulbecco's Modified Eagle's Medium, at 37°C and 5% CO₂. The cells were treated with 0.2 mg/mL of each extract. The formed formazan was dissolved in DMSO and measured spectrophotometrically using a microplate reader at 570 nm. The results showed that the *Acmella alba* leaves and roots ethanol extracts significantly ($p < 0.05$) reduced the cell viability of the Mia Paca-2 cells. The leaf water extracts of both *Acmella alba* and *Acmella oleracea* and the root water extract of *Acmella calirrhiza* significantly reduced the cell viability.
- #28** **UG** **Creating a Standard of Comparison for Nymph and Larval Tick Identification Utilizing Glutaraldehyde Fixation and Scanning Electron Microscopy**
2:30pm *Katie Kanaan, Brian J. Bellott, Shawn A. Meagher [Western Illinois University]
 During the first week of August for the past 10 years, Sherman traps were set at various transects at Kibbe wildlife station in order to capture *Peromyscus leucopus*, or the white-footed mouse. The mice were subsequently dissected for ectoparasite and endoparasite collection and statistical analysis. Ticks of larval and nymph life stages are found on mice, and there are four different species found in the area: *Amblyomma americanum*, *Dermacentor variabilis*, *Ixodes scapularis*, and *Rhipicephalus sanguineus*. However, there is no set standard of comparison for identifying the ticks that are found. It is hypothesized that, by imaging known reference species and life stages of ticks via a scanning electron microscope, the ectoparasites that were collected can be compared to the reference images and identified for analysis of species and life stage prevalence. To prepare the reference species for scanning electron microscopy, each sample went through a 10-hour chemical procedure in order to fixate them. During this procedure, the cell walls were fortified and fixated, and all volatile materials were removed. This was done to prevent collapse of the samples during the pressure change and to prevent the volatile materials from bursting through the cell walls. The samples were then sputter coated and imaged at specified magnifications to create the standard of comparison.
- #29** **Grad** **Potency Testing of Cannabidiol in Hemp-infused Gummies among Nineteen Cannabinoids by Liquid Chromatography Ultraviolet Detection**
1:15pm *Grant Meyer, Ligu Song, Emmanuel Adejumo [Western Illinois University]
 A liquid chromatography ultraviolet detection (LC-UV) method was developed for potency testing of cannabidiol (CBD) in hemp-infused gummies among nineteen cannabinoids. The potency testing was achieved using external standard calibration between 0.02 and 25 µg/mL. The limits of quantitation (LOQ) were determined to be 0.008% CBD in hemp-infused gummies. To recover CBD, a sample was first uniformly dispersed into water and then extracted with methanol. After ultrasonication, centrifugation and filtration, the extract was serially diluted to 250 µg/mL and analyzed by LC-UV. The measurement precision in triplicate was 7.9%. The method was not interfered by other compounds present in hemp-infused gummies.
- #30** **UG** **Analyzing Illicit Drugs Using Silver Nanoparticles**
2:30pm *Lillie Purcell, Harley Davidson, Bradee Finley, Dane Pfeiferling, John J. Determan [Western Illinois University]
 This research project seeks to use nanoparticles to detect illicit drugs such as a methamphetamine analog. Nanoparticles have a diameter of less than 100 nanometers in size. Coinage metal including copper, silver, and gold nanoparticles are stable with high refractive indices. These characteristics allow for a visual color change to

detect the drug. The detection is helpful in the forensic field and can further aid law enforcement in identifying unknown substances in an efficient manner. Research has been performed using gold nanoparticles. However, due to the cost of gold, it is not considered efficient. By using a different metal such as copper or silver with similar chemical and optical properties to gold, the methamphetamine analog can be efficiently detected while reducing the cost.

The detection of methamphetamine is performed using the colorimetric test. Metal nanoparticles have vivid visible colors which is due to their high refractive indices. This makes them susceptible to change due to interaction with other chemicals, such as illicit drugs. Aptamers are oligonucleotides or peptide molecules which selectively interact with the drug of interest. The aptamer will be used to enhance the interaction of the nanoparticles with the methamphetamine analog. Interaction with the drug of choice causes a change in the surface structure of the nanoparticles. As a result, the change in structure will cause a visible change in the color of the aptamer coated nanoparticles. The color change can be quantified using a UV-Vis detector, and the shape and size of particles will be imaged and analyzed using Scanning Electron Microscopy (SEM). Through experimentation and observation, our goal is to efficiently detect a methamphetamine analog, that aids law enforcement in detecting illegal substances.

- #31** **Grad** **Quantification of Cannabidiol in Hemp-infused Water by Ultra High Performance Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry**
1:15pm *Zachary Dodson, Grant Meyer [Western Illinois University]
 An ultra high performance liquid chromatography electrospray ionization tandem mass spectrometry (UHPLC-ESI/MS/MS) method was developed for quantification of cannabidiol (CBD) among twelve cannabinoids in hemp-infused water. The quantification was achieved using internal standard calibration between 0.01 and 12.5 mg/mL with CBD-d₃ as internal standard. The limits of quantitation (LOQ) was determined to be 0.00008% CBD in hemp-infused water. To recover CBD, hemp-infused water was combined with methanol to prepare a 25 mg/mL mixture. After ultrasonication, centrifugation and filtration, the extract was serially diluted to 12.5 mg/mL containing 0.5 mg/mL CBD-d₃. The measurement precision in triplicate was 2.1%.
- #32** **UG** **Oscillating Behavior of Iron in Acidic Media**
2:30pm *Aysha Kirkwood, Dean Campbell [Bradley University]
 Hydrogen peroxide will decompose to produce oxygen gas in the presence of iron plates. In the presence of sulfuric acid at a range of concentrations, the rate of hydrogen peroxide decomposition on an iron surface will oscillate, apparently due to varying concentrations of active and passive iron species on the surface of iron sheets. The oscillating decomposition of hydrogen peroxide produces rapid and slow oxygen production in the form of bubbling. The bubbling creates a fizzing noise that can be measured by using a microphone to measure the sound of the oscillations over time. These oscillating reactions can also produce varying voltages at the iron surfaces. Impacts of experimental variables such as peroxide concentration, acid concentration, interfering ions, and pretreatment of iron plates were explored.
- #33** **Grad** **Towards the Synthesis of o-Iodoxybenzoic Acid Derivatives with Biphenyl and Triphenyl Scaffolds**
1:15pm *Okiki Quadri, Thottumkara K. Vinod [Western Illinois University]
 o-Iodoxybenzoic acid (IBX), **1**, an easily synthesized hypervalent iodine (V) reagent, has been hailed as a mild and effective oxidant for a wide range of synthetic transformations ranging from alcohol oxidation to amine oxidation and dithianes oxidative deprotection. Unfortunately, the IBX has certain drawbacks; the reagent is potentially explosive and insoluble in conventional and user-friendly organic solvents. Several structurally modified derivatives of IBX that still retains its selective oxidative properties have been reported in literature within the last decade and among which water-soluble derivatives **2** and **3** reported by us have received considerable attention among the synthetic community. Our continued interest in developing additional synthetically useful and easily accessed derivatives of IBX has identified biphenyl and triphenyl based IBX derivatives, **4** and **5** as potential targets and our foray into the synthesis of these reagents will be presented. Tandem aryne formation-nucleophilic capture sequence first reported in Hart's laboratory at Michigan State University in the mid-1980s serves as the crucial step in assembling the biphenyl and triphenyl scaffolding in **4** and **5**. The molecular explanation for the reaction pathway of **4** and **5** will be presented.

- #34** UG **Copper-Catalyzed Alkyne-Azide Cycloaddition Reactions Utilizing Copper-Based Nanoparticles Trapped within a Polydimethylsiloxane Matrix**
2:30pm *Zaman Shah, Dean Campbell [Bradley University]
 Copper-catalyzed azide-alkyne cycloaddition (CuAAC) or simply Cu(I) catalyzed azide-alkyne “click reaction” has proven to be a powerful synthetic tool over the past decade as it offers increased accessibility to a broad spectrum of reactions. In a conventional click reaction, several labor-intensive purification steps are required to isolate the products. The catalytic Cu(I) species removed during purification are discarded most of the time. This study explored how copper-based nanoparticles trapped within polydimethylsiloxane (PDMS) can also be used to catalyze these CuAAC reactions. The catalyst is produced by the thermal decomposition of copper(II) acetylacetonate that has been deposited within a PDMS matrix using chloroform. The catalysts were shown to have copper-based nanoparticles which were verified using X-ray diffraction. The catalysts were used to successfully produce ten different triazole compounds confirmed by proton nuclear magnetic resonance spectroscopy. At the end of the click reaction, the PDMS containing catalytically active copper nanoparticles can be easily recovered. Alternative methods to deposit catalytically active copper nanoparticles in PDMS have also been explored.
- #35** Grad **Quantification of Cannabichromene in Cannabichromene Isolates of Hemp among Nineteen Cannabinoids by Liquid Chromatography Ultraviolet Detection**
1:15pm *Grace Brownlee, Emmanuel Adejumo [Western Illinois University]
 A liquid chromatography ultraviolet detection (LC-UV) method was developed for the quantification of cannabichromene (CBC) in cannabichromene isolates of hemp among nineteen cannabinoids. The quantification was achieved using external standard calibration between 0.02 and 25 µg/mL. The limits of quantification (LOQ) were determined to be 0.08% CBC in cannabichromene isolates of hemp. To recover CBC, the sample was combined with methanol to prepare a 25 mg/mL mixture. After ultrasonication, centrifugation and filtration, the extract was serially diluted to µg/mL and analyzed by LC-UV. The measurement precision in triplicate was 8.5%. The method was not interfered by other cannabinoids present in the sample.
- #36** UG **Measuring Varying Levels of Sugars in Soft-Drinks Utilizing RI and Raman Spectroscopy**
2:30pm *Kaitlyn Walls, Dean Campbell, Edward Remsen [Bradley University]
 Commercial sodas contain varying levels of sugars that can be analyzed with refractive index (RI) measurements and Raman spectroscopy. To collect data, an external calibration curve was created with water for RI and an internal calibration curve and internal standards were used with potassium sulfate for Raman. Data points could be collected against these calibrations to confirm the fructose and sucrose concentration in each sample. Clear and colorless samples, such as Ramune soda and Sprite, produce less deviating linear regression lines because of their lack of fluorescence. Samples that are artificially colored typically produced fluorescence which was quenched with potassium iodide. The difference in commercial products from the United States and Korea were explored using these techniques. Additional research students adopted these techniques to confirm their reproducibility.
- #37** Grad **Toxicity Evaluation of *Acmella alba* Crude Extracts on Zebrafish (*Danio rerio*) Embryos**
1:15pm *Ogheneruno Theodora Ideh, Mette Soendergaard, Matthew Blankenship [Western Illinois University]
 Plants of the *Acmella* genus are often used as medicinal plants in Africa and South America where they are widely known as the eyeball or toothache plant. Our previous studies have shown that *Acmella Alba* extracts exhibit anticancer effects and cytotoxicity in the human ovarian adenocarcinoma cell line SKOV-3. Here, the toxicity of *A. Alba* extracts was further investigated in zebrafish (*Danio rerio*) embryos.
A. alba leaves, stems, roots, and flowers were extracted thrice with ethanol, evaporated overnight at 50°C, and dissolved in dimethyl sulfoxide (DMSO). Zebrafish eggs were harvested at 0 hours post-fertilization (hpf) and immediately incubated with 0.2 mg/mL of the *A. alba* extracts. Morphological effects of the extracts including malformation of organs, heart rate, movement, and hatching rate were recorded every 12 h for 5 days. The results showed that the leaves, stems, roots, and flower extracts all were 100% lethal at 12 hpf, whereas the DMSO vehicle resulted in no observed morphological changes. This supports the cytotoxicity of *A. alba* extracts that was previously observed in human ovarian cancer cells and emphasizes the importance of further investigating plants of the *Acmella* genus as possible sources of anticancer and cytotoxic compounds.

- #38 UG Exploring New Nickel-Based Catalysts or Suzuki-Miyaura Reactions**
2:30pm *Scott Huckabay, Jocelyn Lanorio [Illinois College]
 A Suzuki-Miyaura reaction is a cross-coupling reaction that attaches a compound to another compound by their sp² carbons. While there are many different reactions that combine compounds together, there are only a few reactions that can combine compounds via their sp² carbons. The Suzuki-Miyaura reaction often uses a palladium organometallic catalyst, PdCl₂(PCy₃)₂. Previous research shows how NiCl₂(PCy₃)₂ is an effective alternative to PdCl₂(PCy₃)₂ in this reaction. (1) This is important as nickel is significantly cheaper than palladium, with nickel costing around \$0.69 per ounce while palladium costs \$2000 per ounce. (2) Furthermore, nickel is more readily available and less toxic compared to Pd. The objective of this research was to explore more alternate nickel-based organometallic catalysts and compare their effectiveness to the standard and well-reported NiCl₂(PCy₃)₂ complex. We tested various Ni-based catalysts to find their percentage conversion using GC-MS to detect the amount of reactant left and product formed. Alternatives that were found to have 100% conversion were then compared to NiCl₂(PCy₃)₂ in four different Suzuki-Miyaura reactions by monitoring the % conversion at different reaction times. We found out that NiCl₂(DPPE) is the most effective catalyst in three out of the four chosen cross-coupling reactions. These results show that finding further alternate Ni-based catalysts could expand the repertoire of substrates and products that may be available for the creation of new molecules via Suzuki-Miyaura cross-coupling reactions.
- #39 Grad Potency Testing of Cannabinol in Cannabinol Isolates of Hemp among Nineteen Cannabinoids by Liquid Chromatography Ultraviolet Detection**
1:15pm *Keszia Fabien, Liguang Song, Grant Meyer [Western Illinois University]
 A liquid chromatography ultraviolet detection (LC-UV) method was developed for potency testing of cannabinol (CBN) in cannabinol isolates of hemp among nineteen cannabinoids. The potency testing was achieved using external standard calibration between 0.02 and 25 g/mL. The limits of quantitation (LOQ) were determined to be 0.08% CBN in cannabinol isolates of hemp. The sample was combined with methanol to prepare a 25 mg/mL mixture to recover CBN. After ultrasonication, centrifugation, and filtration, the extract was serially diluted to 25 g/mL and analyzed by LC-UV. The measurement precision in triplicate was 8.5%. The method was not interfered with by other cannabinoids present in the sample.
- #40 UG Functionalization of Humic Acid for Metal Extraction Using Iron Nanoparticles**
2:30pm *Briar Hilsabeck, John Determan, Amanda LaPage, Breanna Christensen [Western Illinois University]
 Humic acid is extracted from the humus layer of soil. Humic acid is commercially available and can be prepared from soil samples. Humic acid does not have a definitive structure but can be loosely defined as a porous carbonous net with many ring-like structures and oxygen-containing functional groups throughout the structure. Small amounts of nitrogen, phosphorous, and sulfur functional groups can be found depending on the conditions in which the humic acid was formed.

 Humic acid can be used for soil fertility purposes as humic acid can help the soil retain fertilizing agents and plays an important role in nitrogen and phosphorus cycles. Humic acids also naturally have an affinity for metal binding and further modification to the structure can enhance metal binding character. The properties of nanoparticles can allow for a wide variety of applications and altered properties. For the purpose of this research, the metal binding and extraction process are affected by the nanoparticles. Iron magnetic nanoparticles are decorated with humic acid to allow for metal removal in aqueous solutions and easy extraction from the solution.

 Our production and procedure of metal-binding nanoparticles are guided by articles in the American Chemical Society. The two components, humic acid and iron nanoparticles, are relatively cheap. This allows for the cost-effective production of metal removal agents for environmental applications.
- #41 Grad Quantification of Cannabigerol among Nineteen Cannabinoids in Hemp-infused Gummies by Liquid Chromatography Ultraviolet Detection**
1:15pm *Emmanuel Adejumo, Grant Meyer [Western Illinois University]
 A liquid chromatography ultraviolet detection (LC-UV) method was developed for quantification of cannabigerol (CBG) in hemp-infused gummies among nineteen cannabinoids. The quantification was achieved using external standard calibration between 0.02 and 25 mg/mL. The limits of quantitation (LOQ) were determined to be 0.008% CBG in hemp-infused gummies. To recover CBG, a sample was first uniformly dispersed into water and then extracted with methanol. After ultrasonication, centrifugation and filtration, the extract was serially diluted to 250 mg/mL and analyzed by LC-UV. The measurement precision in triplicate was 3.1%. The method was not interfered by other compounds present in hemp-infused gummies.

- #42** UG **Potency Testing of Cannabidiolic Acid in Dried Hemp Flowers among Sixteen Cannabinoids by Liquid Chromatography Ultraviolet Detection**
2:30pm
 *Aaron Weseloh, Ligu Song, Grant Meyer [Western Illinois University]
 A liquid chromatography ultraviolet detection (LC-UV) method was developed for potency testing of cannabidiolic acid (CBDA) in dried hemp flowers among sixteen cannabinoids. The potency testing was achieved using external standard calibration between 0.02 and 25 µg/mL. The limits of quantification (LOQ) were determined to be 0.04% CBDA in dried hemp flowers. To recover CBDA, dried hemp flowers were combined with methanol to prepare a 25 mg/ml mixture. After ultrasonication, centrifugation and filtration, the extract was serially diluted to 50 µg/mL and analyzed by LC-UV. The measurement precision in triplicate was 5.1%. The method was not interfered by other cannabinoids present in dried hemp flowers.
- #43** UG **Antioxidants in Hot-Brewed and Cold-Brewed Teas (FRAP Method)**
1:15pm
 *Olivia Brinker, Brian Bellott [Western Illinois University]
 Free radicals are dangerous and reactive entities that can enter the body through sources such as fast food, air pollutants, alcohol, and pesticides. It has been postulated that exposure to free radicals can lead to the development of diseases such as cancer, hypertension, and Alzheimer's. Free radicals are highly reactive because they lack an electron, thus making them steal electrons from healthy cells in the human body. Antioxidants have the ability to neutralize the reactivity of free radicals by donating an electron to them. Black and green teas have been studied as an antioxidant source, and they can be prepared in several different ways. The hot-brewed method is the most commonly used method to prepare tea. This process entails soaking tea leaves in hot water for a short period of time. Cold-brewed teas are prepared by soaking tea leaves in cold water for several hours.
 In this study, the antioxidant capacity of hot-brewed teas and cold-brewed teas will be measured. Both black and green teas will be tested using a method called the ferric reducing ability of plasma (FRAP) assay. This method employs the use of a complex that undergoes a reduction reaction that mimics the reaction that occurs between free radicals and healthy cells in the human body. A standard antioxidant source, ascorbic acid, is then added to the complex to neutralize it. The change that occurs is represented with a visible spectrum that is recorded with a spectrophotometer. Thus far, a standard curve using ascorbic acid has been generated, however variables such as light exposure, time of addition of the antioxidants, and boiling water temperature are being investigated. The testing of the hot-brewed teas and cold-brewed teas is still to be conducted.
- #44** UG **Potency Testing of Δ8-Tetrahydrocannabinol in Delta 8 Concentrate among Nineteen Cannabinoids by Liquid Chromatography Ultraviolet Detection**
2:30pm
 *Emily Jovanovich, Emmanuel Adejumo [Western Illinois University]
 A liquid chromatography ultraviolet detection (LC-UV) method was developed for potency testing of Δ8-tetrahydrocannabinol (Δ8-THC) in delta 8 concentrate among nineteen cannabinoids. The potency testing was achieved using external standard calibration between 0.02 and 25 µg/mL. The limits of quantitation (LOQ) were determined to be 0.08% Δ8-THC in delta 8 concentrate. To recover Δ8-THC, the sample was combined with methanol to prepare a 25 mg/mL mixture. After ultrasonication, centrifugation and filtration, the extract was serially diluted to 25 µg/mL and analyzed by LC-UV. The measurement precision in triplicate was 7.2%. The method was not interfered by other cannabinoids present in the sample.
- #45** **ABSENT**
1:15pm
- #46** UG **Quantification of Cannabigerolic Acid among Sixteen Cannabinoids in Dried Hemp Flowers by Liquid Chromatography Ultraviolet Detection**
2:30pm
 *Lindsey LeBlanc, Grant Meyer [Western Illinois University]
 A liquid chromatography ultraviolet detection (LC-UV) method was developed for quantification of cannabigerolic acid (CBGA) among sixteen cannabinoids in dried hemp flowers. The quantification was achieved using external standard calibration between 0.02 and 25 µg/mL. The limits of quantitation (LOQ) were determined to be 0.04% CBGA in dried hemp flowers. To recover CBGA, dried hemp flowers was combined with methanol to prepare a 25 mg/mL mixture. After ultrasonication, centrifugation and filtration, the extract was serially diluted to 50 µg/mL and analyzed by LC-UV. The measurement precision in triplicate was 1.7%. The method was not interfered by other cannabinoids present in dried hemp flowers.

- #47** UG **Shrinking Sticks in Liquid Nitrogen**
1:15pm *Quentin Ott, Dean Campbell [Western Illinois University]
 Foam sticks made of polystyrene can be produced to have a rectangular shape that will not fit into a small hole (e.g., the opening of a soda bottle) at room temperature. After placing the stick in contact with liquid nitrogen, the foam contracts to a smaller volume allowing it to fit into the hole. This is a simple demonstration of Charles's Law, showing how gasses take up less volume at colder temperatures. Many other polymer foams were subjected to the same treatment of liquid nitrogen and did not contract, but they still provide opportunities to discuss and explore their structure and chemical structure.
- #48** UG **Quantification of Δ^9 -Tetrahydrocannabinol among Nineteen Cannabinoids in Delta 8 Concentrate by Liquid Chromatography Ultraviolet Detection**
2:30pm *Jake Provis, Emmanuel Adejumo* [Western Illinois University]
 A liquid chromatography ultraviolet detection (LC-UV) method was developed for quantification of Δ^9 -tetrahydrocannabinol (Δ^9 -THC) among nineteen cannabinoids in delta 8 concentrate. The quantification was achieved using external standard calibration between 0.02 and 25 $\mu\text{g/mL}$. The limits of quantitation (LOQ) were determined to be 0.08% Δ^9 -THC in delta 8 concentrate. To recover Δ^9 -THC, the sample was combined with methanol to prepare a 25 mg/mL mixture. After ultrasonication, centrifugation and filtration, the extract was serially diluted to 25 $\mu\text{g/mL}$ and analyzed by LC-UV. The measurement precision in triplicate was 13.4%. The method was not interfered by other cannabinoids present in the sample.
- #50** **Preparation and Preliminary Application of Imidazolium Ionic Liquids of Varying Carbon-Chain Length**
2:30pm *Eduardo Fulgencio, Jocelyn Lanorio [Illinois College]
 Ionic liquids (ILs) are defined as molten salts or compounds entirely composed of ions with melting points below 100°C. Their properties such as being non-flammable, non-volatile, and non-combustible make them promising alternatives for volatile organic solvents.
 We synthesized and characterized a series of imidazolium ionic liquids with varying carbon-chain lengths. Because ionic liquids have high thermal stability and low solubility in water, we then tested their applicability as solvents and catalysts in biphasic reactions. Particularly, we looked at the hydration of benzonitrile using only water and IL. We utilized those ionic liquids with higher density than water to allow biphasic catalysis.
 Characterization of the ILs and their efficiency as catalysts were monitored using spectroscopic techniques such as IR, UV-Vis, and NMR. Conversion of benzonitrile to benzamide was reported as % conversion using the GC-MS peak integrals. We successfully synthesized a series of imidazolium ionic liquids. We also found out that two imidazolium ILs can serve as hydration catalysts exhibiting 59% conversion for 1-propyl-3-methylimidazolium bromide ([C₃-mim]Br), and 34% conversion for 1-octyl-3-methylimidazolium bromide ([C₈-mim]Br).

COMPUTER SCIENCE

- #1** **Internet of Things (IoT) in Optimizing Supply Chains to Improve Organizational Performance**
1:15pm *Anjum Razzaque [Western Illinois University]
Background and purpose: The Internet of Things (IoT) needs more empirically evidenced claims. Managers are still determining if IoT can augment the supply chain as they get deeply integrated for optimizing supply chain performance and organizational performance: one unempirical evidence claim.
Design/method/approach: The in-progress study pursues a deductive approach and proposes five propositions via a conceptual framework. Future research will distribute a 67-item survey to achieve a minimum of 250 responses, preferably from various industrial sectors. And the aim is to apply multiple regression analyses to confirm IoT-enabled SCI's three dimensions. Internal supply chain Integration, supplier integration, and customer integration for enhancing supply-chain performance and, in turn, improving organizational performance.
Research limitations and implications: Of course, this study has limitations, hence calling for proposed future research propositions such as this study pursues investigating supply-chain integration's internal mechanisms but not the external ones. Also, this study aims to pursue cross-section data collection to answer its research questions. The next step in the research would be to improve this study's model via Structural Equation Modelling (SEM) for a holistic model assessment. Also, future research could longitudinally assess the study's model.

Practical Implications: Theoretical, managerial, social, and technical implications are portrayed.

Originality/value: This is one of the first-of-its-kind studies with its literature-driven research model derived from the Organizational Capability Theory lens.

#2
2:30pm

Changing Teaching and Learning to Improve Learning Outcomes when Moderated by Students' Culture and Mode of Learning

*Anjum Razzaque, George Mangalaraj, Laurence Leff, Antonio Cardenas-Haro [Western Illinois University]

Background: Current literature continues reporting how instructors of internationalized classrooms should critically consider students' cultures and learning modes (face-to-face learning, e-learning, m-learning, and hybrid learning) when designing the most appropriate teaching-learning styles to ensure students' learning outcomes. However, there remains scant empirical evidence to prove so.

Research aim: This in-progress study aims to propose a literature-driven conceptual framework to propose for future empirical assessment that: (1) teaching-learning styles positively and significantly enhance students' desired learning outcomes and (2) students' culture and their model of learning moderate between the various teaching-learning styles and learning outcomes.

Originality, implications, and limitations: This is the first of its kind study investigating teaching-learning styles, students' culture, learning mode, and learning outcomes in one literature-driven theoretical framework, viable for future empirical assessment. Lastly, implications and limitations are also getting unveiled during this presentation.

Key Words: Students' national culture; Learning Outcome; Teaching-learning Style; Mode of Learning.

ENVIRONMENTAL SCIENCE

#49 **Grad**
1:15pm

Assessing Seismic Pollution from Bridges Over Streams and Rivers

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

Aquatic ecosystems are subject to anthropogenic sound pollution. Anthropogenic sound can originate from various sources, such as boating, oil drilling, construction, and road traffic. This form of pollution can interfere with fish communication, hunting ability, and their health/fitness. Effects of anthropogenic sound have been extensively studied in marine systems, but effects in freshwater systems are less well known. There have been studies on sound pollution entering the water from roadways over streams, but there is no information on corresponding seismic vibration in the substrate, thus creating a seismic vibration. We measured seismic vibrations produced when a vehicle drives over a bridge over a waterway. A hydrophone captured sound in the water, while a geophone captured seismic vibrations in the substrate produced as vehicles drove over a bridge across the upper Meramec River in central Missouri. Both outputs were recorded simultaneously using a stereo recorder with two tracks. Both the hydrophone and the geophone captured increased signal output as the vehicle drove over the bridge. However, we did not observe the differential increase in low frequency signals as observed in other studies. We plan to sample a greater range of sites to elevate the effects of vehicular traffic on both the acoustic and seismic environments of streams and rivers.

#51 **Grad**
1:15pm

Spatial Variation of Selenium in Lake Erie Sediments

*¹Samjhana Wagle, ¹Eve Koski, ¹Kate Huang, ²Tiequan Zhang, ²Yingming Zhao, ²Yutao Wang, ³Jan J.H. Ciborowski, ¹Zhi-Qing (ZQ) Lin [¹Southern Illinois University Edwardsville; ²Harrow Research and Development Center, Agriculture and Agri-Food Canada; ³University of Windsor, Ontario, Canada]

The formation of stable selenium (Se)-toxic metal complex could reduce the bioavailability and toxicity of the metal pollutants in the environment. Molecular interactions of selenium (Se) with toxic mercury (Hg) and cadmium (Cd) in Lake Erie sediments would also influence their ecotoxicological risk in the aquatic ecosystem. Toxic metal pollutants in Lake Erie have been previously investigated showing significant spatial and temporal variations of metal contamination in the lake sediments. However, few research has addressed the changes of Se in Lake Erie. This study determined the concentrations of Se in 37 sediment cores collected in Lake Erie in 2010. Preliminary results showed that concentrations of Se in top 10-cm sediments across the whole Lake Erie basin were 0.762 ± 0.194 mg/kg, with a spatial variation pattern of high in the eastern basin (0.814 ± 0.199 mg/kg), followed by 0.807 ± 0.154 mg/kg in the western basin and 0.671 ± 0.197 mg/kg in the central basin. Among 23

sediment cores, high concentrations of Se were observed at deeper sediment layers (0.839 ± 0.287 mg/kg at 10-20 cm and 0.803 ± 0.296 mg/kg at 20-30 cm), followed by 0.765 ± 0.163 mg/kg in the top 10 cm sediment across the whole Lake Erie basin.

- #52 UG**
2:30pm **Establishment and Bioassay of an Isogenic Strain of the DDT-Resistant *Drosophila melanogaster***
*Blake Rentz, Emily Beiler, Kyong Sup Yoon [Southern Illinois University Edwardsville]
Resistance to the insecticide dichlorodiphenyltrichloroethane (DDT) has been studied for many years in a laboratory-maintained strain of *Drosophila melanogaster* (*D. melanogaster*) that is resistant to DDT, commonly called 91-R. In this study, we aimed to establish laboratory strains of *D. melanogaster* that were derived from single mating pairs. Alongside 91-R, mating pairs of DDT-susceptible C.S. and 91-C were prepared to obtain progenies from single mating pairs. After 2-3 generations of rearing through inbreeding, flies were used for DDT-mortality bioassays. Through the bioassays, C.S. showed a knockdown rate of $44.3\% \pm 16.5\%$. 91-C showed a knockdown rate of $38.3\% \pm 19.5\%$. 91-R showed a knockdown rate of $1.7\% \pm 3.7\%$. Further replications of this experiment are being conducted to continue the analysis of resistance in 91-R to both C.S. and 91-C.
- #53 UG**
1:15pm **Selenium Accumulation in Different Cultivars of Garlic (*Allium sativum*) in Southern Illinois**
*Dalton Steinkamp, Lily Schleeper, Zhi-Qing Lin [Southern Illinois University Edwardsville]
Selenium (Se) is an essential nutrient element for humans. Selenoproteins are critically important for human health through diverse metabolic and physiological processes such as antioxidant defense, thyroid hormone metabolism, and immune function. Garlic (*Allium sativum*) is one of few Se accumulator species among common vegetables in the U.S. Previous studies demonstrated that Se-enriched garlic showed significant chemopreventive properties, which has been linked to Se-methyl L-selenocysteine as the dominant Se compound in garlic clove tissues. Selenium accumulation in garlic varies among different soil conditions. This study determined the variation in Se accumulation among 14 different cultivars of garlic under the same soil conditions in Southern Illinois. Preliminary results showed that, with the soil Se concentration of 0.285 ± 0.046 mg/kg, concentrations of Se in fresh garlic clove tissues were highest in Romanian Red (0.141 ± 0.045 µg/g) and Russian Giant (0.131 ± 0.018 µg/g), followed by Armenian (0.090 ± 0.011 µg/g), Carpathian Mountain (0.090 ± 0.037 µg/g), Georgian Crystal (0.083 ± 0.018 µg/g), Bogatyr (0.065 ± 0.014 µg/g), Brown Tempest (0.055 ± 0.045 µg/g), German Red (0.052 ± 0.042 µg/g), and Yugoslavian (0.051 ± 0.017 µg/g). Cultivars Lukan, Spanish Roja, Persian Star, Pehoski Purple, and Creole Red contained relatively low concentrations of Se in clove tissues, ranging from 0.014 ± 0.004 µg/g to 0.039 ± 0.007 µg/g.
- #54 UG**
2:30pm **The Determination of Altered Perfluorooctane Sulfonate Toxicity in Male *Drosophila melanogaster* Following Co-exposure of Ion Channel Modifiers**
*Emily Beiler, Autumn Belt, Kyong Sup Yoon [Southern Illinois University Edwardsville]
Perfluorooctane sulfonic acid (PFOS) is a persistent anthropogenic environmental toxicant found in essentially all trophic levels. Researchers have proposed that PFOS stimulates an influx of intracellular calcium ions and is a potent, non-competitive, γ -aminobutyric acid (GAB) receptor antagonist. This research aims to corroborate these findings using ion channel modifiers to decrease the acute toxicity of PFOS. The ion channel modifiers used were ivermectin (IVM) and carbamazepine (CBZ). 72-hour bottle mortality bioassays were conducted using wildtype adult male *D. melanogaster*. The fruit flies were treated with 20 µM PFOS via ingestion for a period of 72 hr. The flies were also co-treated via topical with IVM (, , and) for a period of 72 hours. PFOS was found to be lethal in concentration and time dependent manners. The flies co-treated with IVM were seen to have decreased mortality. The IVM was found to be protective against the PFOS induced mortality with statistical significance at 48 and 72 hours for all concentrations (t-test, $p < 0.05$). It is anticipated that CBZ will also show protective effects when co-exposed to PFOS.
- #55 UG**
1:15pm **A Comparison of Arboreal Vertebrate Diversity in Forest Edge and Forest Interior Habitats**
*Karli Rose, Raina Schlueter, Richard Essner [Southern Illinois University Edwardsville]
The majority of trail camera surveys from forested habitats have focused on terrestrial vertebrates. Much less is known about the arboreal vertebrate community, especially in fragmented suburban forest. We are examining species richness and diversity among arboreal birds and mammals in bluff forest habitat on the campus of Southern Illinois University Edwardsville. We use infrared camera traps baited with suet to compare species richness and diversity (Shannon diversity index) in forest edge ($n=5$) versus forest interior ($n=5$) transects, with cameras placed at a height of 3 meters and spaced at 100-meter intervals. We hypothesize that species richness and diversity are higher at the forest edge versus the forest interior due to the edge effect resulting from the

ecotone present at the forest edge. The data generated from this study will be used to inform future land management practices in forests on the Southern Illinois University Edwardsville campus.

#56 UG
2:30pm

The Impacts of Ammonium Nitrate on the Growth, Survival, and Behavior of *Planorbella trivolvis* and *Physa gyrina* Snails

*Jessica Guyton, John Marino [Bradley University]

Agricultural runoff is a major issue in regions such as the Midwest United States. The presence of pollutants such as nitrogen compounds in runoff causes large-scale ecological damage through eutrophication, however, the direct effects of nitrogen pollution on many organisms including aquatic snails are understudied. Aquatic snails are important to the overall health of an ecosystem as detritivores, major algae consumers, and prey items for many animals. Additionally, aquatic snails also function as intermediate hosts to several parasites such as flukes of the family Echinostomatidae, which can infect a variety of animals including humans. The goal of this research was to understand how exposure to ammonium nitrate impacts the growth, behavior, and survival of aquatic snails. I hypothesized that snails exposed to high ammonium nitrate concentrations will have negatively impacted growth, activity levels, and survival due to the physiological effects of excess exposure. This hypothesis was tested in a laboratory experiment that exposed two snail species common to Illinois (*Planorbella trivolvis* and *Physa gyrina*) to ammonium nitrate solutions of 0 mg/L, 5 mg/L, or 30 mg/L concentration for twenty days. Results showed a significant negative impact on the survival of both species at 30 mg/L. These results support that ammonium nitrate has a direct negative impact on local snail species, which likely further impacts aquatic ecosystems. The effects of nitrogen pollution on the snails may also affect their interactions with echinostome parasites, which are themselves known to infect hosts on multiple trophic levels.

#58 UG
2:30pm

The Filtering Effects of *Dreissena polymorpha* on *Metschnikowia bicuspidata* Parasitism in *Daphnia dentifera*

*Jenna Staszewski, Alexander Crickman, Isabella Borzeka, Rachel May, Katherine Capra, Tian Tasso, Charlene Kueterman, Alina Khan, C. Tyler MacDougall [Lewis University]

Metschnikowia bicuspidata are parasitic fungi that infect zooplankton including the freshwater microcrustacean, *Daphnia dentifera*, which ingests fungal spores while grazing algae. *Dreissena polymorpha*, or the zebra mussel, is an invasive bivalve mollusk. *Dreissena* have invaded fresh waters in the United States and outcompete many native species. The purpose of this study was to examine the effects *Dreissena* may have on the prevalence of infection among *Daphnia*. The hypothesis is that filtering by *Dreissena* will reduce the number of available spores that can be ingested by *Daphnia* and decrease the prevalence of infection within the population.

Mesocosms were used to study the interactions among the three species. Three treatments were established: (a) *Daphnia*, (b) *Daphnia* with fungus, and (c) fungus with *Daphnia* where *Dreissena* was initially present for 24 hours in the mesocosm with the fungus and then removed prior to the introduction of *Daphnia*. There were three different concentrations of *Metschnikowia* used: 50, 100, and 1000 spores/mL. After 14 days, the densities and prevalence of infection were recorded. It was observed that as the concentration of spores increased, the prevalence of infection increased in treatments exposed to *Dreissena*, but not significantly ($p > 0.05$). Densities in treatments initially exposed to *Dreissena* were lower, but not significantly ($p > 0.05$). The conclusion is that *Dreissena* may reduce the prevalence of infection in *Daphnia* when the concentration of spores is < 50 spores/mL, but not when the concentration of spores is > 100 spores/mL. It appears that the initial presence of *Dreissena* in the mesocosm has a residual effect on *Daphnia* density. The data suggest that *Dreissena*'s influence on *Daphnia* populations goes beyond competition.

#60 UG
2:30pm

Analyzing Decomposition in a Temperate Lotic System

*Trevor Rallo, Thomas Anderson [Southern Illinois University Edwardsville]

Decomposition of allochthonous material (e.g., leaves or woody debris) is an important process in stream ecosystems. Breakdown of this allochthonous matter is dependent on multiple factors, such as species identity or the habitat type (e.g. riffle vs pool). Decomposition rate has received limited attention as a potential metric of stream health, which could be useful for conservation and citizen science groups. In this study, we quantified microbe density and macroinvertebrate diversity, and related these variables back to the decomposer taxa, habitat type and stream health value (quantified as Q-value). Leaf litter bags that varied in mesh size (2.0 and 0.5 mm) were placed, monitored, and collected at 14, 28, and 42 days across 9 sites in the fall of 2022. The 2 mm mesh bag allowed shredder colonization while a 0.5 mm bag restricted their colonization. Colonizers were counted and diversity was calculated using Simpson's Diversity Index. Lastly, a Q-value was calculated for each site following the Illinois Riverwatch Protocol. We found no strong relationships between bag mesh size, habitat type or with stream Q-value. Further inquiry into how decomposition varies across different attributes of streams and whether it can be incorporated into stream health assessments is therefore needed.

HEALTH SCIENCES

- #57** **Grad** **The Effects of Smoking and Vaping on the Oral Microbiome: A Comparative Study**
1:15pm *Maddie Walsh [Southern Illinois University Edwardsville]
 This study examines three bacteria found in the oral cavity and their responses to the presence of electronic cigarette vapors and traditional cigarette smoke. The three bacteria studied are *Aggregatibacter actinomycetemcomitans* (Aa), *Streptococcus mutans*, and *Porphyromonas gingivalis*. Growth curves were generated and compared to control samples of bacteria that were not exposed to electronic cigarette vapor or cigarette smoke. An automatic smoking machine was utilized to expose the bacteria to vapors or smoke. Following exposure, bacteria were plated in a 96-well plate and an Omega plate reader generated 24-hour microbial growth curves. Bacteria had the highest growth curve after the smoke treatment, with bacteria exposed to nicotine having smaller growth averages. The control samples were used to compare the growth of the bacteria exposed to vapor containing nicotine and smoke to determine the effect of e-cigarette vapor and cigarette smoke exposure. The primary purpose of this research is to establish whether vaping e-cigarettes is less harmful for the oral microbiome than smoking traditional cigarettes, as well as observe the effects of bacteria in the mouth in the presence of these carcinogens by comparing them to unexposed bacteria.
- #59** **UG** **Does Cigarette Smoke or E-Cigarette Vapors with or without Nicotine Affect Growth of**
1:15pm ***Actinomyces viscosus*, an Endodontic Pathogen?**
 *Kailynn Bobbett [Southern Illinois University Edwardsville]
Actinomyces viscosus is a Gram-positive, acidogenic bacteria associated with persistent extraradicular endodontic infections and root lesions. This pathogen colonizes the oral cavity of about 70% of adult humans and is capable of causing disease. *A. viscosus* enters through root lesions and can lead to dental necrosis, purulent pulpitis, and acute and chronic apical periodontitis. Recently, studies have shown that the roots of teeth are affected by e-cigarette devices and other nicotine-related products. Although E-cigarette devices are safer alternatives to traditional tobacco products, there is still a considerable amount of research that needs to be conducted to understand their effects on oral health and their correlation with oral bacteria. To understand the effects of cigarette and e-cigarette smoke on the oral microbiome, in this study we evaluated the effects of smoke, e-cigarette vapors, and nicotine on the endodontic pathogen, *Actinomyces viscosus*. The bacteria was grown in BHI media overnight and was then exposed to commercially available tobacco flavored e-cigarette juice containing 0 mg/L, 20 mg/L, IR6F cigarettes, and a control group. After exposure, the bacteria was placed in an incubating Omega plate reader for 24 hours to generate a growth curve. Results indicated that cigarette smoke and e-cigarette vapors both with and without nicotine did not significantly affect the growth of the bacterium. Further studies can be conducted to understand the relationship between cigarette and e-cigarette smoke in the oral cavity, and to assist dental professionals in their individualized treatments.
- #61** **UG** **Does Cigarette Smoke or E-Cigarette Vapors with or without Nicotine Affect Growth of**
1:15pm ***Aggregatibacter actinomycetemcomitans*, a Periodontal Pathogen?**
 *Sahar Rashid [Southern Illinois University Edwardsville]
Aggregatibacter actinomycetemcomitans is a Gram-negative bacterium associated with localized aggressive periodontitis in adolescents, which affects an individual's central incisors, first molars, and breakdown of other supporting structures which can eventually lead to tooth loss if it is left untreated. E-cigarette devices are safer alternatives to traditional tobacco products, yet there is still much research that needs to be conducted to understand their effects on oral health, and their correlation with oral bacteria. Due to recent studies indicating that teenagers and young adults using e-cigarettes more than any other age group, in this study we evaluated the effects of smoke, e-cigarette vapors, and nicotine on the periodontal pathogen, *Aggregatibacter actinomycetemcomitans*. The bacteria was grown in BHI media overnight and was then exposed to commercially available tobacco flavored e-cigarette juice containing 0 mg/L, 20 mg/L, and IR6F cigarettes, and a control group. After exposure, the bacteria was placed in an incubating Omega plate reader for 24 hours to generate a growth curve. Results indicated that cigarette smoke and e-cigarette vapors both with and without nicotine did not significantly affect the growth of the bacterium. Further studies can be conducted to allow for an increased awareness to adolescents, the effects of smoking and e-cigarettes in the oral microbiome, and to assist dental professionals in their individualized treatments for their younger patients.

- #63** UG **Survivability of Opportunistic Oral *Candida albicans* After Exposure to SmartMouth and Other Mouth Rinses**
1:15pm
 *¹Elise Murphy, ²Barbara McCracken [¹Southern Illinois University Edwardsville, ²Southern Illinois University School of Dental Medicine]
 Oral Candidiasis is a common opportunistic infection of the oral cavity characterized by overgrowth of the fungal species *Candida albicans*. When left untreated, the pathogen may travel through the blood to organs causing severe infection and death. In this study, we analyzed mouth rinse: Chlorohexidine, SmartMouth, TheraBreath, and Listerine ability to limit growth of *C. albicans in vitro*. Survivability of the pathogen was quantified using automated cell counting, spectrophotometry growth curves, and plate colony counting. Following exposure to TheraBreath and Listerine, *C. albicans* survivability was not significantly decreased. Exposure to SmartMouth and Chlorohexidine rinse significantly decreased survivability of the pathogen and slowed cell proliferation. SmartMouth rinse displayed comparable effectiveness to Chlorohexidine at decreasing survivability of *C. albicans*. The results of this study suggest that routine use of SmartMouth rinse may reduce the concentration of *C. albicans* and slow proliferation of the species *in vitro*.

MICROBIOLOGY

- #62** UG **Implementing Transposon Mutagenesis to Investigate Proteins that Alter the Expression of Bacterioferritin Comigratory Protein in *Bacillus subtilis***
2:30pm
 *Gia-Maria Calbaza, Melinda Faulkner [Bradley University]
 All organisms that rely on oxygen for survival produce reactive oxygen species (ROS). Living organisms must maintain moderate levels of ROS, otherwise, they may undergo oxidative stress. Oxidative stress has the ability to damage the structures of proteins, lipids, and deoxyribonucleic acids in cells. Damage from oxidative stress disrupts a lot of cellular processes that are important for life and may cause cell death. Bacteria use peroxide-scavenging enzymes to attack ROS and maintain them at low and tolerable levels. In *Bacillus subtilis*, there are nine different enzymes that have been identified to play a role in removing ROS, including bacterioferritin comigratory protein (Bcp). However, little is known about Bcp, including its regulatory proteins. Regulatory proteins control the replication of genetic material and the synthesis of proteins in cells. The goal of this study is to identify the regulatory proteins of *bcp*, and to investigate how they function in terms of influencing Bcp to defend against ROS. In this project, strains containing a *bcp*'-lacZ fusion have been created to measure the expression of the *bcp* gene. These strains have undergone transposon mutagenesis and screening processes to analyze possible mutations that may increase the expression of the *bcp* gene. Three isolates were identified that contain transposon insertions of interest. These isolates are currently being analyzed to determine the location of the transposon insertion and how that insertion may impact the expression of the *bcp* gene.
- #64** UG **Antibacterial Properties of Extracts from the Osage Orange, *Maclura pomifera***
2:30pm
 *Rachel May, Alexander Crickman, Alina Khan, C. Tyler Macdougall, Katherine Capra, Charlene Kueterman, Jenna Staszewski, Isabella Borzeka, Jerry Kavouras, James Rago [Lewis University]
 The need for new antimicrobial agents has become increasingly important as a wide array of pathogens are resistant to many routine antibiotics administered to treat infections. Natural products from the tissues of *Maclura pomifera* have been found to possess characteristics associated with antimicrobial defense, anti-inflammatory properties, and cholinesterase inhibitory capabilities. This study examined extracts from the Osage orange to determine if extracts from the Osage orange would inhibit the growth of bacteria. The Osage orange was soaked in sterile deionized water for 24 hours. The "milk extract" was collected by squeezing fluid from the fruit. The "seed extract" was collected by removing aseptically the seeds from the Osage orange, suspending them in sterile deionized water, and crushing them with a sterilized mortar and pestle. To confirm the antimicrobial activity of the extracts, individual components from the seed and milk extracts were isolated using ethanol precipitation and then resuspended in sterile water. The Mueller Hinton agar plates were individually inoculated with different species of bacteria. Paper discs were soaked in an extract and pressed onto the agar plate. Plates were incubated for 18 hours at 37°C and the zones of inhibition around the disks were recorded. Gram-negative bacteria were consistently resistant. The "milk extract" had a greater prevalence of inhibition among the bacteria tested. *S. aureus*, and environmental isolates, MRSA and TET-R, were highly susceptible to "milk extract." Similar results were observed when the ethanol-precipitated components were tested. Older extracts (stored in the refrigerator) typically presented larger inhibition zones than fresher extracts used in the disc diffusion assays. The conclusion is that extracts from the Osage orange exhibit antimicrobial activity. Future work will examine the antimicrobial activity of the seed and milk extracts and ethanol-precipitated components on clinical isolates.

- #65** **Grad** **The Enemy of My Enemy ss My Friend: Identifying Prophages in *Paraburkholderia* Symbionts of *Dictyostelium discoideum* and Investigating Their Role in Host Colonization Competition**
1:15pm *Andrew Hofferkamp, Susanne DiSalvo, Kennedy Sidwell, My Tran [Southern Illinois University Edwardsville]
 As viruses that infect bacteria, bacteriophages are clearly a threat to their bacterial targets. However, temperate phages that integrate into their host bacteria as prophages may donate novel advantageous traits to their hosts. One potential benefit conferred by prophages could be to act as a defense mechanism against related bacterial competitors. For example, the spontaneous induction of prophages from a small fraction of host bacteria could go on to infect and eliminate phage-susceptible bacteria. These prophage-bacteria interactions could further impact the composition and consequence of bacterial symbionts in their host organisms. Several species of *Paraburkholderia* can establish infections throughout the life cycle of the social amoeba *Dictyostelium discoideum*. We screened *Paraburkholderia* symbiont genomes for intact prophages and attempted to induce prophages in symbiont cultures. Filtered cultures from one symbiont strain (*Paraburkholderia agricolaris* Pa70) consistently produced lysis plaques on a related symbiont strain (*Paraburkholderia agricolaris* Pa317). However, despite evidence for intact prophages in other symbiont genomes, we were unable to detect lysis plaques from other strains tested. Due to the observation that Pa70 produces a prophage that targets Pa317, we speculated that Pa70 may be able to out compete Pa317 in co-culture and in the presence of amoeba hosts. As Pa317 is detrimental to host fitness, we also speculated that Pa70 may protect hosts from the toxic impact of Pa317. Thus, we examined Pa70 and Pa317 populations and amoeba fitness in different culture conditions. Although we found no evidence that Pa70 outcompetes Pa317 in liquid cultures, it appears to enhance amoeba host fitness during co-infections. This suggests that prophages may alter the dynamics of related bacterial strains in certain environments and provide an advantage to not only the prophage harboring strain but also to their host organisms.
- #66** **UG** **Microbiome Analysis After AIMD in Mice**
2:30pm *Brailey Coulter, Cinnamon VanPutte [Southern Illinois University Edwardsville, Southern Illinois University School of Dental Medicine]
 To determine whether antibiotic induced microbiome depletion (AIMD) affects thyroid hormone function and induces dysbiosis of the gut microbiome, we treated mice with an antibiotic cocktail for six weeks. Gut microbiome dysbiosis is an active area of research and because it has been linked to both hyper- and hypothyroidism, our lab induced AIMD in mice, collected fecal samples for microbiome analysis—tests that compared the quantity and species of bacteria in control mice with experimental mice. Our results indicated that there was a change in species distribution. Two bacteria families became more prevalent. These were *Burkholderiaceae* whose distribution increased by 7% and *Xanthomonadaceae* whose distribution increased by 8%. *Burkholderiaceae* has many species that are present in hosts that have an immunocompromised system. *Xanthomonadaceae* is a family commonly comprised of multidrug-resistant bacilli and includes opportunistic pathogens. While counts of the majority of the remaining bacterial families were the same or slightly decreased, *Bacteroidaceae* was the family with the largest reduction of 8%. Members of the *Bacteroidaceae* family are known to help maintain gut eubiosis, are involved in both bile acid metabolism and in detoxification of mutagenic compounds. After six weeks of antibiotic treatment there were no statistically significant differences in total bacteria counts between control mice and AIMD mice. Through rarefaction curve analysis, we determined that at the start of the six-weeks of antibiotic treatment, both control mice and experimental mice had the most microbiome species diversity, whereas after the six-week period, the experimental mice demonstrated the least amount of microbiome species diversity. This indicates that the antibiotic cocktail we used was effective at inducing gut dysbiosis in mice.
- #67** **Grad** **Investigating the Role of Lysozymes and Other Host Factors in Mediating Amoeba Resilience to *Paraburkholderia* Infections**
1:15pm *Caitlin Martin, Jenna Grabowski, Stephanie Lopez, Susanne DiSalvo [Southern Illinois University Edwardsville]
 All organisms are susceptible to bacterial infection and many employ common defense mechanisms. The social amoeba *Dictyostelium discoideum* is a model eukaryotic system that can be infected naturally and experimentally with bacterial symbionts. It uses cell-autonomous and innate immune mechanisms to defend against infections during its developmental cycles, making it a good model host for understanding basic bacterial infection prevention and clearance strategies. Several *Paraburkholderia* species are natural symbionts of *D. discoideum*, which can intracellularly and extracellularly colonize amoeba cells and structures and persist throughout all stages of development. Here, I sought to identify host factors that play a role in *Paraburkholderia* symbiont infection outcomes. I examined the roles of several genes in mediating infections, including potential lysozyme

genes, by characterizing *Paraburkholderia* infection patterns for multiple amoeba mutants. Specifically, I examined host phenotypes and infection levels for gene knock-out mutants and their parental strains after exposure to *Paraburkholderia agricolaris* strain Pa159-RFP. Infections were quantified in spore cells following host development and visualized in amoebas and spores using flow cytometry and confocal microscopy. Several host mutants exhibited different infection patterns than their wildtype counterparts. A mutant of a putative lysozyme gene, *cf45-1*, was of particular interest as it appeared to be more resilient to infection with *P. agricolaris*. However, other lysozyme mutants did not display the same phenotype. I initially hypothesized that this mutant may be compensating by increasing the expression of other lysozyme genes, but found no evidence for an increase in functional lysozyme expression in this mutant. Furthermore, it appears that this mutant responds differentially to distinct *Paraburkholderia* strains. Although these results suggest an important role for *D. discoideum* lysozymes in mediating infection outcomes, the specific mechanisms underlying their relationship to *Paraburkholderia* infections remains an intriguing avenue for research.

#68 UG
2:30pm

Exploring the Role of Antimicrobial Lysozyme Genes in the Susceptibility of Amoeba Host Cells to *Paraburkholderia* Symbiont Infections

*Jenna Grabowski, Caitlin Martin, Stephanie Lopez, Susanne DiSalvo [Southern Illinois University Edwardsville]

The innate immune system is the body's first defense against invading microbes and toxins. The social amoeba *Dictyostelium discoideum* is a widely used model for studying primitive innate immunity mechanisms (which are conserved in more complex eukaryotes). The immune mechanisms employed by *D. discoideum* include the actions of sentinel cells, antimicrobial peptides, and phagocytic digestion and are typically highly effective in preventing bacterial infections. However, bacteria of the genus *Paraburkholderia* have been recognized as effective colonizers and endosymbionts of *D. discoideum*. *Paraburkholderia* bacteria are therefore able to counter or evade the protective measures of *D. discoideum*'s innate immune system. We sought to investigate the role of select immune mechanisms and antimicrobial factors in *Paraburkholderia* infections. Specifically, we aimed to understand the role of host lysozyme genes in mediating *Paraburkholderia* infection efficacy and the importance of lysozyme gene and symbiont strain identity in infection outcomes. We also sought to explore whether these factors interact with additional immune mechanisms operating during the multicellular transition. We monitored host fitness and symbiont infection patterns for multiple amoeba strains with lysozyme gene knockouts after exposure to different *Paraburkholderia* symbionts. The amoeba mutant with a knockout of the putative lysozymal gene *cf45-1* showed significant resilience to infection with specific *Paraburkholderia* symbionts while remaining susceptible to infection by others. This demonstrated that the interaction between amoeba host and bacterial symbiont may be influenced by both host genetics and symbiont identity. To further characterize this relationship, we are working on quantifying lysozyme gene expression patterns during *Paraburkholderia* infections using RT-qPCR. We are also visualizing infections in certain amoeba cell types during the developmental stage to gain further insight into the mechanisms underlying these infection outcomes.

#69 UG
1:15pm

Testing for Drug Resistant Bacteria in Central Illinois Soil

*Kendra LaMarsh, Devan R. Morgan, Gwendolyn S. Knapp [Illinois College]

Bacterial infections can harm humans, and often antibiotics are used to treat the infection. Antibiotic resistance is an issue due to overuse and misuse of antibiotics and results in higher medical costs, prolonged hospital stays, and increased mortality. According to the Center for Disease Control and Prevention (CDC), in the United States alone, there are more than 2.8 million antibiotic resistant infections each year, resulting in more than 35,000 deaths. In order to address the issue of antibiotic resistance, we must first identify how widespread the problem is. Thus, we collected soil samples over time from the Meredosia National Wildlife Refuge and local agriculture sites. The level of resistance to medically relevant antibiotics was determined. It was concluded that antibiotic resistance was present at each site, whether or not there is direct human contact. Kirby-Bauer assays suggest that a subset are resistant to one or more antibiotics.

#70
2:30pm

Beneficial Bacteria Isolated From Yard-Long Bean (*Vigna unguiculata* (L.) Walp. Ssp. *sesquipedalis* (L.) Verdc)

*Scott Holt, Kylee Hill [Western Illinois University]

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

and molecular identification. Leaf samples were also plated on Plate Count Agar to determine non-selective bacterial count. For rhizobia, root nodules were surface sterilized, crushed, plated on Congo Red Yeast Extract Mannitol Agar, and incubated for 14 days at 25°C. Suspected rhizobia colonies were counted and identified using cultural, microscopic, and molecular identification. The rhizobia count was $2.1 \times 10^9 \pm 2.0 \times 10^9$ CFU/nodule. Rhizobia isolates were identified as *Bradyrhizobium* species based on characteristic cultural, microscopic, biochemical, and 16S rDNA sequencing. For methylobacteria, the count was $3.6 \times 10^5 \pm 1.9 \times 10^5$ CFU / g leaf tissue. The methylobacteria isolates were identified as *Methylobacterium* or *Methylorubrum* species based on characteristic cultural, microscopic, biochemical, and 16S rDNA sequencing. For the non-selective aerobic bacteria, the mean CFU count / g leaf tissue was $3.7 \times 10^5 \pm 2.2 \times 10^5$. Heterotroph isolates were identified as *Microbacterium*, *Brachybacterium*, *Brevibacterium*, *Sphingomonas*, and *Bacillus* species. Overall, this is the first report of beneficial bacterial populations associated with the leaf tissues and root nodules of long bean crop. The beneficial bacterial species isolated from productive long beans can be used to develop natural microbial inoculants/fertilizers that support the growth of other important crop plants.

STEM EDUCATION

- #72 Grad 2:30pm** **Investigating Metacognition in Introductory Biology Students at a Public University in Illinois**
 *Jana Wollesen, Maurina Aranda [Southern Illinois University Edwardsville]
 Introductory biology courses can be difficult for students, especially for first-generation students or those from rural communities. Performance in these classes often predicts degree completion. Success in these courses requires high levels of metacognitive awareness (the ability to monitor learning), and this perception of learning is used to predict performance on tasks (metacognitive accuracy). Higher metacognitive awareness is thought to correlate with higher metacognitive accuracy and performance. However, previous studies examining these relationships have been inconclusive. We hypothesized that inconsistent findings are due to aspects of student motivation, such as mindset and locus of control. Understanding relationships between these variables can enhance student success by helping students develop self-regulatory learning skills. These skills are particularly important for biology students as they evaluate and modify mental models during the learning process. Study participants were enrolled in introductory biology courses at a public university in Illinois. Two research questions guided this study: 1. To what extent do mindset and locus of control mediate relationships between metacognitive awareness, metacognitive accuracy, and exam scores? 2. To what extent do levels of awareness, mindset, locus of control, or accuracy change after students take their first exam? We confirmed that there was no relationship between metacognitive awareness, metacognitive accuracy, and exam scores, and showed that mindset and locus of control did not affect these relationships. We did find evidence that suggests mindset and locus of control affect how students perceive their metacognitive awareness level. We also showed significant differences in measurements of study variables after the first exam. This study sought to further investigate relationships between metacognitive awareness, metacognitive accuracy, and performance by examining two additional student characteristics: mindset and locus of control. We believe this information could increase student success by allowing instructors to identify components of metacognition most important to development of self-regulatory skills.
- #74 UG 2:30pm** **Illinois High School Students' Perceptions and Relatability to Scientists Before and After Authoring or Completing Scientist Spotlights**
 *Fabiola Perez, Amanda Stratmann, Alexis Keegan, Maurina Aranda [Southern Illinois University Edwardsville]
 High school students with stereotypical beliefs about scientists and low science identity, often believe they do not fit in to the science community and do not perform as well in their science courses. To address this, Scientist Spotlights can introduce students to diverse scientists. They have been shown to shift undergraduate student perceptions of scientist towards non-stereotypical views of scientists and improve their relatability to scientists (Schinske et al., 2016; Aranda et al., 2021). We expand previous understanding by investigating the impact of Scientist Spotlights on the perceptions of rural high school Illinois students. Our research addresses the following research questions: 1) To what extent does completing or authoring Scientist Spotlight homework assignments shift high school students' perception of scientists? 2) To what extent do rural students relate to scientists before and after completing or authoring Scientist Spotlights? Four Scientist Spotlight assignments were implemented during the Fall 2022 school semester. Students either completed (n=37) an instructor created Scientist Spotlight or authored (n=10) their own Scientist Spotlight on a scientist of their choosing. High School students completed a pre-post assessment where they rated and described their scientist relatability and described the type of people that did science. Results were qualitatively coded to consensus using a pre-established rubric (Schinske et al.,

2016). Our results indicate that Scientist Spotlights impacted high school students across various science courses. We observed a shift to more non-stereotypical views of scientists after implementation of Scientist Spotlights. Authoring Spotlights led to a 60% increase in student relatability to scientists compared to completing Spotlights, with a 2% increase. This highlights the impact of including students in designing curricular interventions. Collectively, this study shows the effectiveness of Scientist Spotlights on high school science students and is the first to describe the impact of authoring Spotlights in high school science courses.

#76 UG
2:30pm

Incorporating Themes into STEM Education Outreach

*Rhiannon Davids [Bradley University]

Scientific outreach is an integral part of informal science communication and informal science education within our communities. A few years ago, the Bradley University Center of STEM Education and the Illinois Math Academy set up regular outreach at the local mall, in collaboration with a variety of STEM-based Bradley undergraduate student groups and other local organizations. In an effort to try to improve the efficiency of running the program and to create short and effective programming, the Center of STEM Education has worked to integrate themes into activities presented at outreach events to make it more cohesive. Considering the variety of students that volunteer for these programs, themes to interconnect demonstrations were used to help undergraduates both learn and distribute information more easily. In addition, the themes were used to keep the general public engaged, by holding a central narrative to connect the variety of short activities together. This allowed the integration of a range of content and subjects without seeming dispersed, which benefits the goals of the organization and works well with the variety of student organizations on campus.

ZOOLOGY

#78 UG
2:30pm

The Long Term Effects of Aerial Exposure on the Invasive Zebra Mussel, *Dreissena polymorpha*

*Sarah Lyons, Jen Jost [Bradley University]

Zebra mussels (*Dreissena polymorpha*) are invasive bivalves, harmful to native aquatic ecosystems, and causing significant economic impact due to their ability to biofoul pipes. Mussel populations are expanding, in part due to their ability to attach to boats. Zebra mussels can survive four days in aerial conditions, allowing for transport into new habitats when boats are moved. However, the long-term consequences for the surviving mussels are unclear. The objectives of this study were to determine survival over a 72-hour aerial exposure at 15°C and 75% relative humidity and to track growth and survival for 4 weeks in the field. A previous study conducted in summer showed little to no long-term physiological impact in aerial vs. aquatic treatments, but survival was low due to the heat. Therefore, another objective of this study was to evaluate mussels under the less stressful field conditions during fall. In October 2022, mussels were exposed to one of three treatments: a submerged control and both a 48 hr and a 72 hr aerial exposure. Survival was checked every 24 hrs during the treatments and a 48-hr aquatic recovery. Surviving mussels were labeled and field-deployed for 4 weeks. Survival, change in dry tissue mass, dry shell mass, and shell size were determined. Survival was high during the aerial exposures and the aquatic recovery period, regardless of treatment. But, while 96% of control mussels survived 4 weeks in the field, only 45% of the exposed treatments survived, suggesting there was a long-term consequence of aerial exposure. However, there were no significant differences in any of the growth parameters, indicating performance was unaffected in the mussels that did survive. Overall, this study demonstrates the tenacity of zebra mussels and their ability to recover post-exposure.

#79 Grad
1:15pm

Using DNA Sequencing to Reveal the Diversity of Echinostome Trematode Parasites in Central Illinois

*Natalie Nicole Lopez, Grace Crull, John Marino [Bradley University]

Parasites can have negative impacts on populations by causing disease and host death. However, despite their ecological significance, the diversity and composition of parasite communities is poorly characterized for many host species. Trematodes (flukes) belonging to the family Echinostomatidae (i.e., echinostomes) are a common group of parasites that infect a wide array of host species (e.g., mollusks, mammals, vertebrates) and are known to have important effects on their hosts and aquatic ecosystems. Assessing echinostome diversity has been challenging because many similar species cannot be distinguished morphologically. To assess echinostome diversity in Central Illinois, snails and tadpoles were collected from 41 different wetlands. Water chemistry data (e.g., dissolved oxygen, pH, specific conductance, N-NO₃ concentrations) were also collected using a YSI probe. Trematode cercariae (larval infective stages) were collected from snails and identified to family level based on morphology. DNA was extracted from preserved cercariae and used to amplify a portion of the 28S ribosomal RNA gene by PCR, followed by sequencing. Since 2018, over 6,000 snails have been collected and screened

from 41 wetlands; 245 (4.1%) of snails were infected with echinostomes. Based on sequencing data that were compared to GenBank using BLAST, there have been a total of 7 species of echinostome identified in our surveys, with *Echinoparyphium recurvatum* being the most prevalent. As a next step, I plan to analyze how patterns of trematode diversity across these wetlands are associated with water chemistry, particularly pH. These findings may provide the foundation for conservation efforts to better understand and mitigate impacts of parasites on wildlife populations occupying these wetlands.

- #80** **UG** **Exploring the Effects of Potassium Chloride during Aerial Exposure on Zebra Mussel Survival**
2:30pm *Patrick Menke, Jen Jost [Bradley University]
 Zebra mussels, *Dreissena polymorpha*, are an invasive bivalve that have shown to cause great economic and ecological damage. These mussels are particularly invasive due to their ability to survive aerial exposure for extended periods of time allowing them to be transported across land between bodies of water. Since their introduction, there have been many attempts to control their spread through the use of lethal chemicals such as potassium chloride (KCl), Earthtec QZ, and zequanox but these are often limited to smaller bodies of water. Therefore, the objective of this study was to determine the impact KCl may have on mussel mortality during aerial exposure. Firstly, the dose of KCl that caused complete mortality within 72 hours had to be determined. This was done by exposing mussels to a variety of different concentrations (0, 125, 175, 225, 275, 300, 350, 400, 450, and 500 mg/L) in non-stressful aerial conditions (15°C, 75% RH) for 72 hours and then moved to a 24-hour aquatic recovery tank. From this, we were able to determine that the optimum dose was 400 mg/L of KCl. Secondly, the effects of different aerial conditions was determined by exposing mussels to KCl (400 mg/L or 0 mg/L) at three different aerial conditions (15°C, 75% RH; 20°C, 75% RH; or 25°C, 75% RH). We determined that at all three aerial conditions, mortality was significantly higher when mussels were exposed to KCl. Overall, this study showed that KCl can be used as an effective way to limit the spread of mussels during aerial exposure and over land travel.
- #81** **Grad** **Microhabitat Characteristics of Calling Sites in the Illinois Chorus Frog, *Pseudacris streckeri illinoensis***
1:15pm *Kehinde Adeniyi, Richard Essner [Southern Illinois University Edwardsville]
 Among the many amphibian species that have exhibited population declines in recent decades is the Illinois Chorus Frog (*Pseudacris illinoensis*). These highly fossorial amphibians spend the majority of their lives burrowed underground in sand prairie habitat. They are listed as threatened in Illinois due to a multitude of factors, including habitat loss and road mortality. Previous studies have investigated the preferred breeding habitat of Illinois chorus frogs. However, the microhabitat characteristics associated with calling site selection of breeding males are unknown. This study will use visual encounter surveys to locate singing males in breeding ponds in Madison County, IL. A suite of microhabitat variables from calling sites will be recorded, including spatial, water quality, and vegetation measurements. These characteristics will be compared with random locations and statistical modeling will be used to identify the most important predictors of calling site selection. It is anticipated that this study will provide key information on microhabitat characteristics of calling males which will inform management practices, including construction of artificial wetlands.
- #82** **UG** **Long-Term Field Growth Following Aerial Lab Exposure in Zebra Mussels *Dreissena polymorpha***
2:30pm *Carter Grieco [Bradley University]
 Zebra mussels, *Dreissena polymorpha*, are invasive bivalve mollusks that have established populations in North America. Zebra mussels are exceptionally invasive, in part due to their ability to survive being removed from water which allows the mussels to be transported into different bodies of water and rapidly spread. These populations pose a significant threat to native species due to competition for food, a reduction in algal biomass, and damage caused to pipes and boats. Zebra mussels are able to survive for up to four days under cold and damp aerial conditions. However, little is known about how this exposure impacts the mussels once they have returned to water. Previous research in our lab suggests mussels aurally exposed for 72 hours have reduced long-term survival, but for those that do survive, there are no long-term consequences on growth. However, the data were collected during the extreme heat of summer and again in the relatively cool fall months. Yet, the physiological response to aerial exposure in the late winter and early spring when mussels are actively growing remains unknown. Therefore, the objective of this study was to repeat the aerial exposures and determine the survival and growth rates of mussels for 4 weeks following either a 48 or 72 hour exposure. Preliminary data show that survival was high in the continually submerged treatment, but that only 28% of mussels survived a 72 hour exposure. Future directions include analyzing long-term survival, change in shell size, and change in both dry tissue and dry shell mass.

- #83** **Grad** **Behavior and Activity Patterns of the Illinois Chorus Frog (*Pseudacris streckeri illinoensis*)**
1:15pm *Amy Docter, Spencer Orvis, Carolyn Kinnunen, Richard Essner [Southern Illinois University Edwardsville]
 The state-threatened Illinois chorus frog (*Pseudacris streckeri illinoensis*) is an enigmatic species due to its fossorial habits. What little is known about their behavior comes from observations of adults, which are above ground during the breeding season. The purpose of the study is to observe the behaviors and activity patterns of juvenile Illinois chorus frogs over the first year of life. The study will encompass both the breeding and non-breeding seasons and will allow us to assess the degree to which Illinois chorus frogs utilize surface habitats. We hypothesize that surface activity is not limited to the breeding season. Study objectives include: (1) describing the behavioral repertoire (e.g., hopping, feeding, burrowing, etc.); and (2) quantifying behaviors according to frequency, duration, and time of day in order to construct an ethogram and define activity patterns. Project goals include identifying novel behaviors, establishing daily and seasonal behavioral patterns, and successfully raising juvenile Illinois chorus frogs in captivity. This will also demonstrate the feasibility of *ex situ* conservation in case it becomes necessary for this species. Illinois chorus frogs ($n = 10$) were hand captured immediately following metamorphosis and were monitored in a controlled, indoor enclosure with an infrared video camera system. Behaviors are recorded using the bout method of continuous sampling. This behavioral data will aid conservation efforts by informing land managers of the daily and seasonal activities of Illinois chorus frogs during their first year of life. Moreover, it will reveal how juvenile frogs interact with their environment, prey, and conspecifics, and offer insight into ontogenetic and seasonal changes in behavior.
- #84** **UG** **Effects of Maternal Age on Offspring Development in Rhesus Macaques at Cayo Santiago**
2:30pm *¹Katelyn Baker, ¹Luci Kohn, ²Qian Wang [¹Southern Illinois University Edwardsville, ²Texas A&M University]
 Cayo Santiago is a 38-acre island off the coast of Puerto Rico known for its exclusiveness to approximately 1000 free-ranging rhesus macaque (*Macaca mulatta*) inhabitants. Founded in 1938, the colony is managed by the Caribbean Primate Research Center (CPRC). All island residents descend from the original colony founders. Identification and observation of colony residents began in approximately 1960. Skeletal remains are available for study following a monkey's natural death. Extensive demographic information is also available for most of individual in the CPRC skeletal collection, including pedigrees. Similar to humans, macaque postnatal development is complex and influenced by numerous genetic and environmental factors. This study examines the influence of environmental factors and maternal age on offspring development through examination of tooth dimensions. Buccal-lingual and mesio-distal dimensions of premolars and molars of 127 individuals of known age, sex and matriline were measured. Maternal age at delivery was classified as immature (under 6 years old) or mature (over 6 years old). Dimensions were analyzed by principal component analysis, and component scores were tested for differences in sex and maternal age. This initial pilot study found significant difference in sex for dental dimensions. While maternal age did not have a significant effect on overall size of female tooth dimensions, mother's age had a significant effect on male tooth size. Maternal age influences offspring development differently in males and females. Further studies of this sex-specific pattern will examine a larger data set along with the addition of deciduous teeth measurements to compare.
- Funding Sources: The Cayo Santiago colony is supported by NIH 5P40OD012217. This project is supported by NSF grants to LK. and QW (NSF #1926481 and 1926601).
- #85** **Grad** **Microhabitat Characteristics of Oviposition Sites of the State-Threatened Illinois Chorus Frog (*Pseudacris streckeri illinois*)**
1:15pm *Garima Ranabhat, Richard Essner [Southern Illinois University Edwardsville]
 Selection of suitable oviposition sites is crucial for successful reproduction of many anuran species. An array of interconnected variables, including biotic and abiotic features of any microhabitat are assessed by anurans when selecting suitable locations for depositing eggs. Illinois Chorus Frog (ICF; *Pseudacris streckeri illinois*) is an state-threatened fossorial anuran that inhabits sand prairie habitat and spends most of its life burrowed underground. ICF emerge from the ground to breed on rainy evenings in early springs. They travel overground to adjacent ponds, flooded fields, wetlands, and ditches. In this study, a conservation-oriented model of microhabitat use for this species will be used to identify key habitat features that reliably predict whether sites are used for oviposition. Visual encounter surveys will be conducted at night in order to locate pair engaged in amplexus. Breeding locations will be marked with flags and the surrounding area is searched next day for the presence of eggs. Quadrat sampling ($0.5m^2$) will be used to determine vegetation composition at oviposition sites. In addition, water characteristics such as pH, temperature, depth, dissolved solute presence will be recorded in

individual breeding sites. We will also record egg mass size and categorize them into <10, 10-20, >20 eggs per clutch. Microhabitat characteristics at random points within the pond will be used for comparison to determine preference relative to availability. We hypothesize that sites used for oviposition have emergent vegetation that is more diverse and taller than random locations. The results of this study will be used to inform land use practices for Illinois chorus frogs in sand prairie habitat.

- #86 UG 2:30pm Relationship Between Starvation Intervals and Longevity in *Drosophila melanogaster***
 *Justin Caldwell, Marianne Robertson [Millikin University]
 The macromolecular effects from starvation and the macromolecular effects of excess sugar on longevity in *Drosophila melanogaster* have been examined. However, research is lacking on the effects of starvation on the lifespan of virgin *D. melanogaster*. We examined the effect of varying periods of starvation on longevity. For both male and female virgin *D. melanogaster* (total number of flies = 948), we had a control group fed *Ad libitum* and four experimental groups with starvation periods of 12 hours, 24 hours, 36 hours, and 48 hours. We transferred flies in the experimental groups to bottles with *Ad libitum* media after their starvation periods and monitored them until death. A two-way Analysis of Variance showed no significant difference in the average survival (days) between males versus females when comparing treatments with the same starvation period; therefore, any differences in how starvation length affected survival are independent of sex. Control groups for both male and female flies survived significantly longer than every experimental group. Survival was significantly shorter as starvation progressed in each 12-hour experimental group with the exception of no significant difference in survival between 36-hour and 48-hour starvation groups. Longer periods of starvation resulted in decreased survival. These findings contribute to our understanding of the impact of starvation duration on *D. melanogaster* which could shed light on survival under different levels of prey availability in nature.
- #87 Grad 1:15pm Prevalence of Infection by *Batrachochytrium dendrobatidis* and Ranavirus in a Sand Prairie Amphibian Community in Southwestern Illinois**
 *Carolyn Kinnunen, Amy Doctor, Spencer Orvis, Richard Essner [Southern Illinois University Edwardsville]
 Global amphibian populations are experiencing dramatic declines and extinctions due to a multitude of causes, including infectious disease. Chytrid fungus and *Ranavirus* are waterborne pathogens that represent major threats to amphibian health. These diseases have no treatment and no means of stopping their spread. The state-threatened Illinois chorus frog (ICF; *Pseudacris streckeri illinoensis*) is a state-threatened fossorial species that utilizes ephemeral ponds for its breeding. This species only emerges during the breeding season and spends the rest of its time underground. ICF only enter bodies of water during the breeding season, which may limit the risk of exposure to waterborne pathogens. This study will examine the prevalence of chytrid and Ranavirus infection among sand prairie amphibians, including ICF. We hypothesize that terrestrial species are less prone to infection than semiaquatic species. To date, we have captured and swabbed 15 Illinois chorus frogs and found no evidence of infection by either pathogen. However, we did find chytrid infection among semiaquatic bullfrogs and southern leopard frogs found in the same ponds. Results from this study will inform management practices and help determine if fossorial species are at risk from waterborne pathogens.
- #88 UG 2:30pm Kin Discrimination in Female *Drosophila melanogaster* (Diptera: Drosophilidae): Signs of Aggression Between Related and Unrelated Females**
 *Emma Antonelli, Marianne Robertson, Travis Wilcoxon [Millikin University]
 Kin recognition is an organism's ability to determine the relatedness of conspecifics, which could lead to kin discrimination, decreasing aggressive behaviors with conspecifics that share close genetic relatedness. Little is known about whether kin discrimination occurs in female *Drosophila melanogaster*. Two trials of 30 pairings of virgin female *D. melanogaster*, 15 related and 15 unrelated were observed under food deprivation to determine whether kin discrimination affected the number of aggressive behaviors observed. Boxing, tussling, and lunging were the observed behaviors for the first trial, picked due to their association with resource guarding. Between the three observed behaviors, lunging showed a statistically significant difference, unrelated females were more aggressive than related. In the second trial, lunging and head-butting were observed due to females using lunging and head-butting aggressive behaviors more common than boxing and tussling behaviors. Again unrelated pairs of females displayed significantly more aggressive behaviors than related pairs. Evidence of significantly more aggressive lunging between unrelated females may be an indication of kin discrimination in female *D. melanogaster*.
- #89 Grad Investigating the Impact of Predator Odor Cue on Field Mice**
 *Efe Oniovokukor, Danielle N. Lee [Southern Illinois University Edwardsville]

1:15pm

Predators in the wild give off repelling scent markings (contained in their urine) within territories providing prey species information of their presence. Exploring the impact of their odor cue on prey is significant in understanding the behavioral response of prey to predation. Evolutionary history of field mice suggests possible avoidance of traps scented with predator cues when field sampling, since prey can detect cues of different predators and respond accordingly. This predator-prey relationship plays a key role in bringing balance to the eco-system and possibly indicate a decline in population growth of the nuisance rodent the field mice. Their behavioral responses to predator odor cues provide insight into how simple or alternate control measures can be developed. In this study, I compare field mice foraging behavior in response to predator odor cues (grey fox urine and coyote urine) and water as control. Bucket camera traps or open arena feeding stations video record field mice entries, time spent in the arena, and foraging behavior in the presence or absence of predator odor cues. Further data analysis and comparison of the field mice behavioral responses to the different predator odor cues are expected to demonstrate variable behavioral responses to the different predator odor cues across different habitat types.

#90 UG
2:30pm

The Effect of Competition-Induced Stress in *Daphnia dentifera* by *Dreissena polymorpha* and its Susceptibility to Infection by *Metschnikowia bicuspidata*

*Alexander Crickman, Jenna Staszewski, Rachel May, Alina Khan, C. Tyler MacDougall, Isabella Borzeka, Tian Tasso, Jerry Kavouras, Charlene Kueterman [Lewis University]
Daphnia dentifera are freshwater microcrustaceans that serve as indicator species and hosts for the fungus, *Metschnikowia bicuspidata*. *Dreissena polymorpha* is an invasive mollusk species that compete with *D. dentifera* for algae. The purpose of this study was to determine if the stress from competition affects the susceptibility of *Daphnia* to infection. The hypothesis is *Daphnia* competing with *Dreissena* will have higher rates of infection by *Metschnikowia* spores and lower population densities than control *Daphnia*. *Daphnia* were stressed by introducing one *Dreissena* into a mesocosm containing 30 *Daphnia*, where they competed for algae over 14 days. The experiment had four treatments: (a) *Daphnia* without fungus, (b) stressed *Daphnia* without fungus, (c) *Daphnia* with fungus, and (d) stressed *Daphnia* with fungus. The prevalence of infection and densities of *Daphnia* were recorded after 14 days. Ribosomal RNA intergenic spacer analysis (RISA) was performed on the *Daphnia* community microbiome. DNA was extracted from samples of stressed and control *Daphnia*. PCR amplification of the intergenic spacer region between the 16S and 23S rRNA genes was performed and then visualized by gel electrophoresis. Stressed *Daphnia* had no significant difference in the prevalence of infection when compared to control *Daphnia* ($p > 0.05$). There was no significant difference in population density in stressed *Daphnia*, whereas *Daphnia* exposed only to fungus showed a significant decline in population density ($p < 0.05$). DNA fingerprints of the community microbiome showed observable differences in band numbers and fragment length between stressed and control *Daphnia*. The conclusion is that the presence of *Dreissena* altered the microbiome but did not influence the prevalence of infection. Future work will further examine the competitive dynamics between *Dreissena* and *Daphnia*.

#91 Grad
1:15pm

The Effect of Sexual Dimorphism in Mosquitofish on Predation of Amphibian Larvae

*John Moore [Southern Illinois University Edwardsville]

Female mosquitofish are significantly larger than their male counterparts. Female mosquitofish display higher feeding rates per unit body size and show a preference for larger prey compared to males. While the sex ratio of immature mosquitofish is 1:1, biological factors may alter this ratio in the mature population. Differential predation by birds on female mosquitofish may lead to extremely high proportions of males in natural populations. However, it is more common to find female dominated populations due to their longer lifespans. This sexual dimorphism has been shown to lead to differences in diet in regards zooplankton, but little has been done to show if it also leads to differences in predation on amphibian larvae. As the introduction of mosquitofish is often implicated in the decline of amphibian abundance and diversity, this is an important metric to quantify. To examine this, I will conduct a 2 x 2 factorial indoor microcosm experiment involving sex (male or female) and two species of amphibian larvae (boreal chorus frog or small-mouth salamander). Mosquitofish predation experiments will be conducted in 10-gal aquaria containing treated tap water and a layer of gravel 2 cm deep. There will be ten trials for each treatment, for a total of 40 trials. In each predation trial, I will add 10 amphibian larvae and 1 mosquitofish. I will then let the experiment run for 24 hours. Individual organisms will only be used once in experiments. After 24 hours, I will record the survivorship of prey and the number of survivors with visible limb or tail injuries (failed predation attempts). This experiment will be conducted during the first week of April 2023.

- #92 UG Repeatability of Peak Corticosterone Response in Recaptured Songbirds**
2:30pm *Sophie Dorgan, Travis E. Wilcoxon [Millikin University]
 Birds secrete a hormone called corticosterone in response to stressful stimuli. Stressful stimuli activate the HPA axis, and one effect of this is that the adrenal cortex releases corticosterone. Acute stress responses are known to increase the rigidity and consolidation of memories; however, very severe, acute stressors, or traumatic stress, may alter, or dysregulate future stress responses and memory pathways. This study examined songbirds in Decatur, Illinois and whether this memory formed from a stress response during the initial capture altered the stress level during the recapture. A baseline sample was taken at 5 minutes after capture, when the stress-induced release of the hormone corticosterone (CORT) had yet to enter the system, and another sample was taken at 30 minutes when the corticosterone had reached its peak in the bloodstream. Samples were collected from birds twice, with at least a two week window of time in between captures. The blood was spun down into plasma, and analyzed using the DetectX Corticosterone Enzyme Immunoassay Kit. We found no significant difference ($p=0.334$) in CORT levels between the initial capture and the recapture. This indicates that the birds' stress response is the same regardless of previous interaction with the stressor.
- #93 Grad Drivers of Life History Variation in a Paedomorphic Salamander**
1:15pm *Jessica Sandoval, Tom Anderson [Southern Illinois University Edwardsville]
 Phenotypic variation is ubiquitous among organisms and is thought to provide an evolutionary advantage for species living in variable environments. Paedomorphosis, or the retention of juvenile traits in sexually mature adults, is a model system for understanding the ecological causes of phenotypic variation. In the facultatively paedomorphic mole salamander (*Ambystoma talpoideum*), the species' complex life cycle can follow three pathways that ultimately lead to the expression of two discrete adult phenotypes. An individual may undergo traditional development from egg to aquatic larva but will (1) remain in the water as a reproductive, gilled adult (i.e., paedomorph), (2) metamorphose into a terrestrial adult, or (3) delay metamorphosis and overwinter in an immature state in ponds, eventually developing into either the terrestrial or aquatic phenotype the subsequent year. We examined the influence of species interactions on phenotypic variation by assessing how larval salamander and predator densities impacted life history outcomes in mole salamanders. In May and December of 2013-2015 and 2022, we sampled twenty ponds in western Kentucky using minnow traps and dip-nets. Increased densities of larval *Ambystoma maculatum* and *A. talpoideum* resulted in greater numbers of overwintering larvae (OWL) and fewer paedomorphs the following winter. Greater predator densities (*Anax* dragonflies and *Notophthalmus viridescens*) during the larval period resulted in fewer OWL but did not impact paedomorph abundance. However, increased densities of both dragonflies and newts resulted in a greater chance of occupancy by paedomorphic individuals. We hypothesize that inter and intra-specific competition among larval salamanders was mediated by predator densities and influenced phenotypic outcomes.
- #94 Population Trends of Introduced Beetles in Forests, Wetlands, and Grasslands Across Illinois Over 20 Years**
2:30pm *¹Elizabeth Hrycyna, ¹David N. Zaya, ²Jacob I. Dixon, ¹T. J. Benson [¹Illinois Natural History Survey, ²Tulane University]
 Introduced beetles can cause widespread damage to crop and natural ecosystems, in part because they can alter the composition and balance of native insect species. Two mechanisms for this process are predation and resource competition. The exotic Japanese Beetle (*Popillia japonica*: Scarabaeidae) is a highly polyphagous herbivore in wetland and grassland environments, and exotic ladybeetles (Coccinellidae) are voracious predators of insects, including aphids (Apidae), in many habitats. There is a need to track the spread and impact of these beetles, particularly in the Midwestern United States where they pose economic threats to agriculture, sustainability threats to the few remaining natural areas, and biodiversity threats to predators and prey. In Illinois, the Critical Trends Assessment Program (CTAP) tracks plant and insect abundances and population data across hundreds of forests, wetlands, and grasslands at five-year intervals spanning up to 25 years. Insects were sampled by CTAP through sweep netting at each site at each visit and are kept in long-term storage in an ethanol solution. We used 20 years of CTAP insect collections to track relative abundance of *P. japonica*, and native and exotic species of ladybeetles. Data will be presented on long-term population trends of all beetles, as well as geographic patterns across time and the state. Preliminary results suggest native ladybeetles have significantly declined from 2000-2020, while exotic ladybeetles and *P. japonica* have not. Native and exotic ladybeetles show a negative relationship in terms of abundance and frequently appear in different habitat types from each other. This may indicate a partitioning of habitats between native and exotic ladybeetles.

- #95** **Grad** **Thermal Acclimation of the Green Sunfish, *Lepomis cyanellus*, Induce Changes in Whole-Organism Thermal Thresholds and Mitochondrial Bioenergetics**
1:15pm
 *Noah Wright, Eloy Martinez, Remington Morrison [Eastern Illinois University]
 Various thermal threshold assessments studies in freshwater fishes show critical thermal maxima (CT_{max}) close to or above the warmest habitat temperatures, along with a compensatory response to changes in the thermal regime of habitat; specimens living in warmer waters tend to show a higher CT_{max} . Shallow water ecosystems such as small streams and lakes often exhibit extreme thermal fluctuations, and 1) the rate of change in the CT_{max} within hourly or daily timescales and 2) the thermal performance of mitochondrial energy transduction after acclimation remains unexplored. The objective of this study was to evaluate the short-term response in CT_{max} of the green sunfish (*Lepomis cyanellus*) while acclimating to a 30°C thermal regime, along with assessing mitochondrial energy transduction efficiency after acclimation. Individuals were held at 20°C for 60 days, then subjected to a 30°C acclimation treatment. CT_{max} were obtained after 24, 72, 96, 120 and 192h of acclimation. CT_{max} increased after 96 h of acclimation, from 35.6°C at 72h to 36.6°C at 96h, and continued increasing over the rest of the acclimation experiment. LEAK and OXPHOS rates were significantly higher in 20°C acclimated specimens, and the reaction norm of both rates were positively correlated to assay temperature. Interestingly, the coupling efficiency, calculated as the respiratory coupling ratio (RCR), was not altered by acclimation. This study demonstrates the plasticity of thermal thresholds in *L. cyanellus* followed by changes in the bioenergetic machinery during acclimation, despite the lack of improvement in coupling efficiency after exposure to warmer thermal regimes.
- #96** **A Test of Reproductive Isolation Between Two Populations of Cave-Dwelling Snails**
2:30pm
 *¹Robert Weck, ²Corina Trapp [¹Southwestern Illinois College, ²Southern Illinois University Edwardsville]
 Snails of the genus *Physa* are a common part of the aquatic community in the largest caves of the Sinkhole Plain Karst in southwestern Illinois. Fogelpole Cave is home to a highly polymorphic population of *P. gyrina*. A majority of individuals lack pigmentation in the head, foot and mantle, while some snails express pigment more typical of surface-dwelling snails. Controlled crosses demonstrated that the lack of pigmentation is heritable and follows the pattern expected of a single recessive allele (albinism). The snail population in Illinois Caverns is entirely albino and individuals resemble one of the morphs seen in Fogelpole Cave. We tested reproductive isolation between pigmented Fogelpole Cave snails and Illinois Caverns snails by pairing immature individuals in no-choice mating experiments carried through to the F2 generation. The pairings produced fertile F1 offspring, indicating no reproductive isolation between lab colonies of the two populations. Over 1000 F2 embryos were screened and a 3 pigmented to 1 albino ratio was observed. Significant differences were observed in the hatching success rate of control crosses. Illinois Caverns snails had a high rate of embryo mortality with many embryos exhibiting an unusual, lethal behavior of twisting to the point of separating their head and foot from the visceral mass inside the shell.
- #97** **UG** **Using Automated Recorders to Study Social Calls of Insectivorous Bats in Siloam Springs State Park**
1:15pm
 *Ainslee Stroup, Jordan Morgan, Bryan Arnold [Illinois College]
 In addition to echolocation calls, which function as a form of autocommunication allowing bats to use sound pulses and returning echoes to navigate and identify prey in their nocturnal environment, bats also produce other sounds broadly termed social calls which can serve a variety of functions depending on the context. The goal of this project is to examine social call structure and function in free flying insectivorous bats using automated recorders which are triggered to record echolocation calls but also record other high frequency calls as well. This will allow us to examine whether certain types of social calls are more prevalent in a specific species of bat, in a specific habitat, and during a specific time of day or year. The area of study is Siloam Springs State Park in Clayton, Illinois. Wildlife Acoustics SM4BAT Recorders were deployed in various locations in the park including open habitat and closed forested corridors from May 16, 2022 until August 22, 2022. To analyze the recordings, we used a program called Kaleidoscope, which uses a call library to classify the recordings to species. During the analysis of recordings, files were marked if they contained a call that was not a normal echolocation call - i.e. a social call including constant frequency calls, upsweep calls, etc. Currently, we are focusing our analysis on files that contain echolocation calls identified to a single species so we can examine social call type and call structure across different contexts and prevalence of different types of calls in different species. While the project is ongoing, so far we have identified four different types of social calls, the most prevalent being quasi-constant frequency, in multiple species of bats from our initial field season and will report our current findings as it pertains to call structure and context.

#98 UG
2:30pm

Acoustic Structure and Variability of Distress Calls in Evening Bats (*Nycticeius humeralis*)

*Jordan Morgan, Bryan Arnold, Ainslee Stroup [Illinois College]

Distress calls are vocalizations produced by animals when faced with an impending predatory threat. From a behavioral perspective, the function of the call may vary and could be used to elicit help from a social groupmate, serve as a warning signal to stay away, or could startle or distract the potential predator and allow the individual to escape. The goal of this study is to analyze distress calls given by captured adult and juvenile evening bats, *Nycticeius humeralis*, to examine call structure and variability to explore hypotheses related to distress call function in this species. To collect recordings, we captured evening bats using mist nets, and from each individual we documented their age, reproductive status, forearm length, and weight. We also took a wing biopsy punch to extract DNA for future work correlating call similarity and genetic relatedness. Our distress call recording methods consisted of one researcher holding the bat within their hand, exposing the bat's mouth to receive a clear recording, and tapping lightly on the bat to agitate it enough to produce a call while the other researcher recorded the bat from a distance of 6 meters using an Avisoft UltraSoundGate microphone. We then analyzed these sounds in the Avisoft SAS Lab Pro Bioacoustics sound analysis program to measure and characterize calls into unique groups. Thus far, we have analyzed calls from 8 bats (1 adult and 7 juveniles) and found that distress calls contain elements that can be grouped into 8 different types of calls, with some being more common and frequent than others. This is an ongoing study, but future goals include a detailed analysis of call similarity both within and among different individuals and expanding the research to examine if there is any relationship between relatedness of bats and their calls produced.

ILLINOIS JUNIOR ACADEMY OF SCIENCE
REGIONAL WINNERS PRESENTATION ABSTRACTS
 1:15pm – 3:30pm, Saturday, April 15, 2023, in Renaissance Coliseum

- #101** **9th**
1:15pm **Grade** **The Effects of a Full Vs. Empty Stomach in Iron Absorption**
 Harmin Patel [Dunlap High School]
Purpose: To find out if the level of satiety in the stomach is related to iron absorption.
Procedure: My experiment was based around how the level of satiety of the stomach can affect the amount of iron absorbed. For my experiment, I modeled a control, a full stomach, and an empty stomach. For each trial, I would mix 2.46446 grams of almond flour into 10 mL of each solution in a test tube. After mixing I would start three stopwatches. At the 10, 20, and 30 minute marks, I would see how much iron was absorbed by using an iron test strip. I would repeat this process five times for a total of 5 trials. My results showed that the empty stomach was able to absorb 15 times as much iron as the full stomach.
Conclusion: My hypothesis was that if the level of satiety in the stomach is related to the amount of iron absorbed, then lower levels of satiety will lead to a greater amount of iron absorbed. After experimentation, it was shown that the lower satiety level performs better in iron absorption than the higher satiety level. This was most likely because there is more space and less food to digest in an empty stomach, making it more efficient than a full stomach.
- #102** **9th**
2:30pm **Grade** **Commercially Labeled Sports and Energy Drinks: Do They Work?**
 Agrini Neekhara [Dunlap High School]
Background: There is an everyday increasing number of commercially labeled sports and energy drinks in the market aimed at helping athletes and active people stay well hydrated and enduring. Electrolytes are important components of these drinks, they are necessary for adequate function of nerves and muscles. This study investigates the electrolyte concentrations of marketed sports/energy drinks vs. natural, every day consumed drinks.
Method: Eleven sports/energy drinks and fourteen everyday drinks were tested for electrical conductivity, which is proportional to the electrolyte concentration, using a multimeter. The multimeter measured the current, which was also proportional to the solutions' electrolyte concentration, closing the open circuit. Each drink went through three trials and the average current was recorded. Using the conductance equation, the electrical conductivity was determined for each drink. The results showed that most of the natural drinks had very similar concentrations, if not better.
Result: Out of all drinks tested, homemade salt/sugar water had the highest electrolyte concentration of 0.00590 S/cm, followed by coconut water, also a refreshing and natural drink. Furthermore, the top five natural drinks all had higher concentrations than the third most concentrated sports/energy drink (Body Armor).
Conclusion: Natural and widely-consumed beverages have nearly the same efficacy as commercially labeled sports/energy drinks based on electrolyte concentration.
- #103** **10th**
1:15pm **Grade** **Let Down Your Hair**
 Gloria Monteen [Trinity Academy]
Purpose: to determine if human hair could support the weight of a man.
Procedure: Preparation
 1. Tie one end of a hair strand securely around the hook on the scale
 2. Attach the other end of the hair strand to a paperclip (using a knot or tape).
 3. Pull gently on the hair, keeping close watch on the scale until the hair breaks.
 4. Restart with two hairs together adding more hairs each repeat.
 Hair donated from a family member; no safety issues due to the donation.
Conclusion: My test concluded that hairs can support more weight when they are pulled together. In this way, my hypothesis was confirmed. In keeping with my research, 500 hairs could hold 100 lbs. Likewise, 100,000 hairs could hold 19,842 lbs. This means that with her full head of hair, not only could Rapunzel lift a 155 lb man, but he could bring his 13,000 lb pet elephant with him. I would like to research this further by possibly testing a rope made out of hair or a braid to see if it could hold mine, or another's, weight.

- #104** **7th**
2:30pm **Grade** **Where the Rubber Meets the Road**
Patrick Swider [St. Athanasius]
- Purpose:** Which material out of the multiple tested will have the highest coefficient of static friction? This topic will be the most useful to roadbuilders, and track builders. The results and methods of this experiment will help to determine the best, safest material to use when building a track or a road.
- Procedure:** An apparatus-like ramp is built that can be positioned at different angles. A material and puck are then placed on the ramp. The ramp is then raised until the puck slides, then the height is recorded, and plugged into a formula to find the coefficient of static friction.
- Conclusion:** The hypothesis, if multiple different materials are tested to find which one has the highest coefficient of static friction, then wood will have the highest coefficient of static friction, because it has the roughest surface out of all the materials, was rejected because plexiglass had the highest coefficient of static friction out of all the materials tested. This can help the world, because by using the results and methods, it can determine the safest material to use in a road or track.
-
- #105** **10th**
1:15pm **Grade** **Advancing Agriculture: Using Leaf Architecture to Improve Crop Production**
Jordon Gully [Governors French Academy]
- Purpose:** Crops that do not receive enough sunlight due to overcrowding or other shadowing develop the need for shade tolerance in order to grow. The purpose of this project is to examine how crop growth responds to shade.
- Growing Cycle:** Secure greenhouse space to grow plants and record information. Get 2 5x10 cone trays and fill 3 rows each (with a row skipped in between them) with Metro 360 soil. Use a marker to create 50 (1 cm) holes in the soil. Take the 50 corn seeds (consisting of 10 seeds each of the 5 genotypes) and plant 25 total seeds (5 seeds of each genotype) in each tray. Once seed is planted, take additional Metro 360 soil, and add a layer of soil to cover the seed. After planting seed, take a plant tag, and label the crops as the following: genotype #; shade or sun (label condition of growth); initials (Example: 661 Shade J.G). Use a water source to moisten the plants every 3 days Record the following information on every water day: temperature (which is recorded through the Govee Hygrometer) and pictures of plants to record progress. Repeat steps 7 and 8 throughout the duration of crop growth (6 weeks).
- Harvest:** Retrieve the 2 5x10 cone trays with the finished crops, a camera, data record sheet and writing tool, and protractor. Harvest plant by gently pulling the bottom stem apart from the roots. When finished, place the plant on the table. Using a protractor, one will manually phenotype the plant by placing the protractor on the ligule region (the beginning of the stem meeting the leaf), then will move the swing arm of the protractor to record the angles of the 2nd and 3rd leaves. Record the following information on the data record sheet: 2nd leaf angle, 3rd leaf angle, and additional notes (condition of leaf, concerns, etc.). When finished, use a camera to take a picture of the plant and label it the following in one's google drive (or equivalent): Genotype # Plant # Sun or Shade Harvest Date (Example: 665_5_Sun_1-18-23). Repeat steps 2-6 for each plant. Use Image J software to record digital leaf angle. Record the digital leaf angle on the data record sheet. Repeat steps 8 and 9 for each plant.
- Conclusion:** The results of this experiment supported the hypothesis, but that really wasn't the mission behind this project. By 2050, our planet will consist of a population of nine billion inhabitants, which means that our agriculture must produce more food to support this population. This project didn't find a solution, but it opened up a potential solution through the growth of crops in shady environments. Through more research and the creation of more advanced technology in the areas of leaf angle measurement and crop growth, such as imaging softwares and genetic breeding. With such improvements, there will be no place where crops can't germinate and thrive.
-
- #106** **8th**
2:30pm **Grade** **The Effect of Different Materials on Sound**
Jack Snizek & Michael O'Malley [Ebinger School]
- Purpose:** Each year, millions of people lose their hearing due to high volume sounds, and it is important that action is taken about this to prevent hearing loss, and since different materials affect sound waves and sound volume differently, we wanted to see which material would muffle sound the best.
- Procedure:** To test how different materials affect sound, we used a Bluetooth speaker as a sound source. A decibel meter was used to measure the amount of decibels the sound had before and after the material being tested was placed around the speaker. The experiment tested materials such as paper, paper towels, aluminum, plastic, cotton, glass, cardboard, wood, a ziploc bag, bubble wrap, and a shirt. For each trial, the decibel meter was held in a different position. Trial 1 had the decibel meter held at the side of the speaker, trial 2 had the speaker held at an angle, and trial 3 had the decibel meter held directly above the speaker. After all the data was collected, we found the average amount of change for each material.

Conclusion: Glass was able to muffle sound the best, followed by wood and cotton balls. The popped bubble wrap had the least effect on sound, followed by the shirt, aluminum, and paper towels. Glass and wood both reflect sound and keep it contained, while cotton was the best at absorbing sound out of all the materials. The popped bubble wrap allowed air to move, which allowed sound to escape from the enclosure.

#107 **11th**
1:15pm **Grade**

Regional Variation in Wind Impact on Sea Ice

Sofia Weber [Northside College Prep]

Purpose: The purpose of this experiment is to determine whether the strength of the Southern Westerly Jet has a statistically significant effect on the sea ice extent in each of the five different sectors of Antarctica during the austral autumn.

Procedure: The procedure involved gathering data on regional Antarctic sea ice extent and Southern Westerly Jet strength covering the satellite era (1979-2018). Linear regression analysis was performed using the two variables for each of the five sectors of Antarctica and for the entire continent as a control group. The resulting coefficients and p-values were analyzed.

Conclusion: Statistically significant effects of Southern Westerly Jet strength on sea ice extent in austral autumn were found for the Amundsen-Bellingshausen sector and the East Antarctica sector, but with Amundsen-Bellingshausen exhibiting an inverse relationship and East Antarctica exhibiting a direct relationship. Marginally significant effects were found for the King Haakon sector, which neighbors East Antarctica and also had a direct relationship. This implies that if the Southern Westerly Jet continues to strengthen over time, the sea ice extent in austral autumn can be expected to decrease to the west of the Antarctic continent and increase to the east of the Antarctic continent.

#108 **12th**
2:30pm **Grade**

The Point Is...

Ellynn Clover-Crowden [Agape Christian High School]

Purpose: The purpose of this design investigation is to create a reusable continuous glucose monitoring device.

Procedure: After programming the sensor with the necessary codes to read the interstitial fluid in the blood and designing an app to retrieve and report this data, the sensor cover and applicator were designed using CAD software and printed using PLA on a 3D printer. It is important to note that in accordance with the Illinois Junior Academy of Science rules and regulations, no human cultures, including blood, were used to test the accuracy of this device. Instead, the device's accuracy was tested using a synthetic controlled, calibration liquid.

Conclusion: This design investigation was conclusive in creating a sustainable, budget-friendly, and user-friendly continuous glucose monitoring device. By creating a reusable applicator and rechargeable sensor inside a sealed cover, the only disposable piece of this device is the enclosed needle, adhesive, and wire. Recyclable options were also offered to encourage sustainability. By creating the sensor to be rechargeable and other pieces reusable, costs were cut. The device reports the data from the interstitial fluid onto an app. However, because of how the accuracy was tested, a MARD percentage could not be calculated; thus, this is not a considerable factor of the device. The device's accuracy was tested using a synthetic controlled calibration liquid.

#109 **9th**
1:15pm **Grade**

***C. elegans* APL-1 Protein Response to Caffeine as a Model for Human β -AMYLOID Peptide for Alzheimer's Disease**

Sahana Garapati [RISE STEM Research Institute]

Purpose: The purpose of this research was to investigate if exposure to caffeine induced a decrease in the protein APL-1. APL-1 has been established to be similar to the human peptide beta-amyloid (β -amyloid) in terms of pathways. β -amyloid accumulates in the brain resulting in Alzheimer's disease (AD). Studies show that caffeine reduces β -amyloid production, and if APL-1 was decreased by caffeine, then it would demonstrate that the protein may be an equivalent of β -amyloid in research. This research is especially important, as AD research is dependent on using expensive β -amyloids, and APL-1 can be an accessible and cheaper model to use.

Procedure: The procedure started by creating agar plates that were separated into different concentrations of caffeine as an independent variable: a low dosage of 10mM, a medium dosage of 20mM, a high dosage of 30mM, and a control group with no caffeine were created for the worms to live on. After exposure to caffeine, APL-1 production was monitored through growth and longevity as the dependent variable.

Conclusion: Overall, the p values were significant at ($p < 0.0001$) when the treatment and control plates were compared. The statistical tests also revealed a lack of significance at ($p = 0.3593$), between the 20mM and 30mM plates, showing a clear difference between high and low concentrations of caffeine affecting APL-1. These results were also observed in best-fit lines and trend progressions. These pieces of evidence ultimately support the experimental hypotheses and reject the null hypothesis.

Keywords: Alzheimer's disease, APL-1, β -amyloid, caffeine, model

- #110** **11th**
2:30pm **Grade** **Human Body Detection with Occlusion**
Aditya Prashanth [Illinois STEM Society]
- Purpose:** The purpose of this design experiment was to attempt to determine the accuracy and possibility of using Kalman filters to approximate a human's location when blocked by an occlusion/obstacle or out of the stereo camera's point of view. This could potentially be implemented in the field of human-robot interaction to allow robots to help contribute to human goals without interference. Additionally, the outcome of this research project could similarly result in more accurate measurements for human- body detection.
- Procedure:** This project consists of the following two different procedures: 1) design steps of solution, 2) testing final design iteration. In order to construct the hypothetical solution to the project, the first procedure must be followed, but to test out the solution, the investigator should follow the steps of procedure number two. Each procedure is extremely descriptive, explaining the several different steps to building and testing the experimental solution precisely with specific details.
- Conclusion:** Based on the results of the experiment, the problem statement was proved inconclusive due to both positive and negative results. Throughout all the data collected and graphs constructed, the Kalman filter's average mean-squared errors were never concretely/always lower than those of the ZED depth camera. The project's findings reveal the inconclusive and ambiguous behavior of the Kalman filter, indicating more trials and testing is needed for a concrete determination.
- #111** **11th**
1:15pm **Grade** **The Impact of Cyanobacteria on the Rate of Regeneration of Planaria to Determine Novel Antiproliferative and Cytotoxic Compounds for Development of a Novel Cancer Treatment**
Anika Sudhir [RISE STEM Research Institute]
- Purpose:** This experiment investigated the anticancer and cytotoxic compounds found in freshwater cyanobacteria for development of new cancer treatments by testing cyanobacterial solutions on bisected planaria and monitoring the rate of regeneration. There are needs for novel pharmacological agents that provide less severe side effects and higher efficiency in killing cancerous cells than traditional therapeutics.
- Procedure:** 6 groups were created– 4 experimental groups (A-D) containing cyanobacteria and 2 control groups. The positive control group contained water and Prazipro, while the negative control group contained spring water. The 4 experimental groups contained *Anabaena*, *Microcystis*, *Cylindrospermum*, or a mixture of *Anabaena* and *Microcystis*. Planaria were bisected and an image was taken of each head and tail before they were placed into one of the six groups. The groups were left for 4 days, after which images of the planaria were taken again. The before and after images were measured in order to ascertain the rate of regeneration.
- Conclusion:** Cyanobacteria did inhibit the rate of regeneration of bisected planaria (ANOVA $p \leq 0.05$ at α 0.05). The group exposed to *Anabaena* and *Microcystin* demonstrated promising results (t -test p , 0.06) with their novel dual-pronged mechanism of action inhibiting planaria growth more than the control group. All bioactive compounds in this experiment (anatoxin-A, microcystin, and cylindrospermopsin) demonstrate promise for novel anticancer treatments that have promise to produce higher efficiency and less side effects.
- Keywords:** Cyanobacteria, anticancer, antiproliferative, planaria, dual-prong
- #112** **12th**
2:30pm **Grade** **Smarter Farming Through Programming**
Vibha Srikanth [Illinois STEM Society]
- Purpose:** In order to initiate a procedure so a computer can conclude the fraction of ground covered by vegetation, using the color histograms of a bird's-eye picture of that specific area, finding an algorithm to distinguish healthy vegetation from areas that have stopped reproducing is crucial.
- Procedure:** Developing an algorithm that a computer can use to differentiate two different colors, and then testing that algorithm on both pictures of construction paper and environmental images. Then, analyzing the histograms on an image editing program to determine the different intensity levels for each image. When looking at the histograms, if the graphs shift rightwards, that means it had a lower intensity, but if it moved to the left, then that meant it had a higher intensity level. After looking at these graphs the algorithm found stayed constant, when the intensity levels changed. This algorithm to determine the amount of green in the image has to be between 140-180.
- Conclusion:** Based on the results, If images of various combinations of construction paper such as solid green, solid brown, half green with half brown, were put into an algorithm for an image editing program to process the fraction of that image covered in green, then the results would be 100%, 0%, and 50%. This is due to the fact that an image of solid green would have a higher green channel intensity value on the histogram, rather than a darker shade such as brown, which would have a lower green channel intensity value, when detecting the level of healthy vegetation on a plantation.

Conventional Paint vs Natural Alternative: Impact on Water Quality Over Time

#113 **11th**
1:15pm **Grade**

Vignesh Tiruvannamalai [Illinois STEM Society]

Purpose: The purpose of this experiment is to analyze how commonly used exterior paints (latex and acrylic) impact water quality, and how they compare to natural paint alternatives (turmeric, henna, and beta—carotene based food coloring that have been waterproofed with beeswax). This can help assess the impacts of current conventional paints and identify inexpensive natural components that could be used in new paint.

Procedure: The two types of conventional paints were applied to two wooden craft boards each, and left to dry. The natural paint alternatives were prepared and applied to two boards each as well, left to dry, then coated with beeswax and left again for the beeswax to dry and harden. Each prepared board was placed in its own tote with 2.5L of tap water (after baseline tests were conducted) and all these totes were tested for pollutants every day until the eighth day. There was also a control group of two totes that were only filled with water and tested along with the other totes.

Conclusion: The acrylic paint had the greatest impact on water quality, followed by the latex paint, henna, beta carotene food coloring, and the turmeric. From the results, the acrylic paint and latex paint were determined to be poor at maintaining safe concentrations of chemicals in drinking water, but turmeric was established as a persistent yet safe coloring agent that has strong potential for application in paints.

#114 **11th**
2:30pm **Grade**

Impact of Airfoil Design on Lift

Aditya Sundar [Illinois STEM Society]

Purpose: The purpose of this experiment is to determine the effect of an airfoil's max camber percentage on the amount of lift it produces using a wind tunnel.

Procedure: Open up the airfoil tools website for airfoil design and download the Onshape CAD software for airfoil creation. Create the NACA 3520 airfoil (3% camber, 50% camber position, and 20% thickness) on airfoil tools and save the data points as a dat file for use in Onshape. Once installed, open Onshape and create a new file. Download the profile generator tool. Input the NACA 3520 into the profile generator and extrude the airfoil shape 2 inches to make the airfoil 5in by 2in. Once the airfoil is made, create a 1in by 0.3in mount attached underneath the airfoil with 0.08in diameter holes for the screws. The mount is used for mounting the airfoil onto the wind tunnel and keeping it secure. Extrude the mount 0.3in down to make the two holes 0.3in deep. Repeat these steps for the 2 other airfoils with camber 6 and 9 percent respectively. Once made, attach the airfoils to the wind tunnel and make sure they are properly fastened. Start the tunnel and keep it running for 10 seconds, then stop it. Print the Angle of Attack vs Coefficient of Lift graphs for all 3 airfoils and manually calculate the average lift generated for all 3 airfoils. Create and analyze graphs and data tables based on collected data.

Conclusion: The purpose of this experiment is to determine the effect of an airfoil's max camber percentage on the amount of lift it produces using a wind tunnel. The hypothesis is that if 4 3D printed airfoils are made, each having a different max camber percentage value (3%, 6%, and 9%), and tested under the same conditions at a 15 degree angle of attack in a wind tunnel, then the airfoil with the highest camber value (9%) will produce the highest lift coefficient. This is because the air that flows over the curved upper surface has to travel a longer distance than the air that flows along the lower surface, increasing speed. This increased speed results in a decrease in air pressure on the upper surface and an increase in air pressure on the lower surface. The difference in air pressure creates lift. By curving the airfoil even more (increasing the camber) a difference in air pressure is increased and thus lift produced is increased.

#115 **10th**
1:15pm **Grade**

Does Fish Type Impact the Effectiveness of the Aquaponics System

May Sughayar [AQSA School]

Purpose: The purpose of this experiment is to see which fish in the aquaponics system will grow the watercress seeds taller?

Procedure:

1. Set up both fish tanks and leave running for 1 day.
2. Set up both tank covers with 6 holes on the top for each tank.
3. Fill 3/4 of the 12 cups with holes with clay pebbles
4. Take 12 cups and make holes at the bottom.
5. Label one cup gold 1, one with gold 2, one with gold 3, one with gold 4, one with gold 5, one with gold 6, one with cat 1, one with cat 2, one with catfish 3, one with catfish 4, one with catfish 5, one with catfish 6. (make sure all the cups with cat or gold have holes on the bottom.)
6. Label 6 additional cups Soil 1, 2, 3, 4, 5, 6 and add soil in those cups.
7. Split the 12 packs of watercress seeds in half and add half of each pack to each cup.
8. Purchase or obtain goldfish and place them into tank 1. Purchase or obtain catfish and place them into tank 2.

9. Seal the tanks with the tank caps.
10. Add the 6 cups that say Gold onto the pre-cut hole in the cap of tank 1 and cups 6 that say cat onto the hole in the caps of tank 2.
11. Position the cups that say soil next to the tanks and add a sunlight lamp.
12. Feed fish twice a day once in the morning and night and feed the plants with soil one time per day (in the morning).

Conclusion: The data of this experiment supported the null hypothesis because the goldfish in tank 1 grew the watercress seeds taller than the catfish in tank 2.

#116 **12th**
2:30pm **Grade** **The Development of a Mobile, Arduino-Based Water Quality Testing Apparatus**
 Macy Putnam [Southeastern High School]

Water quality describes the condition of water based on its chemical, physical, and biological state. Poor water quality poses health risks to humans and the environment, causing disease, an imbalance in the ecosystem, and even death. Water sources across the globe have been negatively impacted by pollution, climate change, and human tampering. Water quality meters need to be more accessible and easy to use in order to monitor water quality globally. A prototype buoy with sensors to measure pH, turbidity, and conductivity was designed using a 3d printer. After the prototype was constructed, multiple redesigns were constructed to improve upon the design's efficiency. The initial torus shape was replaced with a polygon. Once the container and floatation device passed the test for water tightness and floating capabilities, it was assembled and placed in water. The water quality sensors tested the quality of two different ponds and tap water. Multiple readings confirmed the ability of the sensors to take consistent readings for pH, turbidity, and conductivity in all three water types. Aside from the initial cost of \$399 for the 3d Printer, the cost of printing the container and floatation device was under \$5, and the cost of all sensors and electronic parts was \$126, making this a low-cost water quality testing device that is easy to construct and use. Future design adaptations and testing is needed to include sensors to collect additional water quality data. In addition, adding a GPS component would increase understanding of a large body of water being tested.

#117 **10th**
1:15pm **Grade** **Preventing Soil Erosion**
 Eman Abdelal [AQSA School]

Purpose: The purpose of this project is to test which methods are best for combating soil erosion. Excessive soil erosion can cause significant damage to the environment, wildlife, and human health, well-being, and economic prosperity. Erosion has become even more destructive over time due to factors associated with human activities such as logging, overgrazing, and deforestation.

Procedure: Use an X-ACTO knife to cut one side of the bottle and add the same amount of soil in each bottle, then add houseplants in one bottle, grass seeds in another, rocks in the next bottle and remember that the last bottle is only going to have soil. Then you will repeat this step with 8 other bottles. Next you are going to add water to each bottle, hold them at an angle and take off the bottle caps, so that the water can pour into the catching containers. Once there is no more running water, take the water in the containers and then pour the water on the strainer to strain out all of the water. Then, take that soil and measure it using a scale. This step will be repeated for each of the bottles for a total of four days. Document your results.

Conclusion: Soil erosion is a problem that affects our environment and finding solutions to this issue is important to the growth of food on Earth. The data of my experiment supported my hypothesis that soil erosion can be prevented or slowed by plants. The bottles with potted plants and grass that grew from seeds, showed very little soil loss. The roots of plants hold tightly onto the soil and the roots also soak up water, In the real world. Rain would be soaked up by plants and trees. Topsoil is needed to grow all the food we eat.

#118 **7th**
2:30pm **Grade** **How Does Color Absorb Heat?**
 Clare Blasgen & Maria Diagiantis [St. Mary Immaculate – Plainfield]

Purpose: The purpose of this experiment is to determine how colors affect thermal energy.

Procedure: Before we began we made sure to cover up all airways and vents to make sure our experiment was not affected by the blowing air. First, we took nine mason jars and wrapped them each in a different color leaving one clear. Then, we filled each jar with 350 mL of water at room temperature and recorded the beginning temperature of the water. Next, we set the jars near a sliding glass window exposed to the sun for 120 minutes, taking the temperature of the water at 30 minute intervals and computed the difference between the beginning and ending temperatures. We did a total of 5 trials on 5 different days at the same time.

Conclusion: The hypothesis stated that if a glass mason jar of water is wrapped with different colored paper, then the glass jar of water wrapped in black will absorb the most heat. Our hypothesis was correct because our results showed that the water in the black jar absorbed the most heat and became the hottest. As shown in Data Table 1 and Graph K, the average temperature difference between the beginning and ending temperature of the water in the black jar was 9.54°C, meaning that the temperature of the water in the black jar increased 9.54°C over a 120 minute period of time. The jar of water that showed the least change in temperature was the jar wrapped in yellow with a change in temperature of only 2.22°C. Our results showed that the jars wrapped in darker colors (black, green, blue, and purple) had the greatest temperature differences because they absorbed the most light which caused them to heat up more. On the other hand, the jars wrapped in lighter colors (white, red, orange, and yellow), had the least temperature differences because they absorbed the least amount of light, causing them to not heat up as much.

#119 **8th**
1:15pm **Grade** **Mycelium: Powerhouse or Parasite? Testing the Effects of Mycelium on *Zea mays* and *Raphanus sativus***

Grace Stevens & Morgan Wilcox [Southeastern Junior High School]

Purpose: This experiment aims to determine the effects of different concentrations of mycelium on common crops. Specifically, the colonization of mycorrhizal fungi in the roots will be measured and compared to the growth of corn (*Zea mays*) and radishes (*Raphanus sativus*) exposed to various concentrations of Myco Bliss (a concentrated mycorrhizal fungi inoculant).

Procedure: Label 8 plastic pots with the following labels: Control (no mycelium), 10 ml (recommended amount), 20 ml, and 40 ml (one set for *Zea mays* and one set for *Raphanus sativus*).

Fill each pot with 2,500 ml of soil. Add Mycelium to the appropriate pots. Plant the seeds. Water each pot with 300 ml. Monitor moisture meter and water all pots equally as needed. After four weeks of growth, remove the plants from the pots and shake off excess dirt. Cut the plant where the roots connect with the above-ground plant using scissors. Take measurements of the *Zea mays* number of roots, length of the longest root, root biomass, stem biomass, number of leaves, and stem length. Take measurements of the *Raphanus sativus* root length, root biomass, stem biomass, number of leaves, and stem length. Record the results. Using the above procedures, conduct four more trials. Average and graph the results using Microsoft excel. Calculate the standard deviation.

Conclusion: Overall, there was no correlation between the amount of mycelium and the stem and root growth for both species of plants. The calculated standard deviation shows no significant difference in the development of *Zea mays* and *Raphanus sativus* with the various amounts of mycelium added to the soil.

#120 **12th**
2:30pm **Grade** **The Comparison of the Force Generated by Four Different Iterations of 3D-Printed Aerospike Nozzles Using Water Pressure**

Aidan Piper [Althoff Catholic High School]

Purpose: The testing, analysis, and comparison of four aerospike nozzles in order to see if 3D-printed aerospikes of slightly different design produce a significant difference in thrust.

Procedure: All required materials stated in the materials section needed to be available before assembly and testing can commence. The 3/4inch PVC "tee" is plugged at one end and the aerospike nozzle being tested inserted at the other with rubber bands being placed around the outside of the nozzle's outer casing to act as an O-ring. The nozzle should fit tightly into the PVC tubing. A straw is then glued and/or taped to the outside of the PVC aligned parallel to the spike and plug. A hose is then inserted into the remaining opening of the PVC tubing. The rest of the testing platform is a series of clamps, wood, and cinderblocks with the force sensor clamped onto the wood which itself is clamped to the cinderblocks. A metal rod no larger than 6.35mm (¼ inch) in diameter is affixed to the force sensor and the rest of the platform by clamps. The final configuration should have the PVC tubing and its related components resting on the rail with the plug making contact with the force sensor when water is flowing through the system and the resulting force data being transmitted to the LabQuest box connected to a computer running Graphical Analysis. 10 trials were conducted for each nozzle and then analyzed.

Conclusion: Design D overall performed the best as, with a 95%confidence rate, the true average force generated was greater than any other design. Even with a noticeable overlap between the true averages of Designs A, B, and C, an ANOVA Test gave a P-Value significantly less than .05, justifying the rejection of the Null Hypothesis that the averages are equal. Thrust values increased with each iteration of the nozzle but Designs A, B, and D possessed a higher level of variation. Design C performed the most consistently and therefore should be considered for further secondary studies alongside Design D, which should be given primary attention and resources towards its further development.

3D Printed Rubics Cube Solver

#121 **10th**
1:15pm **Grade**

Colin Gerlock [St. Jude Catholic School – New Lenox]

Purpose: Can a robot be built that is able to solve a Rubik’s Cube without too much difficulty? If such a robot can be built, how long will it take for the robot to solve the puzzle? The hypothesis is that such a robot can be built and will take 30 seconds to fully solve the Rubik’s Cube.

Procedure: I will start by 3d printing all the 3d printed parts and having my parents the mechanical hardware. Next, I will sand down the 3d printed parts that have rough edges and the parts that go into each other to make them smoother using a power sander and sandpaper. I then assembled the 4 “arms” using 3d printed pieces, 2 types of servos, and metric bolts. Of course, we will have to do this 4 times to make 4 arms. We will then connect all 4 of the arms together using 3d printed “8 corners” and align the legs together and secure with 3d printed nuts. I will put the 3d printed “short bolts” into the 2 top corner slots and secure with 3d printed nuts. Next, we will screw a 3d printed “short rod” into the heads of the short and long bolts and then screw 3d printed “long rods” into designated slots on the 3d printed camera holder. We will then connect the pairs of short and long rods together using 3d printed “clamp halves” as well as attach the grippers to the DS3218 servos using metric bolts. Finally, we will insert the webcam into the slot in the camera holder. Next, we will attach the wires of the servos into the mini Maestro servo controller accordingly to their given channels and attach the jumper wires from the mini Maestro to the power supply and the Maestro controller to the Apple Laptop. Next, we had to calibrate the servos in a trial and error process. We then had to pay the company money on PayPal to get the unlimited version of the Rubik’s Cube software. After we had the full software, we scrambled Rubik’s Cube and tested the robot a few times. Success! I then scrambled the cube 10, 25, 50, and 100 moves and recorded how long it took each time. I did this 10 times for each time and got an average time of how long it took to solve the cube.

Conclusion: The Hypothesis was correct. It was possible to build a robot that is able to solve a Rubik’s Cube by 3d printing some of the parts and using special software that can solve the Rubik’s Cube. However, the hypothesis was incorrect in how long it took the robot to solve the Rubik’s Cube. All of the recorded times were around 3 minutes, much greater than the times in the hypothesis that stated that the robot would solve the cube in under a minute. The process was much more complicated than it looked and used various different steps to solve the cube.

#122 **12th**
2:30pm **Grade**

Where did the Disc-Go?

Alex Hampton [Althoff Catholic High School]

Purpose: Discovering which design features on a disc golf disc influences the parts of its flight, and how it influences the flight numbers.

Procedure: Acquire discs with similar but different flight numbers, determine the dimensions of the discs using online resources and physical measurements, and compare their flight patterns using publicly available flight paths online and physically throw them with proper form. To test the discs, find a football field or an open field to safely throw discs. Then, use a camera to record the throw and flight path from behind the throw. Draw a centerline over the video to approximate how far left and right the disc deviates.

Conclusion: The speed of the disc is determined by the thickness of the rim. The glide mostly depends on how much of a dome the disc has on the flight plate. The stability, or turn and fade, rely on the shape of the cross section of the rim and how flat the flight plate is.

#123 **12th**
1:15pm **Grade**

Efficient Generation of Arbitrarily Bounded Random Integers

Alexander DiGiovanni [Althoff Catholic High School]

Purpose: To create an algorithm to generate random numbers in an arbitrary range with uniform probability, given a function that generates random bits (or equivalently, random integers in $[0, 2^n)$). Ideally, the algorithm should minimize costly operations to optimize runtime.

Procedure: First, design the algorithm in pseudocode. Implement the algorithm in a function (the language I chose was Rust) that accepts an input n for the upper bound, and returns a random nonnegative integer less than n . Then, run tests (generate a large set of random numbers, verify that the results are uniform, and keep track of metrics like benchmark timings). If the design is biased or exceptionally slow, revise it. Create a mathematical model that describes the probability that the algorithm needs to consume another random word to compare with an existing algorithm.

Conclusion: The algorithm I came up with is similar to Stephen Canon’s Swift algorithm, but, like Lemire’s, it is certainly uniform and can sometimes consume just one random word (of 64 bits). It uses only multiplication, bitwise operators, and addition, so it avoids the modulo use in Lemire’s algorithm. The benchmark results were interesting; they were mostly quite close, with mine being faster for some orders of magnitude, while Lemire’s was faster for others; interestingly, both were somehow slower for $n = 10$ than $n = 100$. The mathematical model

shows that my approach is optimal if the random bit generator is sufficiently fast, since it will never use the modulo operator.

- #124** **11th**
2:30pm **Grade** **Comparing Importance of Dopamine Receptor Types in PD Treatments**
Jad Dibs [Niles West High School]
- Purpose:** Parkinson's disease (PD) is a neurodegenerative disease that causes motor and non-motor dysfunction symptoms; PD is caused by a lack of dopamine and in turn results in a lack of dopamine receptor function. The purpose of this experimental investigation was to discover which dopamine receptor types, from D1 to D5, are most important for dopamine agonists (PD treatments) to bind to in order for the agonists to be most effective at increasing dopamine receptor function and thus relieving Parkinson's disease symptoms in *C. elegans*. Pramipexole represents a dopamine agonist that binds to D2 to D4 receptors; rotigotine represents a dopamine agonist that binds to all receptors (nonselective). The dopamine receptor function of *C. elegans* will be measured using basal slowing, a locomotive food behavior; basal slowing was calculated using the speed of the *C. elegans* in the presence of a bacterial lawn.
- Procedure:** *Caenorhabditis elegans* with a par-1 gene deletion strain (strain which modeled Parkinson's disease; abnormal dopamine receptor function) are placed in petri dishes or groups with varying concentrations of pramipexole and rotigotine. One control group is a petri dish with the par-1 gene deletion strain *C. elegans* and the other control group is a petri dish with N2 wild type strain *C. elegans* (normal dopamine receptor function). The speed of the *C. elegans* in the presence of a bacterial lawn is periodically recorded under a compound microscope and a ZOE Fluorescent Cell Imager. If the *C. elegans* in concentrations move more slowly and more similarly to the N2 wild type strain *C. elegans* control group, their dopamine receptor function is shown to be more effective.
- Conclusion:** The data collected in the experiment supported the hypothesis. Compared to the *C. elegans* with pramipexole concentrations, the *C. elegans* with rotigotine concentrations had a lower average speed and in turn a more normal basal slowing response. Thus, rotigotine resulted in more effective dopamine receptor function than pramipexole. Since the cause of rotigotine's higher efficacy is likely due to its nonselective property, it can be implied that binding to all receptors with a similar or greater affinity compared to rotigotine increases the effectiveness of dopamine agonists.
- #125** **9th**
1:15pm **Grade** **Detection and Evaluation of Skin Cancer with Image Processing**
John Almos & Drew Wang [Edwardsville High School]
- Purpose:** In this project, machine learning was used to make discovering skin cancer much more accessible and reliable. We developed a model to predict the likelihood that the cancer is Basal Cell Carcinoma, Melanoma, Squamous cell carcinoma, or none of the ones listed. This algorithm can be used to determine whether someone has a specific case of skin cancer and can be used in the medical field to help predict skin cancer at an earlier stage. As well as diagnosing the type of skin cancer, we were also able to match each case with an age range to give treatment ideas based on the age. This can also be useful in determining treatment options.
- Procedure:** We used the Python library Tensorflow to build a Convolutional Neural Network model to predict and classify any given image in one of the listed categories. The most optimal result for the skin cancer classification was accuracy over 80%. On top of this, with available metadata, statistical analysis was performed on the distributions of age with their corresponding type of cancer. Through experiment it was made evident that age directly affects the appearance of the tumors. In just 40 epochs there was an increase of over 10% in the accuracy, resulting in an accuracy of ~53%.
- Conclusion:** In all, we used a convolutional neural network to predict and classify the age of the image, and whether the image contains a cancer tumor. This model can be used in the medical field to help diagnose and treat skin cancer.
- #126** **10th**
2:30pm **Grade** **The Effects of Salinization on Plant Growth**
Akosua Haynes [Walter Payton College Prep]
- Purpose:** In this experiment, saltwater and its effects on plant growth were investigated. As a result of climate change, the rate of global sea level has increased to 3.9 millimeters per year. Saltwater's negative effects on crops include leaf burn and reduced growth. Understanding the mechanisms of salinization, saltwater intrusion, and how to grow plants under these conditions is crucial to the future of global food production.
- Procedure:** *Brassica rapa* seeds were planted in a soilless mixture of sphagnum and perlite; watered using a wicking hydroponic bottle system; and fertilized with either NPK, eggshells, or coffee. 12 out of 18 plants were grown in a homemade light box made with milk crates, aluminum foil, and a full spectrum growth light bulb. As the plants grew larger, they osmotically absorbed water from the reservoir, and when necessary, had water

added directly to the soilless mixture. Plants were checked daily and height measurements were taken multiple times throughout the plant's life cycle.

Conclusion: Saltwater negatively affected the germination of the *Brassica rapa* plants. The saltwater plant groups did not germinate. The addition of the 3 types of fertilizer had no effect on the saline groups. The *Brassica rapa* plants grown with NPK fertilizer and distilled water grew the tallest. An average of 10 cm taller than the eggshell group. The coffee plus distilled water group did not germinate. This could be due to high nitrogen levels in coffee.

#127 **11th** **Airfoil Design with Computational Fluid Dynamics**
1:15pm **Grade** Henry Bao [Walter Payton College Prep]

Purpose: In many industries, there is a need to model the flow of air over structural components. With sufficient information from these models, engineers can better implement these parts into a complete design. The purpose of this paper is to provide a model of specific airfoils using computational fluid dynamics (CFD). With computational fluid dynamics, the characteristics of air around an airfoil can be modelled providing useful data to engineers who could be designing an airfoil or airplane.

Procedure: The CFD calculations are performed using Python along with two packages Numpy and Matplotlib. The governing equations of CFD, including Newton's Second Law, small disturbance equation (SDE), wave propagation, etc. are discretized and transformed into partial differential equations (PDE) using the second order derivative of the wave propagation PDE, the SDE can be solved in iterations and plotted on a graph showing the velocity distributions for a particular airfoil.

Conclusion: The results from the CFD calculations showed general trends in velocity distributions regardless of airfoil shape these include a decrease in x-direction velocity at the ends of an airfoil with an increase in the midsection of the airfoil. Also y-direction velocity is generally positive and increasing at the front of the airfoil, but negative and decreasing at the end of the airfoil. What is important to understand is how different airfoil shapes can change velocity distributions moving to using 3D CFD calculations and the possibility of using CFD for modeling air flow over a multitude of objects.