INDIANA ACADEMY OF SCIENCE

138th Annual Academy Meeting

March 18, 2023
J.W. Marriott Hotel and Conference Center
Indianapolis, IN

Program Book

The Indiana Academy of Science has been an important voice of Indiana science since its inception in 1885.

The Indiana Academy of Science continues to enjoy a high professional stature with a membership that includes many of the states' leading scientists from industry and academia, science educators, and science graduate and undergraduate students. It is a non-profit organization with a threefold mission: 1.) promoting scientific research and diffusing scientific information, 2.) encouraging communication and cooperation among scientists, and 3.) improving education in the sciences

The Academy accomplishes its mission by providing opportunity for scholarly exchange through the Annual Academy of Science Meeting – showcasing the research and scientific work of Indiana's scientists, science educators, and Indiana graduate and undergraduate college students; as well as that of invited nationally recognized scientists and others whose work is related; **publishing the celebrated *Proceedings* of the Indiana Academy of Science,** the biannual journal of peer reviewed papers authored by Indiana's scientists (and scientists from the Midwest) --in circulation since 1885 in print, and available online since 2012; **publishing books and special publications and the quarterly Academy Newsletter**; **awarding Indiana Academy of Science Senior Research Grants** to Academy members and graduate and undergraduate science students; **awarding the Indiana Academy of Science Winona Welch Award for Botanical Biodiversity Research Grant**; **offering the Science Talent Search Program** to support the preparedness of Indiana high school students; **partnering Indiana Science Educators** (9-12th grade high school science and math teachers) **with Academy senior scientists**; **cooperating with Indiana community organizations** to reach greater Indiana with public education; **and conducting Bio Blitz field studies.**

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Zhihai Li

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Plant Systematics and Biodiversity: Collin Hobbs (Chair); Richard Hull (Vice Chair)
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Zoology and Entomology: Warren Pryor (Chair); Glené Mynhardt(Vice Chair)

President's Welcome

Welcome to the 138th Annual Indiana Academy of Science Meeting!

Thank you for attending today. You're among the 300+ attendees that make this meeting the largest and longest-running multidisciplinary scientific meeting in the state. This year, we have some very interesting topics being explored by our plenary speakers, *Hot Topic* presenters, and **nearly 200 research presentations!** Some of these presentations are within our newly founded section, *Conservation, Sustainability, and Land Management*. I highly encourage you to check that out during your busy day.

The IAS Council has been hard at work preparing for this year's meeting and that includes bringing back the much-loved student awards! This year, we will have the *Emerging Scientists Research Student Poster Competition* that will result in winners receiving awards (which, of course, includes money!) from each section grouping or section. Next year we hope to continue this tradition and expand it to include oral presentations.

We are honored to have a fellow Canadian, Dr. Ed Squires, as this year's keynote speaker. Dr. Squires is an influential ecologist who has taught biology for over 40 years, has published dozens of peer-reviewed scientific papers and technical reports, and has served on the Indiana Pollution Prevention Board, the boards of the Indiana Heritage Trust and The Nature Conservancy, and multiple IAS committees, including as a past-President. Be sure to stick around for his talk, *What is this Thing called Science?*, during lunch.

As usual, we will have two large time slots dedicated to research talks, *Hot Topic* presentations, and a workshop. This year, our *Hot Topic* presentations include an exploration of the "Meet-a-Scientist" project run by our past-President, VJ Rubenstein, an explanation of how x-rays and pressure may be used to create new materials and understand how chemicals react, a deep dive into therapeutics and a vaccine for the current RSV that has plagued our nation, an update on the most recent climate change data and what it means, and an introduction into the newly founded Global Center for Species Survival at the Indianapolis Zoo. More *Hot Topics* include a primer on mussel conservation and disappearance (cheekily-named *The Silence of the Clams*), and investigations into cell-signaling, autophagy, and disease mapping. Moreover, we have a much-anticipated workshop on the identification of grasses, sedges, and rushes by two of our state's most esteemed botanists, Nathanael Pilla and Scott Namestnik.

I would like to offer thanks to all of the Section Chairs and Vice-Chairs as well as the several IAS committee Chairs and members who put in countless hours of unpaid labor into ensuring that this meeting is planned well and contains a significant amount of interesting content for our members. Let it be known that your work in our organization is recognized, respected, and highly appreciated. A big thanks is also due to our executive director, Dr. Delores Brown, and our administrative assistant, Linda Buff, for much of the planning that went into making today's meeting possible. Finally, thank you again for attending today and thanks to the presenters for sharing your work with us. I look forward to interacting with you all today.

Sincerely,
Marc A. Milne, PhD
President, Indiana Academy of Science
Associate Professor, University of Indianapolis

IAS Meeting Etiquette Guide and Tips for a Successful Meeting

The Indiana Academy of Science welcomes you to our annual meeting! Whether you are a first-timer or a seasoned meeting attendee, we are excited to have you with us today.

The best meetings are ones in which each participant engages deeply with the science, meets new colleagues, and is exposed to new ideas while sharing their own expertise and perspectives. We have lots of activities - including workshops, poster sessions, talks, and discussions - throughout the day designed to provide opportunities for both learning and networking. To help you navigate these activities effectively and to ensure everyone can have a great meeting experience, below are a few etiquette requests (in no particular order).

- Follow the "Golden Rule" – treat others as you would have them treat you.
- Wear your name tag during the meeting.
- Make a point to meet new people at all levels – don't just stick with the group from your institution/organization/corporation or your level of training. This is your chance to find new colleagues, collaborators, mentor/mentees, and friends.
- Be quiet and polite during presentations, use computers and electronics discretely.
- Silence your cell phone and any other electronic device that could give an audible alert.
- You are welcome to change rooms mid-session to attend presentations in different topic areas; however, please make such switches between speakers.
- When asking questions of speakers, please be professional, courteous, and polite. This is especially important when questioning students.
- Be considerate of other people wishing to ask questions. If you have multiple or detailed questions, speak with the presenter after the session.
- When you approach a poster presenter, introduce yourself and share your general scientific area of interest. This helps the presenter know how to pitch their presentation.
- If you take pictures during the meeting, please be considerate of others. Do not use a flash when taking pictures during sessions.
- Do not take photographs or video of another presenter's poster or presentation without their permission.
- Do not share data from another presenter's poster or presentation via social media without their permission.
- Pick up after yourself by depositing trash in the appropriate receptacles.
- It is the responsibility of all Academy members to ensure that all attendees will enjoy an environment free of discrimination, harassment, and retaliation. If you witness or experience such behavior, please contact a member of the IAS DEI leadership team, identified by their **DEI (Elected) Committee Member** badges, immediately.

138th ANNUAL ACADEMY MEETING
JW MARRIOTT, INDIANAPOLIS, INDIANA

INDIANA ACADEMY of SCIENCE 1885

AGENDA

SATURDAY, MARCH 18, 2023

7:00 a.m. – REGISTRATION OPENS/Continental Breakfast

7:00 a.m.- 8:00 a.m. Posters set-up (traditional posters and emerging scientist competition posters); Oral presenters, Workshops and Hot Topics load their morning oral presentations; Exhibitor and Book signing set-up. New Academy Member Meet and Greet Breakfast with Academy president, past presidents, and Section Vice Chairs ; and Student Networking Breakfast.

8:00 a.m. 138th ANNUAL ACADEMY MEETING WELCOME
AWARDS CEREMONY
***LET'S TALK SCIENCE*…MORNING PLENARY**
Marc Milne, Ph.D. Academy President

9:25 a.m. -9:45 a.m. SECTION MEETINGS

9:45 a.m. – 12:00 p.m. SECTION PRESENTATIONS
Research papers, *Hot Topics,* Workshops

12:15 p.m. – 1:45 p.m. 138th ANNUAL ACADEMY MEETING LUNCHEON
Introduction of luncheon keynote speaker by Bill McKnight,
IAS Special Publications Editor
Ed Squires, Ph.D., Luncheon Keynote Speaker
What is this Thing called Science?

Membership Summit (election results, passing of the gavel, etc.)

2:00 p.m. – 3:45 p.m. – SECTION PRESENTATIONS
Research Papers, *Hot Topics/Workshops*

4:00p.m.– 5:30 p.m. POSTER PRESENTATIONS (both Emerging Scientists Research Competition Posters and Traditional Posters)/
NETWORKING RECEPTION
(4:00 p.m. to 4:45 p.m. assigned odd number poster presenters to be present at their poster)
(4:45 p.m. to 5:30 p.m. assigned even numbered poster presenters to be present at their poster)

6:00 p.m.- 6:30 p.m. EMERGING SCIENTISTS RESEARCH COMPETITION AWARDS

6:30 p.m. – ADJOURN

Rebecca W. (Becky) Dolan – IAS Distinguished Scholar

Although retired from Butler University, she still serves the University on its Center for Urban Ecology and Sustainability by conducting research in urban ecology and serving on the Advisory Board. Listed below are Becky's major contributions to the scholar of Indiana and the Indiana Academy of Science.

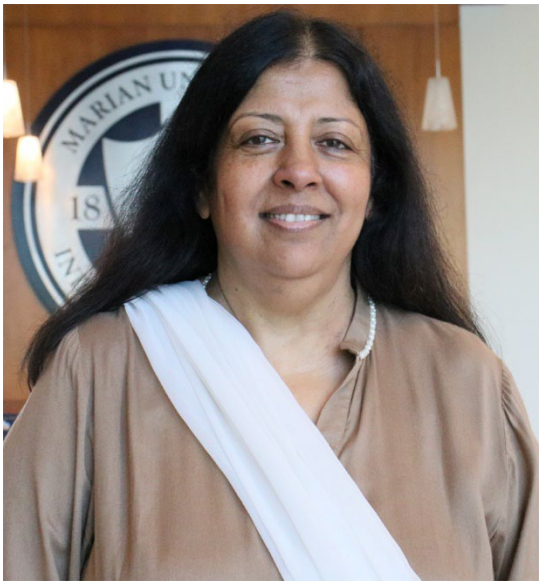
- IAS President, 1999
- IAS Distinguished Service Award, 2018
- IAS Fellow, 2000
- Director of Friesner Herbarium, Butler University, 1991-2018
- As director, she led the online digitization of the herbarium via the Indiana Plant Atlas
- Received approximately $1 million in grants for her work in conservation biology
- Published 40 papers in a variety of journals
- Provided 45 poster and oral presentation, including 15 at the Academy
- Research includes quantitative work on rare plants and plant communities, including *Silene rigida* and barrens; she is an expert in genetics of rare plants

Paul E. Rothrock - Distinguished Service Award

Although retired from Taylor University (2014) and as associate curator (now Emeritus) at the Indiana University Herbarium, Paul continues to find new botanical adventures in Bellevue, Washington. During his 40 years in Indiana, Paul served the botanical community if many ways. Listed below are his major contributions to Indiana and the Indiana Academy of Science.

- IAS President, 2009
- IAS Distinguished Scholar Award, 2014
- IAS Fellow, 1992
- Co-editor, *Proceedings* of the IAS, 2011-2023
- Member *Proceedings'* Editorial Board, 1990-2010
- Books published by the Academy:
  - Sedges of Indiana and Adjacent States: The Non-Carex Species
  - Sedges of Indiana and Adjacent States: Volume 2. The Genus Carex
- Presented multiple workshops at IAS Annual Meetings and throughout the state: (1) Sedge Identification, (2) Digital Herbarium, (3) Floristic Quality Assessment
- IAS Committees: (1) Biodiversity & Natural Areas, (2) Editorial, (3) Budget, (4) temporary committee to review the constitution & leadership structure of IAS
- Bioblitz events: frequent participant and team leader
- Received seven IAS Senior Grants and three Winona Welch Grants

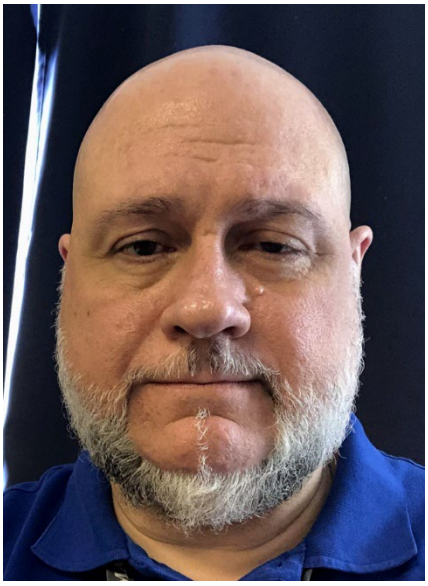
Samina Ken Akbar - IAS Fellow



Associate Professor Microbiology and Immunology
College of Osteopathic Medicine
Marian University

- Member of the Academy since 2013
- Served as Judge at the Science & Engineering Fair
- Served on the Judging Team at the IAS Talent Search
- Chair, IAS Diversity, Equity and Inclusion (DEI) Committee
    - Helped develop the strategic plan approved by the Council
    - Currently helping to implementing the plan
- Contributed to the advancement of science in Indiana:
    - 15 peer-reviewed scientific publications
    - 13 scientific presentations and published abstracts

Ken Andrzejewski - IAS Fellow



Science Teacher
Marian High School
Mishawaka, Indiana

- Member of the Academy since 2013
- Member IAS Youth Activities Committee
- Prior to its disbandment, many of his students were active participants in the IAS Junior Academy of Science competitions
- Over 100 of his research students have participated in the IAS Talent Search
    - Contributed to the advancement of science in Indiana:
    - Teaches AP Biology & dual credit biology courses through Indiana University and Ivy Tech

Jocelyn R. Lewis - IAS Fellow

Indiana State Library
Catalog Division Supervisor
Indianapolis, Indiana

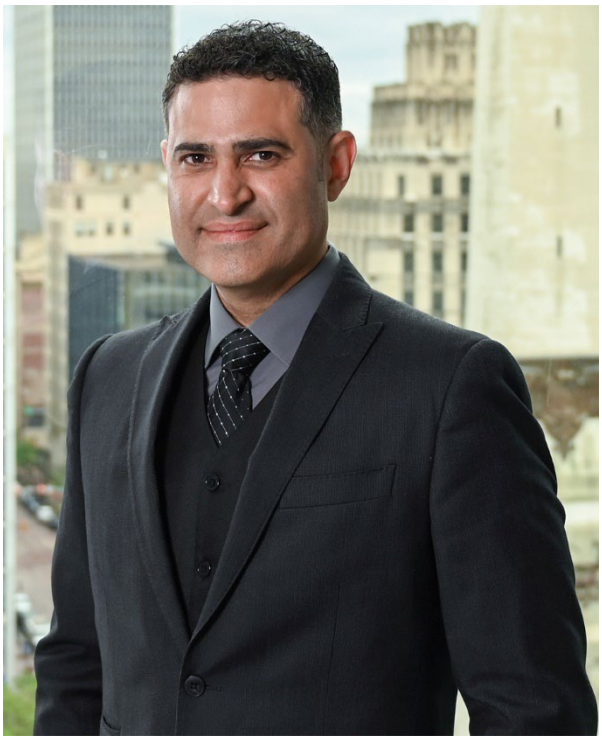
- Honorary member of the Academy since 2012
- She is the Academy's librarian
- Specifically, her primary duties are overseeing maintenance of the John Shepard Wright Memorial Library (JSWML)
    - Bulk of collection - journals received through exchange programs
    - JSWML contains over 13,000 volumes; adds approximately 150 issues annually
    - As librarian, she ensures the exchange program functions, i.e., sending issues of *Proceedings* to exchange partners

Marc Milne - IAS Fellow

Associate Professor of Biology
Biology Department
University of Indianapolis

- Member of the Academy since 2014
- Current IAS President (2022-23)
- Zoology/Entomology Section Chair
- Senior Research Grant Committee (2019-21)
- Budget Committee (2019-present)
- Biodiversity & Natural Areas Committee (2015+)
    - Chair (2019-2021)
- Bioblitz events: frequent participant and team leader
- Contributed to the advancement of science in IN
    - 35+ peer-reviewed scientific publications
    - Presented/co-presented over 20 presentations at IAS

Luis A. Palacio - IAS Fellow



Executive Director and CEO
Diversity and Innovation Institute
Indianapolis, Indiana

- Member of the Academy since 2013
- Member of the Diversity, Equity, and Inclusion (DEI) Committee
    - Founding member to present
- Presenter: virtual discussion of career preparation
    - Sponsored by DEI of the IAS
- Served as a judge at the Hoosier Science & Engineering Fair
- Executive Director & CEO of the Diversity and Innovation Institute
    - Mission is to "unlock innovative potential through STEM Education for a diverse audience in an inclusive and equitable manner"

138th Annual Academy Meeting Keynote Speaker

What is this Thing called Science?

Ed Squires, Ph.D.

In this presentation, we will delve into the history of science both as a concept and as a tool for understanding how the world works. We will follow the development of science as a way of knowing from trial and error in prehistory, to conceptual understanding in the classical and medieval periods, to the modern application of science as a tool to parse truth from falsehood. Along the way, we will explore some of the problems that arise when the knowledge produced by science conflicts with the dogma of political or religious authority, the mechanisms of wealth generation, or the wishful thinking of the public.

Dr. Ed Squires is Canadian born, grew up in Upstate New York, received degrees from SUNY Binghamton (BAs in Biology and Geography), Rutgers University (MS in Ecology) and Ohio University (PhD in Botany), and served in the United States Army (SSG Civil Affairs). His teaching career spanned 40 years and included faculty positions at Taylor University (Indiana), Petrozavodsk State University (Karelia, Russia), George Washington University (DC), and George Fox University (Oregon). His research interests focused on the temporal-spatial dynamics of natural ecosystems and the application of ecological science in environmental assessment. His work led to the publication of more than 3 dozen peer-reviewed papers and numerous technical reports. Squiers' work led to an appointment as a U.S. Fulbright Scholar attached to the Russian Academy of Science, Forest Institute in Petrovavodsk, Russia.

Squiers served the State of Indiana as a member of the Indiana Pollution Prevention Board, the Indiana Heritage Trust, The Nature Conservancy (Indiana Chapter), and the Indiana Academy of Science. IAS positions included: the Publication Committee, the IAS Foundation, the Bonding Committee, the Science and Society Committee, Chair of the Ecology and the Environmental Science Sections, and President of the Indiana Academy of Science (2000-2001).

SECTION MEETINGS

9:25 AM- 9:45 AM, SATURDAY MARCH 18, 2023

(All Academy Members)

SECTION	ROOM #
ANTHROPOLOGY	304
BOTANY	311
CELL BIOLOGY	JW Grand Ballroom 1
CHEMISTRY	JW Grand Ballroom 4
CONSERVATION, SUSTAINABILITY AND LAND MANAGEMENT	JW Grand Ballroom 5
ENVIRONMENTAL SCIENCE	305
EARTH SCIENCE	310
ECOLOGY	JW Grand Ballroom 3
ENGINEERING	301
MATHEMATICS	JW Grand Ballroom 6
MICROBIOLOGY & MOLECULAR BIOLOGY	JW Grand Ballroom 2
PHYSICS AND ASTRONOMY	308
PLANT SYSTEMATICS AND BIODIVERSITY	309
SCIENCE EDUCATION	307
ZOOLOGY AND ENTOMOLOGY	312

GENERAL INTEREST- HOT TOPICS AND WORKSHOPS

TIME	PRESENTER(S)	PRESENTATION	RM#
9:45 AM	**Dr. Eric "VJ" Rubenstein**, Ball State University	**"There's a place for everyone in science": Sharing the "Meet-a-Scientist" interview series** (Hot Topic)	JW 1
2:00 PM	**Dr. Bilon Khambu**, Tulane University School of Medicine	**Role of Autophagy in Liver Zonation** (Hot Topic)	JW 1
3:00 PM	**Dr. Masaru Nakamoto,** Valparaiso University	**Regulation of neural development by cell-cell signaling molecules** (Hot Topic)	JW 1
3:15 PM	**Dr. Alexandra D. Tamerius**, Marian University	**Considerations for In-Situ X-ray Diffraction During High-Pressure Solid-State Syntheses** (Hot Topic)	JW 4
9:45 AM	**Bill Street**, Indianapolis Zoo	**Creation of Indianapolis Zoo's Global Center for Species Survival and the IUCN SSC** (Hot Topic)	307
10:15 AM	**Dr. Beth Hall**, Indiana State Climate Office	**Climate summaries, perspectives, and data** (Hot Topic)	JW 3
9:45 AM	**Dr. Christopher Stobart**, Butler University	**Respiratory syncytial virus (RSV) - Where are we on a vaccine and therapeutics? (Hot Topic)**	JW 2
2:00 PM	**Nathanael Pilla,** Midwest Biological Survey, and **Scott Namestnik**, Indiana Natural Heritage Data Center, Indiana DNR Division of Nature Preserves	**Grass, Sedge, and Rush Identification** (Workshop)	309
2:00 PM	**Dr. Shalini Persaud**, Saint Mary of the Woods College	**Disease Mapping: Innovative way demonstrating secondary diagnoses can arise from primary diagnoses through interrelated risk factors, using endometrial cancer as a model.** (Hot Topic)	307
10:15 AM	**Ieva Roznere**, Ohio State University and the Science Director of the Columbus Zoo & Aquarium Freshwater Mussel Conservation and Research Center.	**The Silence of the Clams** (Hot Topic)	312

COLOR KEY

HOT TOPIC	WORKSHOP	PANEL DISCUSSION

GENERAL INTEREST- HOT TOPICS AND WORKSHOPS

TIME	PRESENTER(S)	PRESENTATION	RM#
10:45 AM	**Dr. Brandy Mmbaga**	**Long Live Diversity: How to engage in sustainable and meaningful diversity**	309
2:00 PM	**Dr. Brandy Mmbaga**	**Long Live Diversity: How to engage in sustainable and meaningful diversity**	JW 3
2:00 PM	**Dr. Virginia Caine,** Marion County Public Health Department	**The Future of Emerging Infectious Diseases**	311

COLOR KEY

HOT TOPIC	WORKSHOP	PANEL DISCUSSION

ORAL PRESENTATIONS BY SECTION

TIME	AUTHOR(S)	PRESENTATION	RM#	
9:45 AM	**Isabel S. Melhado**, BS*, Kaitlyn J. Glavee, BA, Olivia H. Messenger, BA, Jordan E. Roberson, BS, Krista E. Latham, PhD, D-ABFA, University of Indianapolis	**Planning in the Dark: The Necessity of Flexibility When Applying Forensic Science in a Humanitarian Context**	304	ANTHROPOLOGY
10:00 AM	**Dr. Caitlyn Placek**, Ball State University	**Collecting traumas: Childbearing Women's Motivations for Seeking Drugs and Sustaining Treatment**	304	
10:15 AM	**Abu Bakkar Siddique**1, Stephanie Dickinson1, Lilian Golzarri-Arroyo1, Scott W. Keith2,3, Emmanuel M. Rockwell4, Ziliang Zhu4,5, Joseph G. Ibrahim4, David B. Allison1; 1.Department of Epidemiology and Biostatistics, Indiana University Bloomington, IN; 2.Division of Biostatistics, Department of Pharmacology, Physiology, and Cancer Biology, Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, PA; 3. Sidney Kimmel Cancer Center, Thomas Jefferson University, Philadelphia, PA; 4.Department of Biostatistics, University of North Carolina at Chapel Hill, NC; 5. Google LLC	**Variable Selection in Life Span Expectation with Measurement Error in Covariates**	304	
10:30 AM	**Christopher W. Schmidt,** Craig Seidelson, Kelsie Adler, Samantha Foppe, Braden Pefley, Jack Eiteljorge, Aneek Roy, Bailey Dodson, Shannon Dennie, Jonathon O'Dell, Emily Jonas, University of Indianapolis	**Technology in Biological Anthropology: The Importance of Repeatability and Reliability Study for Non-contact Confocal Profilometry**	304	
11:00 AM	**Bobby Luker and Davis Opel**	**Hormonal control of axillary meristem establishment in the moss Mnium cupsidatum after apical meristem removal**	311	BOTANY
11:15 AM	**Jackson Payton**	**Does prior exposure to pathogen challenge strengthen subsequent plant responses in the moss Physcomitrella patens?**	311	
11:30 AM	**Darrin Rubino, PhD.**, Hanover College; Christopher Baas, Ball State University	**Using timber species identification, tree rings, and sapwood analysis to interpret the George Ash House (Switzerland County, Indiana)**	311	
11:45 AM	**Benjamin Spears, PhD.**	**Exploring a conserved transcriptional regulatory mechanism in Physcomitrium patens TCP transcription factors**	311	

ORAL PRESENTATIONS BY SECTION

	TIME	AUTHOR(S)	PRESENTATION	RM#
CELL BIOLOGY	9:45 AM	**Dr. Eric "VJ" Rubenstein**, Ball State University	**"There's a place for everyone in science": Sharing the "Meet-a-Scientist" interview series**	JW 1
	9:45 AM	Kusum Parajuli, **Sumaiya Mesbah***, Nahian Fahim, Janeen Dahouk, Soufanieh Pierre and Ahmed Mustafa, Purdue University Fort Wayne	**Physiological and behavioural stress response of star fish, *Luidia clatharata*, against elevated temperature and arm amputation**	311
	10:00 AM	Nahian Fyrose Fahim, **Abdullahi Idowu***, Kusum Parajuli, Soufanieh Pierre, Makaylah Hamm, and Ahmed Mustafa, Purdue University Fort Wayne	**Immunological Responses of Sea Urchin (*Arbacia punctulata*) in Stressed and Unstressed Conditions**	311
	10:15 AM	Jonathan Lowery and **Sierra Street**, Marian University	**Impact of arthritis on Hoosiers**	311
	10:30 AM	**Brooke Flannagan** and Dean Wiseman, PhD., University of Indianapolis	**Stress Response of Bovine Endothelial Cells to Chemicals Commonly Found in Vaping Fluids**	311
	10:45 AM	**Adam Simons**, Butler University	**Anticancer Properties and Therapeutic Potential of Northern Spicebush (Lindera benzoin)**	JW 1
	10:45 AM	**Beichen Wang**, Purdue University	**A Zebrafish Functional Screen Identifies Leads from FDA-Approved Drugs for Treating Retinitis Pigmentosa**	311
	11:00 AM	**Bryce Kuschel**, Ball State University	**Investigation into the role of APJ and VEGF receptor signaling in the regulation of coronary angiogenesis**	JW 1
	11:15 AM	**Rajnandani Katariya**, Indiana State University	**Fox Transcription Factors Mediate Proper Positioning Of Cardiac Cells By Restricting The Expression Of ECM Genes**	304
	11:15 AM	**Makenzi McClain**, Butler University	**Investigation of cell autonomous and nonautonomous signaling of the G protein-coupled receptor, FSHR-1, in controlling neuromuscular structure and function in C. elegans**	JW 1
	11:30 AM	**Ryan Adkins**, Butler University	**The G protein-coupled receptor (GPCR) FSHR-1 and the SPHK-1 lipid kinase regulate *C. elegans* life- and healthspans via a common pathway**	JW 1
	11:30 AM	**Ashley Kalinski, PhD.,** Ball State University	**Macrophage polarization impacts axonal growth of sensory neurons**	304
	11:45 AM	**Abbigayle Gamble**, Indiana State University	**Twin Roles of the Zinc-Finger Transcription Factor Castor: Specification of Cardiac Cell Subtypes and Regulation of Cardiac Progenitor Cell Division**	JW 1
	11:45 AM	**Connor G. Bailey,** Kyle Richards, Sophia Owutey, LiLi O'Malley, Eric M. Rubenstein, Ball State University	**Characterization of Degradation of Translocon-Clogging Proteins**	304

ORAL PRESENTATIONS BY SECTION

TIME	AUTHOR(S)	PRESENTATION	RM#	
2:00 PM	**Dr. Bilon Khambu**, Tulane University School of Medicine	**Role of Autophagy in Liver Zonation** (Hot Topic)	JW1	CELL BIOLOGY
3:00 PM	**Dr. Masaru Nakamoto,** Valparaiso University	**Regulation of neural development by cell-cell signaling molecules** (Hot Topic)	JW 1	
9:45 AM	**Dr. Jordan Froese**, Ball State University	**Expanding the utility of Rieske dioxygenases through enzyme engineering**	JW 4	CHEMISTRY
10:15 AM	**Arman Khosravi**	**Synthetic Studies on the 4,6-O-Isopropylidene-2,3-di-O-Levulinyl-D-Glucopyranosyl Trichloroacetimidate Donor**	JW 4	
10:45 AM	**Erwin Doe**, Ball State University	**Functionalization of Nucleic Acid Nanoparticles with Clicked Oligonucleotides for Therapeutic Applications**	JW 4	
11:15 AM	**Dr. Meden Isaac-Lam**, Purdue University Northwest	**Light-Activated Treatment for Triple-Negative Breast and Prostate Cancer**	JW 4	
2:00 PM	**David Bwambok, PhD**, Ball State University	**Green approach for removal of polyfluoroalkyl pollutants from water**	JW 4	
2:30 PM	**Griffin Thomas**	**Synthesis of a Photo-Cleavable Linker for Selective Drug Delivery of Ipomoeassin F**	JW 4	
2:45 PM	**Allison Dittmer**, **Alex Thornburgh**, and Emil F. Khisamutdinov, Ball State University	**Overexpression and Isolation of RGVG and Y639F Mutants of T7 RNA Polymerase for in vitro Transcription of Modified RNA Strands**	JW 4	
3:00 PM	**Gbemisola Bamiduro**, Ball State University	**Mineralization of Glyphosate by Pd@BiVO4/BiOBr nanocomposite heterojunction photocatalyst**	JW 4	
3:15 PM	**Dr. Alexandra D. Tamerius**, Marian University	**Considerations for In-Situ X-ray Diffraction During High-Pressure Solid-State Syntheses** (Hot Topic)	JW 4	
9:45 AM	**Bill Street**, Indianapolis Zoo	**Creation of Indianapolis Zoo's Global Center for Species Survival and the IUCN SSC** (Hot Topic)	307	Conservation, Sustainability and Land Management
11:00 AM	**Dr. Monika Böhm,** Global Center for Species Survival, Indianapolis Zoo	**Increasing invertebrate conservation assessments through partner networks and student engagement**	307	
11:15 AM	**Gabriel Van Praag**, U.S. Fish & Wildlife Service	**Contributing to a Better Understanding of Climate Change on US National Wildlife Refuges: The Civilian Climate Corp Fellowship Program**	307	
11:30 AM	**Zachary Truelock**, Indiana DNR	**Status of the Plains Leopard Frog (*Lithobates blairi*) in Indiana**	JW 4	
11:45 AM	**Sergio Henriques**, Global Center for Species Survival, Indianapolis Zoo	**Protecting Indiana's wild lights and dark skies**	JW 4	

ORAL PRESENTATIONS BY SECTION

	TIME	AUTHOR(S)	PRESENTATION	RM#
EARTH SCIENCE	9:45 AM	**James O. Farlow** (Department of Biological Science, Purdue University Fort Wayne) and **James A. Hyatt** (Department of Environmental Earth Science, Eastern Connecticut State University, Willimantic, CT)	**Size, Shape, and Morphological Diversity of Tridactyl Theropod Dinosaur Footprints**	310
	10:15 AM	**Dr. Beth Hall**, Indiana State Climate Office	**Climate summaries, perspectives, and data** (Hot Topic)	JW 3
	11:45 AM	**Mose Nasser**, S&G Excavating, Terre Haute, Indiana	**Possible Faulting of The St. Louis Limestone At Lincoln Park Stone, Putnamville, Indiana**	310
	2:00 PM	**Tracy Branam**, Indiana Geological & Water Survey	**Uplands Springs Online Database at the Indiana Geological and Water Survey**	310
	2:30 PM	**Daniel L. Kelleher** and Tim J. Kemmis, Midwest GeoSciences Group	**Environmental Sequence Stratigraphy of Mid-Town Carmel, Indiana**	310
	3:00 PM	**Victoria Leffel**, Indiana Geological Survey	**Indiana's Landslide Inventory**	310
	3:30 PM	**Darrell G Schulze, PhD**, Purdue University	**Can Soil Taxonomy Be Used to Map the Distribution of Pre-European Settlement Prairies?**	310
ECOLOGY	9:45 AM	**Dr. Rebecca Cain**, Safia Janjua, J. Andrew DeWoody, and Robert K. Swihart, Purdue University	**Coyote (*Canis latrans*) density estimation using scat, SNPs and spatial partial identities**	JW 3
	10:00 AM	Summer Rathfon, Keith Woeste, and **Dr. Michael Jenkins**, Purdue University	**Conservation genetics of relict eastern hemlock population of Indiana**	310
	10:15 AM	**Jeffrey D. Holland**, Rennie McIntosh	**Agent-Based Modeling of an Exotic Species Invasion**	310
	10:30 AM	David Ice and **Dr. Xianzhong Wang**, Indiana University-Purdue University Indianapolis	**Resistance to three common herbicides in chameleon plant (*Houttuynia cordata* Thunb.), a highly invasive exotic species**	310
	10:45 AM	**Brianna Crawley** and Dr. Heather Reynolds, Indiana University	**Variable impacts of herbivore pressure and hydrologic stress on urban understory plant restoration**	310

ORAL PRESENTATIONS BY SECTION

TIME	AUTHOR(S)	PRESENTATION	RM#	
9:45 AM	**Katherine L. Barrett,** Matt Meersman, Michiana Area Council of Governments; Daragh Deegan, City of Elkhart	**How's the water? A case-study of watershed data in the St. Joseph River Basin**	305	ENVIRONMENTAL SCIENCE
10:00 AM	**Grace Walker**, Ball State University	**Impacts of microplastics and a synthetic estrogen on the reproductive social behavior in fathead minnows (*Pimephales promelas*)**	305	
10:15 AM	**Soufanieh Pierre***, Michelle Selo-Ojeme and Dr. Ahmed Mustafa; Department of Biological Sciences, Purdue University Fort Wayne	**Use of Nutraceuticals in an Aquaponics System to Produce Quality Biomass**	305	
10:30 AM	**Edward Brizendine**, Brizendine Statistics	**Rejecting null hypothesis statistical testing. A review of the American Statistical Association board statement on p-values and statistical significance.**	305	MATHEMATICS
10:45 AM	**Danielle Tinsley**, Huntington University	**Using Bifurcation Analysis to Assess the Relative Effects of Harvest and Species Interactions on a Mathematical Model of Fisheries**	305	
11:00 AM	**Dr. Kevin Drury**, Huntington University	**Bifurcation Analysis of Nonlinear Fisheries Models**	304	
9:45 AM	**Dr. Christopher Stobart**, Butler University	**Respiratory syncytial virus (RSV) - Where are we on a vaccine and therapeutics?** (Hot Topic)	JW 2	MICROBIOLOGY & MOLECULAR BIOLOGY
10:30 AM	**Nahian Fahim**, Purdue University Fort Wayne	**Antimicrobial and Antioxidant Activity of Sea Urchin (*Arbacia punctulata* and *Lytechinus variegatus*) Body Wall Extracts, In-Virto**	JW 2	
10:45 AM	**George Papadeas**, Butler University	**Studies Evaluating the Thermal Stability and Replication of a Murine Coronavirus, Mouse Hepatitis Virus (MHV)**	JW 2	
11:00 AM	**Emily Landwehr**, Butler University	**Developing a Mathematical Model of Mouse Hepatitis Virus (MHV) Coronavirus Thermal Stability and Replication**	JW 2	
11:15 AM	**Adam Farmer**, Indiana State University	**trithorax is essential for cardiac Hox gene expression and anterior-posterior patterning of the *Drosophila melanogaster* embryonic dorsal vessel**	JW 2	
11:30 AM	**George Gundelach**, Valparaiso University	**Effect of *Candida albicans* infection on the plasma membrane expression of the Na+-K+-2Cl– cotransporter 1 (NKCC1) in T84 and Madin Darby Canine Kidney cells (MDCK)**	JW 2	
11:45 AM	**Michelle Selo-Ojeme***, Isaac Wendel, Sydney Scherrer, Rana Seyam and Ahmed Mustafa, Purdue University Fort Wayne	**The Effect of L-Theanine on the Immunological Stress Response of Nile Tilapia**	JW 2	
2:00 PM	**Elise Huffman**, Butler University	**Susceptibility of Human Coronavirus HKU1 and OC43 3C-like Proteases (3CLpro) to Inactivation by Baicalein**	JW 2	
2:15 PM	**Sarah Moh**, Purdue University Fort Wayne	**Examining the Relationship between the Gut Microbiome and Central Nervous System Inflammation in Rats with Fetal Alcohol Syndrome**	JW 2	

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	TIME	AUTHOR(S)	PRESENTATION	RM#
MICROBIOLOGY & MOLECULAR BIOLOGY	2:30 PM	**Kusum Parajuli**	**Antibacterial and Hemolytic Effects of Different Tissues Extracts from *Luidia clathrata* (Sea Star) Against Selected Pathogenic Bacteria**	JW 2
	2:45 PM	**Sefunmi Babatunde**, Manchester University	**Investigating the Systemic Effect of Jasmonic Acid Wounding Pathways in Soybean Seedlings**	JW 2
	3:00 PM	**Lyla Vivian**, Butler University	**Microscopic Analysis of Syncytia Formation Dynamics for Coronaviruses and Pneumoviruses**	JW 2
	3:15 PM	**Kate Leonhard**, Indiana University Kokomo	**Growth kinetics of susceptible and resistant isolates of *Staphylococcus intermedius*. A look into the growth mechanisms of resistant bacteria.**	JW 2
	3:30 PM	**Caitlyn Foye**, Riverside High School,	**Comparison of Antimicrobial Properties of Copper and Silver Surfaces**	JW 2
PHYSICS AND ASTRONOMY	11:00 AM	**Dr. Horia Petrache**, Indiana University-Purdue University Indianapolis	**Electrostatic charging of lipid membranes by neuromodulators**	305
	11:30 AM	**Kyle Koeller**, Ball State University	**Python Package for Eclipsing Binary Stars**	305
PLANT SYSTEMATICS AND BIODIVERSITY	9:45 AM	**Terry Cox, Jr.**, Taylor Tatlock and Alice Long Heikens, Franklin College	**Changes in population ecology of Beechdrops at Hougham Woods Biological Field Station over 10 years**	309
	10:00 AM	**Michael A. Homoya**	**Anniversary of the Discovery of the Federally Threatened Small Whorled Pogonia *Isotria medeoloides* (Orchidaceae) in Illinois and Potential for Its Occurrence in Indiana**	309
	10:15 AM	**Richard Hull,** Dr. Eric Knox, Department of Biology at Indiana University-Bloomington	**An Update on the Modern Analysis of the Vascular Plant Flora of the Indiana Wabash River Corridor**	309
	10:30 AM	**Scott Namestnik** and Wyatt Williams, Indiana Natural Heritage Data Center, Indiana DNR Division of Nature Preserves	**The Vascular Flora of Burket Bog, Kosciusko County, Indiana**	309
	2:00 PM	**Nathanael Pilla,** Midwest Biological Survey, and **Scott Namestnik**, Indiana Natural Heritage Data Center, Indiana DNR Division of Nature Preserves	**Grass, Sedge, and Rush Identification** (Workshop)	309

ORAL PRESENTATIONS BY SECTION

TIME	AUTHOR(S)	PRESENTATION	RM#	
11:30 AM	**Dr. Kristi Bugajski,** Valparaiso University	**BIO 101: An EPIC Beginning for Beacon Biologists**	307	SCIENCE EDUCATION
11:45 AM	**Jon Agley**,1 Yunyu Xiao,2 Esi E. Thompson,3 Lilian Golzarri-Arroyo4; 1. Prevention Insights, Department of Applied Health Science, School of Public Health Bloomington, Indiana University Bloomington, Bloomington, IN, US; 2. Department of Population Health Sciences, Weill Cornell Medicine, New York, NY, US; 3. The Media School, Indiana University Bloomington, Bloomington, IN, US' 4. Biostatistics Consulting Center, School of Public Health Bloomington, Indiana University Bloomington, Bloomington, IN, US	**The Science of Trust: Does Language Choice Matter When Sharing Scientific Findings?**	307	
2:00 PM	**Dr. Shalini Persaud**, Saint Mary of the Woods College	**Disease Mapping: Innovative way demonstrating secondary diagnoses can arise from primary diagnoses through interrelated risk factors, using endometrial cancer as a model.** (Hot Topic)	307	
9:45 AM	**Samantha L. DiBiasio,** Madeline R. Mann, Emmeline M. Mann, Brian G. Gall, Hanover College	**Differential Predation Risk on Two-Line Salamander Larvae (*Eurycea cirrigera*) by Two Species of Stream Crayfish**	312	ZOOLOGY AND ENTOMOLOGY
10:00 AM	**Madeline Mann**, Samantha L. DiBiasio, Emmeline M. Mann, Katelyn M. Enginger and Brian G. Gall, Hanover College	**Avoidance Strategies of Southern Two-Lined Salamander Larvae (*Eurycea cirrigera*) in response to Two Species of Predatory Stream Crayfish.**	312	
10:15 AM	**Ieva Roznere**, Ohio State University and the Science Director of the Columbus Zoo & Aquarium Freshwater Mussel Conservation and Research Center	**The Silence of the Clams** (Hot Topic)	312	
11:00 AM	**Kasey J. Watterson,** Olivia M. Waldridge, Katelyn M. Enginger, Cassie M. Winn, and Brian G. Gall, Hanover College	**An Assessment of Learning Modalities in Wild-Caught Freshwater Flatworms (*Dugesia tigrina*)**	312	

ORAL PRESENTATIONS BY SECTION

	TIME	AUTHOR(S)	PRESENTATION	RM#
ZOOLOGY AND ENTOMOLOGY	11:15 AM	**Dr. Christopher Wirth** and Abigail M. Vernon, Purdue University	**Blatchley's Butterflies**	312
	11:30 AM	**Casey Venable**, University of Indianapolis	**Countless Creatures of the Caverns: Spelunking into Virginia's Cave Spider Diversity**	312
	11:45 AM	**Dr. Brian G. Gall**, Sidney J. Goedeker, Nettie A. Eigel, Madeline R. Mann, and Samantha L. DiBiasio, Hanover College	**Land Ho! Polarized Light Serves as a Visual Signal for Landward Orientation in Displaced Spiders**	312
	2:00 PM	**Kent Edmonds** and Natalie Stewart, Department of Biology, Indiana University Southeast	**Compensatory Gonadal Hypertrophy in the Male Marsh Rice Rat (Oryzomys palustris)**	312
	2:15 P.M.	**Nathan Engbrecht**, Indiana Department of Natural Resources	**Updated Report on Green Treefrog (Hyla Cinerea) Range Expansions in Indiana 2013-2023**	312

POSTER PRESENTATIONS- 4:00 PM TO 5:30 PM

(NOTE: Odd Numbered Posters 4:00 PM- 4:45 PM; Even Numbered Posters 4:45 PM -5:30 PM)

1*	AN	**Chastidy Gilbert**, University of Indianapolis	Clinical Significance of Type IV Hiatal Hernias in Geriatric Age Patients
2*	MB	**Caiden Lukan**, Butler University	Verification of aberrant mRNAs in mantle cell lymphoma using polymerase chain reaction
3*	AN	**Alex F. Wong**, BA, Isabel S. Melhado, BS, Krista E. Latham, PhD, D-ABFA, University of Indianapolis, Biology Department, 1400 East Hanna Avenue, Indianapolis, IN 462277; Cynthia Cale, MS, DNA Mavens LLC, P.O. Box 669, New Caney, TX 77357**.**	A Targeted Sampling Approach to Recovery of Informative DNA Profiles from Eyeglasses
4*	MB	**Audrey Nicol**, Purdue University Fort Wayne	The Impact of modifier genes on obesity and Drosophila AKH/glucagon signaling
5	BO	**Anna Childers**, Butler University	Post-translational Modification Sites in AtTCP8 IDR 2 Influence Localization and Interaction Behavior
6*	MB	**Evan Rogers**, Ball State University	The role of Dhx36/G4R1 in coronary angiogenesis and heart development
7*	BO	**Andrew Deppe,** Blake Talbert, and Alice Long Heikens, Ph.D., Franklin College	Fungi in Blossom: Mushroom Diversity at Laura Hare Nature Preserve at Blossom Hollow
8	MB	**Jacob Rashid[1],** Dr. C. Patience Masamha[2] Department of Health Sciences[1], Department of Pharmaceutical Sciences[2], College of Pharmacy and Health Sciences, Butler University	Inducing Cell Death in Mantle Cell Lymphoma with Abemaciclib
9	BO	**Maura Donnelly**, Butler University	Post-translational Modification Sites in AtTCP8 IDR 2 Influence Localization and Interaction Behavior
10*	MB	**Luke Reynolds**, Marion High School, Science Talent Search Winner	The Evasion of Cell Death By Cancer Cells Detached From the Extracellular Matrix
11*	BO	**Raegan Mozal**, Butler University	Genetic characterization of TCP gene family in Physcomitrium patens
12	MB	**Rheanna Walther**, Ball State University	Characterizing pug1âˆ†, tna12âˆ†, and pug1âˆ†tna12âˆ† in the human fungal pathogen *C. albicans*
13*	BO	**Maya Nietzel**, Valparaiso University	Morphological Effects of Simulated Low-Gravity in *Neurospora crassa*
14	SE	**Elizabeth Delery** and Troi Graves, Marian University College of Osteopathic Medicine	An Evaluation of the Perceptions of Sunscreen Use in Preventing Skin Cancer
15	BO	**Christian Talbert**, Franklin College	Fungi in Blossom
16*	ZO	**Katelyn M. Enginger**, Kasey J. Watterson, Jax D. Betzner, and Brian G. Gall, Hanover College	An Analysis of Startle Behavior in Red-Eyed Tree Frogs (*Agalychnis callidryas*)
17	CB	**Ellie Brill**, Butler University	Potential for *Symphyotrichum patens* (Purple Aster) to inhibit cancer cell proliferation and virus replication
18	ZO	**Kaylee Huyser** and **Maranda Powell**, Valparaiso University	The Effect of Plastic Bags on Necrophagous Fly Composition
19*	CB	**Animesh Dali**, DePauw University	Inhibiting S100B using miRNA and Troubleshooting Cell Growth
20*	ZO	**Brooke Karasch**, Ball State University	Embryonic Learning in Lake Sturgeon (*Acipenser fulvescens*) Under Warming Conditions
21*	CB	**Henry Giesel**, Wabash College	A "Key" Template for Unlocking Protein Degradation in *C. elegans*
22*	ZO	**Waqar Majeed**, Purdue University	Diversity pattern of arthropods in different landscapes

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POSTER PRESENTATIONS

23*	CB	**Samantha K. Gosser**, Samantha M. Turk, Christopher J. Indovina, Eric M. Rubenstein, Ball State University	Effects of impaired lipid synthesis on protein degradation in the endoplasmic reticulum and nucleus
24*	ZO	**Emmeline M. Mann**, Kasey J. Watterson, Madeline R. Mann, Cassie M. Winn and Brian G. Gall, Hanover College	Aggression and Feeding Behavior with Respect to Competition and Hunger Status in Rusty Crayfish (*Faxonius rusticus*)
25	CB	**Taylor Hiland,** Chris Stovall, Elizabeth Delery, PhD, Marian University College of Osteopathic Medicine	Modeling Repeat Mild Traumatic Brain Injuries (rTBIs) In-Vitro
26*	ZO	**Cassie M. Winn**, Suellen E. Ronk, Jax D. Betzner and Brian G. Gall, Hanover College	Flight Behavior by Two-Line Salamander Larvae in Response to Two Predatory Crayfish
27*	CB	**Augustus Isaac**, Wabash College	Bacdegron-LOCKR: When You Want to Break Up With Your Proteins
28	AN	Dr. Arden Mower & **Dr. Stephen Nawrocki**, University of Indianpolis	A Description of Fungal Species Sampled from Decomposing Human Remains
29*	CB	**Sumaiya Islam**, Indiana State University	Polycomb patterns the anterior embryonic dorsal vessel by repressing abdominal A expression
30	AN	Olivia H. Messenger, BA, University of Indianapolis Biology Department, 1400 E Hanna Avenue, Indianapolis, IN 46227; **Jordan E. Roberson**, BS, University of Indianapolis Biology Department, 1400 E Hanna Avenue, Indianapolis, IN 46227; Krista E. Latham, PhD, D-ABFA, University of Indianapolis Biology Department, 1400 E Hanna Avenue, Indianapolis, IN 46227; Cynthia Cale, MS, DNA Mavens LLC, P.O. Box 669, New Caney, TX 77357	DNA Transfer to Bedsheets
31	CB	**Morgan Jackson**, Butler University	Studies into the Therapeutic Potential of Botanical Extracts from Lamb's Ears (*Stachys byzantina*) on Cancer Cell Proliferation and Virus Replication
32	BO	**Russell Baas**, Liz Marthaler, Laurynn Thieme, Ball State University; Darrin Rubino, Hanover College; Christopher Baas, Ball State University	Tree-ring dating of the Bronnenberg I-house at Mounds State Park, Anderson, Indiana
33*	CB	**Kyle McCreary**, Marian University	Investigations into WNT Signaling in Breast Cancer and Chemoresistance
34	BO	**Simranjit Kaur**, Valparaiso University	Gene-by-Environment Interactions in *Arabidopsis thaliana* in Response to Precipitation Extremes
35*	CB	**Jacob M. Miller**, Samantha M. Turk, Christopher J. Indovina, Eric M. Rubenstein, Ball State University	Impaired Phosphatidylcholine Biosynthesis Disrupts Protein Degradation in *Saccharomyces cerevisiae*
36	CB	**Brian Ault**, Ball State University	The Investigation of Key Mechanisms Driving Chemotherapy Resistance in T-cell Acute Lymphoblastic Leukemia
37*	CB	**Natalie Link**, Butler University	Common Sage (*Salvia officinalis*) exhibits anti-proliferative impacts on cancer cells and antiviral activity against human respiratory syncytial virus (hRSV) in vitro

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38	CB	Kaitlyn Wilson, Andres Carranza, Tylene Wadkins, and **Kimberly M. Baker,** University of Indianapolis	Suppression of Breast Cancer Cell Proliferation by the Dietary Phytochemicals Coumaric Acid, Chlorogenic Acid, Betulinic Acid, and Indole-3-Carbinol
39*	CB	**Mason Naaman**, Wabash College	Switching On Protein Degradation in *C. elegans*
40	CB	**Julianna Bennett**, Rachel E. Williamson, Maxx Martinez, and Ashley L. Kalinski, Ball State University	Macrophage polarization impacts axonal growth of sensory neurons
41*	CB	**Thomas Oppman**, Wabash College	Worming Our Way into Understanding Proteasome Function in vitro
42	CB	Elias Bittar, Chase Throop, Marissa Remedi, Kalie Kopecek, **Bhupal P. Bhetwal**, Marian University	Role of cell-extracellular matrix interaction in bitter melon extract induced cytotxic effects on human breast cancer cell
43*	CB	**Abigail Screen**, Butler University	Investigation of the intestinal site of action and candidate glycopeptide ligand of the FSHR-1 receptor in the regulation of neuromuscular signaling in *C. elegans*
44	CB	**Md Rezaul Hasan**, Indiana State University	Scraps, an anilin, and Nebbish, a kinesin, are integral components of a Fox transcription factor-regulated subnetwork that mediates specific cardiac progenitor cell divisions.
45	CB	**Chhiring Sherpa**, Ball State University	Expression analysis of Dhx36 and selective genes involved in regulating coronary angiogenesis in endothelial cell specific Dhx36 knockout embryonic hearts compared to control.
46	CB	**Muiz Rana**, Butler University	Investigation of oxi-1 ubiquitin ligase gene function in neuromuscular signaling and chemosensory behavior in *C. elegans*
47	CB	**Mary E. Tragesser-Tina**, Samantha M. Turk, Christopher J. Indovina, Mahmoud M. Daraghmi, and Eric M. Rubenstein, Ball State University	The effect of perturbed lipid biosynthesis on cytosolic and endoplasmic reticulum protein degradation
48	CB	**Madison Mathew**, Ball State University	Conditioning injury fails to enhance regeneration in Sarm1-/- mice
49	CB	**Sam Walsh**, Ball State University	Wildtype vs. SARM1 Knockout: Spinal Cord Neurons Post Sciatic Nerve Crush
50	CB	**Md Sayeed Abu Rayhan**, Indiana State University	Polycomb patterns the anterior embryonic dorsal vessel by repressing abdominal A expression
51*	CH	**Emmanuel Adeniyi**, Ball State University	Experimental and Computational Studies of Halogen and Hydrogen-Bonded Complexes of Haloforms with Amines
52	CB	**Kyra E. Simmons** and Kimberly M. Baker, University of Indianapolis	Inhibition of Breast Cancer Cell Proliferation by Theaflavin and EGCG
53	CH	**Temitope Alonge**, Ball State University	Multifunctional Human Serum Albumin Nanoparticles for Theranostics
54	CH	**Davis Anum**, Ball State University	Evaluation of multifunctional human serum albumin nanoparticles with indocyanine green and rhodamine 6G- based ionic chemotherapeutic agent for theranostics
55	CH	**Nolan Beam** and David K. Bwambok, Ball State University	Evaluation of Poly Lactic-co-Glycolic Acid (PLGA) polymeric nanoparticles for delivery of near infrared ionic dyes with selective toxicity to cancer cells
56	CH	**Abigail Coffman**, Ball State University	Evaluation of thermodynamic stabilities of in silico designed nucleic acid 3WJ motifs

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POSTER PRESENTATIONS

57*	CH	**Charles Behrman**, Derek A. Coers, Rubyat Sara, and Mahamud Subir, Ball State University	Molecular Adsorption at the Liquid/Liquid Nanoemulsion Interface
58	CH	**Joel Moss** and David K. Bwambok, Ball State University	Extraction of textile dyes for forensic analysis using paramagnetic ionic liquids
59	CH	**Jasney Combs**, **Angel Esquivel Vazquez,** Kelsi Goshinsky and Zhihai Li*, Ball State University	AFM Characterization of Semiconductor Nanomaterials and Solar Cell Electrodes
60	CH	**Bailey Rutkowski**, Ball State University	Expanding the substrate scope of Rieske dioxygenases through enzyme engineering
61	CH	**Nicole Dominguez** and David K. Bwambok, Ball State University	Evaluation of toxicity and extraction efficiency of paramagnetic ionic liquids used for removal of polyfluoroalkyl pollutants from water
62	EC	**Travis Beckett and Abby Yake**, Ball State University	Transgenerational effects of microplastic exposure on embryo behavior in fathead minnows (*Pimephales promelas*)
63*	CH	**Arman Harutyunyan**, Manchester University School of Pharmacy	Anti-Neuroinflammatory Activity of a Novel, Nitrile-Containing Dithiolethione
64	EC	**Lana Bolin,** Cieara Carpenter, Hannah Turnbull, Dylan Mann, Indiana University	"Seed predation differs between native and exotic plant species, and between light and dark colored seeds"
65	CH	**Hannah Hayth**, Ball State University	Bioconjugation of functionalized oligodeoxynucleotides to fluorescence reporters
66*	EC	**Kaija Carr** and Amerti Guta, DePauw University	Does urban-induced herbivory lead to increased urban cyanogenesis in white clover?
67	CH	**Cassidy Jean,** Davis Anum, Temitope Alonge and David K. Bwambok, Ball State University	Evaluation of human serum albumin nanoparticles for delivery of near infrared ionic dyes for theranostics
68	EC	**Julian Grudens** and Kamal Islam, Ball State University	Avian Blood Parasite Infections in a Southern Indiana Population of Cerulean Warbler (*Setophaga cerulea*)
69*	CH	**Charles Kuedukey**, Davis Anum, Julianna Borgia, John L. McKillip and David K. Bwambok, Ball State University	Extraction of compounds from stem bark of *Alafia multiflora* and evaluation of antimicrobial activity
70	EC	**Settha Vongprachanh**, DePauw University	Is shoot density of *Phragmites australis* associated with flowering and patch expansion in the DePauw University Nature Park?
71*	CH	**Kathryn Rowberg**, Purdue University Northwest	Detection of lead in drinking water using hydrogels to precipitate lead
72	EQ	**Diana Wilson**, Manchester University	Assessing Water Cabbage (*Rorippa aquatica*) Potential for Nitrogen Fixation in Water Treatment
73*	CSLM	Abbigail Zimmerman, Asanti Tafesse, **Rylie Farr,** ReBecca Zorn, and F. Collin Hobbs, Department of Biology, Huntington University	Urban environments negatively impact sugar maple health
74	EQ	**Mathew Simpson**, Ball State University	Effects of Raw and Aged Microfibers on Growth of Aquatic Plants
75*	CSLM	**Mary Moffett**, Indiana University-Purdue University Indianapolis	Applying the Greening IUPUI Grant to Boost Biodiversity, Support Sustainability, and Create Conservation Corridors

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76	MA	**Isaiah Bartlett**, Dr. Jeff Kinne, Dr. Christopher Schwab, Indiana State University	An integrated software tool provides robust developmental time series expression signature classification using high-throughput RNA-seq (Gene expression) analysis
77	ES	**James Bingaman**, W. Brian Shehorn and Paul K. Doss, University of Southern Indiana	Impacts of Precipitation Trends and Forest Resource Management on a Shallow Groundwater System in Manistee National Forest, Michigan
78	MB	**Chris Cole* (1**), Dr. Jeff Hansen (2), Dr. Sarah Mordan-McCombs (1) (1) Department of Biology, (2) Department of Chemistry and Biochemistry, DePauw University, Greencastle IN	Investigating Cellular Pathways Affected by a Novel Pyrrolidine Drug
79*	EC	Rebecca Schutt, Celeste Ryman, **Jennifer Brown**, Annika Rae, and F. Collin Hobbs, Department of Biology, Huntington University	Recovery of native shrub layer following invasive species removal in a Midwestern forest
80	MB	**Tara Hoffman**, Indiana State University	Using Bioinformatics to Uncover Small Transmembrane Proteins in Bacteria and Archaea
81*	EC	Karlee Franklin, Jessica McWatters**, Kayla Estrada Wilson, Haven Wolfe**, and F. Collin Hobbs, Department of Biology, Huntington University	Traffic rates drive roadkill numbers on Midwestern roads
82	MB	**Anu Kumal**, Ball State University	Determining the location of Pus7 in yeast and filamentous *C. albicans*
83*	EC	**Brittany Nahorney**, and Kamal Islam, Ball State University	Synchronization of Cerulean Warbler (*Setophaga cerulea*) Nest Stages and Lepidoptera Abundance Peaks in South-Central Indiana
84	MB	**Kaitline Martin**, Indiana University Kokomo	Effects of a Pesco-Vegetarian Diet and Supplements on Protection Against Oxidative Stress in Hispanic Populations
85	EC	**Ray Peck**, Indiana University	Dynamic Measure of Glucocorticoid Hormones using Feathers and Plasma in the Polymorphic White-throated Sparrow (*Zonotrichia albicollis*)
86	MB	**Laura Ullom-Minnich**, Manchester University	Examining wound-induced protein signaling between unifoliate leaves in transgenic soybean
87	EC	**Mackenzie Persinger**, Ball State University	Microplastics and its effects as a vector of 17 α-ethinylestradiol (EE2) on early life stage behaviors in juvenile *Pimephales promelas*
88	MB	**Emeline Scott**, Ball State University	Generation ofÂ pug1âˆ†, pug1âˆ†cha1âˆ†Â &Â pug1âˆ†met2âˆ† in *C. albicans* to assess pseudouridine degradation
89*	EC	**Danielle Sommerman**, DePauw University	Effects of Human Error on Long Term Research of a *Phragmites australis* Invasion
90	MB	**Olivia Terry**, Indiana University Kokomo	Impacts of Pesco-Vegetarian Diet with Herbal Supplements on Cytokine Production
91*	EN	**Jayendra Bhatta**, Singhania University	Public Procurement Issues of Construction Project and Its Effects on Contract Performance
92	PA	**Madeline Shepley**, Ball State University	A Reanalysis of PHOEBE Models for W Ursae Majoris Variable NSVS 6099331
93*	EQ	**Abdulgadir Elnajdi**, Ball State University	Assessment of Lead Levels in Soil and Dust on Playground Equipment in Muncie, Indiana, United States

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PS	Psychology	CSLM	Conservation, Sustainability and Land Management	*	Emerging Scientist Research Competition

POSTER PRESENTATIONS

POSTER PRESENTATIONS- 4:00 PM TO 5:30 PM

(NOTE: Odd Numbered Posters 4:00 PM- 4:45 PM; Even Numbered Posters 4:45 PM -5:30 PM)

94	PA	**Caleb Whitcomb**, Ball State University	Analysis of Short-Term Eclipsing Binary System ASASJ061151-4519.7
95*	EQ	**Justin Vangilder** and Kathryn Mudica, Indiana State University	Using crayfish as sentinels for mercury levels in Indiana creeks
96	SE	**Dr. Robert Hougham**, University of Wisconsin	Justice, Equity, Diversity and Inclusion in Environmental Science Education: Science Strikes Back
97*	MB	**Quinn Anderson**, Ball State University	Effect of Dhx36 knockout on brain tissue morphology and gene expression with implications for frontotemporal dementia
98	SE	**Dr. Armando Pena**, Indiana University School of Public Health	Mapping the Characteristics of Gestational Diabetes Prevention Lifestyle Interventions
99	MB	**Jon Brooks**, Butler University	Andrographolide as a Potential Inhibitor of Human Coronavirus OC43 and HKU1 3CLpro Protease Activity
100	SE	**Dr. Sridhar Ramachandran**, Indiana University Southeast	Small single-board computers (SBCs) for Science Education in the K-12 classrooms.
101*	MB	**Joseph Gonsiorowski,** Tulasi Jaladi, Zarah Khan1, Shayan Khurram, Krutil Patel, Samina Akbar*, PhD Marian University College of Osteopathic Medicine, 3200 Cold Spring Road, Indianapolis, IN, 46222 *Principal Investigator, 1Purdue University	Evaluation of Antibiotic Resistance in Gram-negative Bacteria with the use of Kirby Bauer Assays and Genomic Isolation
102	SE	Dr. Rona Robinson-Hill**, Asia Wyatt,** Sandy Gonzalez and KaMya Evans, Ball State University	The Impact of the Training Future Scientist Ambassador Program on High School and Undergraduate Students in Delaware County
103*	MB	**Leah Gouwens and Nishi Natalia**, Marian University College of Osteopathic of Medicine	Using CRISPR-Cas to Characterize Gibberellic Acid Secretion and Sex Susceptibility in *C. neoformans*
104	ZE	**Claudia Chaverri**, University of Indianapolis	Analysis of dorsal skin patterns as unique identifiers of *Xenopus laevis* frogs
105	MB	**Hunter Hoffman**, Marian University College of Osteopathic of Medicine	Characterization of *C. neoformans* isolated from M1- or M2-polarized RAW264.7 macrophages

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GENERAL SCHEDULE OF ORAL PRESENTATIONS

TIME	AUTHOR(S)	PRESENTATION	SEC	RM#
9:45 AM	**Isabel S. Melhado**, BS*, Kaitlyn J. Glavee, BA, Olivia H. Messenger, BA, Jordan E. Roberson, BS, Krista E. Latham, PhD, D-ABFA, University of Indianapolis	**Planning in the Dark: The Necessity of Flexibility When Applying Forensic Science in a Humanitarian Context**	AN	304
	Dr. Eric "VJ" Rubenstein, Ball State University	**"There's a place for everyone in science": Sharing the "Meet-a-Scientist" interview series (Hot Topic)**	CB	JW 1
	Kusum Parajuli, **Sumaiya Mesbah***, Nahian Fahim, Janeen Dahouk, Soufanieh Pierre and Ahmed Mustafa, Purdue University Fort Wayne	**Physiological and behavioural stress response of star fish, *Luidia clatharata*, against elevated temperature and arm amputation**	CB	311
	Dr. Jordan Froese, Ball State University	**Expanding the utility of Rieske dioxygenases through enzyme engineering**	CH	JW 4
	Bill Street, Indianapolis Zoo	**Creation of Indianapolis Zoo's Global Center for Species Survival and the IUCN SSC** (Hot Topic)	CSLM	307
	James O. Farlow (Department of Biological Science, Purdue University Fort Wayne) and **James A. Hyatt** (Department of Environmental Earth Science, Eastern Connecticut State University, Willimantic, CT)	**Size, Shape, and Morphological Diversity of Tridactyl Theropod Dinosaur Footprints**	ES	310
	Dr. Rebecca Cain, Safia Janjua, J. Andrew DeWoody, and Robert K. Swihart, Purdue University	**Coyote (*Canis latrans*) density estimation using scat, SNPs and spatial partial identities**	EC	JW 3
	Katherine L. Barrett, Matt Meersman, Michiana Area Council of Governments; Daragh Deegan, City of Elkhart	**How's the water? A case-study of watershed data in the St. Joseph River Basin**	EQ	305
	Dr. Christopher Stobart, Butler University	**Respiratory syncytial virus (RSV) - Where are we on a vaccine and therapeutics?** (Hot Topic)	MB	JW 2
	Terry Cox, Jr., Taylor Tatlock, and Alice Long Heikens, Franklin College	**Changes in population ecology of Beechdrops at Hougham Woods Biological Field Station over 10 years**	PB	309
	Samantha L. DiBiasio, Madeline R. Mann, Emmeline M. Mann, Brian G. Gall, Hanover College	**Differential Predation Risk on Two-Line Salamander Larvae (*Eurycea cirrigera*) by Two Species of Stream Crayfish**	ZE	312

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GENERAL SCHEDULE OF ORAL PRESENTATIONS

TIME	AUTHOR(S)	PRESENTATION	SEC	RM#
10:00 AM	**Dr. Caitlyn Placek**, Ball State University	**Collecting traumas: Childbearing Women's Motivations for Seeking Drugs and Sustaining Treatment**	AN	304
	Nahian Fyrose Fahim, **Abdullahi Idowu***, Kusum Parajuli, Soufanieh Pierre, Makaylah Hamm, and Ahmed Mustafa, Purdue University Fort Wayne	**Immunological Responses of Sea Urchin (*Arbacia punctulata*) in Stressed and Unstressed Conditions**	CB	311
	Dr. Michael Jenkins, Purdue University	**Conservation genetics of relict eastern hemlock population of Indiana**	EC	310
	Grace Walker, Ball State University	**Impacts of microplastics and a synthetic estrogen on the reproductive social behavior in fathead minnows (Pimephales promelas)**	EQ	305
	Michael A. Homoya	**Anniversary of the Discovery of the Federally Threatened Small Whorled Pogonia Isotria medeoloides (Orchidaceae) in Illinois and Potential for Its Occurrence in Indiana**	PB	309
	Madeline Mann, Samantha L. DiBiasio, Emmeline M. Mann, Katelyn M. Enginger and Brian G. Gall, Hanover College	**Avoidance Strategies of Southern Two-Lined Salamander Larvae (*Eurycea cirrigera)* in response to Two Species of Predatory Stream Crayfish.**	ZE	312
10:15 AM	**Abu Bakkar Siddique**1, Stephanie Dickinson1, Lilian Golzarri-Arroyo1, Scott W. Keith2,3, Emmanuel M. Rockwell4, Ziliang Zhu4,5, Joseph G. Ibrahim4, David B. Allison1; 1.Department of Epidemiology and Biostatistics, Indiana University Bloomington, IN; 2. Division of Biostatistics, Department of Pharmacology, Physiology, and Cancer Biology, Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, PA; 3. Sidney Kimmel Cancer Center, Thomas Jefferson University, Philadelphia, PA; 4.Department of Biostatistics, University of North Carolina at Chapel Hill, NC; 5.Google LLC	**Variable Selection in Life Span Expectation with Measurement Error in Covariates**	AN	304
	Jonathan Lowery and **Sierra Street**, Marian University	**Impact of arthritis on Hoosiers**	CB	311
	Arman Khosravi	**Synthetic Studies on the 4,6-O-Isopropylidene-2,3-di-O-Levulinyl-D-Glucopyranosyl Trichloroacetimidate Donor**	CH	JW 4
	Dr. Beth Hall, Indiana State Climate Office	**Climate summaries, perspectives, and data** (Hot Topic)	ES	JW 3
	Jeffrey D. Holland, Rennie McIntosh	**Agent-Based Modeling of an Exotic Species Invasion**	EC	310

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GENERAL SCHEDULE OF ORAL PRESENTATIONS

AUTHOR(S)	PRESENTATION	SEC	RM#	TIME
Soufanieh Pierre*, Michelle Selo-Ojeme and Dr. Ahmed Mustafa; Department of Biological Sciences, Purdue University Fort Wayne	**Use of Nutraceuticals in an Aquaponics System to Produce Quality Biomass**	EQ	305	**10:15 AM**
Richard Hull, Dr. Eric Knox, Department of Biology at Indiana University-Bloomington	**An Update on the Modern Analysis of the Vascular Plant Flora of the Indiana Wabash River Corridor**	PB	309	
Ieva Roznere, Ohio State University and the Science Director of the Columbus Zoo & Aquarium Freshwater Mussel Conservation and Research Center.	**The Silence of the Clams** (Hot Topic)	ZE	312	
Christopher W. Schmidt, Craig Seidelson, Kelsie Adler, Samantha Foppe, Braden Pefley, Jack Eiteljorge, Aneek Roy, Bailey Dodson, Shannon Dennie, Jonathon O'Dell, Emily Jonas, University of Indianapolis	**Technology in Biological Anthropology: The Importance of Repeatability and Reliability Study for Non-contact Confocal Profilometry**	AN	304	**10:30 AM**
Brooke Flannagan and Dean Wiseman, PhD., University of Indianapolis	**Stress Response of Bovine Endothelial Cells to Chemicals Commonly Found in Vaping Fluids**	CB	311	
David Ice and **Dr. Xianzhong Wang**, Indiana University-Purdue University Indianapolis	**Resistance to three common herbicides in chameleon plant (Houttuynia cordata Thunb.), a highly invasive exotic species**	EC	310	
Edward Brizendine, Brizendine Statistics	**Rejecting null hypothesis statistical testing. A review of the American Statistical Association board statement on p-values and statistical significance.**	MA	305	
Nahian Fahim, Purdue University Fort Wayne	**Antimicrobial and Antioxidant Activity of Sea Urchin (Arbacia Punctulata and Lytechinus Variegatus) Body Wall Extracts, In-Virto**	MB	JW 2	
Scott Namestnik and Wyatt Williams, Indiana Natural Heritage Data Center, Indiana DNR Division of Nature Preserves	**The Vascular Flora of Burket Bog, Kosciusko County, Indiana**	PB	309	

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GENERAL SCHEDULE OF ORAL PRESENTATIONS

TIME	AUTHOR(S)	PRESENTATION	SEC	RM#
10:45 AM	**Adam Simons**, Butler University	**Anticancer Properties and Therapeutic Potential of Northern Spicebush (*Lindera benzoin*)**	CB	JW 1
	Beichen Wang, Purdue University	**A Zebrafish Functional Screen Identifies Leads from FDA-Approved Drugs for Treating Retinitis Pigmentosa**	CB	311
	Erwin Doe, Ball State University	**Functionalization of Nucleic Acid Nanoparticles with Clicked Oligonucleotides for Therapeutic Applications**	CH	JW 4
	Brianna Crawley and Dr. Heather Reynolds, Indiana University	**Variable impacts of herbivore pressure and hydrologic stress on urban understory plant restoration**	EC	310
	Danielle Tinsley, Huntington University	**Using Bifurcation Analysis to Assess the Relative Effects of Harvest and Species Interactions on a Mathematical Model of Fisheries**	MA	305
	George Papadeas, Butler University	**Studies Evaluating the Thermal Stability and Replication of a Murine Coronavirus, Mouse Hepatitis Virus (MHV)**	MB	JW2
	Dr. Brandy Mmbaga	**Long Live Diversity: How to engage in sustainable and meaningful diversity**	GI	309
11:00 AM	**Bobby Luker and Davis Opel**	**Hormonal control of axillary meristem establishment in the moss Mnium cupsidatum after apical meristem removal**	BO	311
	Bryce Kuschel, Ball State University	**Investigation into the role of APJ and VEGF receptor signaling in the regulation of coronary angiogenesis**	CB	JW1
	Dr. Monika Böhm	**Increasing invertebrate conservation assessments through partner networks and student engagement**	CSLM	307
	Dr. Kevin Drury, Huntington University	**Bifurcation Analysis of Nonlinear Fisheries Models**	MA	304
	Emily Landwehr, Butler University	**Developing a Mathematical Model of Mouse Hepatitis Virus (MHV) Coronavirus Thermal Stability and Replication**	MB	JW 2
	Dr. Horia Petrache, Indiana Univeristy-Purdue University, Indianapolis	**Electrostatic charging of lipid membranes by neuromodulators**	PA	305
	Kasey J. Watterson, Olivia M. Waldridge, Katelyn M. Enginger, Cassie M. Winn, and Brian G. Gall, Hanover College	**An Assessment of Learning Modalities in Wild-Caught Freshwater Flatworms (*Dugesia tigrina*)**	ZE	312

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GENERAL SCHEDULE OF ORAL PRESENTATIONS

TIME	AUTHOR(S)	PRESENTATION	SEC	RM#
11:15 AM	**Jackson Payton**	**Does prior exposure to pathogen challenge strengthen subsequent plant responses in the moss *Physcomitrella patens*?**	BO	311
	Makenzi McClain, Butler University	**Investigation of cell autonomous and nonautonomous signaling of the G protein-coupled receptor, FSHR-1, in controlling neuromuscular structure and function in *C. elegans***	CB	JW 1
	Rajnandani Katariya, Indiana State University	**Fox Transcription Factors Mediate Proper Positioning Of Cardiac Cells By Restricting The Expression Of ECM Genes**	CB	304
	Dr. Meden Isaac-Lam, Purdue University Northwest	**Light-Activated Treatment for Triple-Negative Breast and Prostate Cancer**	CH	JW 4
	Gabriel Van Praag, U.S. Fish & Wildlife Service	**Contributing to a Better Understanding of Climate Change on US National Wildlife Refuges: The Civilian Climate Corp Fellowship Program**	CSLM	307
	Adam Farmer, Indiana State University	**trithorax is essential for cardiac Hox gene expression and anterior-posterior patterning of the Drosophila melanogaster embryonic dorsal vessel**	MB	JW 2
	Dr. Christopher Wirth and Abigail M. Vernon, Purdue University	**Blatchley's Butterflies**	ZE	312
11:30 AM	**Darrin Rubino, PhD.**, Hanover College; Christopher Baas, Ball State University	**Using timber species identification, tree rings, and sapwood analysis to interpret the George Ash House (Switzerland County, Indiana)**	BO	311
	Ryan Adkins, Butler University	**The G protein-coupled receptor (GPCR) FSHR-1 and the SPHK-1 lipid kinase regulate C. elegans life- and healthspans via a common pathway**	CB	JW 1
	Ashley Kalinski, PhD., Ball State University	**Macrophage polarization impacts axonal growth of sensory neurons**	CB	304
	Zachary Truelock, Indiana DNR	**Status of the Plains Leopard Frog (Lithobates blairi) in Indiana**	CSLM	JW 4
	George Gundelach, Valparaiso University	**Effect of Candida albicans infection on the plasma membrane expression of the Na+-K+-2Cl– cotransporter 1 (NKCC1) in T84 and Madin Darby Canine Kidney cells (MDCK)**	MB	JW 2
	Kyle Koeller, Ball State University	**Python Package for Eclipsing Binary Stars**	PA	305
	Dr. Kristi Bugajski, Valparaiso University	**BIO 101: An EPIC Beginning for Beacon Biologists**	SE	307
	Casey Venable, University of Indianapolis	**Countless Creatures of the Caverns: Spelunking into Virginia's Cave Spider Diversity**	ZE	312

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GENERAL SCHEDULE OF ORAL PRESENTATIONS

TIME	AUTHOR(S)	PRESENTATION	SEC	RM#
11:45 AM	**Benjamin Spears, Ph.D.**	**Exploring a conserved transcriptional regulatory mechanism in *Physcomitrium patens* TCP transcription factors**	BO	311
	Abbigayle Gamble, Indiana State University	**Twin Roles of the Zinc-Finger Transcription Factor Castor: Specification of Cardiac Cell Subtypes and Regulation of Cardiac Progenitor Cell Division**	CB	JW 1
	Connor G. Bailey, Kyle Richards, Sophia Owutey, LiLi O'Malley, Eric M. Rubenstein, Ball State University	**Characterization of Degradation of Translocon-Clogging Proteins**	CB	304
	Sergio Henriques, Global Center for Species Survival, Indianapolis Zoo	**Protecting Indiana's wild lights and dark skies**	CSLM	JW 4
	Mose Nasser, S&G Excavating, Terre Haute, Indiana	**Possible Faulting of The St. Louis Limestone At Lincoln Park Stone, Putnamville, Indiana**	ES	310
	Michelle Selo-Ojeme*, Isaac Wendel, Sydney Scherrer, Rana Seyam and Ahmed Mustafa, Purdue University Fort Wayne	**The Effect of L-Theanine on the Immunological Stress Response of Nile Tilapia**	MB	JW 2
	Jon Agley,1 Yunyu Xiao,2 Esi E. Thompson,3 Lilian Golzarri-Arroyo4	**The Science of Trust: Does Language Choice Matter When Sharing Scientific Findings?**	SE	307
	Dr. Brian G. Gall, Sidney J. Goedeker, Nettie A. Eigel, Madeline R. Mann, and Samantha L. DiBiasio, Hanover College	**Land Ho! Polarized Light Serves as a Visual Signal for Landward Orientation in Displaced Spiders**	ZE	312

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GENERAL SCHEDULE OF ORAL PRESENTATIONS

AUTHOR(S)	PRESENTATION	SEC	RM#	TIME
Dr. Bilon Khambu, Tulane University School of Medicine	**Role of Autophagy in Liver Zonation** (Hot Topic)	CB	JW 1	2:00 PM
David Bwambok, PhD, Ball State University	**Green approach for removal of polyfluoroalkyl pollutants from water**	CH	JW 4	
Tracy Branam, Indiana Geological & Water Survey	**Uplands Springs Online Database at the Indiana Geological and Water Survey**	ES	310	
Elise Huffman, Butler University	**Susceptibility of Human Coronavirus HKU1 and OC43 3C-like Proteases (3CLpro) to Inactivation by Baicalein**	MB	JW 2	
Nathanael Pilla, Midwest Biological Survey and **Scott Namestnik**, Indiana Natural Heritage Data Center, Indiana DNR Division of Nature Preserves\	**Grass, Sedge, and Rush Identification** (Workshop)	PB	309	
Dr. Shalini Persaud, Saint Mary of the Woods College	**Disease Mapping: Innovative way demonstrating secondary diagnoses can arise from primary diagnoses through interrelated risk factors, using endometrial cancer as a model.** (Hot Topic)	SE	307	
Dr. Virginia Caine, Marion County Public Heatlh Department	**The Future of Emerging Infectious Diseases**		311	
Kent Edmonds and Natalie Stewart, Department of Biology, Indiana University Southeast	**Compensatory Gonadal Hypertrophy in the Male Marsh Rice Rat (Oryzomys palustris)**	ZE	312	
Dr. Brandy Mmbaga	**Long Live Diversity: How to engage in sustainable and meaningful diversity**	GI	JW 3	
Sarah Moh, Purdue University Fort Wayne	**Examining the Relationship between the Gut Microbiome and Central Nervous System Inflammation in Rats with Fetal Alcohol Syndrome**	MB	JW 2	2:15 PM
Nathan Engbrecht, Indiana Department of Natural Resources	**Updated Report on Green Treefrog (Hyla Cinerea) Range Expansions in Indiana 2013-2023**	ZE	312	

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GENERAL SCHEDULE OF ORAL PRESENTATIONS

AUTHOR(S)	PRESENTATION	SEC	RM#	TIME
Griffin Thomas	**Synthesis of a Photo-Cleavable Linker for Selective Drug Delivery of Ipomoeassin F**	CH	JW 4	2:30 PM
Daniel L. Kelleher and Tim J. Kemmis, Midwest GeoSciences Group	**Environmental Sequence Stratigraphy of Mid-Town Carmel, Indiana**	ES	310	
Kusum Parajuli	**Antibacterial and Hemolytic Effects of Different Tissues Extracts from Luidia Clathrata (Sea Star) Against Selected Pathogenic Bacteria**	MB	JW 2	
Allison Dittmer, **Alex Thornburgh**, and Emil F. Khisamutdinov	**Overexpression and Isolation of RGVG and Y639F Mutants of T7 RNA Polymerase for in vitro Transcription of Modified RNA Strands.**	CH	JW 4	2:45 PM
Sefunmi Babatunde, Manchester University	**Investigating the Systemic Effect of Jasmonic Acid Wounding Pathways in Soybean Seedlings**	MB	JW 2	
Dr. Masaru Nakamoto, Valparaiso University	**Regulation of neural Development by Cell-Cell Signaling Molecules** (Hot Topic)	CB	JW 1	3:00 PM
Gbemisola Bamiduro, Ball State University	**Mineralization of Glyphosate by Pd@BiVO4/BiOBr nanocomposite heterojunction photocatalyst**	CH	JW 4	
Victoria Leffel, Indiana Geological Survey	**Indiana's Landslide Inventory**	ES	310	
Lyla Vivian, Butler University	**Microscopic Analysis of Syncytia Formation Dynamics for Coronaviruses and Pneumoviruses**	MB	JW 2	

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GENERAL SCHEDULE OF ORAL PRESENTATIONS

AUTHOR(S)	PRESENTATION	SEC	RM#	TIME
Dr. Alexandra D. Tamerius, Marian University	**Considerations for In-Situ X-ray Diffraction During High-Pressure Solid-State Syntheses** (Hot Topic)	CH	JW 4	3:15 PM
Kate Leonhard, Indiana University Kokomo	**Growth kinetics of susceptible and resistant isolates of Staphylococcus intermedius. A look into the growth mechanisms of resistant bacteria**.	MB	JW 2	
Darrell G Schulze, PhD, Purdue University	**Can Soil Taxonomy Be Used to Map the Distribution of Pre-European Settlement Prairies?**	ES	310	3:30PM
Caitlyn Foye, Riverside High School,	**Comparison of Antimicrobial Properties of Copper and Silver Surfaces**	MB	JW 2	

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ANTHROPOLOGY

Planning in the Dark: The Necessity of Flexibility When Applying Forensic Science in a Humanitarian Context (Oral Presentation)

Isabel S. Melhado, BS*, Kaitlyn J. Glavee, BA, Olivia H. Messenger, BA, Jordan E. Roberson, BS, Krista E. Latham, PhD, D-ABFA, University of Indianapolis

Forensic scientists follow strict standards and best practices to achieve high levels of quality and replicability in the field. However, applying forensic science in humanitarian contexts often requires a level of flexibility and creative problem-solving not faced by traditional forensic scientists. The University of Indianapolis Human Identification Center (UIHIC) provides forensic anthropological analyses to the Midwestern US and has a 30-year history of forensic science outreach. Since 2013, the UIHIC has also volunteered forensic science services to the Texas-Mexico border crisis by participating in the exhumation of unidentified migrant decedents and large-scale search and recovery operations. In January 2023, the UIHIC partnered with Texas State University's Operation Identification (OpID) to excavate a section of a cemetery in Eagle Pass, Texas containing recently deceased migrants. Goals included the proper exhumation, analysis, identification, and repatriation of unidentified migrants who perished crossing the Rio Grande. The UIHIC team typically formulates a tentative plan grounded in forensic archeological techniques before arrival on any death scene based on the provided knowledge of the site. In this case, a number of confounding factors created the need for adjusting that plan, while ensuring that the ultimate goal was never compromised.
Prioritizing team safety in extreme weather conditions and respect for the community and families of the deceased necessitated adaptations and adjustments to the original plan. Burial depths and orientations, as well as soil consistency also challenged original strategies and catalyzed the need for modified approaches to locating burials and removing individuals. The ability to simultaneously maintain flexibility and structure are essential attributes of forensic scientists working in human rights and humanitarian contexts, as are attention to both the practical skills-based and cultural community-based aspects of this type of work.

Collecting traumas: Childbearing Women's Motivations for Seeking Drugs and Sustaining Treatment (Oral Presentation)

Dr. Caitlyn Placek, Ball State University

Why do women, particularly, childbearing women, use drugs, and what factors motivate them to seek and sustain treatment? In both theoretical perspectives in biological anthropology and social discourse within the United States, there is an emphasis on explaining why women avoid (or should avoid) using psychoactive substances during their reproductive years, especially during pregnancy, rather than addressing the reality of their experiences with substance use disorders. In this paper, I describe how collective traumas influence women to seek illicit drugs and sustain treatment. Qualitative data were collected from n=40 women in Indiana, and thematic analysis was used to uncover themes associated with motivations to use drugs and seek addiction treatment. Findings reveal that traumatic events across the lifespan influence women's choices to engage in illicit drug use, and the realization of these events help them in recovery.

Technology in Biological Anthropology: The Importance of Repeatability and Reliability Study for Non-contact Confocal Profilometry (Oral Presentation)

Christopher W. Schmidt, Craig Seidelson, Kelsie Adler, Samantha Foppe, Braden Pefley, Jack Eiteljorge, Aneek Roy, Bailey Dodson, Shannon Dennie, Jonathon O'Dell, Emily Jonas, University of Indianapolis

In 2010, the University of Indianapolis Bioarchaeology Laboratory acquired a Sensofar Plu 2300 white-light confocal profiler (nicknamed Indie) for the study of human molar surfaces in the context of dietary reconstruction (NSF, BCS 0922930). Indie is a precision device that reconstructs surface relief at submicron scales. For dental study, data are collected at 0.17 mm in the X-Y plane and 0.20 mm in the Z plane at 100X. Currently there are no standards in biological anthropology for maintaining measuring devices as well as demonstrating instrument precision and accuracy. Researchers conducted measurement system analysis across Indie's bias (e.g., accuracy compared to a NIST traceable artifact), linearity (i.e., change in accuracy across measurement range), reproducibility (i.e., precision of multiple measurements for a single user), and reliability (i.e., precision of multiple measurements across multiple users). All measurements were collected across three users performing three trials each. Data were interpreted per ISO 25178. Researchers concluded for two surface parameters (Sa & Sq) Indie had strong reliability and reproducibility, but it had a reliability issue with a depth parameter (Sv). Across Sa and Sq gauge bias was acceptable, but linearity results indicated that Indie should not be used to measure features below about 0.1 microns. These findings demonstrate the strengths and limits of Indie, which are critical for its use going forward. As biological anthropology embraces advanced technology, it, likewise, must embrace the validation processes necessary to ensure proper data collection and interpretation.

Variable Selection in Life Span Expectation with Measurement Error in Covariates (Oral Presentation)

Abu Bakkar Siddique1, Stephanie Dickinson1, Lilian Golzarri-Arroyo1, Scott W. Keith2,3, Emmanuel M. Rockwell4, Ziliang Zhu4,5, Joseph G. Ibrahim4, David B. Allison1

1. Department of Epidemiology and Biostatistics, Indiana University Bloomington, IN
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In forensic settings, there is frequently a desire to estimate what a person's age at death would have been had that person not experienced some untimely death from a quasi-random cause. That is, when a plaintiff is "hit by the proverbial bus," how long would they have lived had they

not been hit by that proverbial bus? This is important in determining reasonable payouts for wrongful death suits. In the process of conducting such estimations, scientific experts and statisticians may be asked to build statistical models to predict what the person's age at death would have been and be asked to include especially salient characteristics that either the defense or the prosecution think should be taken into account because of their plausibly strong influence on age at death. Such factors can be negative factors such as diseases or disease risk factors or positive factors such as getting regular exercise or having a family history of longevity. Yet, by selecting covariates to include in a prediction model, as is the recommended norm in the field, on the basis of their extremity in value for the person whose longevity is to be predicted, we conjecture that bias may be introduced. This bias may be introduced both in the prediction of lifespan itself or in the estimation of the precision of that prediction, or both. We show via proofs and simulations that our conjecture is correct. We show that bias is exacerbated when the data in the plaintiff's record is measured with greater error than are the data from a more rigorous research study used to generate the predictive model. We show further that the direction and degree of bias depends on multiple factors. We offer recommendations for generating models in the forensic setting to predict the remaining lifespan and, importantly, interpreting potential biases that may be introduced by this normatively used and recommended covariate selection processes in the forensic setting.

Clinical Significance of Type IV Hiatal Hernias in Geriatric Age Patients (Poster) (EMSR Poster Competition)

Chastidy Gilbert B.A., Claire Eichen B.A., Zachary Rude B. S., Amandine Eriksen Ph.D., University of Indianapolis

Hiatal hernias (HH) are the invasion of abdominal viscera and related structures through an opening within the diaphragm that allows the esophagus to pass from the thoracic cavity into the abdomen. These hernias are subdivided into four categories, types I-IV, which increase in severity and number of structures impacted. Type IV HH are congenital and exceedingly rare, accounting for less than 5% of all HH cases (Patel, 2020). Its presence can seriously impact various structures in both the thorax and abdomen, including the size of the stomach, esophagus, the size and root formation of the lungs, and the associated neurovasculature. There are a number of common presentations between types II-IV in HH including symptoms of acid reflux, coughing, and iron deficiency anemia (Dean, 2012). These can be particularly detrimental for geriatric patients who are already at a higher risk of morbidity. This case study presents a type IV HH found in the routine dissection of a human donor in the Gross Anatomy Laboratory at the University of Indianapolis. This variation is pertinent to those in the medical and anatomical fields striving to understand the body's function and adaptability. Ultrasounds conducted to monitor fetal health and development can aid in the early diagnosis of HH. In children and adults, examinations such as radiography, endoscopy, & computed tomography (CT) scans can also be conducted. Based on the structures that may be impacted and their associated symptoms, a greater appreciation of HH variability will aid in the identification during routine or emergency examinations. Such an understanding will allow for more accurate diagnoses leading to improved medical treatment and increased patient quality of life.
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A Description of Fungal Species Sampled from Decomposing Human Remains (Poster)

Arden Mower & **Stephen Nawrocki**, University of Indianapolis

Forensic mycology is an emerging field that utilizes fungal evidence in forensic investigations. Fungal spores are unique forms of trace evidence that can place suspects and victims at specific locations or help to estimate the postmortem interval (PMI), or time since death, for decomposing human remains. To date, very few forensic investigations have utilized fungi to approximate PMI due to a lack of foundational research. Additionally, decomposition is affected by multiple internal and environmental factors that make it difficult to study the effects of single variables in the process. It is hypothesized that fungi are more closely tied to human decomposition than previously thought, especially in the latter stages of decomposition. The current study provides an overview of an effective fungal sampling technique as well as a description of fungal samples collected from a small pilot group of forensic cases in the Midwest, including identification to the genus or species level. Epidermal fungal growths were sampled from 5 decedents in different stages of decomposition at the Marion County Coroner's Office (Indianapolis, IN) and the Northern Michigan University Forensic Research Outdoor Station (Marquette, MI). These included cases of both indoor and outdoor decomposition. DNA was extracted from the fungi, amplified, and identified using internal transcribed spacing (ITS) sequencing by the Aime Lab at Purdue University. Additionally, mummified skin with visible fungal growth was sampled from a decedent at the Pima County Office of the Medical Examiner (Tucson, AZ) and examined histologically. A dozen genuses of fungi were identified, particularly Cladosporium and Penicillium, with greater diversity in the outdoor cases. Hyphae and spores were seen invading the epidermis and hair follicles. Surface samples taken from human remains underscore the potential for utilizing postmortem fungal growths as a standard tool in forensic investigation.

DNA Transfer to Bedsheets (Poster)

Olivia H. Messenger, BA, **Jordan E. Roberson**, BS, Krista E. Latham, PhD, D-ABFA, University of Indianapolis, Cynthia Cale, MS, DNA Mavens LLC, P.O. Box 669, New Caney, TX 77357

Bedsheets may be swabbed for biological material when assaults occur in the home. The goal is to detect the DNA profile of the suspect; however, no studies to date have investigated how cohabitation may influence the interpretation of DNA profiles collected from household items like bedsheets. The purpose of this project is to compare how cohabitation may impact DNA transfer to bedsheets. This experiment involved two individuals in the same household utilizing separate beds and two individuals in the same household utilizing the same bed. Identical bedsheets were purchased, sectioned into horizontal thirds, and marked with a top, bottom, and participant label. Bedsheets were individually washed and placed on their respective beds. Participants slept on their bedsheets for one week; then each section was swabbed in its entirety. This process was repeated for four weeks.

Samples were extracted using QIAamp DNA Mini Kit (QIAGEN Hilden, Germany), processed with Applied Biosystems™ (Carlsbad, CA) products, quantified with Quantifiler™ Trio DNA Quantification Kit on a 7500 Real-Time PCR System, amplified using Globalfiler™ Amplification Kit on a ProFlex™ PCR System, and analyzed on a 3500xL Genetic Analyzer before deconvolution and likelihood ratio generation via STRmix™ v2.6.1.

Results suggest strong support for inclusion of both individuals sharing a bed. However, results were variable for cohabitants in separate beds ranging from strong inclusion of the sleeper and strong exclusion of the roommate to moderate inclusion of the sleeper and limited exclusion of the roommate. Approximately 60% of samples from single-occupant beds have multiple contributors and 42% of samples from the shared bed have more than two contributors. Additionally, some samples contained DNA from individuals in households they never visited, indicating external interactions are enough for DNA transfer to occur. In conclusion, more studies need to be conducted to understand DNA transfer within shared households better.

A Targeted Sampling Approach to Recovery of Informative DNA Profiles from Eyeglasses (Poster) (EMSR Poster Competition)

Alex F. Wong, BA, Isabel S. Melhado, BS, Krista E. Latham, PhD, D-ABFA, University of Indianapolis, Cynthia Cale, MS, DNA Mavens LLC, P.O. Box 669, New Caney, TX 77357.

Transfer DNA is obtained from shed skin cells and other biological material transported from a donor to an object or person. In the not-so-distant past, the ability to detect and generate an informative genetic profile from transfer DNA was considered nearly impossible to achieve. However, the increased sensitivity of modern DNA technology allows for the generation of DNA profiles from transfer DNA and has enhanced the likelihood of detecting samples that include contributions from more than one individual. A targeted sampling approach when swabbing objects for transfer DNA may have the potential to reduce the number of DNA mixtures and focus on sampling areas that are more indicative of the actual wearer. With a targeted approach, one can determine provenience of DNA profile(s) recovered, reduce backlogs of uninformative samples, and add efficiency in forensic investigations.

BOTANY

Hormonal control of axillary meristem establishment in the moss Mnium cupsidatum after apical meristem removal (Oral Presentation)

Bobby Luker and Davis Opel

In plants, axillary meristem outgrowth occurs once the apical meristem is removed. These outgrowths occur subapical to the stem tip and reestablish stem growth. Little is known about this process in Mnium cupsidatum. Here we describe the normal events that occur post-apical meristem decapitation. Then, we investigate the influential role of auxin and an auxin inhibitor on axillary meristem establishment. Two centimeter segments of M. cupsidatum were cut off a cultured specimen and the apical meristem was decapitated. Segments were replated on either standard BCD medium or standard medium with 2,4D or TIBA. Growth was observed over a one week period. A week after apical meristem decapitation, the mean of 6 outgrowths were observed on a segment. 2,4 D did not influence the number of meristem outgrowths; however, increased concentrations show greater axillary meristem outgrowth lengths as compared to the control. TIBA concentration decreased the number of axillary meristem outgrowths. Future directions may include the discernment of pre-existing axillary meristem or de novo synthesis of axillary meristems. Additionally, the role of further hormones such as cytokinins could be investigated.

Does prior exposure to pathogen challenge strengthen subsequent plant responses in the moss Physcomitrella patens? (Oral Presentation)

Jackson Payton

Plants like all other organisms must be able to defend themselves from pathogens. There are a number of defense related activities that are upregulated during a pathogen challenge. One common class of defense proteins are peroxidases. These enzymes are diverse in defense function including lignification, wound healing, reactive oxygen species generation, and cell wall metabolism. More recently evolved plants, such as angiosperms, have been shown to exhibit a memory of exposure to pathogen challenge such that the response to a second exposure is stronger than the first. In this study we tested whether this phenomenon is present in Physcomitrella patens, a moss species from the Bryophyta division. The basic protocol was to compare peroxidase activity and hydrogen peroxide concentration using colorimetric assays from mosses previously exposed to chitosan, a fungal plant elicitor, compared to an unchallenged specimen. Clear differences were measured in both endogenous and exogenous peroxidase activity and hydrogen peroxide concentration between control and challenged treatments. The data for memory is highly variable and at this time no conclusion can be made on the presence of plant memory of pathogen challenge in this species. A future direction for this study aims to measure changes in gene expression of defense related genes that may support presence of memory.

Using timber species identification, tree rings, and sapwood analysis to interpret the George Ash House (Switzerland County, Indiana) (Oral Presentation)

Darrin Rubino, PhD., Hanover College

George Ash, kidnapped as a child near Bardstown, Kentucky, spent 17 years with his Shawnee captors. When Ash left the tribe circa 1797 he was gifted land along the 1795 Greenville Treaty line in Switzerland County. Land ownership and the construction date of Ash's house, a two-story brick Federal Style I-house, has been disputed due to conflicting interpretation of historical accounts/records. Depending on the construction date, the house may represent the oldest surviving brick house in Indiana. During a recent restoration, all timbers in the building were accessible for sampling and identification. The goals of this investigation were to determine the different types of timber used in construction and to use dendrochronology to date the house's construction and subsequent modification(s). Species identification was performed for 142 timbers from throughout the house. The house was originally constructed of mostly tulip poplar, ash, and butternut; subsequent additions were almost exclusively tulip poplar. Tree-ring analysis of 49 timbers (60 samples) yielded a chronology spanning from 1581 to 1885 (4418 rings). Analysis of timbers original to the house suggests an 1809 construction date, a date suggested by family lore. The exact modification dates for the house could not be determined since harvest dates could not be established for any of the timbers; bark and wane were absent. However, extensive analysis of local tulip poplar timbers obtained from regional structures provided a robust estimate for the expected number of sapwood rings in 19th century timbers. Using the estimate and the number of sapwood ring present in a timber enabled estimation of when the ground floor was repaired (after 1880); the first story was divided into rooms (after 1876), and the interior staircase was modified (approximately 1836). The George Ash house currently represents the second oldest known Indiana brick building scientifically dated with tree rings.

Exploring a conserved transcriptional regulatory mechanism in Physcomitrium patens TCP transcription factors (Oral Presentation)

Benjamin Spears, PhD.,

Plants experience a variety of stresses and signals in their growing environments, with increasingly erratic patterns expected in the face of a changing climate. The expression, accumulation, and activities of proteins called transcription factors (TFs) are required for plants to integrate these signals and respond in an appropriate manner with changes to physiology. The Arabidopsis thaliana TCP-family TFs have been characterized in many roles associated with these responses, but genetic studies of individual TCP activities can be hindered by redundancies between genes in the relatively massive 24-member gene family. TCP genes have recently been identified in the ancestral, nonvascular moss Phycomitrium patens, raising the possibility of homologous regulatory properties and behaviors to the A. thaliana TCPs. However, with only 4 related PpTCPs identified, the reduced genomic scale and simplicity of mutant generation via CRISPR-cas9 gene editing makes P. patens an intriguing model to pursue studies of evolutionarily conserved regulatory mechanisms for this TF family. Additionally, conserved regions of intrinsic disorder and predicted post-translational modification sites in the PpTCPs that closely resemble the same motifs in AtTCPs suggest a potential mechanism of regulatory control of P. patens transcription that is conserved in vascular plants like A. thaliana.

Tree-ring dating of the Bronnenberg I-house at Mounds State Park, Anderson, Indiana (Poster)

Robert Baas, Ball State University

Tree-ring analysis offers a unique opportunity to date the construction and expansion of historic buildings of an unknown age. The goal of this investigation was to determine the build and modification(s) dates for the Bronnenberg I-house at Mounds State Park, Anderson, Indiana. This traditional, vernacular house type displays form and stylistic evidence of a mid-nineteenth century construction. Patterns in the masonry suggest a late-nineteenth century expansion. Archival research presented a variety of possible construction dates that make the house a candidate for tree-ring analysis. Since the house appeared to be modified, timber samples were obtained from throughout the building (attic, interior, and cellar). We focused sampling on timbers with a bark or wane edge (rounded outer surface of a timber from which bark has sloughed off or was removed) since the outermost ring in these samples indicates the year in which a tree was felled and subsequently used for timber. We collected samples from six different timber species. Crossdating, comparing the tree-ring growth patterns in samples of unknown age with regional reference chronologies (series of accurately dated and measured tree-rings), was performed to accurately assign calendar dates to the tree rings in each timber. A total of 29 samples from 16 different timbers were successfully dated. Accurate date assignment was achieved by comparing the growth patterns in the samples to numerous chronologies that have been created from the region. A 149-year-long chronology spanning from 1704 to 1852 (1738 total rings) was created from the house's timbers. Harvest dates were clustered in 1852 and 1853. Given the distribution of cutting dates throughout the building, we hypothesize that the structure was originally erected as a traditional I-house in 1853, but limitations in accessible sampling locations prohibited assigning dates to the house's expansion.

Fungi in Blossom: Mushroom Diversity at Laura Hare Nature Preserve at Blossom Hollow (Poster) (EMSR Poster Competition)

Andrew Deppe, Blake Talbert, and Alice Long Heikens, Ph.D., Franklin College

The Laura Hare Nature Preserve at Blossom Hollow is a 60.2 ha nature preserve in Johnson County within the larger 281-hectare Hills of Gold Conservation Area, owned and managed by the Central Indiana Land Trust. The preserve, a mixture of oak-hickory and bottomland forest, hosts 179 native Indiana plants. The objectives of this research are to determine the mushroom diversity at this high-quality site, and document the specimens by establishing a fungarium at Franklin College. In 2022, 78 mushrooms were collected for identification during 17 forays from March to November. To date, 32 species and 38 genera have been recorded, with 67 of the collected specimens identified to genus or species level. The specimens identified include multiple species of the mycorrhizal families Boletaceae, Russulaceae, and Amanitaceae, highlighting the diversity and health mature plants at Blossom Hollow. Results point to a rich fungal diversity at Blossom Hollow, the benefits of its current management plan, and the need for future surveying of surrounding areas in central Indiana to better determine fungal diversity. Research will continue in 2023 to further explore the mushroom diversity at Blossom Hollow through continued forays, genetic sequencing of unidentified specimens, and studying bioluminescence fungi.

Gene-by-Environment Interactions in Arabidopsis thaliana in Response to Precipitation Extremes (Poster)

Simranjit Kaur, Valparaiso University

Precipitation patterns in the Midwest are becoming more extreme due to climate change. Spring floods and summer droughts are predicted to increase in frequency. This rapid change in precipitation may challenge plant growth throughout the region. We simulated the effects of these extremes in precipitation on 100 Arabidopsis thaliana recombinant inbred lines (RIL) to investigate gene-by-environment interactions on five growth and development phenotypes. We calculated the genetic variance, correlation, and heritability of the phenotypes, and will perform a QTL analysis to determine candidate genes that may play a role in plant success in this environment. The long-term goal of the project is to identify genes with an effect on plant fitness in the Midwestern environment as it is impacted by climate change.

Genetic characterization of TCP gene family in Physcomitrium patens (Poster) (EMSR Poster Competition)

Raegan Mozal, Butler University

TCP-family transcription factors have been well-studied as diverse regulators of plant physiology, but largely in vascular plants. Nonvascular plants like Physcomitrium patens represent a simpler physiological system to work in with fewer gene redundancies to complicate phenotypic studies. The roles of PpTCPs are unknown, however, their gene structure is remarkably similar to that of Arabidopsis thaliana, and it is possible that their respective proteins behave similarly. The work described in this proposal aims to use molecular cloning to generate several tools for characterizing the TCP transcription factor gene family. One tool utilizes a CRISPR:Cas9 system for generating mutant plant lines to observe phenotypic changes. While another set of constructs will be made to visualize and characterize the behavior of TCP proteins in a tobacco expression system. This project focuses on building toward a larger comparative genomic study of the PpTCP gene family with a future goal of phenotypic characterization.

Morphological Effects of Simulated Low-Gravity in Neurospora crassa (Poster) (EMSR Poster Competition)

Maya Nietzel, Valparaiso University

The control of branching in Neurospora crassa has been studied under numerous environmental conditions. Here we present the observations of N. crassa morphology in simulated low-gravity across two main experiments. Wildtype samples were grown on solid and liquid media. The control group was grown on the lab bench while the experimental group was grown in a clinostat. In the first experiment, the samples were allowed to grow for two days so that the edges of growth could be observed. Qualitative properties including density and growth patterns were first compared. Photographs of microscope images were then used to measure branch intervals, frequency of branching, and branch types. In the second experiment, growth rates were calculated using the amount of growth every 24 hours over four days. Using statistical analysis, it was found that lateral branching, branch intervals, and growth rates were not significantly different between control and experimental samples. However, the growth patterns and density variations were dissimilar, and significant difference was found with the

number of main hyphae and apical branching. It was concluded that simulated low-gravity has some effects on the morphology of N. crassa.

Fungi in Blossom (Poster) (EMSR Poster Competition)

Christian Talbert, Franklin College

The Laura Hare Nature Preserve at Blossom Hollow is a 60.2 ha nature preserve in Johnson County within the larger 281-hectare Hills of Gold Conservation Area, owned and managed by the Central Indiana Land Trust. The preserve, a mixture of oak-hickory and bottomland forest, hosts 179 native Indiana plants. The objectives of this research are to determine the mushroom diversity at this high-quality site, and document the specimens by establishing a fungarium at Franklin College. In 2022, 78 mushrooms were collected for identification during 17 forays from March to November. To date, 32 species and 38 genera have been recorded, with 67 of the collected specimens identified to genus or species level. The specimens identified include multiple species of the mycorrhizal families Boletaceae, Russulaceae, and Amanitaceae, highlighting the diversity and health mature plants at Blossom Hollow. Results point to a rich fungal diversity at Blossom Hollow, the benefits of its current management plan, and the need for future surveying of surrounding areas in central Indiana to better determine fungal diversity. Research will continue in 2023 to further explore the mushroom diversity at Blossom Hollow through continued forays, genetic sequencing of unidentified specimens, and studying bioluminescence fungi.

Post-translational Modification Sites in AtTCP8 IDR 2 Influence Localization and Interaction Behavior (Poster) (EMSR Poster Competition)

Anna Childers, Butler University

Protein interactions can be affected by changes in structure, which changes behavior and causes separation from other things in the cell by phase. This is often seen in proteins with intrinsically disordered regions (IDRs), or parts of a protein with no specific structure. The plant-specific Arabidopsis transcription factor AtTCP8 is important to cellular signaling and transcriptional activities and potentially determines their response to environmental stressors. Recently the movement of TCP8 into phase-separated locations was seen in response to hormones within the nuclei of Nicotiana benthamiana, as well as interactions with other growth and defense-related transcription factors. TCP8 contains three IDRs which are likely sites of post-translational modifications that determine whether the transcription factor is enhancing growth or defense, as TCP8 cannot do both at once. We suspected that these IDRs contributed to the observed phase change. To explore this, we observed dynamic movement of TCP8 into localized condensates, using a confocal microscope. In our preliminary studies, we performed a truncation analysis that allowed us to identify sites with altered localization patterns, seen through a lack of condensates, after the removal of IDR 2. To narrow down to specific regions, we identified amino acids known to be post-translationally modified and generated site directed mutants in which they were eliminated. This mutant TCP8 protein (27) exhibits altered protein-protein interaction between TCP8 and brassinosteroid regulatory proteins. Our data points toward IDR 2 and associated PTMs as regulatory elements of TCP8 governing TCP8 phase-separation and associated behaviors.

Post-translational Modification Sites in AtTCP8 IDR 2 Influence Localization and Interaction Behavior (Poster) (EMSR Poster Competition)

Maura Donnelly, Butler University

Protein interactions can be affected by changes in structure, which changes behavior and causes separation from other things in the cell by phase. This is often seen in proteins with intrinsically disordered regions (IDRs), or parts of a protein with no specific structure. The plant-specific Arabidopsis transcription factor AtTCP8 is important to cellular signaling and transcriptional activities and potentially determines their response to environmental stressors. Recently the movement of TCP8 into phase-separated locations was seen in response to hormones within the nuclei of Nicotiana benthamiana, as well as interactions with other growth and defense-related transcription factors. TCP8 contains three IDRs which are likely sites of post-translational modifications that determine whether the transcription factor is enhancing growth or defense, as TCP8 cannot do both at once. We suspected that these IDRs contributed to the observed phase change. To explore this, we observed dynamic movement of TCP8 into localized condensates, using a confocal microscope. In our preliminary studies, we performed a truncation analysis that allowed us to identify sites with altered localization patterns, seen through a lack of condensates, after the removal of IDR 2. To narrow down to specific regions, we identified amino acids known to be post-translationally modified and generated site-directed mutants in which they were eliminated. This mutant TCP8 protein (27) exhibits altered protein-protein interaction between TCP8 and brassinosteroid regulatory proteins. Our data points toward IDR 2 and associated PTMs as regulatory elements of TCP8 governing TCP8 phase separation and associated behaviors.

CELL BIOLOGY

“There’s a place for everyone in science”: Sharing the “Meet-a-Scientist” interview series (Hot Topic)

Dr. Eric “VJ” Rubenstein, Ball State University

Women, people of color, and LGBTQ+ individuals are underrepresented in science textbooks and among classroom instructors, affecting all students’ perspectives of who can be successful in science. Further, scientists are often reduced to their most successful singular contribution. If the goal of the science classroom is simply to cover as much content as possible, this exclusionary narrative is sufficient; however, if the goal is to support students’ journeys in science, this approach is deeply inadequate. To address this persistent issue, I designed the “Meet-a-Scientist” interview series for my sophomore-level Cell Biology course. I carefully selected and interviewed cell biologists from diverse backgrounds (e.g. scientists of color). During recorded Zoom interviews, I asked theses scientists to describe their research as well as their journeys into science, including personal or professional challenges. These interviews were no more than 20 minutes and required little preparation from the interviewees. After watching the interviews, students completed brief reflections, and the responses were highly encouraging. In addition to learning about cutting-edge scientific research, students appreciated these scientists’ discussions of their journeys and struggles. A number of emergent themes from these interviews resonated with students, including the ideas that successful scientists experience the same struggles and self-doubt as students, one’s background does not limit potential for success in a career in STEM, and failure does define one’s potential to make scientific contributions. Students from marginalized backgrounds deeply related to these scientists’ stories. As one student wrote, “I sympathize with her as I am a disabled queer woman in science. I find it sometimes extremely hard to fit in... I am extremely grateful for these videos.” In this session, I will describe the process of conducting and curating interviews, share student responses, and provide guidance on how other educators can implement a similar series.

The G protein-coupled receptor (GPCR) FSHR-1 and the SPHK-1 lipid kinase regulate C. elegans life- and healthspans via a common pathway (Oral Presentation)

Ryan Adkins, Butler University

Later years of life are often characterized by reduced cognitive function and mobility. One contributor is the cellular accumulation of reactive oxygen species (ROS), but our understanding of how cells respond to ROS to promote health and survival is incomplete. Follicle stimulating hormone receptor-1 (FSHR-1) and sphingosine kinase-1 (SPHK-1) mediate responses to oxidative stress and regulate life history traits in the roundworm Caenorhabditis elegans. The genes encoding both proteins are conserved in humans where they are implicated in stress responses, cell survival and neuronal function. fshr-1 and sphk-1 work together to mediate responses to intestinal oxidative stress in C. elegans. Here we show sphk-1 and fshr-1 are required for normal life- and healthspan in C. elegans. We found significant reductions in mutant lifespans on both lawns versus wild type worms, fshr-1, sphk-1 and double mutants had decreased swimming rates compared to wild type worms, but no significant difference in motor decline over time between the genotypes. This suggests the genes may not act in a timed manner to regulate accumulation of oxidative stress. We also saw non-additive effects for the genes on both lifespan and healthspan, as double mutants showed phenotypes equal to single mutants, indicating fshr-1 and sphk-1 work in a single pathway to mediate life- and healthspan.

These data provide evidence of a common genetic pathway between sphk-1 and fshr-1 during aging, consistent with their known roles in oxidative stress mediation. Current studies are exploring details of this relationship via tissue-specific fshr-1 rescue, overexpression, and depletion experiments. Preliminary data indicate that the overexpression of fshr-1 in the intestine or glia increases healthspan.

Characterization of Degradation of Translocon-Clogging Proteins (Oral Presentation)

Connor G. Bailey, Kyle Richards, Sophia Owutey, LiLi O'Malley, Eric M. Rubenstein, Ball State University

Protein degradation is essential for cellular health. Misfolded or aberrant proteins that cannot serve their function must be degraded. Protein degradation at the endoplasmic reticulum (ER) membrane is particularly important since ~33% of proteins are produced at the ER. Translocons are important channels located in the ER membrane that allow for protein translocation (import into the ER). If misfolded proteins stall in translocons, this can have a toxic effect. Such translocon-clogging proteins include Deg1-Sec62, an engineered transmembrane protein, and IAPP, which can form toxic aggregates in diabetes patients. These proteins may be expressed in Saccharomyces cerevisiae to study the impact of and responses to translocon clogging. Two translocon quality control enzymes (Hrd1 and Ste24) contribute to Deg1-Sec62 degradation. Dfm1 is a protein involved in retrotranslocation (extraction from the ER) of different aberrant ER-associated degradation (ERAD) substrates. The role of Dfm1 in degradation of translocon-clogging proteins such as Deg1-Sec62 has not been determined. Further, whether translocon-clogging IAPP oligomers are degraded and the genetic requirements of such degradation have not been characterized. IAPP oligomers display similar proteotoxicity in yeast cells as they do in human cells; overexpression of either DFM1 or STE24 can suppress this toxicity. We hypothesized that Dfm1 promotes Deg1-Sec62 degradation, and that Dfm1 and translocon-declogging proteins Hrd1 and Ste24 and contribute to IAPP degradation. Cycloheximide chase and western blotting were used to examine Deg1-Sec62 and IAPP degradation. Preliminary data indicates that Dfm1 does not play a substantial role in degradation of Deg1-Sec62, and that IAPP oligomers are highly stable. Since IAPP is not degraded by cells in normal cellular conditions, reduction of IAPP toxicity by STE24 or DFM1 overexpression may occur through means other than direct degradation.

Physiological and behavioural stress response of star fish, Luidia clatharata, against elevated temperature and arm amputation (Oral Presentation)

Kusum Parajuli, **Sumaiya Mesbah***, Nahian Fahim, Janeen Dahouk, Soufanieh Pierre and Ahmed Mustafa, Purdue University Fort Wayne

Gradual temperature rise resulting from global warming is one of the serious stressors adversely affecting the community structure in marine environments. Keystone predator species like sea stars, in particular, are susceptible to temperature stress in a variety of ways, including in their behavior, physiology, and immunity. These economically significant species are also stressed by anthropogenically caused factors including invasive fishing practices and heavy metal discharge, which may result in arm amputation. In this study, we aimed to understand the stress response in Luidia clathrata, exposed to elevated temperatures and arm amputation by simulating the oceanic environments in lab. In addition to the effects of each individual stressor, we also attempted to study the combined effects of temperature and arm amputation. To have the through grasp on physiological and behavioral alteration caused by the aforementioned

stressor, we leveraged the parameter such as total and differential coelomocyte counts, total coelomocyte protein, coelomocyte phagocytic activity and righting behavior. We will discuss our observations at the conference.

Twin Roles of the Zinc-Finger Transcription Factor Castor: Specification of Cardiac Cell Subtypes and Regulation of Cardiac Progenitor Cell Division (Oral Presentation)

Abbigayle Gamble, Indiana State University

Mutations in the zinc-finger transcription factor-encoding gene CASZ1 lead to aberrant heart development in humans, Xenopus, and mice, indicating its conserved role in cardiogenesis. Our phenotypic analysis of a null mutation of castor (cas), the Drosophila ortholog of CASZ1, shows that cas has two distinct roles in heart development. First, cas is required for mediating all three categories of cardiac progenitor cell division: asymmetric, symmetric, and cell divisions at an earlier developmental stage. Second, cas prevents subsets of cells in the most anterior region of the heart, the anterior aorta, from becoming specified as seven up-expressing cardial cells (Svp-CCs). Svp-CCs are present in the posterior aorta and the even more posterior heart proper, regions of the heart determined by the expression of the Hox genes Ultrabithorax (Ubx) and abdominal A (abd-A). Intriguingly, both Ubx and abd-A repress cas, and ectopic expression of either of these two Hox genes in the anterior aorta leads to the ectopic specification of Svp-CCs there—a result which phenocopies cas loss-of-function mutants. Collectively, these data raise the possibility that that Ubx and abd-A specify Svp-CCs in the posterior aorta and the heart proper by repressing cas in those regions. In contrast, in the anterior aorta, in the absence of both Ubx and abd-A, cas levels may be sufficiently high to repress the Svp-CC fate. We are presently testing this hypothesis for cas-mediated Svp-CC specification and attempting to elucidate the pathways through which cas regulates cardiac progenitor cell division.

Immunological Responses of Sea Urchin (Arbacia Punctulata) in Stressed and Unstressed Conditions (Oral Presentation)

Nahian Fyrose Fahim, **Abdullahi Idowu***, Kusum Parajuli, Soufanieh Pierre, Makaylah Hamm, and Ahmed Mustafa, Purdue University Fort Wayne

As echinoderm, sea urchins perform essential ecological roles in the marine environment. Unfortunately, the world is experiencing significant environmental changes and transformations. These changes are causing severe stress to marine species including sea urchins. Therefore, it is important to study how environmental stresses affect their physiology and find solutions to prevent the extinction of this species. The aim of this study was to investigate the impact of stress and the immune responses of sea urchins (Arbacia punctulata) in three different stress conditions that included increased temperature as a physical stressor, lipopolysaccharides (LPS) as a chemical stressor, and a combination both (increased temperature and LPS together). In sea urchins, coelomocytes are comprised of phagocytic cells, vibratile cells, red spherule cells, and colorless spherule cells that freely circulate in the body fluid of coeloms and build the defense system. We specifically investigated the phagocytic and lysozyme activity of Arbacia punctulata in different stressed conditions and compared them with the control. Our results reveal those chemical and physical stressors significantly (p<0.05) impact sea urchins' (Arbacia punctulata) immunity.

Macrophage polarization impacts axonal growth of sensory neurons (Oral Presentation)

Ashley Kalinski, PhD., Ball State University

Neurons are responsible for sending and receiving signals that result in everything from thoughts to movement. Immune cells are responsible for fighting against pathogens to keep the host healthy. Macrophages are the most heterogenous and plastic of the immune cells and exist in one of two polarization states, pro-inflammatory or anti-inflammatory (labeled as M1 and M2 respectively). In the peripheral nervous system, macrophages appear to be essential in the regeneration process, but how they affect neuronal growth is not clear. We hypothesized that M2, but not M1 macrophages enhance neuronal growth. To test this, splenic macrophages were cultured and grown for five days in medium containing the cytokine m-CSF to promote survival. On day 5, one of three cytokines were added to the growth medium; m-CSF (control), IL-4 (anti-inflammatory), or IFNɣ (pro-inflammatory). After 24 hours they were replated onto a culture with wildtype or Sarm1-/- dorsal root ganglion neurons (DRGs). The cultures were allowed to grow for twenty-four hours, and macrophage morphology and neuronal outgrowth were measured. We were able to successfully grow both macrophages and DRG neurons in culture and found that cytokine treatment affected macrophage morphology. Axonal length measurements showed that the neurons grown in culture with the anti-inflammatory macrophages grew the longest axons of the three conditions, while the pro-inflammatory macrophages induced axonal retraction. Wildtype and Sarm1-/- neurons were positively affected by the anti-inflammatory macrophages to the same degree, but the Sarm1-/- neurons were not as negatively affected by the pro-inflammatory macrophages as the wildtype. SARM1 is a toll-like adaptor protein that negatively regulates NFκb production during viral and bacterial infections. Our data suggests SARM1 might be required for neuronal responses to macrophages. Future experiments will examine this relationship further and enhance our understanding of how macrophages influence neuronal growth after injury.

Fox Transcription Factors Mediate Proper Positioning Of Cardiac Cells By Restricting The Expression Of ECM Genes (Oral Presentation)

Rajnandani Katariya, Indiana State University

The development of a complex organ requires the specification of appropriate numbers of its constituent cell types as well as their correct positioning within the organ. We previously showed that Fox transcription factors (TFs) Checkpoint suppressor homologue (CHES-1-like) and Jumeau (Jumu) determine the correct number of different cardiac cell types by regulating cardiac progenitor cell divisions. Here we show that CHES-1-like and jumu are also required for the correct positioning of these cardiac cell types: null mutations in either gene result in the misalignment and incorrect location of cardial and pericardial cells within individual hemisegments. Statistical analysis demonstrated that these positioning defects cannot be completely explained by steric constraints caused by differing number of cardial cells in contralateral hemisgments due to cell division defects. In order to discover the other cause underlying positioning defects, we compared genome-wide transcription expression profiles of purified mesodermal cells from wild-type embryos and Fox mutants to identify Fox-regulated targets. Among the 2,131 target genes we identified, genes encoding extracellular matrix (ECM) proteins were overrepresented among genes repressed by the Fox TFs. In particular, the ECM proteins Viking, Collagen type IV alpha 1, and Terribly reduced optic lobes were all overexpressed in Fox mutants. Our preliminary phenotypic analysis of these specific targets suggests that the Fox TFs bring about the correct positioning of cardiac cell types by restricting their expression: ectopic overexpression of each of these ECM genes in the mesoderm

phenocopies the cardiac cell positioning defects observed in CHES-1-like and jumu loss-of-function mutants.

Investigation into the role of APJ and VEGF receptor signaling in the regulation of coronary angiogenesis (Oral Presentation)

Bryce Kuschel, Ball State University

Coronary artery disease (CAD) is one of the leading causes of death worldwide; however, a therapeutic remedy has not been developed. Coronary angiogenesis, a process by which new coronary vessels are formed in the embryos, is primarily a function of endothelial cells which form the inner lining of the vessel wall. Therefore, understanding coronary endothelial cells' cellular and molecular biology can teach us how to effectively stimulate the repair and regeneration of damaged coronary vessels. Investigations in mice have identified the Apelin receptor (alias: APJ) and Vascular endothelial growth factor receptor 2 (VEGFR2) signaling as regulators of coronary angiogenesis. However, it is unclear whether APJ and VEGFR2 signaling interact with one another in the regulation of coronary angiogenesis. To investigate this, we performed in vitro cell culture experiments using isolated coronary endothelial cells and in vivo experiments with APJ KO mice. We hypothesize that ELABELA/APJ signaling downregulates VEGFR2 expression in coronary endothelial cells. Our expression analysis using immunostaining and qPCR show that APJ loss-of-function in coronary endothelial cells results in increased VEGFR2 expression. Collectively, our results show that ELABELA/APJ suppresses VEGFR2 signaling during coronary angiogenesis. This study is supported by NIH R15 (1R15HL159660-01) research grant to Bikram Sharma.

Impact of arthritis on Hoosiers (Oral Presentation)

Jonathan Lowery, Marian University

Arthritis is a group of over 100 joint conditions and diseases that affects more than 54 million adults in the US. Arthritis places an enormous burden on the US. healthcare system, accounting for over $140 million in direct costs, and is the nation's number one cause of disability. Despite this, there is a poor understanding of the real-life experiences and daily challenges faced by patients with arthritis. Arthritis disproportionately affects African American/Black individuals, Hispanic/Latin American individuals, patients with low-income, and those living in rural areas. These individuals are also disproportionately affected by other chronic illnesses that impacts their experience with arthritis leading to significant challenges regarding ability to manage pain and/or the cost associated. Hence, we took a patient-oriented, outcomes approach to develop and implement a survey aimed at determining the impact of arthritis on patients' emotional and social health, and experience of care. The electronic Live Yes! Insights survey, hosted on Qualtrics, was developed was developed with input from 110 different patients, healthcare providers, and measurement experts to reflect a patient living with arthritis while incorporating measures included in the PROMIS-29, PROMIS Emotional Support Short Form v2.0, and the Health Care Empowerment Questionnaire, thus allowing for comparison to established benchmarks of the general population. Nationwide, the survey has received over 40,000 responses. Among the 515 responses from Indiana, most respondents have osteoarthritis (43%) along with a variety of other forms of arthritis including Rheumatoid Arthritis (32%), Psoriatic Arthritis (7.4%), and Degenerative Disc Disease (5.5%). Most respondents from Indiana, hereafter referred to as "Hoosiers," are female (79%) and identify as "white" (82%), with

10.6% identifying as African American/Black, 1.19% identifying as Hispanic/Latino American (1.19%) and 1.38% identifying as Asian American. 62% of Hoosier patients with a higher pain score – i.e., 7 or higher out of 10 –report difficulty with doing all of their regular leisure activities with others compared to 7% of patients with a low pain score of 4 or below. 66% of Hoosier patients report difficulty of all activities with friends that they would like to do compared to 13% of patients with a low pain score. 85% of Hoosier patients with a high pain score report their pain interferes with their day-to-day activities compared to 6.5% of patients with a low pain score. In addition, 75% of Hoosier patients with a high pain score report their pain interferes with their ability to participate in social activities compared to 6% of patients with a low pain score. Additionally, just 30% of Hoosier patients with a higher pain scale reported they received all the help they needed compared to the 76% of patients with a low pain scale, patients scoring 0-4. 33% of patients with a high pain score reported they got all the information they needed compared to the 76% of patients with a low pain scale. 50% of patients with a high pain scale reported they felt their choices were respected compared to 82% of patients with a low pain scale. 45% of patients with a high pain scale reported they were able to speak with a professional to get their questions answered compared to the 75% of patients with low pain. This study provides insight into the impact of arthritis on Hoosiers. Future work will focus on diversifying the respondent pool to gather information from underrepresented patient groups to better understand arthritis on these individuals.

Investigation of cell autonomous and nonautonomous signaling of the G protein-coupled receptor, FSHR-1, in controlling neuromuscular structure and function in C. elegans (Oral Presentation)

Makenzi McClain, Butler University

Regulation of neuronal signaling balance is critical for nervous system function. At neuromuscular junctions (NMJs), this occurs via the regulation of excitatory and/or inhibitory signaling events. The G protein-coupled receptor (GPCR), FSHR-1, is a key regulator of NMJ signaling, as well as germline differentiation, and stress responses. Prior research showed that C. elegans with an fshr-1 deletion exhibit decreased muscle excitation along with an accumulation of fluorescently labeled synaptic vesicles (SNB-1::GFP) in excitatory cholinergic motor neuron presynapses. We used swimming assays and quantitative imaging of the synaptic vesicle protein SNB-1::GFP to confirm the NMJ defects of fshr-1 loss-of-function (lf) mutants. Expression of fshr-1 in all neurons, and in excitatory cholinergic or inhibitory GABAergic neurons alone, restored NMJ activity in these animals but not synaptic vesicle localization. Endogenous fshr-1 expression was detected in several head cells, along with its known intestinal expression, but not in body wall motor neurons, suggesting a complex site of action. Behavior experiments in which re-expression of fshr-1 under intestinal, neuronal, and glial promoters rescued behaviors of fshr-1 mutants further support non-motor neuron sites of action. Currently, we are imaging SNB-1::GFP to quantify the abundance and localization of synaptic vesicles in cholinergic NMJs of animals with fshr-1 re-expressed under these non-motor neuron-specific promoters to determine if the rescue of NMJ function with these promoters correlates with expected changes in SNB-1::GFP accumulation. Future work will include the use of tissue-specific deletions to identify where fshr-1 is required for NMJ structure and function in diverse physiological conditions. Together these data should provide a more complete picture of the cell-autonomous and non-autonomous mechanisms by which FSHR-1 controls NMJ function that may be relevant to mammalian FSHR, which has been implicated in neurological dysfunction.

Anticancer Properties and Therapeutic Potential of Northern Spicebush (Lindera benzoin) (Oral Presentation)

Adam Simons, Butler University

Cancer remains a leading cause of death in humans. Traditional approaches to the treatment of illnesses such as cancer have relied heavily on herbal medicine and natural plant products. Northern Spicebush (Lindera benzoin) is a native Indiana plant that has been used by several Native American tribes for medicinal applications, however, there remains little known of its therapeutic potential to treat both cancer and inhibit viruses. In this study, we prepared L. benzoin aqueous extracts and tested whether they were capable of inhibiting proliferation of a cervical cancer cell line (HEp2) and a common human respiratory pathogen, respiratory syncytial virus (RSV). Using an MTS assay and microscopy, we found that L. benzoin extracts were able to induce significant morphological differences to treated HEp2 cells in vitro, including higher rates of apoptosis and cytotoxicity compared to control treatment. While high concentrations were also able to inhibit RSV replication, there was no significant reduction in virus observed at non-cytotoxic concentrations. These studies show the therapeutic potential of a native Indiana plant to induce apoptosis in cancer cells in vitro.

A Zebrafish Functional Screen Identifies Leads from FDA-Approved Drugs for Treating Retinitis Pigmentosa (Oral Presentation)

Beichen Wang, Purdue University

Retinitis pigmentosa (RP) is a genetically inherited form of retinal degeneration that affects approximately 1 in 4,000 people worldwide. RP can be caused by mutations in phototransduction genes, including RHODOPSIN (RHO). One RHO mutation, Q344X, can cause early-onset autosomal-dominant (ad) RP in humans, which has no treatment. Hence, we aimed to discover new drugs for Q344X RP by repurposing FDA-approved drugs, which is faster and cheaper than de novo drug discovery. To achieve this aim, we screened a SelleckChem FDA-approved drug (FDA) library (1430 compounds) on a transgenic Q344X zebrafish model, which displayed an early onset of RP like human patients. We used a visual-motor response (VMR) assay, where Q344X larvae showed reduced responses compared with wildtype (WT) during light offset at 7 days post-fertilization (dpf). Therefore, we expected that potential hit drugs would ameliorate Q344X responses. We exposed Q344X larvae to 10 μM compounds from 5 to 7 dpf. We first eliminated 191 drugs that showed toxicity (13.4%) and then measured the effect of 1239 non-toxic drugs in the VMR assay. The positive and negative controls were drug-carrier-treated WT and Q344X, respectively. After the screening, we identified two types of positive hits: 1) 8 compounds that increased Q344X light-Off VMR compared with the negative controls (Welch's t-test, Bonferroni-adjusted p < 0.05), and 2) another 8 compounds induced Q344X to display a light-Off VMR profile similar to that displayed by the positive WT controls (analyzed by hierarchical clustering). We further investigated one hit that induced the Q344X larvae to display a WT-like VMR and found this hit induced more rod photoreceptors in the Q344X eyeballs. These results suggest that the hit can potentially benefit Q344X RP patients. Our future characterizations will identify more potential hits for downstream drug development.

Stress Response of Bovine Endothelial Cells to Chemicals Commonly Found in Vaping Fluids (Oral Presentation)

Dean Wiseman, PhD., University of Indianapolis

Electronic cigarettes, or e-cigs, have become increasingly popular, especially in young people as an alternative to traditional tobacco cigarettes. However, not much is known about their long-term effects, as they were only first sold in America in 2007, and assumptions exist regarding safety. E-cigs have a heating element which aerosolizes vaping fluid for inhalation. Nicotine and delta-9-tetrahydrocannabinol (Δ9-THC) vaping liquids can be used in e-cigs, as well as vaping fluids with no psychoactive additives. Other common chemicals found in vaping liquids include flavorings and solvents like glycerol and propylene glycol. Vitamin E acetate (aka α-tocopherol) is another common additive used to increase absorption. Previous studies found that vitamin E acetate consistently produces damaging levels of superoxide, indicating it as a strong candidate for acute lung injury seen with vaping and e-cig use. Given this, the CDC has expressed concern over use of vitamin E acetate in vaping because it may remain in the lungs longer than other chemicals, and trigger inflammatory responses leading to lung damage. Although vitamin E acetate remains a leading candidate, nevertheless, hundreds of other potentially injurious compounds continue to be used.

The Investigation of Key Mechanisms Driving Chemotherapy Resistance in T-cell Acute Lymphoblastic Leukemia (Poster)

Brian Ault, Ball State University

T-cell acute lymphoblastic leukemia (T-ALL) is an aggressive cancer driven by malignant expansion and transformation of T-cell progenitors, from T-cell committed lymphoblasts, with a diffuse invasion of bone marrow and peripheral blood. Current treatment of T-ALL consists of high-intensity combination chemotherapy which comes with significant short-term and long-term side effects, including relapse in up to 20% of pediatric and 40% of adult cases. Ectopic expression of transcription factors, such as TAL1 alone, can be an initiating step in T-ALL development, but additional mutations are required to fully transform normal T- cells into leukemia cells. Moreover, heterozygous somatic mutations are acquired that introduce binding motifs for the MYB transcription factor in a precise non-coding site, which creates a super-enhancer upstream of the TAL1 oncogene. Furthermore, MYB-binding is thought to provide a genetic mechanism for TAL1 monoallelic expression. This super-enhancer complex is constructed through physical associations with enhancers of TAL1, LMO1/2, MYB, GIMAP cluster, LBD1, and the GATA family of transcription factors. Additionally, TAL1, GATA3, and RUNX1 form an autoregulatory loop and have been linked to an early arrest in the T-cell differentiation program and elevated levels of anti-apoptotic genes. Specifically, TAL1 and other associated transcription factors are located near main signaling pathways (RAS, JAK, PI3K, NOTCH) on the chromosomal locus. I propose that this translocated TAL1 can alter the expression of these signaling pathways. Altered expression of anti-apoptotic members such as the IAP family of proteins has been implicated in T-ALL. Specifically, Survivin and Livin proteins are overexpressed in many cancers. Additionally, it has been proposed that there is the presence of an atypical p65/c-REL transcription factor complex rather than the classic p65/p50 NF-κβ dimer. With this, the goal of this research is to improve existing treatment strategies by utilizing siRNA to knock down the expression of key players that are thought to result in chemotherapy resistance. In the end, new, undefined key players in T-ALL may be identified and targeted as a way to improve prognosis and treatment.

Suppression of Breast Cancer Cell Proliferation by the Dietary Phytochemicals Coumaric Acid, Chlorogenic Acid, Betulinic Acid, and Indole-3-Carbinol (Poster)

Kaitlyn Wilson, Andres Carranza, Tylene Wadkins, and **Kimberly M. Baker**, University of Indianapolis

Breast cancer is a worldwide health problem that continues to rank as one of the leading causes of death in women. Coumaric acid, chlorogenic acid, betulinic acid, and indole-3-carbinol, dietary phytochemicals found in a variety of fruits and vegetables, have been shown to exhibit anticancer activity; thus, the use of these dietary agents in combination may be effective for the chemoprevention and therapy of breast cancer. In this study we evaluated the antiproliferative effects coumaric acid, chlorogenic acid, betulinic acid, and indole-3-carbinol individually and in combination, using MCF-7 breast cancer cells. We found that each of the phytochemicals inhibited MCF-7 cell proliferation in a dose-dependent manner. Furthermore, we found that co-administration of lower doses of coumaric acid and chlorogenic acid or betulinic acid and indole-3-carbinol, resulted in greater inhibition of cell proliferation than either agent alone at the same dose and indicate an additive effect. These results suggest that combinatorial treatments using coumaric acid and chlorogenic acid or betulinic acid and indole-3-carbinol may be an effective chemotherapeutic strategy against breast cancer.

Macrophage polarization impacts axonal growth of sensory neurons (Poster)

Julianna Bennett, Rachel E. Williamson, Maxx Martinez, and Ashley L. Kalinski, Ball State University

Neurons are responsible for sending and receiving signals that result in everything from thoughts to movement. Immune cells are responsible for fighting against pathogens to keep the host healthy. Macrophages are the most heterogenous and plastic of the immune cells and exist in one of two polarization states, pro-inflammatory or anti-inflammatory (labeled as M1 and M2 respectively). In the peripheral nervous system, macrophages appear to be essential in the regeneration process, but how they affect neuronal growth is not clear. We hypothesized that M2, but not M1 macrophages enhance neuronal growth. To test this, splenic macrophages were cultured and grown for five days in medium containing the cytokine m-CSF to promote survival. On day 5, one of three cytokines were added to the growth medium; m-CSF (control), IL-4 (anti-inflammatory), or IFNɣ (pro-inflammatory). After 24 hours they were replated onto a culture with wildtype or Sarm1-/- dorsal root ganglion neurons (DRGs). The cultures were allowed to grow for twenty-four hours, and macrophage morphology and neuronal outgrowth were measured. We were able to successfully grow both macrophages and DRG neurons in culture and found that cytokine treatment affected macrophage morphology. Axonal length measurements showed that the neurons grown in culture with the anti-inflammatory macrophages grew the longest axons of the three conditions, while the pro-inflammatory macrophages induced axonal retraction. Wildtype and Sarm1-/- neurons were positively affected by the anti-inflammatory macrophages to the same degree, but the Sarm1-/- neurons were not as negatively affected by the pro-inflammatory macrophages as the wildtype. SARM1 is a toll-like adaptor protein that negatively regulates NFκb production during viral and bacterial infections. Our data suggests SARM1 might be required for neuronal responses to macrophages. Future experiments will examine this relationship further and enhance our understanding of how macrophages influence neuronal growth after injury.

Role of cell-extracellular matrix interaction in bitter melon extract induced cytotxic effects on human breast cancer cell (Poster)

Elias Bittar, Chase Throop, Marissa Remedi, Kalie Kopecek, **Bhupal P. Bhetwal**

Introduction: Bitter melon extract (BME) is known to exhibit cytotoxic effects on breast cancer cells (MCF-7). However, the molecular mechanisms by which BME exerts cytotoxic effects are not established. Integrins (which are transmembrane cell surface proteins) are universally expressed in all cell types and play critical roles in anchoring cells to the extracellular matrix and hence their survival. Integrin proteins when activated in turn activates a cascade of intracellular signaling steps (such as activation of focal adhesion kinase, FAK) which facilitates cell attachment, migration, survival, division etc. Aims: We aimed to investigate if BME exerts cytotoxic effects on MCF-7 cells via inhibiting attachment of cells to the extracellular matrix. We hypothesized that BME exerts decreases expression of integrins and hence activation of FAK leading to cell cytoxicity. Methods: Fresh bitter melons were purchased from an Asian grocery store and the extract (BME) was extracted, centrifuged, and filter sterilized. The MCF-7 cells were cultured in DMEM medium with 1% BME (v/v). After culturing cells for 48 hours, pictures of cultures were taken to confirm cytotoxic effects on cells. In our earlier experiments, BME induced decrease in cell viability was also confirmed using Trypan blue exclusion and MTT assays. The cells were harvested and changes in the protein expression of β1-integrin and phospho-FAK (activated FAK) were determined using anti-β1-integrin and anti-phospho-FAK antibodies in the western blotting. Results & Discussion: BME exerted cytotoxic effects on MCF-cells (N=4). BME also reduced expression level of β1-integrin protein (N=2 with duplicate gels). Also, BME reduced expression of phospho-FAK. The data together supports our hypothesis. In the future, we will be running more sets of experiments with loading controls to confirm our findings.

Potential for Symphyotrichum patens (Purple Aster) to inhibit cancer cell proliferation and virus replication (Poster) (EMSR Poster Competition)

Ellie Brill, Butler University

Symphyotrichum patens (purple aster) has been used by the native tribes in Indiana to treat respiratory infections for generations. In this study, we aimed to discover the cytotoxic and antiviral properties of purple aster. We used S. patens extracts to evaluate both the cytotoxicity and ability to induce apoptosis in a human cervical cancer line derived from HeLa cells (HEp2). Additional studies were performed to evaluate whether S. patens extracts were capable of inhibiting infection by respiratory syncytial virus (RSV), a major human respiratory pathogen of infants and the elderly. We found that purple aster had no significant impact on cytotoxicity or virus viability. These studies provide more clarity into the therapeutic potential of S. patens and indicate that the effects seen in traditional medicine might be from a more indirect method that isn’t completely replicated in cell culture requiring future study.

Inhibiting S100B using miRNA and Troubleshooting Cell Growth (Poster) (EMSR Poster Competition)

Animesh Dali, DePauw University

S100B is a protein that is over-expressed in neuronal cells following Traumatic Brain Injury (TBI). It is an apoptotic factor and overexpression of this protein results in neuronal death. In our research, we grew human cell cultures, Sk-Mel-28 and A375, that express S100B and performed hexylamine treatment on them in order to investigate the cell viability using wound healing and MTT assays. We have previously identified miRNAs that could be potential inhibitors of S100B. Our current objective is to transfect our human cell cultures with these identified miRNAs and confirm if they can successfully inhibit S100B. Western Blots will be used to visualize a change in protein concentration. We encountered a problem where our cell culture died repeatedly. To troubleshoot this problem, we decontaminated our incubator, grew our culture in smaller T25 flasks, increased FBS concentration in our media, and applied PenStrip to the culture.

Modeling Repeat Mild Traumatic Brain Injuries (rTBIs) In-Vitro (Poster) (EMSR Poster Competition)

Taylor Hiland, Chris Stovall, Elizabeth Delery, PhD, Marian University College of Osteopathic Medicine

Chronic Traumatic Encephalitis (CTE) is a degenerative brain disorder characterized by a dementia-like phenotype and declination in memory, executive dysfunction, and mood. It is commonly seen in NFL players due to its association with repetitive head trauma commonly associated with contact sports. Existing literature supports the belief that repetitive head trauma, even mild, may accumulate eventually leading to lasting and irreparable damage. College football players, on average, experience 1,400-1,500 head impacts per year, or roughly 14 per game (Crisco et al., 2010). This study sought to determine the cytokine profile in repeat mild traumatic brain injuries (rTBI) in choroid plexus endothelial cells (CPECs), which comprise the blood-CSF barrier. It is our hypothesis that pro-inflammatory cytokines and chemokines play a role in exacerbating post-rTBI symptomology. Identifying these cytokines and chemokines and critical timepoints post-injury is important to allow us to better treat TBIs and prevent cumulative damage. Using primary human CPECs and the FlexCell Tension system to apply a repetitive 12% mechanical elongation strain over one hour to mimic mild axonal stretching injury in a college football game, researchers examined 36 different cytokines at multiple time points post-injury using RnD microarrays. There were numerous changes in multiple cytokines in the 24- to 48-hour period post injury, but most notable was a 2-fold increase in CCL5 (RANTES) between 24- and 48- hours post-injury compared to the control. RANTES has been associated with neurodegenerative diseases like Alzheimer's disease, a relative of CTE. Additionally, there was a 2-fold increase in both chemokine CXCL12 and Macrophage Migration Inhibitory Factor (MIF), indicating a complex immunological response that seems to favor T cell response over monocytes/macrophages post-insult. These results can be used to understand the response of human CPECs to the strain forces seen during repeat mild TBIs like those seen in college football players during gameplay.

A “Key” Template for Unlocking Protein Degradation in C. elegans (Poster) (EMSR Poster Competition)

Henry Giesel, Wabash College

The ability to control protein expression in an organism allows scientists to understand how different proteins function in development and disease. The Latching Orthogonal Cage-Key pRoteins (LOCKR) system is a de novo protein control tool with two parts, a Key and a Switch. When the Switch is in an “off” state (locked), it masks a bioactive sequence, such as a degron, responsible for protein destruction. When the corresponding Key is added, the degronSwitch is turned “on” (unlocked), which exposes the degron, causing the Switch and any attached protein to be degraded. While the LOCKR system has proved useful for protein control in tissue culture cells and yeast, we are developing LOCKR for use in a multicellular organism, the C. elegans worm, for the first time. In our work, we designed templates for two distinct Keys (A and C) using PCR and Gibson cloning. Our templates contain a C. elegans-optimized Key sequence, a small epitope tag used for detection in the worm, a tubulin 3’ UTR for sequence stability, and ,most importantly, a docking site for promoters. The docking site allows us to efficiently insert different promoters, facilitating targeted degradation in different tissues within the animal. To date, we have added two promoters, one for ubiquitous Key expression throughout the animals and one for germline-specific expression. The Key templates designed here complement a set of fluorescently tagged Switch templates (A and C) created by other lab members. We are currently generating transgenic worms using MosSCI, a powerful gene editing technique, and will characterize Key-containing animals for brood size, fertility, and longevity relative to wild type animals. We anticipate that the development of the LOCKR system will provide an additional tool for analyzing protein function during development and disease in the C. elegans community.

Effects of impaired lipid synthesis on protein degradation in the endoplasmic reticulum and nucleus (Poster) (EMSR Poster Competition)

Samantha K. Gosser, Samantha M. Turk, Christopher J. Indovina, Eric M. Rubenstein, Ball State University

The ability to degrade proteins is vital to cell health. Proteins can be degraded at the endoplasmic reticulum (ER) via ER-associated degradation (ERAD) and at the inner nuclear membrane (INM) through INM-associated degradation (INMAD). Both processes depend on ubiquitin ligases that reside within a phospholipid membrane. How these degradation pathways are affected by membrane lipid composition is not fully known. Recent data suggest ERAD is inhibited when phospholipid synthesis is impaired in a yeast model system. We hypothesized that both ERAD and INMAD are broadly dependent on lipid biosynthesis. To determine if ERAD could be affected by lipids other than phospholipids, we analyzed the impact of sterol synthesis on degradation of an ER protein. We conducted cycloheximide chase and western blot experiments in wild type yeast and yeast with a knockdown allele of ERG1 (required for sterol synthesis). We found yeast with defective sterol synthesis exhibited decreased ER protein degradation. To assess the sensitivity of INMAD to lipid biosynthesis, we determined if phospholipid synthesis is required for degradation of nuclear substrates. We analyzed nuclear substrate degradation in wild type yeast and yeast lacking INO4 (required for phospholipid biosynthesis). Our preliminary results show impaired lipid biosynthesis delays protein degradation at the INM. Finally, we assessed the requirement of lipid synthesis for cellular fitness in the presence of hygromycin B (which causes proteotoxic stress) and a range of

temperatures. We found that while altered temperature did not affect growth of lipid synthesis-defective yeast, such yeast were sensitive to hygromycin B. Taken together, these results suggest that lipid biosynthesis broadly affects both ERAD and INMAD and is required to resist proteotoxic stress. Diseases such as Alzheimer's, Huntington's, and diabetes are associated with impaired lipid synthesis; progression of these diseases may be linked to inability to efficiently degrade proteins.

Scraps, an anilin, and Nebbish, a kinesin, are integral components of a Fox transcription factor-regulated subnetwork that mediates specific cardiac progenitor cell divisions. (Poster)

Md Rezaul Hasan, Indiana State University

Fox transcription factors mediate multiple cardiogenic processes in both mammals and Drosophila. The Drosophila Fox genes jumeau (jumu) and Checkpoint suppressor homologue (CHES-1-like) mediate three categories of cardiac progenitor cell division—asymmetric, symmetric, and cell division at an earlier stage. jumu also regulates the expression of the kinesin Nebbish (Neb) and the activity of the kinase Polo to mediate symmetric and earlier cardiac progenitor cell divisions in a CHES-1-like-independent process. By comparing expression profiles, we identified scraps (scra), an anilin-encoding gene, that like neb, is also transcriptionally activated by jumu, but not by CHES-1-like. Phenotypic analysis of mutations show that scra, like neb, is required for only two of the three categories of jumu-regulated cardiac progenitor cell division—symmetric and cell division at an earlier stage. Synergistic genetic interactions between scra, neb, jumu, and polo, and the absence of such synergistic interactions between either scra and CHES-1-like or neb and CHES-1-like, demonstrate that scra and neb are integral components of a jumu-regulated subnetwork mediating a specific subset of cardiac progenitor cell divisions. Preliminary data from our phenotypic analysis of other exclusively jumu-regulated genes suggests that the kinesin Pavarotti, the citron kinase Sticky, and the Rho GTPase Tumbleweed may be other components of this subnetwork. Using genetic interaction and rescue assays, we are attempting to position neb and scra topologically relative to each other and these other potential subnetwork components. Collectively, our results illustrate how an individual regulator can utilize different combinations of downstream effectors to control distinct developmental processes.

Bacdegron-LOCKR: When You Want to Break Up With Your Proteins (Poster) (EMSR Poster Competition)

A. J. Isaac, Wabash College

Protein degradation mediates the clearance of unnecessary or damaged proteins from the cell and is crucial to maintaining cellular activities and responding to external stimuli. Degrons are short protein motifs that mark target proteins for degradation by the proteasome, a multi-protein complex. The degron-LOCKR (Latching Orthogonal Cage/Key pRoteins) system is a designed bioactive protein Switch that elicits protein degradation of LOCKR and any protein it is attached to in the presence of an inducible Key. Despite its use in eukaryotic systems, the potential applications of LOCKR have not been explored in prokaryotes. Therefore, this research aims to develop degron-LOCKR to control protein degradation in bacteria. First, we redesigned LOCKR to contain the bacterial ssrA degron sequence (bacdegron). Next, we fused bacdegron-LOCKR to a green fluorescent protein using PCR and Gibson Assembly techniques. To assess the functionality of our bacdegron-LOCKR design, we expressed bacdegron_LOCKR using a constitutive promoter in E. coli. Upon Key induction, we observed a reduction in fluorescence, providing evidence of the bacdegron-LOCKR system's capacity to degrade proteins in

prokaryotic cells. While our current investigation focuses on enhancing the performance of the LOCKR system in degrading proteins in bacterial cells, we anticipate that the incorporation of alternative bioactive motifs, such as those facilitating novel protein-protein interactions, will enable the bacdegron-LOCKR system to manipulate bacterial proteins in novel ways. Moreover, the ability to control gene expression in bacteria using the bacdegron-LOCKR system contributes to the advancement of prokaryotic cellular engineering, by enabling the design of novel synthetic feedback regulation pathways.

Polycomb patterns the anterior embryonic dorsal vessel by repressing abdominal A expression (Poster) (EMSR Poster Competition)

Sumaiya Islam, Indiana State University

Embryonic development requires the precise regulation of transcription which is partially controlled by the actions of the Trithorax group (TrxG) and Polycomb group (PcG) proteins. We have previously identified trithorax (trx) as a positive regulator of Hox expression within the Drosophila embryonic dorsal vessel (the linear heart tube). The loss of abdominal A (abd-A) expression within the trx mutant induces a striking homeotic transformation of the heart-proper into an aortic fate. Since trx activates cardiac abd-A expression, the repressive PcG genes may silence abd-A within the anterior regions of the dorsal vessel. Here, we show that Polycomb (Pc), a gene that encodes an essential component of the Polycomb Repressive Complex 1 (PRC1), represses the anterior abd-A expression within the dorsal vessel. The de-repression of abd-A throughout the Pc mutant dorsal vessel induces several cellular and morphological abnormalities that deform the cardiac patterning. Since abd-A is the primary homeotic selector of the posterior heart-proper region, it is likely that the loss of abd-A repression has induced the homeotic transformation of the entire dorsal vessel into a heart-proper-like fate. These data suggest that trx and Pc antagonize the regulatory activities of one another ensuring that abd-A expression and heart-proper development is restricted to the posterior dorsal vessel.

Studies into the Therapeutic Potential of Botanical Extracts from Lamb's Ears (Stachys byzantina) on Cancer Cell Proliferation and Virus Replication (Poster) (EMSR Poster Competition)

Morgan Jackson, Butler University

Lamb's ears (Stachys byzantine) is a common plant found throughout Indiana and has been used medicinally by local Native American tribes in the state. Despite its prevalence, the specific effects of Lamb's Ear on the proliferation of cancer cells and viruses are still unknown. Previous studies with plants of the same genus have been shown to reduce the size of polycystic ovaries and have antifungal properties. To test Lamb's Ear anticancer properties, Hep-2 (cervical cancer) cells were exposed to varying concentrations of aqueous S. byzantine extract. Cytotoxicity was measured with an MTS assay and morphological changes were assessed with fluorescent microscopy. No significant changes were found in the apoptotic, mitotic, or cytoskeletal scores. Lamb's Ear extract was also used in virus inactivation assays to test for inhibition of respiratory syncytial virus (RSV) replication in Hep-2 cells. Our data suggests that virus replication may be inhibited at higher concentrations, but further study is required. These data provide useful knowledge of the bioactivity and therapeutic potential of plants found here in Indiana.

Investigation of oxi-1 ubiquitin ligase gene function in neuromuscular signaling and chemosensory behavior in C. elegans (Poster)

Jennifer Kowalski, Butler University

The UBE3B gene encodes a ubiquitin ligase that is crucial for human cognitive function and particularly important in conditions of oxidative stress, which increase with aging and/or disease. Loss of function mutations in UBE3B occur in Kaufman oculocerebrofacial syndrome, an intellectual disability syndrome; however, the mechanisms by which UBE3B regulates neuronal development and function are unknown. It is hard to study UBE3B in humans with billions of neurons, so Caenorhabditis elegans roundworms with simpler nervous systems of only 302 neurons are used. oxi-1 is the C. elegans homolog of the UBE3B gene. Under normal conditions and following chronic oxidative stress exposure, body bending decreases in oxi-1 mutants compared to wild type worms, demonstrating a role for oxi-1 in neuromuscular function and in oxidative stress responses. Here, we investigate how oxi-1 regulates neuromuscular function and whether oxi-1 has any role in chemosensory regulation given its reported expression in chemosensory neurons. We hypothesized oxi-1 promotes muscle excitation through effects on synaptic vesicle release and is required for chemotaxis to odorants sensed by AWA neurons. We used quantitative imaging of the fluorescently labeled synaptic vesicle protein, SNB-1::GFP, in the dorsal nerve cords of wild type or oxi-1 mutant strains to determine whether the abundance or localization of synaptic vesicles depends on the presence of oxi-1. We found no significant difference in the intensity of SNB-1::GFP puncta, axonal (cord) fluorescence, or synapse density in oxi-1 mutants, indicating altered synaptic vesicle localization may not explain the neuromuscular defects. Chemotaxis experiments testing attraction to the AWC neuron-specific attractant, isoamyl alcohol, indicate oxi-1 mutants have a slight but statistically insignificant chemotaxis defect. Experiments testing chemotaxis to the AWA neuron-specific attractants, diacetyl and pyrazine, are ongoing. Future studies also will explore roles for oxi-1 in inhibitory neurons and nervous system development.

Effects of a Pesco-Vegetarian Diet and Supplements on Protection Against Oxidative Stress in Hispanic Populations (Poster)

Kaitline Martin, Indiana University Kokomo

Free radicals are linked to aging and human diseases. Oral consumption of antioxidants has been shown to decrease free radicals in the human body. In this study, we investigated the effect of a pesco-vegetarian-based diet with ginger and turmeric supplements on free radical scavenging capacity of blood. Participants of a mainly Hispanic population between the ages of 18-45 were recruited to be on the diet for one week. Their blood was drawn before and after the diet. The antioxidant capacity of blood serum was assessed by the reaction with a free radical, 2,2-diphenyl-1-picryhydrazyl (DPPH). A fluorescent microscope was used to determine the extent of DNA damage following the application of hydrogen peroxide by measuring the mobility of DNA fragments in low-melt agar. In this presentation our current progress with these two assays will be discussed.

Conditioning injury fails to enhance regeneration in Sarm1-/- mice (Poster)

Madison Mathew, Ball State University

Axons do not regenerate after injury in the central nervous system (CNS) as they would in the peripheral nervous system (PNS). In the PNS, 3 major processes occur that lead to axon regeneration: Wallerian degeneration, macrophage activation, and production of repair Schwann cells. SARM1 (sterile alpha and TIR motif containing 1), is an enzyme that degrades NAD+ to trigger Wallerian degeneration. Sarm1-/- mice fail to induce Wallerian degeneration after injury and subsequently have impaired axon regeneration, macrophage recruitment and repair Schwann cell production. One way to promote regeneration in the CNS is a conditioning injury to the sciatic nerve prior to CNS injury. This double injury can also enhance regeneration in the PNS. This activates an injury induced regeneration program and we hypothesized that this might rescue the deficits seen in Sarm1-/- mice. To test this, we performed 2 different conditioning injury paradigms; 10 days after the first injury we either performed a second injury proximal (dSNC-P), or at the same site (dSNC-I), of the first injury. We then harvested the nerves 3 days later and performed immunostaining to visualize nerve sections from WT and Sarm1-/- mice. Nerves were stained for macrophages, repair Schwann cells, and regenerating axons. We found that a dSNC-P failed to rescue any phenotype in the Sarm1-/- mice, but enhanced regeneration in the WT mice. However, a dSNC-I rescued the repair Schwann cell phenotype in Sarm1-/- mice. Interestingly, this did not rescue axon regeneration. This suggests that repair Schwann cells alone, are not sufficient to induce axon regeneration in Sarm1-/- mice. Further exploration into the microenvironment of the Sarm1-/- injured nerve is required to understand the regeneration failure.

Investigations into WNT Signaling in Breast Cancer and Chemoresistance (Poster) (EMSR Poster Competition)

Kyle McCreary, Marian University

WNT signaling was revealed as a major player in a variety of cancers with implications for disease development, progression, and metastasis. Both canonical and noncanonical signaling through WNT receptors and/or mediators appears to be of critical clinical interest particularly for advanced or refractory disease. Exploration into this diverse pathway has generated a deeper understanding of the wide-ranging effects induced by signaling involving WNT and WNT mediators; however, much remains to be explored and understood particularly in the areas of chemoresistance. Preliminary investigations in breast cancer chemoresistance against paclitaxel, a microtubule stabilizing drug, revealed significant changes in WNT signaling receptors and mediators as either part of developing resistance or a consequence of resistance. These preliminary investigations hinted at potential conflict in WNT signaling and indicated a need for understanding global WNT signaling in triple negative breast cancer and particularly chemoresistance. This study expanded on those preliminary investigations and explored global WNT signaling in triple negative breast cancer and began to elucidate mechanisms for WNT signaling in the process of chemoresistance. The initial results of these investigations hint at extracurricular activities for WNT mediators as global WNT signaling may not be as important to chemoresistance or paclitaxel sensitivity as targeting specific WNT mediators. These results demonstrate a need for tailored, ongoing investigations into key targets rather than emphasizing pathway activity overall.

Impaired Phosphatidylcholine Biosynthesis Disrupts Protein Degradation in Saccharomyces cerevisiae (Poster) (EMSR Poster Competition)

Jacob M. Miller, Samantha M. Turk, Christopher J. Indovina, Eric M. Rubenstein, Ball State University

The translocon is a channel protein located in the membrane of the endoplasmic reticulum (ER) in humans and other organisms such as Saccharomyces cerevisiae. The translocon allows proteins to enter the ER, where they are modified before transport to their subcellular location or secreted out of the cell. Translocon clogging by unprocessed proteins contributes to ER stress. Mechanisms of translocon quality control (TQC) are incompletely characterized. Recent research has established that phospholipid biosynthesis is required for efficient degradation of a model engineered translocon-clogging protein, Deg1*-Sec62, in S. cerevisiae. Deletion of either INO2 or INO4 disrupts Deg1*-Sec62 degradation. Ino2p and Ino4p form a heterodimeric transcription factor that promotes transcription of many genes involved in biosynthesis of several different lipid classes, including phosphatidylcholine, phosphatidylethanolamine, and phosphatidylserine. We hypothesized that phosphatidylcholine biosynthesis is required for translocon quality control. To determine if phosphatidylcholine biosynthesis is required, we performed cycloheximide chase and western blot analyses to assess Deg1*-Sec62 degradation in cells lacking OPI3 or CHO2. Opi3p and Cho2p catalyze sequential steps in the phosphatidylcholine biosynthesis pathway. We predicted that OPI3 and CHO2 knockout would impair Deg1*-Sec62 degradation. Deg1*-Sec62 was stabilized in opi3Δ and cho2D cells compared to wild-type. Deg1*-Sec62 stabilization in opi3D and cho2D yeast was not as strong as observed in the ino4Δ strain. These results are consistent with a model whereby defective phosphatidylcholine biosynthesis partially account for the degradation defect observed in yeast lacking INO2 or INO4. Further understanding of the factors influencing TQC can shed light on the mechanisms that impair protein degradation at the translocon, which is linked to diseases such as hypercholesterolemia and diabetes.

Common Sage (Salvia officinalis) exhibits anti-proliferative impacts on cancer cells and antiviral activity against human respiratory syncytial virus (hRSV) in vitro (Poster) (EMSR Poster Competition)

Lori Moore, Butler University

Common Sage (Salvia officinalis) is found throughout Indiana and has been used in traditional medicinal practices by many local Native American tribes in the state. While several studies have investigated the herb for a variety of applications, its impacts on cancer cell proliferation and potential to inhibit viruses remain unclear. In this study, we investigated the impact of aqueous sage extracts on the viability and morphology of cervical cancer cells by both an MTS assay and through immunofluorescence microscopy. Compared to untreated controls, sage extracts were associated with both significant reductions in viability and morphological changes consistent with induction of apoptosis. Additional studies were performed to identify whether sage extracts were capable of inhibiting the replication of human respiratory syncytial virus (hRSV), a major pediatric respiratory pathogen. Sage extracts were able to inhibit RSV infection during concurrent treatment in vitro. These data collectively support further study into potential uses of natural sage extracts for treating both cancer cells and RSV infections.

Switching On Protein Degradation in C. elegans (Poster) (EMSR Poster Competition)

Mason Naaman, Wabash College

The 'Latching Orthogonal Cage/Key pRoteins' (LOCKR) technology utilizes the combination of de novo designed Switches and Keys to control gene expression at the protein level. The Switch contains a caged protein sequence that becomes exposed when the Switch interacts with the Key. The caged sequence we are investigating is a degron, which when exposed, will elicit protein degradation in the cell. The LOCKR system is especially useful due to its orthogonal design, as it can utilize different Switch and Key combinations that function in specified pairs. The LOCKR approach has been successfully used in yeast and mammalian cell culture, but not yet in an animal model. This work describes development of fluorescently tagged Switches (A and C) to control eff-1, a fusogenic protein, and sel-8, a transcription factor in the nematode worm C. elegans. Using PCR and Gibson cloning, we fused Switch A to wrmScarlet and Switch C to C. elegans' optimized GFP (ceGFP). We plan to add SwitchA and SwitchC to sel-8 and eff-1, respectively, using CRISPR-Cas-9 gene editing. As such, we designed Switch-containing homology-directed repair (HDR) templates with 35 bp homology arms and mutated PAM sites. The Switch designs here function to complement a set of epitope-tagged Keys (A and C) created by other lab members. We plan to use LOCKR's orthogonal design to control eff-1 and sel-8 simultaneously and independently within the same animal, which has not been possible with existing methods. Our next steps involve generating CRISPR-Cas9 modified worms and characterizing these animals. The development of LOCKR offers a new method for protein level control in C. elegans.

Worming Our Way into Understanding Proteasome Function in vitro (Poster) (EMSR Poster Competition)

Thomas Oppman, Wabash College

Proteins are constantly generated by cells to regulate processes required for cellular life; however, old or damaged proteins need to be degraded and broken down. The 26S proteasome is a multi-subunit protein complex responsible for breaking down proteins in cells. Our team is testing the in vitro activity of the C. elegans nematode proteasome complex using Z-GGL-AMC, a short-chain peptide which fluoresces upon degradation. Ongoing assays using either nematode lysate or purified proteasome showed unexpected variations and patterns in the 26S proteasome degradation mechanism which included either rapid or delayed degradation of Z-GGL-AMC. We term the period between assay initiation and detectable degradation onset as the lag-phase. To further characterize these observed lag phases, our lab altered either overall protein levels or 26S proteasome levels specifically. To specifically alter proteasome levels, we used different strains of C. elegans, known to differ in proteasome concentrations, and biochemically purified proteasome for in vitro assays. Low concentrations of proteasome resulted in observable lag phases in our in vitro degradation assays, while increasing proteasome concentrations resulted in the shortening and eventual disappearance of these lag phases. Additionally, increased concentration of overall protein concentration, achieved by addition of nonreactive Bovine Serum Albumin (BSA) protein, lengthened the observed lag phases. Based on our data, we propose that the 26S proteasome engages in some cooperative interaction with other nearby proteasome complexes, which induces the proteasome to change from a latent to an active conformation. Understanding the concentration-dependent conformational change in the 26S proteasome will allow us to better predict how the complex will behave in different experimental conditions and expands our knowledge of the nuances of this important multi-protein complex.

Polycomb patterns the anterior embryonic dorsal vessel by repressing abdominal A expression (Poster)

Md Sayeed Abu Rayhan, Indiana State University

Embryonic development requires the precise regulation of transcription which is partially controlled by the actions of the Trithorax group (TrxG) and Polycomb group (PcG) proteins. We have previously identified trithorax (trx) as a positive regulator of Hox expression within the Drosophila embryonic dorsal vessel (the linear heart tube). The loss of abdominal A (abd-A) expression within the trx mutant induces a striking homeotic transformation of the heart-proper into an aortic fate. Since trx activates cardiac abd-A expression, the repressive PcG genes may silence abd-A within the anterior regions of the dorsal vessel. Here, we show that Polycomb (Pc), a gene that encodes an essential component of the Polycomb Repressive Complex 1 (PRC1), represses the anterior abd-A expression within the dorsal vessel. The de-repression of abd-A throughout the Pc mutant dorsal vessel induces several cellular and morphological abnormalities that deform the cardiac patterning. Since abd-A is the primary homeotic selector of the posterior heart-proper region, it is likely that the loss of abd-A repression has induced the homeotic transformation of the entire dorsal vessel into a heart-proper-like fate. These data suggest that trx and Pc antagonize the regulatory activities of one another ensuring that abd-A expression and heart-proper development is restricted to the posterior dorsal vessel.

Investigation of the intestinal site of action and candidate glycopeptide ligand of the FSHR-1 receptor in the regulation of neuromuscular signaling in C. elegans (Poster) (EMSR Poster Competition)

Abigail Screen, Butler University

The ability of cells to communicate is vital to an organism's success. Neurons, for example, send signals to muscle effector cells at sites called neuromuscular junctions (NMJs) via signaling molecules known as neurotransmitters. An excellent model organism for studying neuronal signaling is Caenorhabditis elegans, a microscopic nematode that shares many genes with humans. Muscle contraction in C. elegans is partially controlled by release of acetylcholine (ACh) neurotransmitters from excitatory motor neurons, but the mechanisms controlling the amount and timing of signaling at the NMJ and at many other synapses are incompletely understood. Previous research identified the G-protein coupled receptor, FSHR-1, as a regulator of neuromuscular signaling, as fshr-1 mutants are resistant to paralysis induced by the drug aldicarb, which enhances excitatory signaling for muscle contraction. FSHR-1 activates downstream factors that initiate ACh release from motor neurons, but the ligand for FSHR-1 is unknown, as are the cells where FSHR-1 acts to control muscle excitation. FSHR-1 is highly expressed in the C. elegans intestine but not in motor neurons, and the closest C. elegans homolog to the human FSH ligand is the α glycopeptide, FLR-2. Thus, we hypothesized FLR-2 is an activating ligand of FSHR-1, which functions cell non-autonomously in the C. elegans intestine to control NMJ function. Using aldicarb paralysis assays, we found flr-2 and fshr-1 single mutants exhibit similar paralysis rates that are reduced from wild type worms, and fshr-1;flr-2 double mutants show similar paralysis rates to these single mutants. These data support a common pathway for FSHR-1 and FLR-2 function at the NMJ. Intestine-specific knockdown and rescue experiments to determine whether fshr-1 is necessary and/or sufficient in the intestine for NMJ regulation are underway. Together, results of these studies will provide insight into the roles and relationship of FSHR-1, FLR-2, and neuronal signaling likely relevant in humans.

Expression analysis of Dhx36 and selective genes involved in regulating coronary angiogenesis in endothelial cell specific Dhx36 knockout embryonic hearts compared to control. (Poster) (EMSR Poster Competition)

Chhiring Sherpa, Ball State University

As there is a higher mortality rate worldwide due to coronary artery disease (CAD), there is an urgent need for understanding genetic pathways that regulate coronary angiogenesis, a process by which new coronary vessels are formed. The proposed study will investigate the role of Dhx36, a helicase enzyme, in the regulation of coronary angiogenesis. Dhx36 is hypothesized to have a major role in coronary angiogenesis based on the phenotypic data obtained from histological analysis of coronary vessels in Dhx36 conditional knock-out (cKO) mouse model. In Dhx36 cKO mouse models, Dhx36 gene is deleted using Cre-Loxp gene editing system. To fully validate that the cKO phenotypic data is due to a lack of Dhx36 gene expression, it is important to show that Dhx36 expression is indeed reduced at a significant level in cKO groups of mice compare to control. Thus, this study will verify Dhx36 expression levels in cKO mice using qPCR, a molecular method of gene expression analysis. Such verification is a requisite to validate existing cKO mouse model. Based on the phenotypic data of Dhx36 cKO, we hypothesize that Dhx36 regulate genes that regulate coronary angiogenesis such as APJ, SOX17, VEGFR2, VEGFR3, VEGFC, and HIF-1 α. Using qPCR, we will analyze the differential gene expression of these genes in embryonic cKO hearts compared to control at various embryonic stages (e13.5, e16.5, e18.5, and P2) of coronary vessel development. Results from this study will characterize the novel function of Dhx36 in the regulation of coronary angiogenesis, which has not been previously described.

Inhibition of Breast Cancer Cell Proliferation by Theaflavin and EGCG (Poster)

Kyra E. Simmons and Kimberly M. Baker, University of Indianapolis

Phytochemicals are bioactive non-nutrient compounds present in plant-based foods that have been shown to exhibit cancer-preventive and anticancer properties. Theaflavin (TF) and Epigallocatechin-3-gallate (EGCG) are both phytochemicals found naturally in black and green tea that inhibit cell proliferation, prevent tumorigenesis, and induce cell death through apoptotic pathways. In this study, we evaluated the effects of TF and EGCG, individually and in combination, on MCF-7 breast cancer cell proliferation. We found that TF and EGCG each exhibited antiproliferative activity in a dose-dependent manner. Co-administration of TF and EGCG at lower doses, however, did not result in synergistic inhibition of breast cancer cell proliferation. Nonetheless, utilizing TF and EGCG individually may be may be an effective chemotherapeutic strategy against breast cancer.

The effect of perturbed lipid biosynthesis on cytosolic and endoplasmic reticulum protein degradation (Poster) (EMSR Poster Competition)

Mary E. Tragesser-Tina, Samantha M. Turk, Christopher J. Indovina, Mahmoud M. Daraghmi, and Eric M. Rubenstein, Ball State University

Protein degradation is crucial for a cell's ability to function. Protein levels are determined by rates of synthesis and degradation. Aberrant proteins are removed to eliminate mistakes or damage incurred during or after protein synthesis. Aberrant proteins may accumulate in multiple cellular compartments, such as in the endoplasmic reticulum (ER) or in the cytosol. Therefore, distinct degradation pathways in different compartments mediate abnormal protein degradation. Lipids are important biological molecules that make up cell membranes like the ER. Recent

results from our lab indicated that impaired lipid synthesis impairs degradation of aberrant ER proteins in Saccharomyces cerevisiae. This study addresses two questions. First, we asked if impaired lipid synthesis alters abundance of ER protein degradation enzymes. We found that when lipid synthesis in the ER was disrupted, the abundance of one ER protein degradation enzyme (Hrd1) was not reduced, while another (Ubc7) was. Thus, one potential mechanism by which lipids impact protein degradation is due to a reduction in stability of a cofactor. Second, we examined the effects of disrupted ER lipid synthesis on degradation of misfolded cytosolic proteins. To address the second question, we compared the degradation of engineered model misfolded proteins residing in the ER and cytosol to identify the breadth of the impact of disrupted ER lipid synthesis. We found that both the ER and cytosolic proteins were stabilized when lipid synthesis was disrupted. These results suggest a broad and under-appreciated connection between lipid biosynthesis and protein degradation. The symptoms of diseases associated with impaired lipid biosynthesis (fatty liver disease, obesity, type 2 diabetes, muscular atrophy, and cardiomyopathies) may be at least partially explained by impaired protein degradation.

Wildtype vs. SARM1 Knockout: Spinal Cord Neurons Post Sciatic Nerve Crush (Poster) (EMSR Poster Competition)

Sam Walsh, Ball State University

The sterile alpha and TIR motif containing 1 (SARM1) gene encodes for SARM1, a Toll-like receptor adaptor protein (Estera et al., 2021). SARM1, a catalyst for neuronal death, has been identified as a potential therapeutic target for neurodegeneration. Fascinatingly, when a peripheral nerve, such as the sciatic nerve, is damaged by injury, it induces changes in the spinal cord. This is partly because the axons that form the sciatic nerve also comprise the dorsal column of the spinal cord. The resident microglia are sensitive to this peripheral injury. It is also possible that microglia are responding to neurodegenerative diseases that begin in the peripheral nervous system, like amyotrophic lateral sclerosis (ALS). SARM1's effects have been studied more extensively in the brain than in the spinal cord, but because both the brain and the spinal cord comprise the central nervous system, it is essential to study both parts so that a more complete representation of SARM1 can be ascertained. We asked whether or not the loss of SARM1 protects or compromises the microenvironment of the spinal cord through microglia-neuronal interactions. To investigate this, I immunostained spinal cord cross sections at 3 days, 7 days, and 14 days post sciatic nerve injury. I looked for numerical and morphological abnormalities in neuronal and microglial populations in both Sarm1-/- and wildtype mice. I found that Sarm1-/-, compared to WT, has more neurons at 3 days and 7 days but a nearly identical number of neurons at 14 days. Further, Sarm1-/- also has greater microglial activation at 14 days. My data suggests that loss of SARM1 might be protective from injury induced cell death.

The Evasion of Cell Death By Cancer Cells Detached From the Extracellular Matrix (Poster) (EMSR Poster Competition)

Luke Reynolds, Marion High School, Science Talent Search Winner 2022

The evasion of anoikis and ferroptosis by cancer cells heightens the lethal effect of cancer. This project tests different treatments to induce cell death in cancer cells, both through anoikis (death due to detachment from the ECM) and ferroptosis (a type of iron-dependent cell death). This study was carried out using alamarBlue assays, which test cellular viability. The different treatments used are as follows. BSO, which inhibits Glutathione synthesis by preventing

gamma-glutamylcysteine synthetase, is one. BSO combined with ferric ammonium citrate (FAC) was another treatment. FAC heightens intracellular iron concentrations, which can induce ferroptosis. Erastin, a third treatment, inhibits the uptake of Cystine within a cell. The inhibition of Glutathione synthesis causes lipid peroxidation to occur, thus inducing ferroptosis. Finally, RSL3 inhibits Glutathione peroxidase and works similarly to Erastin by inducing lipid peroxidation within the cell. Each of these treatments were tested in various concentrations in two cell lines: MDA-MB-231 and A549. RSL3 showed the greatest potential in reducing cell viability in attached conditions, especially in MDA-MB-231 cells. However, BSO combined with FAC proved most promising in suspended conditions for A549 cells. Both RSL3 and BSO+FAC treatments will be used in further testing and the development of future therapies for cancer patients. BSO and Erastin will also be tested further on different cell lines and doses. My research provided insight into how these two cell lines react to different treatments and why.

CHEMISTRY

Considerations for In-Situ X-ray Diffraction During High-Pressure Solid-State Syntheses (Hot Topic)

Dr. Alexandra D. Tamerius, Marian University

In-situ X-ray diffraction is a flourishing approach for exploring the progression of solid-state syntheses that have long eluded investigation due to the requirement of high-temperature for solid-state reactions. As with any reaction, solid-state syntheses are driven by chemical properties, such as electron configuration, electronegativity, and atomic radius. The application of high-pressure can manipulate these properties, affording the opportunity to examine how they influence synthesis. By combining in-situ X-ray diffraction with high-pressure to monitor reaction progression, we can both synthesize novel materials and, more importantly, deepen our fundamental understanding of reactivity. Here we present an overview of three different high-pressure, high temperature synthetic methods. We discuss their benefits, challenges, and opportunities when combined with in-situ X-ray diffraction and present key considerations for sample preparation, synthesis, and data collection. The aim of this presentation is to provide a getting started guide to high-pressure synthesis and inspire future exploration into the field of high-pressure chemistry.

Expanding the utility of Rieske dioxygenases through enzyme engineering (Oral Presentation)

Dr. Jordan Froese, Ball State University

In the Ball State Laboratory for Biocatalysis Research, we strive to develop new green-chemical tools through enzyme engineering that can contribute to alleviating the chemical industry's reliance on fossil fuels.
With the recent advances in Synthetic Biology and Directed Evolution, the potential for engineering enzymes as robust, selective, and environmentally benign chemical catalysts has exploded. Rieske dioxygenases, with their unique ability to perform oxidative dearomatization to produce chiral cis-diol metabolites, have long been utilized as green-chemical catalysts in bioremediation efforts and by synthetic chemists, although their utility has been limited by their substrate scope and selectivity. In the Ball State Laboratory for Biocatalysis Research, we have developed a novel periodate-based reactive assay system that has demonstrated the capacity to screen for the cis-dihydroxylation activity of large Rieske dioxygenase variant libraries, and to identify Rieske dioxygenase variants with significantly altered reactivity. By applying our novel assay system, we are developing new catalysts based on Rieske dioxygenases, which have expanded the chemical utility of this class of enzymes. To this end, we have developed new dioxygenase catalysts with significantly increased activity in the production of valuable chiral synthons through rational mutagenesis and high-throughput screening. Through our continued mutagenesis and screening efforts, we are endeavoring to alleviate the constraints on the substrate scopes and activities of Rieske dioxygenases, enabling their application in a much wider variety of synthetic contexts.

Mineralization of Glyphosate by Pd@BiVO4/BiOBr nanocomposite heterojunction photocatalyst (Oral Presentation)

Gbemisola Bamiduro, Ball State University

Glyphosate, N-(phosphonomethyl) glycine, is the most common herbicide used for weeding control. It was previously classified as a low-toxicity weedkiller. However, recent reports have demonstrated direct links between Glyphosate contamination and detrimental health effects on animals and humans. In this presentation, we report the photocatalytic degradation and complete mineralization of Glyphosate with a highly efficient Pd@BiVO4/BiOBr nanocomposite heterojunction photocatalyst. We synthesized the ternary composite photocatalyst by a low-temperature CTAB-assisted hydrothermal method. The as-synthesized material was characterized with a transmission electron microscope (TEM), scanning electron microscope (SEM), Energy dispersive spectroscopy (EDS), and x-ray diffraction spectroscopy (XRD). The Pd@BiVO4/BiOBr photocatalyst rapidly degraded Glyphosate in 5 minutes with a pseudo first-order rate constant of 1.2 min-1. This is highly efficient compared to the non-palladized composite BiVO4/BiOBr photocatalyst, degrading the same Glyphosate concentration in 30 minutes at a rate of 0.29 min-1. We investigated the pathway of degradation followed by the Pd@BiVO4/BiOBr nanocomposite to mineralize Glyphosate. Mechanistic studies show that the superoxide radicals and the holes were the main species involved in the degradation of Glyphosate. Catalytic stability studies also demonstrated that the ternary nanocomposite was stable and recyclable because it maintained over 75% of its efficiency after six phases of glyphosate degradation. This catalyst proves a promise for efficient technological application for the remediation of pesticide pollution.

Green approach for removal of polyfluoroalkyl pollutants from water (Oral Presentation)

David Bwambok, PhD, Ball State University

Per- and polyfluoroalkyl substances (PFAS) that persist in the environment pose a problem to water contamination. Persistent PFAS contaminants include perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS). Owing to their chemical and thermal stability as well as lipophilic and hydrophilic nature, PFAS chemicals are used in polymers, surfactants, film-foams in fire extinguishers, textiles, and coatings. The widespread use and persistence of PFAS to degradability allow these chemicals to accumulate and they have been detected in ground, surface water, ocean waters and marine organisms. Their toxicological impact is a big concern and in fact, several studies have implicated PFAS as a cause for reproductive toxicity and a threat to aquatic life. This study presents a green sustainable approach for the removal of hazardous PFAS chemicals from water. This environmentally friendly approach extracts the persistent PFAS contaminants into paramagnetic ionic liquids medium followed by separation from the aqueous phase using an external magnet. This approach alleviates the use of toxic organic solvents for extraction. In addition, the recycling of paramagnetic ionic liquids for use in multiple extractions, toxicological evaluation and photocatalytic degradation of pollutants will be explored.

Functionalization of Nucleic Acid Nanoparticles with Clicked Oligonucleotides for Therapeutic Applications (Oral Presentation)

Erwin Doe, Ball State University

Nucleic acid-based therapeutics involves conjugation of small molecule drugs to nucleic acid oligomers to surmount the challenge of solubility, and inefficient delivery of these drug molecules into cells. “Click” chemistry has become the most popular conjugation approach due to its simplicity and high conjugation efficiency. However, the major drawback on the conjugation of oligonucleotides is the purification of the products, as traditionally used chromatography techniques are usually time-consuming and laborious, requiring copious quantities of materials. Herein, we introduce a simple and rapid purification methodology to separate excess of unconjugated small molecules and toxic catalysts using molecular weight cut-off (MWCO) centrifugation approach. As a proof-of-concept, we deployed “click” chemistry to conjugate a Cy3-alkyne moiety to an azide-functionalized oligode-oxynucleotide (ODN), as well as a coumarin-azide to an alkyne functionalized ODN. The calculated yields of the conjugated products were found to be 90.3 ± 0.4% and 86.0 ± 1.3 % for the ODN-Cy3 and ODN-coumarin respectively. Analysis of purified products by fluorescence spectroscopy and gel shift assays demonstrated a drastic amplitude of fluorescent intensity by multiple folds of the reporter molecules within DNA nanoparticles. This work is intended to demonstrate small-scale, cost-effective, and robust approach to purify ODN-conjugates for nucleic acid nanotechnology applications.

Light-Activated Treatment for Triple-Negative Breast and Prostate Cancer (Oral Presentation)

Dr. Meden Isaac-Lam, Purdue University Northwest

Photodynamic therapy (PDT) or light treatment is an anticancer procedure that uses a photosensitizer (PS) which upon light activation produces cytotoxic oxygen species destroying tumor cells. PDT is minimally-invasive and can be repeated few times without accumulating significant toxicity in the surrounding tissues. Targeted therapy for cancer treatment that exploits ligands to selectively deliver cytotoxic agents to malignant cells has gained attention in the past few years. Ligand-targeted therapies offer high selectivity for a particular cancer cell type and efficient delivery of membrane-impermeable drugs. Within the growing class of targeted pharmaceuticals, vitamin-drug conjugates constitute a class of receptor-targeted therapeutics. Vitamins are required for the survival of all living cells including rapidly-dividing cancer cells which overexpress receptors on the cell surface for increased vitamin uptake. Hence, vitamin receptors serve as useful tumor-targeting drug delivery. In this study, vitamins and vitamin analogues were conjugated to a chlorophyll derivative (a light-activatable molecule) and used as photosensitizers for PDT. These synthesized chlorin-vitamin conjugates were tested in vitro using triple-negative breast and prostate cancer cell lines. Experimental results indicated that the indium complex of chlorin-lipoic acid conjugate exhibited the best photodynamic efficacy against triple-negative breast and prostate cancer cells. The synthesized vitamin-chlorin conjugates can have potential application for PDT as anti-cancer treatment.

Synthetic Studies on the 4,6-O-Isopropylidene-2,3-di-O-Levulinyl-D-Glucopyranosyl Trichloroacetimidate Donor (Oral Presentation)

Arman Khosravi

Resin glycosides are structurally unique natural products containing embedded carbohydrates. In this group of natural products, ipomossiean F shows the highest potency against cancer cell growth. Ipomossiean F has a disaccharide moiety consisting of D-glucose and D-fucose. To synthesize the natural product, the 4,6-O-isopropylidene-2,3-di-O-levulinyl-D-glucopyranosyl trichloroacetimidate donor is an essential intermediate, which couples with a fucosyl acceptor to make the carbohydrate core. Compared with the acceptor, the glucosyl trichloroacetimidate donor is highly reactive that cannot be easily recovered once activated during glycosylation reactions. Therefore, it is important to develop an efficient synthesis for the donor. Previously, the donor was prepared using ethane thiol, a very smelly reagent that is hard to work with due to its high volatility. In this work, we aim to replace ethane thiol with much less smelly thiophenols. Our current synthesis highlights a critical dethiolation step that renders the entire synthesis much more convenient.

Synthesis of a Photo-Cleavable Linker for Selective Drug Delivery of Ipomoeassin F (Oral Presentation)

Griffin Thomas

Ipomoeassin F is a compound with proven cytotoxic characteristics which have been shown effective in killing cancer cells using IC50 values. The drug was originally isolated from the morning glory flower and has since been completely synthesized in lab. It however has no specificity between tumor and nontumor cells. Therefore, we propose the 7-step synthesis of two linker molecules that can join ipomoeassin F with a cell specific RNA delivery vehicle. This setup would deliver ipomoessin F to cancer cells specifically, while avoiding general toxicity to healthy cells. We speculate that the large RNA portion may considerably decrease the biological activities of the drug–RNA conjugate; hence this linker is designed to have a photocleavable moiety as proof of concept. This will allow for release of ipomoeassin F from RNA upon delivery to maintain the drug's cytotoxic properties. This linker will also include an azido group on the opposite end for click chemistry to connect the drug with the RNA molecule. Successful synthesis and implementation would benefit future development of ipomoeassin F and its derivatives as cell specific anti-cancer agents.

Overexpression and Isolation of RGVG and Y639F Mutants of T7 RNA Polymerase for in vitro Transcription of Modified RNA Strands. (Oral Presentation)

Allison Dittmer, Alex Thornburgh, and Emil F. Khisamutdinov

Intrinsic properties of RNA to form Watson-Crick base pairing allows it to self-assemble into specific and programmable nano-sized complexes. However, the naturally occurring RNA strands are not stable, and they hydrolyze quickly in blood serum. This limits RNA application, for example, as a nanovehicle for targeted drug delivery. The replacement of the hydroxyl group at the 2' position of the ribose to 2'-Fluoro (2'-F) or 2'-Methoxy (2'-Met) can drastically elevate the resistance of the RNA to nucleases and improve overall stability. However, to synthesize such modified RNAs, a mutated version of traditionally used T7 RNA polymerase is often required. The recombinant RNApol will not discriminate between regular

riboNucleotideTriphosphates (rNTPs) vs modified-rNTPs and, hence, can be implemented to transcribe modified RNA strands. Herein, we describe overexpression and isolation of RGVG and Y639F RNA polymerases from E.Coli cells using metal-ion immobilized affinity chromatography. We demonstrated that in optimized conditions, these RNA polymerases can be used to obtain milligram quantities of 2'-F and 2'-Met RNA polymers possessing high levels of resistance to nuclease degradation in blood serum.

Experimental and Computational Studies of Halogen and Hydrogen-Bonded Complexes of Haloforms with Amines (Poster) (EMSR Poster Competition)

Emmanuel Adeniyi, Ball State University

Halogen bonds (HaB) are intermolecular attraction between covalently-bonded halogen atoms and electron-rich species (also known as HaB acceptors), which is similar to hydrogen bonds (HyB). HaB has similar strength as HyB, and if a molecule has halogen and hydrogen substituents, these bonding may compete or cooperate. This work aims to differentiate HaB from HyB coexisting in solution, which is needed to determine the mode of interaction of such molecules. Specifically, we studied the coexisting HaB and HyB complexes between haloforms and aromatic and aliphatic amines in solutions using UV-Vis and NMR measurements and computational analysis. We performed solution phase measurements and computational analysis of haloform interactions with 1,4-diazobicyclo-[2,2,2]-octane and tetramethyl-p-phenylenediamine (TMPD). Several haloforms, including CHI3, CHCl3, and CHBr3, exhibit strong absorption bands with TMPD and DABCO, suggesting significant interactions between haloform and amine. As a comparison, HyB compounds showed spectra close to the interferences of the spectra of their individual reactants. In NMR spectra, the intermolecular interactions were dependent on the amine nature. As a result of the association of HyB and HaB with aliphatic amines, the proton signals in the NMR spectrum shifted in opposite directions. This study showed that combining UV-Vis and NMR measurements allows to distinguish HaB and HyB complexes forming in solutions.

Multifunctional Human Serum Albumin Nanoparticles for Theranostics (Poster) (EMSR Poster Competition)

Temitope Alonge, Ball State University

Nanoparticles from human serum albumin (HSA) are biocompatible drug delivery agents and have been approved by the Food and Drug Administration. This study focused on the evaluation of HSA nanoparticles for encapsulation of both near-infrared ionic dye (IR 780) and chemotherapeutic drug (paclitaxel) for theranostics against cancer. IR 780 is a near-infrared dye has selective tumor toxicity based on the choice of anion. When illuminated with NIR laser, IR 780 dye has photothermal properties against tumor cells. In this study, a desolvation method was used to prepare multifunctional HSA nanoparticles with a particle size of ~ 150 nm using 1-Ethyl-3-(3-dimethylamino propyl)carbodiimide (EDC) as the crosslinker. The potential for improved therapeutic activity against tumor cells. The release of the therapeutic agents from these HSA nanoparticles is achieved by the enzymatic action of metalloproteinases that are overexpressed in tumor cells and by photothermal heating under laser irradiation. This study reports the encapsulation efficiency and the enzymatic release of the NIR dye and chemotherapeutic drug from the HSA nanoparticles.

Evaluation of multifunctional human serum albumin nanoparticles with indocyanine green and rhodamine 6G- based ionic chemotherapeutic agent for theranostics (Poster)

Davis Anum, Ball State University

This study evaluated human serum albumin (HSA) nanoparticles for delivery of near-infrared ionic dye (IR 780) and rhodamine 6G chemotherapeutic drug for theranostics against cancer. Rhodamine 6G has selective tumor toxicity whereas IR 780 is a near-infrared (NIR) dye with photothermal effect upon NIR laser irradiation. The HSA nanoparticles synthesized with a size of 150 nm were obtained and have potential for effective treatment of tumors based on the synergistic chemotherapeutic and photothermal effect. This study reports the encapsulation efficiency and the release of these therapeutic agents from HSA nanoparticles by the enzymatic action of metalloproteinases that are overexpressed in tumor cells and by photothermal heating under near-infrared laser irradiation.

Evaluation of Poly Lactic-co-Glycolic Acid (PLGA) polymeric nanoparticles for delivery of near infrared ionic dyes with selective toxicity to cancer cells (Poster) (EMSR Poster Competition)

Nolan Beam and David K. Bwambok, Ball State University

Nanoparticles have gained interest in drug delivery because their small size enables their uptake into most parts of the body and enhances permeability and retention effect in tumors. In particular, nanoparticles from Poly Lactic-co-Glycolic Acid (PLGA) copolymer are suitable for drug delivery due to their biocompatibility and biodegradability. In this study, the PLGA nanoparticles are used for encapsulation and delivery of a near-infrared ionic dyes with IR 780 cation and various anions for potential therapeutic applications against cancer. IR 780 is a near-infrared dye which provides selective toxicity for tumor mitochondria and non-toxic to normal cells based on the anion. The results from dynamic light scattering indicate that PLGA nanoparticles (containing IR 780 dye) in the range of 200 nm were produced through nanoprecipitation method. In addition, UV-vis and fluorescence spectroscopy were used to determine the encapsulation efficiency of the dye in the PLGA nanoparticles and the release profile. The IR 780 dyes emit light in the NIR wavelength region of the spectrum which provides the additional advantage for tumor diagnosis.

Molecular Adsorption at the Liquid/Liquid Nanoemulsion Interface (Poster) (EMSR Poster Competition)

Charles Behrman, Derek A. Coers, Rubyat Sara, and Mahamud Subir, Ball State University

Oil-in-water (O/W) nanoemulsions (NEs) play an important role in nanotechnology, medical science, and fundamental colloidal chemistry. Different types of NEs are widely used in petroleum industries, personal care and food products, and drug delivery. NEs are liquid nanodroplets dispersed in another liquid, with surfactants residing between the two liquid phases (i.e., at the interface). The interface thus can have different degrees of hydrophobicity and interfacial charge. These properties can influence the binding interactions of small organic compounds onto the NE surface from the solution phase. We have explored the effect of surfactant compositions, and thereby, the interfacial charges on the adsorption proclivity of different organic compounds. Using a surface selective laser-based technique, adsorption isotherms of charged and neutral organic dyes have been measured for NEs with different surfactant compositions. The adsorption of these compounds to the air/water interface using

surface tensiometry has also been tested. The results suggest that Coulombic interaction is the primary driving force for the binding interaction. Comparing these results, the influence of non-specific vs. specific interactions describing adsorption on colloidal NEs will be discussed.

Evaluation of thermodynamic stabilities of in silico designed nucleic acid 3WJ motifs (Poster)

Abigail Coffman, Ball State University

Nucleic Acid (NA) nanotechnology is a rapidly emerging field demonstrating application of polynucleotides as a versatile biopolymer to fabricate nanostructures of various dimensions and shapes in a programmable and highly predictable way. The folding of DNA or RNA strands into a stable double helix configuration mainly relies on the Watson-Crick (Canonical) base pair composition (G=C and A-T or A-U in the case of RNA), base stacking, and metal ion concentrations. The thermodynamic parameters of DNA B-form helix formation and A-form helix of RNA can be computed using empirically defined sets of nearest neighboring parameters encompassed within the 2D structure predicting programs for example mfold, NUPAC. However, these programs are lacking parameters for a hybrid DNA/RNA base pairing and non-canonical base interactions. In this report, we focused our study to evaluate thermodynamic parameters of several in silico designed three-way junction (3WJ) DNA and hybrid DNA-RNA structural elements. The designed 3WJ motifs contain three helical stems linked with 4,3,2,1, and 0 single stranded Thymidine (T) or Uridine (U) nucleotides. We will report assembly efficiency of the 3WJs investigated by gel shift assay and thermodynamic parameters measured by UV-melting technique. Our experiments reveal that the amount of Ts and Us linkages in the three-way junction dictate the stability of the overall 3WJ conformations. This study is important as we expect it will contribute to the existing set of parameters used for NA structure prediction algorithms as well as provide a guidance for rational design of NA nanostructures.

Evaluation of toxicity and extraction efficiency of paramagnetic ionic liquids used for removal of polyfluoroalkyl pollutants from water (Poster) (EMSR Poster Competition)

Nicole Dominguez and David K. Bwambok, Ball State University

Polyfluoroalkyl substances (PFAS) are pollutants of concern due to their persistence in the environment. We have demonstrated the removal of PFAS substances including perfluorooctanoic acid (PFOA) and perfluorosulfonic acid (PFOS) from water using paramagnetic ionic liquids (PILs). The PILs used consist of tetraalkyl phosphonium cation that is paired with an anion containing a paramagnetic species such as iron and manganese. The PILs interact with PFAS and can be extracted using an external magnet which avoids the use of volatile and toxic organic solvents used for liquid-liquid extraction. This study provides results of toxicity evaluation and extraction efficiency of PFAS from water using various paramagnetic ionic liquids. Results from toxicological evaluation using seed germination as bioindicators are useful for establishing potential utility of paramagnetic ionic liquids in environmental remediation for cleaning water contaminated with PFAS pollutants.

Anti-Neuroinflammatory Activity of a Novel, Nitrile-Containing Dithiolethione (Poster) (EMSR Poster Competition)

Arman Harutyunyan, Manchester University School of Pharmacy

Multiple sclerosis (MS) is an autoimmune disease characterized by destruction of the protective myelin sheath of neurons, resulting in impairment of neurotransmission. The pathophysiology of the disease is largely driven by inflammatory events in the central nervous system. As such, most MS drugs target immunological processes. Despite the numerous clinical therapies available, many MS patients eventually become disabled. Our research group is interested in developing novel treatments for MS with the aim of addressing shortcomings of current treatments. One promising class of molecules are the sulfur-containing dithiolethiones (DTTs). Our group has previously identified DTTs as powerful immunomodulatory agents in both in vitro and in vivo models of MS. In this study, we report the activity of a novel, nitrile-containing dithiolethione, 6-37. This new compound suppressed numerous pro-inflammatory molecules in activated microglia, including IL-6, TNF, and nitric oxide in a dose-dependent fashion. Additionally, 6-37 lowered the gene expression of numerous inflammatory mediators. Mechanistic studies suggested 6-37 exhibits its immunomodulatory properties via activation of the anti-inflammatory Nrf2 pathway. Taken together, our data demonstrate 6-37 possesses broad anti-inflammatory activity and should be further explored as a potential MS treatment.

Bioconjugation of functionalized oligodeoxynucleotides to fluorescence reporters (Poster) (EMSR Poster Competition)

Hannah Hayth, Ball State University

In the field of oligonucleotide (ODN) therapeutics, there is an imperative need to improve the ODNs properties by either chemical modification of the oligonucleotides structure or covalently linking reporter or therapeutic moieties with biologically relevant properties. Chemical conjugation can thus, significantly improve the intrinsic property not only of ODNs but also reporter/therapeutic molecules. Bioconjugation of nucleic acids to small molecules also serve as nano-delivery facilities to transport drugs to specific targets. This study deployed azide–alkyne cycloaddition, a click reaction, to successfully conjugate a Cyanine-3 alkyne moiety to an azide-functionalized ODN 12-mer, as well as 3–azido–7–hydroxy–chromen–2–one, a coumarin azide to an alkyne functionalized ODN 12-mer. The clicked products were subsequently hybridized with DNA nanoparticles to serves as fluorphore-labeled drug delivery units. The application of Huisgen 1,3–dipolar cycloaddition (HDC) of azides to terminal alkynes via a Cu(I)–catalyzed reaction pathway has been scientifically established to produce high yield and stable 1,4–disubstituted 1,2,3–triazoles. Post-conjugation investigation of the clicked products via fluorescence spectroscopy and denaturing polyacrylamide gel electrophoresis demonstrated a drastic amplitude of fluorescent intensity by multiple folds of the reporter molecules.

Evaluation of human serum albumin nanoparticles for delivery of near infrared ionic dyes for theranostics (Poster) (EMSR Poster Competition)

Cassidy Jean, Davis Anum, Temitope Alonge and David K. Bwambok, Ball State University

Human serum albumin (HSA) nanoparticles have gained interest in drug delivery because of their biocompatibility. As a result, the HSA nanoparticles have been approved by the Food and Drug Administration for delivery of an anticancer drug, paclitaxel. This study explores the use of HSA nanoparticles for encapsulation and delivery of a near-infrared ionic dye with IR 780 cation

and ascorbate anion with potential therapeutic applications against cancer. IR 780 is a near-infrared dye which provides selective toxicity for tumor mitochondria and non-toxic to normal cells based on the anion. Results from dynamic light scattering suggests that nanoparticles in the size range 180 nm were formed by desolvation method. In addition, UV-vis and fluorescence spectroscopy were used to evaluate the encapsulation efficiency and release of the dye from the HAS nanoparticles. The results from this study suggest that the dye in HSA particles can be released by using enzymes that are overexpressed in tumors such as collagenase, or by photothermal heating of the nanoparticles using a near infrared laser illumination.

Extraction of compounds from stem bark of Alafia multiflora and evaluation of antimicrobial activity (Poster) (EMSR Poster Competition)

Charles Kuedukey, Davis Anum, Julianna Borgia, John L. McKillip and David K. Bwambok, Ball State University

Natural products provide a rich source of various medicinal compounds. For example, the extracts from the bark of Alafia multiflora used in this study are traditionally used for wound treatment. Inspired by traditional antimicrobial application of this plant extract, this study focused on isolation and characterization of compounds from Alafia multiflora for activity guided fractionation against multidrug resistant bacteria. Extraction of crude compounds was carried out on dried, ground stem bark using hexane, ethyl acetate, dichloromethane and methanol and water. Results from the antimicrobial activity screening showed that water/methanol (80/20) extract is active against various bacteria pathogens. For example, a minimal inhibitory concentration of 0.3 µg/mL was obtained against Staphylococcus aureus, Klebsillae pneumonae, pseudomonas aeruginosa strains. After bioactivity screening, the crude compounds were separated by column chromatography and characterized using nuclear magnetic resonance, infrared spectroscopy, UV-vis spectroscopy and liquid chromatography-mass spectrometry techniques for chemical identification of the active compounds.

Extraction of textile dyes for forensic analysis using paramagnetic ionic liquids (Poster)

Joel Moss and David K. Bwambok, Ball State University

Forensic analysis of dyes from textile fibers can provide information for identifying and matching dyes from different sources. Identifying textiles and dyes found at crime scenes and forensic sites requires analytical methods to extract dyes from fibers without destroying the chemical nature of the dyes. Fiber samples pose a particular challenge, as they require a solvent harsh enough to denature the fiber but nondestructive to dyes. In addition, the dye must have significant solubility in this denaturing system to allow their separation from the fiber and analyzed with minimal sample preparation. Ionic liquids (ILs) are solvents that can inherently achieve the multiple functionalities necessary to disrupt the fibers and extract the organic dyes. This study demonstrates that paramagnetic ionic liquids can be used for extraction, magnetic separation and analysis of dyes in a single step. This study presents an approach for removal of various textile dyes from cotton using paramagnetic ionic liquids. The paramagnetic ionic liquids consist of a tetraalkyl phosphonium cation that is paired with an anion containing a paramagnetic metal such as iron. Using the synthesized paramagnetic ionic liquids, magnetic extraction was carried out for various dyes including malachite green, kiton red, acid yellow,

acid red, among others. Extraction of the dyes using an external magnet alleviates the use of volatile and toxic organic solvents for liquid-liquid extraction.

Detection of lead in drinking water using hydrogels to precipitate lead (Poster) (EMSR Poster Competition)

Kathryn L. Rowberg, Purdue University Northwest

The presence of lead in drinking water is a growing concern for many cities and towns in the state of Indiana and the nation. Early detection of lead and use of filters or alternative sources of clean drinking water will benefit children who are most susceptible to lead poisoning and may suffer symptoms such as developmental delay and learning difficulties. Our project is to develop a simple and nontoxic method to test for lead at home.

Our research investigated the use of commercially available polyacrylamide beads and thin films of agarose hydrogel that were prepared in our lab. These polymeric materials readily absorb water and form cavitations when they swell. We tested several methods of incorporating ions into the polymers and tested their potential to absorb and precipitate dissolved lead from water samples.

Expanding the substrate scope of Rieske dioxygenases through enzyme engineering (Poster)

Bailey Rutkowski, Ball State University

Rieske dioxygenases, a class of enzyme systems found in soil bacteria, play an important role in the bacterial metabolism of aromatic “pollutants” in their environment. Rieske dioxygenases have long been utilized in organic synthesis due to their ability to catalyze the asymmetric dihydroxylation of aromatics to produce chiral diene-diol metabolites. Despite their utility, the range of potential applications for these green catalysts has been limited by steric and electronic constraints on their substrate scopes and activity. Our work in the Ball State Laboratory for Biocatalysis Research is focused on developing new green-chemical tools in the form of engineered enzymes that operate in aqueous solutions to help attenuate the reliance of the chemical industry on non-renewable energy sources. To this end, we have applied active site targeted mutagenesis along with a recently reported high throughput screening platform to develop new Rieske dioxygenase variants with activity for amide-functionalized substrates, revealing key active site residues that modulate the enzyme’s activity and selectivity. This research has led to the identification of a series of dioxygenase variants that demonstrate significantly improved activity for the dihydroxylation of ester-functionalized substrates over the parent enzyme. These variants have been characterized, which has afforded the development of an index of beneficial substitutions in this context. Further, we have iteratively combined these identified beneficial mutations to determine whether any additional synergistic effects on the enzyme activity can be obtained in this way. We aim to apply the knowledge gained in this study in engineering more improved Rieske dioxygenase variants to broaden the utility of these environmentally sustainable catalysts.

AFM Characterization of Semiconductor Nanomaterials and Solar Cell Electrodes (Poster) (EMSR Poster Competition)

Jasney Comb, **Angel Esquivel Vazquez**, Kelsi Goshinsky and **Zhihai Li***, Ball State University

Atomic force microscopy (AFM) has the power of characterizing surface morphology and has been widely used in many fields including biology, chemistry, physics, geology, and materials. At Ball State, we allow undergraduate researcher using AFM to receive some hand-on experiences in the lab and obtain the necessary skills for further scientific research. In this poster, we first introduce AFM working principle, including the different operational modes of AFM, how AFM can image surface morphology. Then, the sample preparation and procedure of carrying out an AFM experiment were described. We will present some experimental data on the characterization of different nanomaterials (such as NiWO4, CoWO4, CuWO4, etc.) and solar cell electrodes using taping mode AFM imaging technique. The high-resolution AFM images show that morphology and size of metal tungstate nanomaterials can be determined. AFM also allow reveal different surface morphology of solar cell electrode surface prepared by depositing TiO2 and platinum nanomaterials on FTO glasses.

CONSERVATION, SUSTAINABILITY, AND LAND MANAGEMENT

Creation of Indianapolis Zoo's Global Center for Species Survival and the IUCN SSC (Hot Topic)

Bill Street, Indianapolis Zoo

In 2021, the Indianapolis Zoo founded the Global Center for Species Survival, a partnership with the International Union for Conservation of Nature (IUCN) Species Survival Commission (SSC). This Center, opening to the public in 2023, serves to increase the assessment of endangered species, develop integrated conservation plans to improve their conditions, and then to implement these plans to help recover species. A team of 7 taxon/realm coordinators and experts in communications and human behavior change are working with over 10,000 volunteer conservationists around the world to have global impact on species conservation right here from Indianapolis. Learn more about this Center, the team and how you can become engaged in the Species Survival Commission.

Increasing invertebrate conservation assessments through partner networks and student engagement (Oral Presentation)

Dr. Monika Bohm

Global biodiversity decline is continuing largely unabated. The International Union for Conservation of Nature (IUCN) Red List of Threatened Species (hereafter, Red List) provides us with the gold standard for assessments, but taxonomic coverage for species such as invertebrates remains very low. Many players contribute to IUCN Red Listing efforts, for example the Specialist Groups and Red List Authorities (RLA) of the IUCN Species Survival Commission (SSC). However, it is vital that we develop the next generation of contributors to sustain the huge assessment effort required to fill data gaps. The IUCN SSC Butterfly & Moth Specialist Group and IUCN SSC Terrestrial and Invertebrate Red List Authority are two such SSC groups that are establishing partner networks within the educational sector to build additional capacity for species assessments. In this brief talk, I will introduce our efforts of linking academia directly into the Red List assessment process. We aim to increase Red List “literacy” amongst potential future conservationists and help students to increase publication output, form professional networks, and develop writing and research skills. Professors can build Red List learning into their teaching and offer Red Listing opportunities that directly contribute to the Red List to students as assignments or research projects. I will highlight some recent achievements and expansion opportunities and hope to engage with interested academics on training and engaging the next generation of invertebrate conservationists.

Protecting Indiana's wild lights and dark skies (Oral Presentation)

Sergio Henriques, Indianapolis Zoo

The Say's firefly (Pyractomena angulata) has been Indiana's official state insect since March 2018. Exactly half a decade later, I reflect on what is this species conservation status in its "home state" and discuss how it could easily have been extirpated from multiple counties, or from the entire state altogether, without anyone noticing.

As DNR's State Wildlife Action Plan starts the next decade of conservation action in Indiana, I take a closer look at some of the rarest and threatened species of fireflies in the state, and

discuss why we should incorporate the protection of dark skies towards preserving the remarkable wild lights of our state.

Status of the Plains Leopard Frog (Lithobates blairi) in Indiana (Oral Presentation)

Zachary Truelock, Indiana DNR

The Plains Leopard Frog (Lithobates blairi) is a widely distributed prairie species that reaches the eastern edge of its range in Indiana. A relic of the Prairie Peninsula, Indiana records for this species have been scarce and an approximately 30-year dearth of confirmed sightings has made it difficult to assess the species' status in the state. From 2019–2022, we used a combination of sampling techniques to survey for Plains Leopard Frogs across western Indiana. To date, populations have been identified at over 20 sites in eight Indiana counties. At all localities, the frogs were located along riparian corridors and inhabited both near-shore and adjacent aquatic habitats within the floodplain. Preliminary data indicate the Wabash and Iroquois river drainages play an important role in the distribution of this state endangered species in western Indiana.

Contributing to a Better Understanding of Climate Change on US National Wildlife Refuges: The Civilian Climate Corp Fellowship Program (Oral Presentation)

Gabriel Van Praag, U.S. Fish & Wildlife Service

The U.S. Fish and Wildlife Service's (Service) National Wildlife Refuge System (NWRS) is the world's most extensive network of lands and waters specifically dedicated to wildlife conservation. Although refuges are protected from some anthropogenic stressors (e.g., urbanization), the effects of climate change still pose a threat to wildlife and their habitat. Considering this, the NWRS partnered with Hispanic Access Foundation to place one of the six Civilian Climate Corps (CCC) Fellows at the Big Oaks and Muscatatuck National Wildlife Refuge Complex (Refuges). The objective of the fellowship is to perform a climate change vulnerability assessment of priority resources of concern, determine the potential for ecosystem transformations, and to incorporate climate change adaptation into planning efforts.
Big Oaks is a globally important bird area thanks to its vital grassland habitat, and one of the largest continuous blocks of forests in Indiana. Muscatatuck's managed wetlands are a key stopping point for migratory waterfowl, including approximately 50,000 wintering Sandhill Cranes. These grasslands and forested habitats are vulnerable to potential shifts in community composition due to a combination of climate-induced stress, increased invasive plant pressure, and likely shifts in disturbance regimes. Wetlands and associated priority species at both refuges are vulnerable to the potential impacts of early season drying and an increase in extreme rainfall events. Species turnover is also of major concern. We are incorporating findings from this ongoing analysis into step-down management plans at Big Oaks National Wildlife Refuge. Additionally, we will utilize the Resist-Accept-Direct decision support tool to incorporate management recommendations for future ecosystem change.

Urban environments negatively impact sugar maple health (Poster) (EMSR Poster Competition)

Abbigail Zimmerman, Asanti Tafesse, **Rylie Farr**, ReBecca Zorn, and F. Collin Hobbs, Department of Biology, Huntington University

Trees grown in urban environments face multiple stressful conditions, including increased heat, drought, impervious surfaces, pollution, and direct disturbances. Yet urban trees provide vital services to urban ecosystems—cooling their environment, filtering pollutants, decreasing storm water runoff, and providing habitat for urban animals. Our need to better understand the effect of urban environments on tree health has never been greater as urban centers continue to rapidly grow in the 21st century, especially in developing countries. Previous research has used factors such as crown density, leave discoloration, and vigor as indicators of tree health. Our research focused on stem, trunk, and root damage of sugar maple (Acer saccharum), an abundant urban tree in our region. We hypothesized that sugar maples found in natural areas would have less damage than those planted in human-impacted (urbanized) areas. We selected 20 individual trees: 10 in an undeveloped forested area, and 10 in nearby human-impacted environments. We measured and recorded circumference, number of stem wounds and dead stems, exposed roots, trunk damage, and annual growth rate using tree cores. Each damage category was standardized to a score ranging from 0 (no damage) to 10 (most damage), which allowed us to calculate a damage score across all categories by tree. The average damage score for all human-impacted trees was 3.97, which was significantly larger than the average damage score for undeveloped trees at 2.05 (P=0.008). A significant difference was also observed for exposed roots, but not other individual damage categories. While human-impacted trees had higher rates of damage than undeveloped trees in our study, simple modifications to their immediate environment could decrease the damage they experience and improve their overall health, thus benefitting the entire urban ecosystem.

Applying the Greening IUPUI Grant to Boost Biodiversity, Support Sustainability, and Create Conservation Corridors (Poster) (EMSR Poster Competition)

Mary Moffett, Indiana University-Purdue University Indianapolis

Biodiversity, the variation among organisms, is currently facing an unprecedented decline due to human activity. The importance of native plants in our landscapes and their interconnectedness with biodiversity is well-documented, benefiting ecosystem services and ecological literacy. Using Doug Tallamy's model of "shrinking lawns" to replace monocultures with native plantings in the form of conservation corridors, I wrote a Greening IUPUI Grant in March 2022 with the intent to transform a neglected area of campus overrun with invasive wintercreeper (Euonymus fortunei) into a dry prairie planting of Indiana native plants. My application identified benefits to the three pillars of sustainability; detailed alignment with six core focus areas; provided additional economic benefits to the wider community by sourcing plants from a local nonprofit; and analyzed how the grant would bolster IUPUI's Sustainability Tracking, Assessment and Rating System (STARS) score in support of its Gold rating from the Association for the Advancement of Sustainability in Higher Education (AASHE). Four grants were awarded in May 2022, with my proposal funded at nearly 50 percent beyond the initial request. IUPUI Sustainability and Campus Facility Services Grounds identified a planting area that better fit their needs and purchased plants from Keep Indianapolis Beautiful, while I enlisted the help of the Indiana Native Plant Society's (INPS) Central Chapter for assistance with landscape design. The planting was held in late September 2022, with IUPUI Sustainability, CFS Grounds, Purdue

Extension Marion County, and student volunteers installing 1,375 native plants and spreading mulch. Creating conservation corridors supports biodiversity and sustainability while providing a wealth of ecosystem services. This project could be the beginning of a network of conservation corridors on campus, and could help inspire community engagement with native plants, sustainability, and conservation.

EARTH SCIENCE

Climate summaries, perspectives, and data (Hot Topic)

Dr. Beth Hall, Indiana State Climate Office

As 2022 ended, Indiana was recovering from brutally cold temperatures and a blanket of snow that offered a White Christmas for many. What this a typical year or a year of extremes? How do we know? How does temporal perspective change the answer and is that misleading? This presentation will provide an overview of last year's climate across Indiana as well as a discussion on climate perspectives and information on where to find reliable data for educators, scientists, and researchers to utilize for advancing research and climate science literacy.

Uplands Springs Online Database at the Indiana Geological and Water Survey (Oral Presentation)

Tracy Branam, Indiana Geological & Water Survey

The Indiana Geological and Water Survey (IGWS) has recently collected data for more than 100 perennial springs in the Uplands region of south-central and southern Indiana through funding provided by the Indiana University Center for Rural Engagement. The data collected include field chemistry, flow estimates, anion and cation chemistry, selected trace elements, and coliform bacteria screening. Data was loaded into an enterprise geodatabase, which allows for existing records to be updated as well as new records added. This database powers a web-based front-end application where users can search and filter data (both textually with forms and drop-downs, and spatially with a map) to learn more about the springs near them. The application also directs users to a Survey123 form where they can submit the location of a spring and request a field check from IGWS researchers. If it is a previously unrecorded spring, it will be added to the database and could be included in future measurements and studies. As time and interest allow, researchers plan to regularly monitor water quality and chemistry, the measurements of which will be added to the database to create a growing and dynamic resource for researchers and the community. A demonstration of the application will be presented along with examples of how the data can be used to help interpret spatial and chemical relationships for this data set using maps, cluster analyses, and Durov diagrams.

Size, Shape, and Morphological Diversity of Tridactyl Theropod Dinosaur Footprints (Oral Presentation)

James O. Farlow (Department of Biological Science, Purdue University Fort Wayne) and **James A. Hyatt** (Department of Environmental Earth Science, Eastern Connecticut State University, Willimantic, CT)

Tridactyl (three-toed) footprints attributed to theropod (mostly carnivorous) dinosaurs are not uncommon in continental sedimentary rocks of the Mesozoic Era. Footprints of these dinosaurs span a huge size range, from only a few centimeters to about a meter in length. Many parataxonomic names have been applied to putative theropod footprints from rocks of different age around the world, but it is suspected that many such names are redundant for characterizing these footprints. The published literature provides many measurements of theropod footprints, but there is no guarantee that all measurements of a particular parameter were made the same way by different authors. We measured several shape parameters, following consistent protocols, of a large sample of well-preserved theropod prints (the footprints

themselves, or casts or 3D replicas thereof), to see how print shape is affected by overall size, and whether such measurements consistently distinguish one large theropod ichnogenus from another. With increasing size, putative theropod footprints show relative increases in width across the tips of the outer toes and across the base of the print, and the length of the footprint "heel," and relative decreases of the projection of the middle toe beyond the tips of the two outer toes. For large (length greater than 250 mm) theropod footprints, prints assigned to the same ichnogenus are often as much or more like footprints of other ichnogenera, suggesting that there is indeed considerable redundancy in the nomenclature of these trace fossils, and marked conservatism in the shape of large theropod trackmaker feet.

Environmental Sequence Stratigraphy of Mid-Town Carmel, Indiana (Oral Presentation)

Daniel L. Kelleher and Tim J. Kemmis, Midwest GeoSciences Group

Subsurface engineering projects during recent the redevelopment of mid-town Carmel, Indiana have revealed the sedimentary sequence of past geologic history. The sedimentary sequence yield multiple origins ranging from stream deposits, subglacial tills to thick intervals of proglacial outwash.

The drilling investigation revealed the stratigraphic sequence consists of from youngest to oldest, Surficial Alluvium, Bedded Trafalgar Formation, Massive Trafalgar Formation, Glaciofluvial Deposits, Massive Pre-Trafalgar Formation, and Bedrock.

The site stratigraphy became predictable based on deciphering depositional environments. Stratigraphy revealed the variability and uniformity in soils, physical properties, and groundwater conditions that were applied to the engineering design and construction. Laboratory testing yielded data pertaining to geotechnical, thermal, resistivity, conductivity, corrosivity, and geochemical properties. Understanding the site stratigraphy provided the framework for how each lab result related to the subsurface.

Although the process for defining and mapping stratigraphy is a basic premise of geologic principles, the United States Environmental Protection Agency published a 2017 report about the need for understanding basic subsurface characterization titled Environmental Sequence Stratigraphy. The subsurface characterization work in mid-town Carmel followed basic three phases of the process for defining and mapping stratigraphy, but the process unraveled the complex stratigraphic sequence derived from different depositional environments coupled with yielding a meaningful geologic framework that will prove valuable for the City of Carmel for many years to come.

Indiana's Landslide Inventory (Oral Presentation)

Victoria Leffel, Indiana Geological Survey

Landslides affect Indiana's transportation network in connection with constructed highway embankments and cut slopes into existing ground, especially throughout southern Indiana. With the availability of INDOT's landslide datasets, state light compliant detection and ranging (LiDAR) data, and the combination of aerial and ortho-imagery, landslide areas were mapped and developed into one uniform GIS polygon data layer. The landslide data layer provides an inventory of historic and recent landslides along Indiana's transportation network. To investigate the relationship between landslide areas with other geological and anthropogenic factors, a preliminary analysis compared landslide areas and other available GIS data. The analysis

revealed bedrock and topography highly influence the occurrence of landslides in Indiana. With these two factors highly influencing landslide occurrences, reviewing landslides in terms of physiographic regions is extremely useful. When comparing the area size of landslides and the physiographic regions, the Dearborn Upland, the Crawford Upland, and the Charlestown Hills were the most landslide prone physiographic regions in Indiana. Landslide inventories are a key component in determining landslide susceptibility and risk, in addition to disaster emergency management.

Possible Faulting of The St. Louis Limestone At Lincoln Park Stone, Putnamville, Indiana (Oral Presentation)

Mose Nasser, S&G Excavating, Terre Haute, Indiana

The quarry is located mostly in the SW¼NE¼ sec. 8, T. 13N., R. 4 W., of the 2nd Principal Meridian and After removing 20 million tons of St. Genevieve Limestone the underlying St. Louis Limestone is exposed. Approximately 25 feet below the Lost River Chert there are layers of bedrock that show distinct vertical displacement of 6 feet. This displacement could be interpreted as minor faulting and indicate larger strata offset at greater depths due to 2 earthquakes in Putnam County during the last 32 years and possibly many more in the geological past. December 20, 1990 there was a 3.5 magnitude event in the northeastern part of the county and April 14, 2000 there was a 3.2 magnitude event in the southwestern part of the county (Walter E. Grey & John C. Steinmetz, Miscellaneous Map 84, Indiana Geological & Water Survey, 2014) When looking at the Putnam County earthquakes on the cited map they trend along a northwest to southeast line from Montgomery to Washington Counties that has 2 more earthquakes and a known fault. Southeast of Putnam County a 3.3 magnitude event occurred in Morgan County on January 29, 1907 and the Mt Carmel Fault. Northwest of Putnam County they line up with a 3.3 magnitude event that happened December 17, 1990 in Montgomery County. This could possibly be a northwestern extension of the Mt Carmel Fault or a separate fault complex across Morgan, Putnam and Montgomery counties in Indiana. Seismic reflection studies would create an accurate geological profile showing deep faulting if any across those three counties. The author plans to monitor the highwall at the S&G quarry and report any future bedrock displacement that is revealed.

Can Soil Taxonomy Be Used to Map the Distribution of Pre-European Settlement Prairies? (Oral Presentation)

Darrell G Schulze, PhD, Purdue University

The U.S. has detailed, ground truthed soil maps for most of the country. The soils are classified in Soil Taxonomy, a rule-based classification system that requires detailed morphological descriptions plus laboratory-determined physical and chemical properties. Thus, soil taxonomic classes contain imbedded quantitative information about the soils they represent. Soils with dark colored surface horizons high in organic matter are considered to have formed under prairie. In principle, therefore, a map showing soils with dark surface horizons should show the distribution of prairies prior to European settlement. Using the gSSURGO soils database, a map was created of all soils with dark surface horizons as defined by their classification as follows: (1) all Mollisols, (2) mollic, humic, umbric, and melanic suborders, great groups, and subgroups of other soil orders, and (3) two soil series in northwest Indiana with dark surfaces not reflected in their classification. The resulting map shows the eastern most extent of the prairie peninsula in northwest Indiana and delineates the presettlement prairies of Indiana reasonably well, but major areas of prairies are not shown in other parts of the US for a variety of reasons. These

include: (1) very sandy, well drained prairie soils, such as those in the Nebraska Sand Hills, do not develop dark surfaces, (2) Vertisols and vertic subgroups of other soil orders may have dark surfaces, but this is not reflected in their classification, as occurs in northeast Missouri and the Blackland and Coastal Prairies of Texas, and (3) mistakes or inconsistencies in the gSSURGO database, as occurs in western Iowa and other areas. Thus, while a map of dark surface soils delineates prairies in Indiana quite well, it does not always do so in other parts of the U.S.

Impacts of Precipitation Trends and Forest Resource Management on a Shallow Groundwater System in Manistee National Forest, Michigan (Poster) (EMSR Poster Competition)

James Bingaman, University of Southern Indiana

The Pines Point Semi-Primitive Area of Manistee National Forest, MI lies atop a thick sequence of well-sorted, fine outwash sand which supports a dynamic, linked groundwater-surface water system along the White River. An important aquatic resource, the White River is a designated Michigan State Natural River and candidate Federal Wild and Scenic River. Three drilled monitoring wells (PPW1, PPW2, PPW3) were installed in 2010 and instrumented to record high-resolution groundwater levels shortly after the US Forest service began savanna restoration efforts in Pines Point. Since the mid-1800's, savanna ecosystems have been lost to land use changes throughout the Midwest, including Michigan and Indiana. The Pines Point wells generally record an annual hydrological cycle characterized by a single dominant spring groundwater recharge event. The magnitude, timing, and duration of recharge events vary based upon complex interactions among precipitation, antecedent conditions, and forest management efforts. This investigation seeks to distinguish the impact of changes in monthly and annual precipitation on groundwater levels recorded in PPW2 from the effects of forest canopy reductions as part of savanna restoration near site PPW3. Since 2013, PPW2 and PPW3 have displayed distinctly different annual recharge events, most notably the absence of groundwater recharge in PPW2 in 2021, which corresponds to the lowest annual precipitation in our period of record. Groundwater levels at PPW3, a site of forest canopy reduction, does show a recharge event despite the low annual precipitation. Monthly precipitation for the period 2011 – 2022 displays a trend of 0.89cm/year increase in August, and 0.31cm/year increase for October. This increase in precipitation during summer and fall seasons is consistent with larger scale observations of seasonal precipitation trends throughout the Midwest, including Indiana. Correlations among groundwater, precipitation, and forest cover dynamics may permit isolation of distinct hydrologic drivers in this complex and changing groundwater-surface water system.

ECOLOGY

Coyote (Canis latrans) density estimation using scat, SNPs and spatial partial identities (Oral Presentation)

Dr. Rebecca Cain, Purdue University

Density estimation is important for wildlife conservation. For species like the coyote (Canis latrans), the complex population dynamics and social structure across broad spatial scales make it difficult to obtain valid estimates of density because individuals in a population are imperfectly detected. Although many statistical models have been developed to account for imperfect detection, spatial capture-recapture (SCR) models have become a preferred methodological approach to obtain robust estimates of population density for carnivore species. SCR models are hierarchical and describe the spatially explicit process of sampling, how individuals in a population are distributed in an area, and how those individuals use the space. Consequently, SCR models require researchers to collect spatial encounter information with individual identity data associated with each capture event. Noninvasively collected genetic samples are commonly used to study the population dynamics of elusive predator species, including coyote. Genetic data extracted from scat samples can be used to identify individuals. However, a problem with the standard methods for estimating density from noninvasive genetic samples is that lower-quality samples (i.e., samples that fail to meet some minimum amplification threshold) are discarded from the analysis. Recently, Augustine et al. (2020, PNAS) introduced the genotype spatial partial identity model (gSPIM), a new methodological approach that makes use of these poorer-quality samples by allowing errors and uncertainty in individual identity. They demonstrated the value of their approach using microsatellite markers from fisher (Pekania pennanti) hair samples. We extended the gSPIM approach to evaluate its utility in estimating coyote densities in 3 areas across Indiana using single nucleotide polymorphisms (SNPs) to genotype individuals from scat. We consider the limitations to using SNPs and scat data under this new gSPIM approach and the potential benefits over more traditional methods that use cutoffs for data inclusion.

Conservation genetics of relict eastern hemlock population of Indiana (Oral Presentation)

Dr. Michael Jenkins, Purdue University

Disjunct relict populations of eastern hemlock (Tsuga canadensis) persist throughout central and southern Indiana. These small remnants of larger, post-glacial forests persist in steep ravines and on rocky sandstone cliffs, where they historically held a competitive advantage over hardwood species. The sustainability of these relicts is threatened by stagnant reproduction, possibly due to inbreeding and reduced genetic diversity within disjunct populations, dispersal limitations, and spatial limitations of suitable habitat. We assessed the gene flow and reproduction within and between local populations in order to assess reproductive health. We used microsatellites to quantify gene flow between populations, within populations, and between established cohorts. In addition, we examined seed germination rates within each population to assess the reproductive health of T. canadensis in Indiana. We discovered substantive genetic differentiation among populations, indicating a lack of pollen flow between many populations. Our quantification of gene flow within and among populations, and our assessment of viable reproduction, will help guide the continued study and future conservation of T. canadensis

populations, which are a unique part of Indiana's treasured state parks, nature preserves, and private lands.

Agent-Based Modeling of an Exotic Species Invasion (Oral Presentation)

Jeffrey D. Holland, Rennie McIntosh

Agent-based modeling holds the promise of being a tool to move ecological investigations beyond phenomenological correlations to mechanistic understanding. One important implementation of such models is understanding the invasion process of exotic species. The polyphagous shot hole borer is an exotic ambrosia beetle that is currently spreading across the southwest and threatening native trees and orchards. We are developping an agent-based model of this exotic beetle as part of a larger project to control exotic vegetation and preserve an endangered bird. Model parameters are obtained from the literature and from field monitoring. The model is then validated by its ability to recreate patterns that emerge from the invasion process. This talk will introduce the invasive beetle model both conceptually and with visual simulations played out on a habitat map. We then show how emergent pattern-matching can lead to unintuitive results.

Variable impacts of herbivore pressure and hydrologic stress on urban understory plant restoration (Oral Presentation)

Dr. Heather Reynolds, Indiana University

Restoration of urban greenspaces faces challenges from abiotic and biotic factors. Greenspaces bordering waterways are often subject to rapid, heavy flood events due to widespread impervious surface and stormwater diversion. This novel disturbance regime can hinder the establishment of native plants and disperse invasive species. Urban greenspaces are also highly vulnerable to herbivory from deer and rabbits. High herbivore pressure particularly impacts native plants, as exotic invasive species are often less palatable to herbivores. We investigate the impact of hydrologic pressure and mammalian herbivory on native plant establishment in urban woodlands. Based on pilot data, we predicted an interaction between flood and herbivore pressure, with flooding limiting biomass of native species within flood zones and herbivore pressure limiting palatable species outside of flood zones. We established experimental sites across seven forested park areas in Indianapolis, IN. At each site, we planted grids of three native understory forbs –zig-zag goldenrod (Solidago flexicaulis), bottlebrush grass (Elymus hystrix) and blue mistflower (Conoclinium coelestinum). To determine the impact of hydrologic stress on plant establishment, each of the seven sites included plots within flood zones along waterways as well as plots in non-riparian zones. To assess the impact of mammalian herbivores, three herbivory treatments were employed: caged plots to exclude mammalian herbivores, open caged plots to permit access to small mammalian herbivores, and uncaged control plots. Fall aboveground biomass was harvested, dried and weighed. Preliminary analyses indicate that as predicted, biomass of the most palatable species, zig-zag goldenrod, was strongly limited by flood pressure, with a trend for herbivore pressure to limit biomass in non-riparian woodland. Blue mistflower failed to establish well in non-riparian zones and high variability limited inference for both this species and bottlebrush grass.

Resistance to three common herbicides in chameleon plant (Houttuynia cordata Thunb.), a highly invasive exotic species (Oral Presentation)

David Ice and **Dr. Xianzhong Wang**, Indiana University-Purdue University Indianapolis

Chameleon plant (Houttuynia cordata Thunb.) is native to Southern and Southeastern Asia. It reproduces sexually through seeds and asexually through rhizomes. There has been much research on H. cordata as a medicinal species and as a potentially exotic invasive species. However, its resistance to herbicides has not been previously examined. In this study, we conducted two rounds of tests to examine the resistance of H. cordata plants to three commonly used herbicides: SpeedZone, Weed-B-Gon, and Roundup. Two concentrations of each herbicide were used during each trial, the recommended concentration and twice the recommended concentration. Herbicide treatments were applied outside on a calm day. Herbicides were sprayed uniformly on leaves and stems until dripping. Growth of treated plants was then monitored in a greenhouse. Herbicides generally reduced growth of the plants temporarily. However, plant extermination was not achieved. New shoots from all treated plants regrew from rhizomes in time. Results from our study showed that H. cordata could not be controlled effectively by herbicides at the recommended concentrations of herbicides commercially available for horticultural uses in the U.S. Doubling the recommended herbicide concentration was also ineffective in exterminating H. cordata plants. Results from our study clearly showed that H. cordata has the potential to become a highly invasive species that will be difficult to control once established in the U.S.

Transgenerational effects of microplastic exposure on embryo behavior in fathead minnows (Pimephales promelas) (Poster)

Travis Beckett, Ball State University

Microplastics (MPs) have well-known adverse physiological and behavioral effects in affected aquatic species. Moreover, chemicals may sorb to the surface of MPs, providing an additional route of exposure for other contaminants. However, comparatively little is known about the effects of MP exposure on individuals during development, or the potential for cross-generational effects of exposure. To address this gap, this ongoing study aims to examine transgenerational and multigenerational effects of MP exposure on fish at early life stages (embryos and larvae). In this experiment, we are exposing reproductively mature fathead minnows (Pimephales promelas; F0 generation) to microplastics alone, or those associated with a low or high dose of a common endocrine-disrupting chemical (17-alpha ethinyl estradiol) for 30 days using a dietary exposure protocol. The effects of F0 exposure on the development and behavior of F1 embryos are then assessed at 4 dpf. After hatching, half of the F1 larvae are further exposed to MPs for 14 or 21 days, and then tested in swimming performance assays. Our initial results suggest that fish may have substantial exposure to MPs during natural foraging events. Exposure during critical periods of gamete development may also have detectable effects on the behavior and physiology of offspring. These data will help fill an important knowledge gap in our understanding of the effects of contaminants on aquatic populations.

"Seed predation differs between native and exotic plant species, and between light and dark colored seeds" (Poster)

Lana Bolin**, Cieara Carpenter**, **Hannah Turnbull**, **Dylan Mann**, Indiana University

Species interactions such as competition, predation, and mutualism are a key focus of ecology. These interactions are highly context dependent, and commonly differ in strength between invasive and native species. The Enemy Release Hypothesis posits that invaders may be successful by escaping their co-evolved enemies during the invasion process. However, evidence for the Enemy Release Hypothesis has been mixed. Seed predation may also be influenced by seed color. For example, seeds of different color may differ in visibility, or may differ in chemical composition in ways that affect seed predation. Here, we investigated how a species interaction – seed predation – is affected by seed color, and whether seed predation rates differ between invasive and native species. As part of a summer research program designed to increase research access for community college students (Science CORPS: sciencecorpsprogram.org), we conducted a distributed study that took place at sites across Indiana and Illinois. We set out trays containing white sand and seeds from five native and five exotic plant species that were light or dark in color, and counted the number of seeds of each species remaining after three days. We found that seed predation was higher for light-colored seeds than dark-colored seeds, and tended to be higher for exotic plant species than native species. These results suggest that camouflage may not reduce seed predation, and that the Enemy Release Hypothesis may not explain the success of these exotic plant species, at least in terms of release from seed predators.

Recovery of native shrub layer following invasive species removal in a Midwestern forest (Poster) (EMSR Poster Competition)

Rebecca Schutt, Celeste Ryman, **Jennifer Brown**, Annika Rae, and F. Collin Hobbs, Department of Biology, Huntington University

Invasive species can cause long-term damage to ecosystems that can persist even after eradication. Non-native bush honeysuckles (Lonicera sp.) are highly invasive, allelopathic shrubs that are common in Midwestern forests. Numerous studies have shown that bush honeysuckles negatively impact native understory plants, crowding out existing plants and suppressing recruitment, though little is known about the persistent effects of bush honeysuckle after its removal. Our study assesses the recovery of native woody shrubs and tree saplings following the removal of bush honeysuckle in a forest understory. Our study site was a portion of Huntington University's campus woods that had been heavily invaded by bush honeysuckle. Honeysuckle has been actively removed from approximately half of our study area for the past nine years (treated) while the other half was left unmanaged (untreated). In November 2022 we sampled 24 1m2 plots, twelve in treated and twelve in untreated portions of the woods. Every woody-stemmed plant larger than 1mm in diameter was identified, recorded, and its stem diameter measured. We then calculated the species richness, Shannon diversity, stem density, and basal area for each plot. Native species had a 2.6 times increase in stem density (P=0.04) and a 8.1 times increase in basal area (P=0.003) in treated plots compared to untreated plots. Invasive species had a similar stem density between treated and untreated plots (P=0.97), however their basal area decreased by a factor of 9.1 in treated plots (P=0.02). Shannon diversity was also higher in treated plots (2.41) compared to untreated plots (1.44). Our results

indicate that native woody shrubs and trees can quickly recover following the removal of a dominant invasive species.

Does urban-induced herbivory lead to increased urban cyanogenesis in white clover? (Poster)

Kaija Carr and **Amerti Guta**, DePauw University

To increase our understanding of the selective factors driving adaptation along urbanization gradients, we examined adaptive phenotypic changes by quantifying the relative frequency of cyanogenesis (HCN) in Trifolium repens (white clover plants). White clover is naturally polymorphic for cyanogenesis; a chemical defense against herbivores. The production of HCN in white clovers is determined by the two alleles Ac and Li, where the absence of either allele prevents HCN production. In this study, we examined the relationship between herbivory and the rate of cyanogenesis. We sampled from 22 and 24 populations/locations along the urbanization gradient (rural to city) of Indianapolis, IN and Urbana-Champaign, IL., respectively approximately every 1 mile, each population containing 15 plants. We classified herbivory as notch, mining, or hole formation. To examine the relationship between herbivory and the rate of cyanogenesis, Feigl-Anger assay papers were placed on macerated plants in 96 well-plates and incubated at 37° for 3 hours. The presence of HCN was indicated by a blue dot on the assay paper. In both cities, the white clovers collected closer to the rural center had a higher proportion of cyanogenic plants, while the white clovers collected closer to the city had a lower proportion of cyanogenic plants. In general, both cities showed a negative relationship between cyanogenesis and the increased distance from the rural center. We found herbivory rates decreased in T. repens populations with increasing urbanization in Indianapolis city, but reversed pattern seen along Urbana-Champaign urbanization gradient. These results suggest that in locations that are more rural and have an increased herbivore population, as seen in Indianapolis transect, that there is a higher proportion of cyanogenic white clover plants. However, more studies are needed to elucidate if increased herbivory but not cyanogenesis in plants is associated with current global urbanization trends.

Traffic rates drive roadkill numbers on Midwestern roads (Poster) (EMSR Poster Competition)

Karlee Franklin, Jessica McWatters, **Kayla Estrada Wilson**, Haven Wolfe, and F. Collin Hobbs, Department of Biology, Huntington University

Roadkill rates are important because they affect the population and abundance of species. Other research has shown that buffer zones and speed limits can influence roadkill rates. However, few studies have assessed the role of traffic rates on roadkill in the Midwest. In our research, we determine whether traffic rates on primary and secondary roads in Huntington County, IN, impact the frequency of roadkill. We predicted that roadkill rates would be significantly higher on primary roads than on secondary roads because of the higher traffic rates on primary roads such as state highways. We collected roadkill data from five primary and five secondary roads in Huntington County once a week for three consecutive weeks in November 2022. Each week we drove a two-mile segment for each of the ten roads and recorded the number of observed roadkill. Traffic rates for each road were determined using traffic records from the Indiana Department of Transportation. Lastly, we compared average daily traffic rates to average daily animal deaths. The average number of roadkill per 10 miles of primary roads was 10.33 compared to only 2.00 on secondary roads (P=0.011), indicating road type has a

large effect on roadkill rates. However, when roadkill numbers are standardized with traffic rates we found that there were 2.381 roadkill per 10,000 vehicles on primary roads, which was remarkably similar to the 2.111 roadkill per 10,000 vehicles observed on secondary roads (P=0.33). Our data suggest that roadkill rates are significantly higher on primary roads because of the higher traffic rates found on primary roads rather than other factors.

Avian Blood Parasite Infections in a Southern Indiana Population of Cerulean Warbler (Setophaga cerulea) (Poster)

Julian Grudens, Ball State University

Avian blood parasites or avian malaria, are protists referred to as avian haemosporidians (Apicomplexa: Haemosporida), and include the genera Haemoproteus, Plasmodium, and Leucocytozoon. These parasites manifest various pathologies in wild birds, which mostly occur during chronic stages and do not result in mortality. However, infections are shown to have negative effects on survival, body condition, and breeding success of songbirds in some studies. Two previous studies investigated haemosporidian infections in Cerulean Warblers using microscopy of blood smear slides, but found no relationship with body condition or plumage as measured. Additionally, one of these studies conducted in 2002 reported the prevalence of infection and median infection intensity (parasitemia) for a sample of 19 Cerulean Warblers from Indiana. In the present study, we used similar methods of microscopy to identify and quantify infections from blood samples of 20 male Cerulean Warblers collected from 19 May – 19 June, 2022. We present preliminary results from this first field season of study on haemosporidian infections in a southern Indiana population of Cerulean Warbler. This includes our finding of a potential relationship between body mass and parasitism in our sample, and compares infection sample statistics of prevalence and parasitemia to the historic 2002 study from Indiana.

Timing of Cerulean Warbler (Setophaga cerulea) Nest Stages and Lepidoptera Peaks in a Hardwood Forest Ecosystem (Poster)

Dr. Kamal Islam, Ball State University

The time of arrival for many avian species to their breeding grounds is synchronized with peak abundance of their food source to improve the chances of fledging success. Long distance migrants winter far from than breeding grounds and cannot rely on local environmental cues that may be vital for advancing spring migration. Studies have shown that climate change can alter the phenology of bird reproduction and their prey which can lead to a mismatch in food availability, negatively affecting nestling body mass. The Cerulean Warbler (Setophaga cerulea) is a rapidly declining neo-tropical migrant listed as state-endangered in Indiana. Since 2007, we have monitored breeding Cerulean Warbler populations within the Hardwood Ecosystem Experiment in Southern Indiana's Yellowwood and Morgan-Monroe state forests. Previous research has identified Lepidoptera larvae as the main food source for Cerulean Warbler nestlings, particularly caterpillars in the families Noctuidae and Notodontidae. Other studies have found that oak and hickory species are important foraging trees for breeding Cerulean Warblers who glean arthropods from tree canopies. The objective of this study is to determine what stages in the Cerulean Warbler nest period overlap with peak numbers of Lepidoptera larvae. In the summer of 2022, we conducted a preliminary study on six Cerulean Warbler territories at our long-term study units. We placed frass traps under oak and hickory species in demarcated territories, and determined the average frass mass of each trap at different dates

during the Cerulean Warbler breeding season. The dates of each Cerulean Warbler nest stage were recorded as we monitored nests from May through July. We will present results from this preliminary study. Data from this study will determine how the timing of Cerulean Warbler reproduction coincides with peaks in Lepidoptera abundance which may provide insight into factors that affect nest success and phenological plasticity.

Synchronization of Cerulean Warbler (Setophaga cerulea) Nest Stages and Lepidoptera Abundance Peaks in South-Central Indiana (Poster) (EMSR Poster Competition)

Brittany Nahorney, Ball State University

To improve the chances of fledgling success, many avian species rely on the synchronization of arrival dates to their breeding grounds with peak abundance of their food source. Long distance migrants cannot rely on local environmental cues that may be vital for advancing spring migration due to the distance between their wintering and breeding grounds. Studies have shown that climate change can alter the phenology of bird reproduction and their prey which can lead to a mismatch in food availability, negatively affecting nestling body mass. The Cerulean Warbler (Setophaga cerulea) is a Nearctic-Neotropical migrant listed as state-endangered in Indiana with population declines of 2.63% per year. Cerulean Warbler breeding populations have been monitored since 2007 within the Hardwood Ecosystem Experiment in Southern Indiana's Yellowwood and Morgan-Monroe state forests. Previous research has identified oak and hickory species as important foraging trees for breeding Cerulean Warblers that glean arthropods and Lepidoptera larvae from tree canopies as the main food source for Cerulean Warbler nestlings, particularly caterpillars in the families Noctuidae and Notodontidae. The objective of this study is to determine what stages in the Cerulean Warbler nest period overlap with peak numbers of Lepidoptera larvae. During May-July 2022, a preliminary study was conducted on six Cerulean Warbler territories at our long-term study units. We placed frass traps under oak and hickory species in demarcated territories, measured the average frass mass of each trap at different dates during the Cerulean Warbler breeding season, and recorded the dates of each Cerulean Warbler nest stage for all nests that we monitored during the breeding season. We will present preliminary results from this study. Data from this study will determine how the timing of Cerulean Warbler reproduction coincides with peaks in Lepidoptera abundance which may provide insight into factors that affect nest success and phenological plasticity.

Dynamic Measure of Glucocorticoid Hormones using Feathers and Plasma in the Polymorphic White-throated Sparrow (Zonotrichia albicollis) (Poster) (EMSR Poster Competition)

Ray Peck, Indiana State University

The White-throated Sparrow (Zonotrichia albicollis) is a polymorphic species with two distinct morphs with unique life-history strategies. They differ in such behaviors as paternal care, territorial defense, reproductive effort, promiscuity, and site selection. White morph males engage in less parental care than do tan morphs, and so this study seeks to learn how the contrasting life strategies and subsequent parental investment affect basal corticosterone (CORT) levels of offspring. It also seeks to answer the relationship between neighbor density and habitat selection with CORT. The study intends to do this via plasma CORT and also feather CORT, which is shown to accumulate CORT over the growth of the feather. A recent study found little CORT in the feathers of five species; therefore, it is important to determine

what is being detected in WTSP feather CORT assays, which this study intends to do, while also validating the methods of extracting and assaying CORT in White-throated Sparrow feathers.

Microplastics and its effects as a vector of 17 α-ethinylestradiol (EE2) on early life stage behaviors in juvenile Pimephales promelas (Poster) (EMSR Poster Competition)

Mackenzie Persinger, Ball State University

Microplastics are ubiquitous contaminants in freshwater systems and understanding the effects on aquatic biota are of increasing importance. Unique properties of MPs allow them to act as vectors for common environmental contaminants such as endocrine-disrupting chemicals (EDCs). One common aquatic EDC in urban systems, 17 α-ethinyl estradiol (EE2), is known to affect the hypopituitary axis responsible for behavior in vertebrate organisms. Microplastics have the potential to serve as an additional route of exposure for this and other EDCs, compounding their effects on physiology and behavior. However, few studies have considered the synergistic effects of microplastics and contaminants on the early life-stage behaviors in freshwater aquatic vertebrates. We exposed juvenile Pimephales promelas to microplastics alone, and associated with a low (MPEE2 5) or high (MPEE2 25) concentration of EE2 for 14 or 21 days, and then assessed larval swimming performance and space use using open-field swimming trials. Swimming performance was statistically similar in larvae from all treatment groups at both 14 and 21 days post-hatch with the exception that larvae in the MPEE2 50 treatment had significantly faster angular velocity at 14 days. However, there were several non-significant trends seen across the data. Exposed larvae showed trends towards increased time spent in the middle of the arena across treatments for day 14 and a decrease in time for day 21, as well an increase of latency of time it took to first entrance in the middle for both days. There was also a trend towards increased time spent moving, velocity, and total distance moved during the trial for day 21 across treatments. These results suggest that early developmental exposure to microplastics, alone or in combination with other contaminants can impact larval behavior and performance in important fitness contexts. Such individual-level differences may translate into higher-order effects for populations and communities.

Effects of Human Error on Long Term Research of a Phragmites australis Invasion (Poster) (EMSR Poster Competition)

Danielle Sommerman, DePauw University

Since 2006, over 100 students in the DePauw Biology Department have mapped the distribution of Phragmites for thirteen separate seasons, most recently in fall of 2022. With this variation in contribution, we noticed subtle differences in seasonal data recording. We wanted to explore whether Phragmites growth from 2008 to 2022 is mainly described by ecological invasion or human error. Our null hypothesis states that all changes in P. australis area is attributed to ecological invasion alone, but we predict that at least some of this difference is due to error in data collection from season to season. In this study we calculated the total area of all Phragmites patches for each data collection season and examined attribute tables from all student teams from 2008-2022. We visually inspected Phragmites distributions from two different time frames, Fall 2014-Fall 2015 and Fall 2020-Fall 2022. Using Arc-GIS overlays, we determined if there are clear errors in data collection, and/or clear evidence of biological expansion of Phragmites. We can confidently state that human error has caused substantial variation in recorded Phragmites australis distributions from year to year. Some of this error

might be attributed to variation inexperience or motivation among students in different contexts (e.g. research vs. class project). In future seasons, we recommend that student researchers on Phragmites confer with previous students to keep collection methods consistent or consult the database of “gray data” from previous years before beginning data collection. Overall, data consistency and communication among researchers is crucial to every Long-Term Ecological Research project, including the examination of the Phragmites invasion in the Nature Park.

Is shoot density of Phragmites australis associated with flowering and patch expansion in the DePauw University Nature Park? (Poster)

Settha Vongprachanh, DePauw University

Students have mapped the distribution and growth of Phragmites australis in the limestone quarry at the DePauw Nature Park since 2006 in an attempt to follow predict the invasion’s progression P. australis patch expansion can be predicted using a number of different variables (Jung et al. 2017). Patches of P. australis were mapped using handheld GPS units and Arc-GIS Pro and categorized as point patches or full patches. We investigated if there is a relationship between flowering and shoot density along patch perimeters. In 2022, we observed tradeoffs among the traits of flowering status, asexual reproduction, and size. We found that individual shoots in the densest areas were smaller therefore not likely to be flowering, possibly due to young age or intraspecific competition at early life stages. Less dense areas that are flowering may be more likely to reproduce sexually via seed dispersal, while areas with dense growing shoots may be more likely to reproduce asexually via propagation. Although flowering shoots produce copious seeds, we lack data on seed dispersal and germination in the quarry. More research is needed to highlight the relationship between interior and edge shoot densities, and how this connection may be affecting overall spread of Phragmites. In predicting further expansion of P. australis, looking at point-patch distance to other patches will be essential to understanding how this species spreads in subsequent years. But we also need to understand how new patches form in the quarry: by seeds or stolons.

Transgenerational effects of microplastic exposure on embryo behavior in fathead minnows (Pimephales promelas) (Poster)

Abigail Yake, Ball State University

Microplastics (MPs) have well-known adverse physiological and behavioral effects in affected aquatic species. Moreover, chemicals may sorb to the surface of MPs, providing an additional route of exposure for other contaminants. However, comparatively little is known about the effects of MP exposure on individuals during development, or the potential for cross-generational effects of exposure. To address this gap, this ongoing study aims to examine transgenerational and multigenerational effects of MP exposure on fish at early life stages (embryos and larvae). In this experiment, we are exposing reproductively mature fathead minnows (Pimephales promelas; F0 generation) to microplastics alone, or those associated with a low or high dose of a common endocrine-disrupting chemical (17-alpha ethinyl estradiol) for 30 days using a dietary exposure protocol. The effects of F0 exposure on the development and behavior of F1 embryos are then assessed at 4 dpf. After hatching, half of the F1 larvae are further exposed to MPs for 14 or 21 days, and then tested in swimming performance assays. Our initial results suggest that fish may have substantial exposure to MPs during natural foraging events. Exposure during critical periods of gamete development may also have detectable effects on the behavior and physiology of offspring. These data will help fill an

important knowledge gap in our understanding of the effects of contaminants on aquatic populations.

ENGINEERING

Public Procurement Issues of Construction Project and its Effects on Contract Performance (Poster) (EMSR Poster Competition)

Jayendra Bhatta, Singhania University

Public procurement and contract management during construction projects in poor resource settings specially conflict-affected countries/contexts (CAC) encounters contract performance failure creating significant impacts on development, economy, peace, and stability of CAC. The World Bank and Procurement report (2014) estimates about 30-35 countries fall in the list of CAC annually impacting approximately 1.5 billion people. Currently, limited research has been done in CAC that examines key factors which hinder contract performance on each stage of public procurement and contract management (PCM) cycle. The aim of this study is to explore issues of public procurement in conflict-affected situations and recommend their context-based solutions.

For this study, mixed method approach of qualitative and quantitative techniques; case study of health infrastructure projects in CAC (Nepal and Timor-Leste) is carried out. For the content-based analysis, key issues of public procurement effecting the contract performance in CAC were identified using project documents, literature review, focus group discussion and project stakeholder interviews. In total 20 project sites were selected adopting purposive sampling method. Overall, 80 participants (project stakeholders) have participated in the focus group discussions, questionnaire survey and in-depth interviews. Findings of content analysis shows that most of research did not cover all components of stage-1: needs assessment and preparation and stage-4: handover and closing among four stages of PCM cycle.

Other identified top 10 key issues include: i) political instability and interference in procurement decisions, ii) weak legal and institutional frameworks, iii) lack of qualified human resources and budget, iv) weak procurement market and construction management, v) delay decisions by government and donors, vi) frequent changes in procurement policies and staffs, vii) poor needs identification and project execution, viii) conflict and security situations, ix) delay approval and payment process, x) weak coordination/communication system among project stake holders.

ENVIRONMENTAL SCIENCE

How's the water? A case-study of watershed data in the St. Joseph River Basin (Oral Presentation)

Katherine L. Barrett, Michiana Area Council of Governments; Matt Meersman, Holy Cross College; and Daragh Deegan, University of Notre Dame

During the early part of the 20th century, the St. Joseph River (SJR) within the St. Joseph River Basin (SJRB), the 3rd-largest watershed draining to Lake Michigan, was considered dead. Following the passage of the landmark Clean Water Act of 1972, the river has experienced a rebound in the ecological integrity of its fish and macroinvertebrate communities. Amid this ecological resurgence, several agencies have been involved in monitoring efforts throughout the SJR and its tributaries to establish baseline knowledge and track trends in water quality over time. Despite the dramatic revival in biological communities and an impressive water quality monitoring history, determining the status and long-term trends in water quality throughout the basin proves a formidable challenge. In this paper, we establish the promises and pitfalls of long-term water quality data by presenting a multivariate approach that synthesizes the state of water quality through ecological and public health lenses. When analyzed separately, chemical and biological data can tell a very different story about water quality. Accordingly, our paper addresses approaches to align biological and chemical water quality data to infer potential associations among different variables. Our results show that the ability to relate biological trends with water chemistry is limited because of differences in monitoring schedules, uneven sampling efforts across agencies, and differences in field and laboratory methods. We conclude with a set of recommendations for watershed managers to consider, chief among these being the need for cross-county and state partnerships that allow for the coordination and collaboration of sampling efforts on a basin-wide scale.

Impacts of microplastics and a synthetic estrogen on the reproductive social behavior in fathead minnows (Pimephales promelas) (Oral Presentation)

Grace Walker, Ball State University

Microplastics (MPs) is an emerging topic of concern due to its ubiquity and negative physiological impacts on aquatic organisms. Despite the growing literature on physiological changes when exposed to MPs, little effort has been focused on behavioral changes, which may have vital fitness consequences for individuals. In addition, the porous and hydrophobic structure of microplastics allows for the sorption of endocrine disrupting chemicals (EDCs) and other contaminants, allowing the latter to serve as a transport vector for harmful compounds. The goal of this project was to determine if MPs, alone or as a vector for 17-alpha ethinyl estradiol (EE2) alters the intraspecific reproductive social interactions in a freshwater fish. Fathead minnows (Pimephales promelas) were part of a control group (no MPs) or exposed to virgin MPs (MPvirgin) or a low (10 µg/L; MPEE2 10 or high (50 µg/L; MPEE2 50) concentration of EE2. After a 30-day exposure, mate choice trials involving a paired exposed and control males between control and exposed females were conducted. Female time spent with each male along with male courtship time was recorded. Male courtship behavior was not significantly affected by exposure to MPs. Control females tended to choose control males in all exposure groups and exposed females were not definitively selective in their mate choice. These results demonstrate that (i) MPs have the potential to alter social dynamics, and (ii) may act as an

additional route of exposure for other local contaminants. Understanding the changes in behavior is important as it can have direct impact on the structure of population and change evolutionary projections, so understanding how MPs and the EDCs that bind to them can guide fisheries management decisions.

Use of Nutraceuticals in an Aquaponics System to Produce Quality Biomass (Oral Presentation)

Soufanieh Pierre*, Michelle Selo-Ojeme and Dr. Ahmed Mustafa; Department of Biological Sciences, Purdue University Fort Wayne

Aquaponics is a combination of both aquaculture and hydroponic processes. All without the need of soil, this production method circulates water to concurrently supply nutrients to fish and plants. Water resource conservation thereby serves the system as a secondary benefactor. To further determine the impacts of Aquaponics on the provision growth of herbs and protein sources, data collection of vegetative weights was taken (of various plants) and compared. A symbiotic relationship was fostered with fish, namely Nile tilapia (Oreochromis niloticus), and plants, which included basil, mint, lettuce, and cilantro. This is so due to the natural nutrients supplied by one another to one another. Supplied nutraceuticals on the fish feed also stabilized the organismal health in the aquaponics system. After corresponding plants were seeded, upon the system's top layer, they grew lavishly until big enough for harvest. After three months, from baseline data, sustainable fish sources of energy more than doubled from their original weight. Similarly, total production of plant sources showcased a 30% increase. Thus, the quality and the amount of nutraceuticals collected were quite substantial for human consumption. Furthermore, physiology, microbiology and immunology studies were executed to better analyze fish growth and health.

The results of this study provide an easier way to facilitate the farm-to-table movement/strategy in environments where soils are too dry and entirely inadequate for cultivation. It also solves the issue of necessary food production over long periods of space travel. Finally, the system provides an understanding of how to use Aquaponics to possibly serve human populations inhabiting other planets in our solar system: such as Mars!

The Preparation of Dye Sensitized Solar Cells and their Characterization by Atomic Force Microscopy (Poster)

Conor Dailey, Ball State University

This is a poster presentation which will include information on the process associated with preparation of dye sensitized solar cells, measuring their effectiveness, and characterizing the cathodes and anodes utilizing Atomic Force Microscopy.

Assessment of Lead Levels in Soil and Dust on Playground Equipment in Muncie, Indiana, United States (Poster) (EMSR Poster Competition)

Abdulgadir Elnajdi, Ball State University

Over the past century, lead (Pb) has become an element of significant interest in the environment and healthcare sectors. Pb is associated with health risks such as elevated blood lead levels, kidney diseases, bone diseases, and affected regions inside the brain responsible for executive functions in the human body. Dust is a source that is significantly related to blood

lead. The present study assesses lead levels in playground soil and accumulated dust on playground equipment. Dust and soil composite samples were obtained from 15 playgrounds around Muncie in the Summer of 2022. Dust samples were swept from the surfaces of playground equipment using surface wipes. Environmental Pb data will be compared to blood lead data to estimate, the respective contributions of dust lead to a child's blood lead level. We will calculate the correlation coefficient between soil lead and dust lead in Muncie to understand the association between these two sources of environmental Pb. The results will provide valuable references for evaluating the Pb-contaminated playground dust in future studies.

Using crayfish as sentinels for mercury levels in Indiana creeks (Poster) (EMSR Poster Competition)

Kathryn Mudica, Indiana State University

Ephemeral creeks and streams can be difficult to monitor and assess for water quality. For this reason, they are often overlooked despite playing a significant role in the water quality of major waterways. Mercury in modern aquatic systems is the result of the remobilization of legacy pollution and nonpoint sources, making assessment and exposure prevention difficult. Most risk assessments for mercury exposure to Indiana residents are based on fish collected and tested on a 10-year watershed rotation basis. While economical, this approach could miss fluxes of mercury or mercury “hotspots” that contaminate fish. An economical and reliable approach to determining mercury exposure in these areas would be to identify reliable sentinel species that are endemic, easily identified, and respond in a quantifiably significant way to metals in the environment. For this project, crayfish samples, water samples, and sediment samples were collected in several creeks in Indiana representing a variety of environmental exposures. We hypothesized that crayfish environmental interactions as omnivores and biotic engineers place them in a unique environmental niche, making them a reliable sentinel species for mercury biomagnification in fish. By testing and comparing the bioaccumulation of metals in crayfish tissue, water, and sediments, to dominant species, average crayfish size, and population density, we can reliably predict creek health for metals. Our results determined that Faxonius rusticus (rusty crayfish) were found in creeks with higher metal concentrations. Also, crayfish cephalothorax measurements were smaller in streams with higher metal concentrations. This data, along with metal bioaccumulation and biomagnification make crayfish an excellent sentinel for water quality in Indiana creeks.

Effects of Raw and Aged Microfibers on Growth of Aquatic Plants (Poster)

Mathew Simpson, Ball State University

Current research reveals that microplastics are hazardous to many types of organisms; however, there is a significant knowledge gap regarding microplastic interactions with plants. The objectives of the current study were to: (1) augment our understanding of how specific polymer types impact the growth of aquatic plants; and (2) investigate the toxicity of pure polymers versus microplastics that have aged and sorbed contaminants. Polyethylene microfibers were synthesized and chemically aged using photo-Fenton oxidation. The aged microfibers were placed in river water containing 5 $mg \cdot l^{-l}$ of cadmium and one droplet of fresh motor oil. Sedge (*Carex comosa*) plants were placed into glass pots and microfibers were added weekly at concentrations of 0 (control), 10, 50, and 100 $mg \cdot l^{-1}$ for a total of 15 weeks, Plant health was measured weekly using an SPAD™ chlorophyll meter. At the end of incubation, potential impacts of microfibers on plants was evaluated using attenuated total

reflectance Fourier-transform (ATR-FTIR) infrared analysis of plant tissue. Over twelve weeks of dosing, a slight decline in chlorophyll content was observed in the 50 and 100 $mg \cdot l^{-1}$ treatments of both virgin (7 and 20% decreases, respectively) and aged microfibers (5 and 23% decreases, respectively). Principle component analysis (PCA) of the infrared spectra demonstrate areas of substantial overlap between samples that suggests no significant differences in plant tissue ATR-FTIR spectra across microfiber concentrations. PCA for aged and virgin treated sedge revealed that PC1, PC2, and PC3 (eigenvalue > 1) explained 97% of total variation. The extent of microplastic pollution in aquatic ecosystems is anticipated to increase in coming years. Microplastics are emerging contaminants whose effects on biota are not clear; the need to accurately quantify potential hazards with these reactive and mobile particles is vital.

Assessing Water Cabbage (Rorippa aquatica) Potential for Nitrogen Fixation in Water Treatment (Poster)

D. F. Wilson, Manchester University

The availability of clean freshwater is a growing concern and action is needed to maintain and preserve the freshwater that is currently available. There is a lot of agriculture in rural Indiana and fertilizers runoff fields into waterways. Aquatic plants have been used to remove nutrients from the ecosystem which are then stored in their cells, and they have often been used to treat water pollution. To be sustainable for water treatment the plants would need to be native to the region to prevent invasive species from creating an imbalance in the ecosystem. This paper investigates using an Indiana native aquatic plant to reduce concentrations of nitrogen and other nutrients to improve water quality. Two rounds of testing of three groups were conducted with water cabbage (Rorippa aquatica), to determine its efficiency in nitrogen fixation and whether it was suitable for bioremediation. There was a control group kept at 0.12 to 2.2 mg/L total N, the second group had 3-4mg/L total N, and the third had 6-7mg/L total N. It was concluded that Rorippa aquatica would not be suitable for bioremediation, in the two weeks there was no significant change in growth or amount of nitrogen in the water. In the future, there should be more research conducted on the types of aquatic plants there are in Indiana and their potential for bioremediation.

MATHEMATICS

Rejecting null hypothesis statistical testing. A review of the American Statistical Association board statement on p-values and statistical significance. (Oral Presentation)

Edward Brizendine, Brizendine Statistics

Null hypothesis statistical testing (NHST) was developed as a way to answer the question that every researcher has: Are my results significant? Since its beginning a little over 100 years ago, the use and interpretation of NHST was been fraught with controversy among statisticians and has been abused, misused, and misinterpreted by researchers. Dichotomizing a statistical test into being either "statistically significant" or "insignificant" based solely on whether the resulting p-value is below or above an arbitrary level of significance (i.e. alpha=0.05) was never the intent of NHST. Ultimately NHST does not answer the true question being asked: Are my results scientifically meaningful?

To address the controversies concerning the continued use of NHST, the American Statistical Association (ASA) created a task force to identify the challenges with the continued use of statistical tests of significance. In 2016, the ASA issued a board statement on statistical significance and the use of p-values. This statement highlighted 6 areas of concern regarding the continued use of NHST. This presentation will review this board statement and will discuss alternatives to using p-values in the interpretation of study results.

Bifurcation Analysis of Nonlinear Fisheries Models (Oral Presentation)

Dr. Kevin Drury, Huntington University

Nonlinear models yield a rich set of possible system behaviors, including stable equilibria, stable limit cycles, chaos, and transitions between these attracting states. We used bifurcation analysis to identify critical parameters in a nonlinear fisheries model at which transitions between these stable states occur. Such transitions in the qualitative behavior of dynamical systems near equilibria are called bifurcations. Decades of research reveal fisheries collapses worldwide, which are consistent with saddle node bifurcations, whereby stable equilibria, representing historical fish abundance, become unstable, resulting in the system being attracted to an alternate stable state in which the target of harvest is rare or absent. Thus, we used bifurcation analysis to explore interactions between nonlinear model parameters and population harvest. Here, we focus primarily on a reparameterization of the model in Drury and Lodge (2009), and demonstrate the possibility of an uncommon subcritical Hopf bifurcation. Specifically, as a parameter is varied, the area of state space inside the resulting unstable limit cycle increases or decreases, varying the area of the basin of attraction for the stable focus within. At a critical value of the bifurcation parameter, the stable focus and unstable limit cycle collide, the focus becomes unstable, and the species that is the target of harvest goes extinct.

Drury, KLS and DM Lodge. 2009. Using mean first passage times to quantify equilibrium resilience in perturbed intraguild predation systems. Theoretical Ecology. Vol 2, pgs 41-51.

Using Bifurcation Analysis to Assess the Relative Effects of Harvest and Species Interactions on a Mathematical Model of Fisheries (Oral Presentation)

Danielle Tinsley, Huntington University

Nonlinear models often yield the possibility of bifurcations, which are changes in the qualitative behavior of dynamical systems near their equilibria. For example, equilibria can lose stability, or cease to exist, leading to migration of state variables to other attracting states. Intraguild Predation, defined as competition for resources between organisms that consume each other, comprises highly nonlinear interactions, and is common in marine fisheries. Fisheries collapses are becoming more common, an outcome that can arise from bifurcations. We therefore asked the question, how does harvest interact with smooth parameter variation, to generate bifurcations, and hence, harvested fish population collapse. Our bifurcation analysis shows that constant harvest increases the basin of attraction for the collapsed state, and reveals which model parameters (quantifications of interaction strengths within and among species) combine most strongly with harvest to generate fisheries collapse.

An integrated software tool provides robust developmental time series expression signature classification using high-throughput RNA-seq (Gene expression) analysis (Poster)

Isaiah Bartlett, Indiana State University

Introduction:

devGEA (Developmental Gene Expression Analysis) provides a suite of high-throughput gene expression analysis tools via R programming, allowing pre-processing, normalization, data visualization, statistical testing, correlation analysis, and gene list manipulation in to be performed within a single tool. Furthermore, the software uses gene correlation methods to efficiently classify unique developmental gene expression patterns into specific developmental gene expression signatures.

Our aim is to provide a comprehensive solution for all researchers seeking to analyze gene expression data in time course experiments. With devGEA, researchers can easily identify and classify genes based on their expression profiles across multiple developmental stages, providing a useful tool for investigating temporal gene expression. To demonstrate the usefulness of the tool, we analyzed developmental time series data profiling the directed differentiation of human pluripotent stem cells (hiPSCs) into cardiomyocytes.

Methods:

To demonstrate the utility of this software, we selected two publicly available datasets utilizing the same cardiomyocyte differentiation procedure. One goal was to categorize differential gene expression of cardiomyocyte differentiation into the five biological signatures that describe the developmental stages of heart development.

Results:

Several thousand genes were reproducibly categorized into the correct developmental expression signature demonstrating the utility of this tool.

Conclusion:

The gene signature classification generated using devGEA will guide future investigation into developmental gene function in cardiomyocyte differentiation. Using our gene signatures, we will compare other cardiomyocyte differentiation data sets to investigate the efficiency of using devGEA. Ultimately, our tool provides a valuable resource for researchers seeking to analyze gene expression data in time course experiments, particularly those focused on the functions of genes involved in cardiomyocyte differentiation.

MICROBIOLOGY & MOLECULAR BIOLOGY

Respiratory syncytial virus (RSV) - Where are we on a vaccine and therapeutics? (Hot Topic)

Dr. Christopher Stobart, Butler University

Respiratory syncytial virus (RSV) is an upper and lower respiratory pathogen that remains a leading cause of hospitalizations and mortality among young infants and the elderly. Despite nearly 60 years of research, there remains no commercially available vaccine and limited options for treating RSV infections. In this talk, we will discuss past and present efforts to develop both vaccines and therapeutics to treat and hopefully prevent RSV infections.

Antimicrobial and Antioxidant Activity of Sea Urchin (Arbacia Punctulata and Lytechinus Variegatus) Body Wall Extracts, In-Virto (Oral Presentation)

Nahian Fahim, Purdue University Fort Wayne

To fight against diseases, the discovery of bioactive compounds from natural sources is a common practice. Sea urchins, which are members of the phylum Echinodermata, are consumed as a delicacy in many parts of the world. The bioactive compounds obtained from them also have substantial therapeutic potentials. This study aims to determine the antimicrobial (antibacterial and antifungal), and antioxidant activity of the body wall extract of Arbacia punctulata and Lytechinus variegatus. The concentrated crude body wall extracts were used against five gram-positive and five gram-negative pathogenic bacteria by disk diffusion method to observe the zones of inhibitions. Our study reveals methanol and ethyl acetate extracts of Arbacia punctulata and Lytechinus variegatus body wall have potential antibacterial and antifungal activity against pathogenic bacteria. Remarkably, body wall extract in ethyl acetate of both sea urchin species exhibited higher inhibitory activity (P< 0.05) against all bacteria observed for this experiment. 2, 2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging assay was also used to evaluate the extracts' antioxidant properties. The ability to neutralize DPPH free radicals of Arbacia punctulata extract (extracted with ethyl acetate) was compared to ascorbic acid as standard. We also observed a significant free radical scavenging activity. Our findings clearly demonstrated that both Arbacia punctulata and Lytechinus variegatus can be great sources of potential therapeutic agents.

trithorax is essential for cardiac Hox gene expression and anterior-posterior patterning of the Drosophila melanogaster embryonic dorsal vessel (Oral Presentation)

Adam Farmer, Indiana State University

The Drosophila melanogaster embryonic heart (dorsal vessel) is a linear contractile tube composed of myoepithelial cardiac cells (CCs) with a wide lumen heart proper region that propels hemolymph anteriorly through a narrower aorta region to the anterior embryo. The dorsal vessel is further segmented into repeated 'hemisegments' containing Seven-up (Svp) CCs and Tinman (Tin) CCs. The colinear expression of Antennapedia (Antp) and the Bithorax Complex (Bx-C) Hox genes along the dorsal vessel length patterns the aorta and heart proper region, as well as the hemisegments. While Hox genes have well established roles in dorsal vessel patterning, little is known about their cardiac specific regulation. Within the developing embryo, Hox gene expression is positively regulated by trithorax group genes. We have

identified the COMPASS-like H3K4 methyltransferase gene, trithorax, as an essential regulator of colinear cardiac Hox gene expression and anterior-posterior dorsal vessel patterning. trx inactivation in Drosophila causes a remarkable homeotic transformation of the posterior heart proper segment into an aorta-like fate as shown by the loss of heart proper markers and cardiac Abdominal-A (Abd-A), the Bx-C Hox gene that confers heart proper specification. Furthermore, cardiac expression of Antp, Ultrabithorax (Ubx), and Abdominal-B (Abd-B) is also dysregulated within the trx mutant. Antp and Abd-B are lost within the aorta and posterior terminus, respectively. As expected from the loss of Antp, the trx null dorsal vessel shows a loss of a Svp-CC in the anterior most hemisegment. Additionally, excess Tin-CC proliferation at the posterior terminus of the dorsal vessel was observed as expected from the loss of Abd-B. Ubx was maintained at low levels throughout the dorsal vessel thereby maintaining hemisegment patterning within the aorta and heart proper. Together, these data demonstrate trx is a critical regulator of cardiac Hox gene expression and anterior-posterior dorsal vessel patterning.

Effect of Candida albicans infection on the plasma membrane expression of the Na+-K+-2Cl– cotransporter 1 (NKCC1) in T84 and Madin Darby Canine Kidney cells (MDCK) (Oral Presentation)

George Gundelach, Valparaiso University

Candida albicans is a commensal human fungal pathogen. To infect the human body, it must penetrate the intestinal mucosal barrier. Fluid secretion is one of the intestinal defense mechanisms and NKCC1 is a key protein regulating fluid secretion in the colon. We hypothesize that C. albicans decreases fluid secretion prior to invasion by inducing NKCC1 internalization. In our experiments, we used Madin Darby canine kidney (MDCK) cells expressing a GFP-NKCC1 fluorescent tag and T84 cells, a human colonic cell line. Cells were infected with 100,000 C. albicans for varying lengths of time, fixed, stained and mounted for fluorescence microscopy. Images were acquired using an Olympus IX83 microscope equipped with a DP80 CCD camera. The number of internalized vesicles was evaluated using FIJI. Our preliminary results show that in MDCK cells, phorbol-12-myristate-13-acetate (PMA), a positive control, induced a significant increase in the number of internalized vesicles containing NKCC1 (P < 0.001), whereas C. albicans only increased NKCC1 internalization at the 30 minute time point (P<0.05). All other time points tested were insignificant. Similarly, PMA induced a significant increase of NKCC1 internalization (P<0.05) in T84 Cells. Infecting T84 cells with C. albicans significantly induced NKCC1 internalization at the 30 minute (P<0.05), 1 hour (P<0.05), and 90 minute (P<0.05) time points. Past 90 minutes, we observed a sharp decline in the number of internalized vesicles that continued to decrease through 6 hours of exposure to C. albicans. Our results suggest that C. albicans induces internalization of NKCC1, which would decrease fluid secretion and allow infection, adhesion, and penetration of the epithelium. The non-significance at some time points may be due to the low number of replicates, whereas at later time points we suspect that NKCC1 is already degraded and cannot be detected.

Susceptibility of Human Coronavirus HKU1 and OC43 3C-like Proteases (3CLpro) to Inactivation by Baicalein (Oral Presentation)

Elise Huffman, Butler University

Baicalein is a flavonoid isolated from Scutellaria baicalensis that has been shown to have a wide array of biological activities including modulating cell signaling and inflammation as well as inhibiting bacteria and viruses. Previous studies have shown that baicalein binds to and blocks

the 3CLpro protease of SARS-CoV-2, however it remains unclear if this molecule can inhibit endemic human coronaviruses associated with the common cold. We used chimeric murine coronaviruses expressing the 3C-like (3CLpro) proteases of HKU1 and OC43 to test for inhibition by baicalein. We show that both chimeric viruses were inhibited by baicalein at low micromolar concentrations without significant cytotoxicity. This work highlights a novel natural product with the potential to inhibit several different coronaviruses.

Developing a Mathematical Model of Mouse Hepatitis Virus (MHV) Coronavirus Thermal Stability and Replication (Oral Presentation)

Emily Landwehr, Butler University

Coronaviruses are positive-strand RNA viruses associated with respiratory diseases of varying severities in humans. Several replication models have been developed to predict the replication of viruses and the specific contributions of both factors of the cell population and different stages of infectivity to their replication. However, many of these models fail to directly incorporate the role of viral thermal stability in the clearance of virus particles. In this study, we use the murine coronavirus, mouse hepatitis virus (MHV), to examine virus replication kinetics and the rates of thermal inactivation over a range of temperatures. These data were then used to develop an improved replication kinetics model to describe the replication of MHV. These studies shed new light on the contribution of thermal inactivation to coronavirus replication and provide a novel direction for improving on existing replication models of infection.

Examining the Relationship between the Gut Microbiome and Central Nervous System Inflammation in Rats with Fetal Alcohol Syndrome (Oral Paper)

Sarah Moh, Purdue University Fort Wayne

Fetal Alcohol Syndrome (FAS) is the most serious form of Fetal Alcohol Spectrum Disorder (FASD) and the most prevalent neurodevelopmental disorder in North America. Patients with FAS may exhibit cognitive problems with working memory, manipulating information, and reduced executive functioning. Gut microbiota compositions can also influence stress responses and memory, as several studies have shown strong relationships between the enteric gut system and the brain. Additionally, previous studies exhibited that stress responses are affected by prenatal alcohol consumption by the mother. However, few studies have examined how this relationship affects the gut microbiome or neuroinflammatory responses. For this study, pregnant HsdBlu:LE Long Evans rats were treated with either a dry diet, liquid diet, or liquid diet with alcohol. On day 28 and 42 after birth, three male and three female adolescent pups from each treatment group had their gut microbiome (fecal samples) analyzed through 16S rRNA amplicon sequencing. Brain histology staining was also done to evaluate tissue damage through microglial counts and morphology analysis. While there were no significant differences in alpha diversity of the fecal microbiome between groups, beta diversity PCoA analyses suggested distinct microbial communities between the treatment groups. Average cortex microglial counts also indicated that female rats exhibited increased inflammation in the ethanol treated group. Furthermore, the microglial count comparisons between the three different groups were statistically significant in the dentate gyrus.This baseline study is examining the relationship between the gut microbiome and neuroinflammatory responses in adolescent rats with FAS to give a better understanding of how these responses affect cognitive function.

Studies Evaluating the Thermal Stability and Replication of a Murine Coronavirus, Mouse Hepatitis Virus (MHV) (Oral Paper)

George Papadeas, Butler University

Coronaviruses are positive-strand RNA viruses that are capable of causing infections in a wide array of animal hosts. In humans, there are 7 known coronaviruses that are capable of causing upper and lower respiratory infections of varying severity. Efforts to develop both therapeutics and vaccines are dependent upon understanding the dynamics of both coronavirus replication and environmental persistence. In this study, we have evaluated the stability and replication patterns of a murine coronavirus, mouse hepatitis virus (MHV) over several different temperatures. MHV remains a common model for the study of coronavirus replication and pathogenesis due to its close similarities to two human coronaviruses, HKU1 and OC43, which are associated with the common cold. We demonstrate that MHV is capable of replicating at temperatures ranging from 30 to 37C, albeit with increased replication kinetics and decreasing stability at elevated temperatures. These studies highlight how temperature affects both the replication and stability of an important model coronavirus and provides data to support the development of improved models of coronavirus replication dynamics.

Antibacterial and Hemolytic Effects of Different Tissues Extracts from Luidia Clathrata (Sea Star) Against Selected Pathogenic Bacteria (Oral Presentation)

Kusum Parajuli

It is essential to search for efficient antimicrobial agents in natural resources since antimicrobial resistance to conventional antibiotics has become a serious problem. Among all resources, marine environment is one of the potential resources to explore as it is the hub of various natural bioactive compounds. In this study, we used the disk diffusion method to test the antibacterial and hemolytic activity of different tissue extracts of Luidia clathrata (slender armed sea star), a richly endowed species with bioactive potential against five gram-positive and five gram-negative pathogenic bacteria. Among the three solvents (methanol, ethyl acetate, and hexane) used, the crude extract of body wall with ethyl acetate (1.78µg/ml) exhibited impressive inhibitory ability against all tested pathogens. In gonad extracts (0.107µg/ml), antibacterial activity was only observed on six, out of ten, selected pathogens. The methanol extract of body wall showed the significant ($p<0.05$) beta-haemolysis, a complete destruction of red blood cells. Our current discoveries may open the door to the development of novel antibiotics to combat disease resistance as well as more in-depth research to pinpoint and comprehend the precise active ingredients. The detailed observation and findings will be discussed at the conference.

Investigating the Systemic Effect of Jasmonic Acid Wounding Pathways in Soybean Seedlings (Oral Presentation)

Jennifer Robinson, Manchester University

The primary goal of this research is to investigate the role of the jasmonic acid signaling pathway in defense responses in soybean. The effects of wounding within the first 24 hours on transgenic soybean plants leaves were examined. This study utilized four semiquantitative RT-PCR on three genes known to be part of the jasmonic acid pathway and a non-stress responsive control. Jasmonate resistant 1 (JAR1) protein which is a known catalyst for the

production of bioactive jasmonoyl-isoleucine (JA-Ile). Jasmonate ZIM-domain (JAZ1) protein primers, which function as repressors of JA-regulated transcription. Receptor tyrosine kinases (KIT1) protein is responsible for the activation of the signaling pathways that controls many important cellular processes such as cell proliferation, and survival. A ubiquitin (UBQ3) primer was used as the housekeeping gene because the small protein is found in almost all cellular tissues of eukaryotic organisms. ImageJ was utilized to determine pixel density and each gel was normalized to the 3,000 bp, 60 ng band in the 1kb Plus DNA Ladder (NEB) and then compared to the UBQ3 housekeeping gene. The only significant, and consistent, change was in JAZ1 which was undetectable until 16 hours in the local leaf and 24 hours in the distal leaf. This suggests a wounding delay of 8 hours, though more research is required for confirmation.

The Effect of L-Theanine on the Immunological Stress Response of Nile Tilapia (Oral Presentation)

Michelle Selo-Ojeme*, Isaac Wendel, Sydney Scherrer, Rana Seyam and Ahmed Mustafa, Purdue University Fort Wayne

Fish are one of the top sources of animal proteins. However, their protein contents can be reduced in various ways, one of them being stressed and eventually being immune-compromised. Fish farmers try to solve these problems with the use of antibiotics and other chemical drugs. These chemicals can be harmful to fish, further reducing their protein quality. In this study, we investigated the effect of L-theanine on the lysozyme and macrophage activities of acutely stressed Nile tilapia and determined the best concentration for modulating stress. We divided the fishes into 5 groups: a control group, a stress control group, and 3 treatment groups administered with different concentrations of L-theanine (0.0002%, 0.0004%, and 0.001% L-Theanine). The fish were subjected to hormonal stress by the administration of hydrocortisone (0.01% of their body weight). The lysozyme and phagocytic capacity were analyzed using the lysozyme activity assay (LAA) and the proportions of positive macrophages. Positive macrophages were those that engulfed at least 5 bacteria. Since L-theanine has been found to mitigate stress in humans, if stressed fish are treated with L-theanine, I expect their immune activity to be restored to its normal levels.

Microscopic Analysis of Syncytia Formation Dynamics for Coronaviruses and Pneumoviruses (Oral Presentation)

Lyla Vivian, Butler University

Virus spread is often aided by the formation of multinucleated cell masses called syncytia. However, many existing replication models which have been developed to describe the kinetics of viral infections fail to incorporate the role of syncytia formation in virus spread. Coronaviruses and pneumoviruses are two examples of viruses known to form syncytia in vitro. In this study, we examined the kinetics and cellular dynamics of syncytia formation of mouse hepatitis virus (MHV), a murine coronavirus, and respiratory syncytial virus (RSV), a human pneumovirus. Using our microscopy data collected for each virus system, we developed mathematical models to describe syncytia formation and its role in replication models for MHV and RSV. These data provide new insights into the process of syncytia formation for viruses and its role in viral replication.

Effect of Dhx36 knockout on brain tissue morphology and gene expression with implications for frontotemporal dementia (Poster) (EMSR Poster Competition)

Quinn Anderson, Ball State University

There are currently 50,000-60,000 Americans suffering from frontotemporal dementia (FTD) and an additional ~5,000 patients diagnosed annually. Median mortality post-diagnosis is 6 +/- 1.1 years (95% CI) and there is no known cure. A common genetic mutation associated with FTD is the increase of a G4C2 repeat in the C9orf72 gene. Healthy individuals typically have <30 G4C2 repeats whereas FTD patients will have 100s to 10,000s. These G-rich repeat expansions form “knot-like” structures termed G-quadruplexes (G4s), which cause C9orf72 haploinsufficiency, increase toxic (G4C2) RNAs and dipeptide repeat proteins (DPRs), and induce brain neuron degeneration. G-quadruplexes can be resolved by Dhx36, an enzyme responsible for the majority of G-quadruplex unwinding activity in human cells. The effects of Dhx36 resolving G4s has been studied in heart, sperm, muscle, and blood tissue – showing that Dhx36 is essential to unwind G4 structures and maintain homeostatic function within these cells. The effects of Dhx36 knockout on mouse behavior, brain tissue morphology, and gene expression in brain tissue have not been studied. Therefore, I seek to understand the effects of Dhx36 knockout on mouse behavior, brain tissue morphology, and gene expression. I hypothesize that altering Dhx36 levels within the brain will impact mouse cognition and behavior, brain tissue morphology, and expression of genes regulated by G4s. I will test this hypothesis using novel transgenic Dhx36 knockout mice models. To knock out Dhx36, a brain-specific Cre-lox-P system will be used. Finally, I will develop a novel triple transgenic mouse line to test the effect of modulating Dhx36 in the context of C9orf72-linked FTD to determine the effect of Dhx36 on C9- FTD progression. I hypothesize that Dhx36 exacerbates C9-FTD progression by increasing toxic RNA foci and DPR levels. Once completed, these experiments will expand our knowledge of Dhx36 function in brain tissues, for which is currently little data. Furthermore, this work will provide a novel tool to study Dhx36’s role in both RNA foci and DPR formation in C9-FTD potentially establishing Dhx36 as a potential therapeutic target for C9-FTD.

Andrographolide as a Potential Inhibitor of Human Coronavirus OC43 and HKU1 3CLpro Protease Activity (Poster) (EMSR Poster Competition)

Jon Brooks, Butler University

Emergence of SARS-CoV-2 and the rapid onset of cases of COVID-19 has highlighted the need to identify potential therapeutic options to treat active coronavirus infections. Considerable energy and effort have been made to identify treatments for SARS-CoV-2 given the ongoing clinical impacts of the pandemic, however, there remains the need to identify compounds to treat both endemic common cold coronaviruses as well as the potential for novel future emerging coronaviruses. In this study, we evaluate the potential of andrographolide, a diterpenoid molecule isolated from widely available Andrographis paniculata, to inhibit the 3CLpro proteases of endemic human coronavirus strains HKU1 and OC43. Prior work has shown that andrographolide inhibits the 3CLpro protease of SARS-CoV-2. Using chimeric mouse hepatitis virus (MHV) strains that express the 3CLpro proteases of HKU1 and OC43, we demonstrate that andrographolide is capable of strain-specific inhibition towards common cold coronaviruses. However, significant cytotoxicity was observed in our tested cell line. This study provides insight into the therapeutic potential of andrographolide in treating human coronavirus infections.

Comparison of Antimicrobial Properties of Copper and Silver Surfaces (Poster)

Caitlyn Foye, Riverside High School (Educator)

Common touch surfaces such as door handles, elevator buttons, and railings can transfer bacteria from one individual to the next. These surfaces are typically constructed from stainless steel, but could be plated with antimicrobial materials such as copper and silver to actively kill bacteria after they are deposited. Both metals kill bacteria through ionization, but previous research indicates that copper kills bacteria faster than silver due to its additional oxidation states. This experiment aims to determine the difference in the antimicrobial properties of pure copper and 925 sterling silver when compared to 304 stainless steel over time through measuring the half-life of E. coli populations inoculated on dry metal surfaces. Because bacteria dies exponentially, the half-life of a bacteria population can be calculated from two samples of its size with an equation derived from the natural decay and the half-life formulas. Results indicated that pure copper yielded the lowest mean half life of E.coli at 1.86 minutes, followed by 925 sterling silver with a half life of 38.34 minutes when compared to stainless steel at 116.90 minutes ($p=0.002$). Further analysis involved subtracting the effect of the control environment from the treatments' decay constants. When directly compared, copper's dry surface yielded antimicrobial properties that were at least 11.56 times more effective than that of silver. Overall this study suggests the need for further investigation into the practical application of copper in preventing the spread of infectious diseases.

Evaluation of Antibiotic Resistance in Gram-negative Bacteria with the use of Kirby Bauer Assays and Genomic Isolation (Poster) (EMSR Poster Competition)

Joseph Gonsiorowski, Tulasi Jaladi, Zarah Khan1, Shayan Khurram, Krutil Patel, Samina Akbar*, PhD, Marian University College of Osteopathic Medicine, Marian University

Background: Antibiotic resistance (AR) has become a prevalent issue in the Indiana region. Thus, it is essential to sample and isolate bacteria to test for resistance and susceptibility to commonly prescribed antibiotics. In addition to natural resistance, bacteria may also contain antibiotic resistance genes in the genome. Therefore, DNA analysis is needed to determine specific mechanisms of resistance. With a census on bacteria and the resistance genes they may have, we can predict, and therefore prepare to treat disease-causing agents specific to Indiana.

Objective: To isolate and purify DNA from gram-negative bacteria samples for PCR and to determine the susceptibility and resistance of gram-negative bacteria to various antibiotics using the Kirby-Bauer assay.

Methods: Samples of bacterial strains collected from the White River watershed were inoculated in MH broth and then plated on MH agar overnight. Samples were then spread onto MH agar, stamped with 17 antibiotics, and incubated at 37 ℃ overnight. The zones of inhibition were measured to determine possible resistance. All tested strains were also inoculated for genome preparation and GenElute's Bacterial Genomic DNA Kit was used to prepare DNA for later genomic sequencing.

Results: Kirby-Bauer analysis showed 100% resistance of gram-negative isolates to at least one antibiotic tested, with 99.18% showing multidrug resistance. Three isolates were omitted from analyses due to lack of growth. Most isolates displayed overall resistance to commonly used

Beta-Lactams. Notable resistance was also observed against Aminoglycosides and Quinolones. DNA extractions from recent and prior investigations were analyzed for AR genes. Analysis to date has identified six isolates containing the beta-lactamase genes CMY-2 (5) and SHV-1(1).

Conclusion: Based on the observed AR, additional information on antibiotic utilization and disposal methods as well as additional sampling throughout Indiana is needed. Moreover, PCR and sequencing can be utilized to further identify AR genes.

Using CRISPR-Cas to Characterize Gibberellic Acid Secretion and Sex Susceptibility in C. neoformans (Poster) (EMSR Poster Competition)

Leah Gouwens, Marian University College of Osteopathic of Medicine

Cryptococcus neoformans has clinical implications for severe cryptococcal meningitis in immunocompromised males. Addition of physiological levels of testosterone to C.neoformans induces gibberellic acid (GA) secretion, increasing production of melanin which protects C.neoformans against degradation. Recently, six genes were correlated with the synthesis of GA.

The objective was to create reconstituted strains of CNAG_05356 and CNAG_03857 using CRISPR-Cas and analyze them and the knock-out strains for GA secretion in the presence of estrogen and progesterone. CRISPR-Cas9 knock-out strains were phenotypically tested for GA secretion in the presence of sex hormones using an ELISA in minimal media (MM)+L-DOPA. Overlapping PCR and Gibson Assembly were used to construct the reconstituted strains using the genes inserted into the pAllet plasmid. The three components for CRISPR-Cas9 included: U6 promoter+guideRNA+scaffold, a construct of 5'UTR+Gene, neomycin, and the 3'UTR, and amplified Cas9. CRISPR-Cas9 editing will incorporate the pAllet construct into the C.neoformans genome in the place of nourseothricin. The transformed cells will then be tested for GA secretion in the presence of sex hormones.

For the reconstituted strains, the three components for CRISPR-Cas9 electroporation were sufficiently amplified. For CNAG_03857, Gibson Assembly successfully incorporated the 5'UTR+gene and 3'UTR into the pAllet plasmid, but only half of neomycin. Due to hypothesized self-toxicity, Gibson Assembly of CNAG_05356 was unsuccessful. ELISA analysis showed that in MM+ethanol, both CNAG_05356 and CNAG_03857 increased GA production compared to H99S. When compared to the H99S control, CNAG_05356 in MM with progesterone or estrogen produced double the amount of GA in both trials suggesting another gene may be compensating.

Upon successful construction of the reconstituted strains, further phenotypic testing will analyze GA and melanin production in the presence of sex hormones. These studies allow greater understanding of the pathogenicity of C.neoformans infection.

Characterization of C. neoformans isolated from M1- or M2-polarized RAW264.7 macrophages (Poster) (EMSR Poster Competition)

Hunter Hoffman, Marian University College of Osteopathic Medicine

Background: Cryptococcus neoformans (Cn) is an encapsulated fungus with pathogenic effects in humans and is isolated from dirt, decaying trees, and bird droppings [1,2]. The first immune cells that come into contact with Cn are alveolar macrophages, which are polarized into two

different states: M1, or M2. To determine how the macrophage polarization state affects the phenotype of intracellular Cn, RAW264.7 macrophages polarized to the M1 or M2 state were used as a model.

Methods: RAW264.7 macrophages were polarized to the M1 state and then infected with Cn for 2 h. Extracellular Cn were washed away and then the M2 macrophages were repolarized to the M2 state using IL-4. Both M1 and M2 infected macrophages were incubated for 24 h, washing away any extracellular Cn every 6 h. After 24 h, the cells were washed again to remove extracellular Cn, macrophages were lysed, and the intracellular Cn were collected and used immediately for RNA sequencing, qRT-PCR, and phenotypic testing.

Results: RNA sequencing identified 17 genes that were upregulated and 87 genes that were downregulated in M2 vs M1 macrophages. Upregulated genes were part of pathways involved in “amino acid biosynthesis” and “ribosome”, while downregulated genes were involved in cell cycle, meiosis, and the pentose phosphate pathway. Cn isolated from M1 macrophages had significantly larger capsules, but there were no specific differences in Cn isolated from M1 or M2 macrophages in urease production, catalase production, melanin production, and resistance to reactive oxygen species or cell wall stressors.

Discussion: The polarization state of macrophages drastically affects the outcome of a Cn-macrophage interaction. We were a little surprised that there were no apparent differences in resistance to reactive oxygen species or cell wall stressors, as M1 macrophages produce much higher levels of reactive oxygen species than M2 macrophages. However, it is possible that there may be differences in resistance to nitrosative or osmotic stressors. Additionally, Cn isolated from M2 macrophages seemed to have increased levels of translation, but not increased levels of replication, as demonstrated by increased Cn cell diameter in M2 conditions. These data support a new study by Jung et al. showing that intracellular Cn produces various proteins that affect the Cn-macrophage interaction. Clearly more research is needed on how the different macrophage polarization states affect the phenotype and transcriptional state of intracellular Cn.

Using Bioinformatics to Uncover Small Transmembrane Proteins in Bacteria and Archaea (Poster)

Tara Hoffman, Indiana State University

Prokaryotic chromosomes have many small open reading frames (ORFs) less than 200 bases. In most cases, it is not easy to identify whether or not they encode small proteins because high throughput proteomics methods easily miss proteins containing less than 60 amino acids. Recent studies have found that some small proteins are transmembrane proteins with only one membrane spanning α-helix. Since transmembrane motifs can be easily identifiable using a computer algorithm such as Phobius or TMHMM, the ORFs encoding small transmembrane proteins (STMPs) can be predicted with high accuracy. In this study, we used a systematic approach to identify STMPs using well-verified algorithms such as Orfipy, Phobius, and BLAST. In our process, Orfipy was used to find open reading frames between 60-180 nucleotides, Phobius to determine transmembrane likelihood between 15 and 30 amino acids, and BLAST to both identify the conservation degree of the STMPs among other organisms and level of expression in RNA-sequencing if it is available. Our result shows that each prokaryote possesses at least several STMPs, including many that are newly identified located in intergenic regions of current annotated chromosomes. More studied microorganisms such as E. coli and

B. subtilis have more identified STMPs in their genome, indicating that many STMPs in less studied microorganisms are not identified yet. In this study, We have created a software pipeline with accompanying online interface for discovering STMPs to help researchers find new STMPs encoded in genes and in the intergenic regions of a microbial chromosome of interest.

Determining the location of Pus7 in yeast and filamentous C. albicans (Poster)

Anu Kumal, Ball State University

Candida albicans is an opportunistic and prevalent human fungal pathogen. It causes the fourth most hospital-acquired bloodstream infections in the USA. Few antifungal drugs are available to treat C. albicans, and C. albicans has acquired resistance to many of these. To develop the next generation of antifungal treatments, we must better understand what differentiates C. albicans from mammalian cells at the molecular level. Our proposed study seeks to understand these differences by examining Pseudouridine synthase 7 (CaPus7), a synthase that catalyzes psuedouridylation of RNAs and a crucial player in biofilm formation. I will determine the location of CaPus7 in yeast and filamentous forms of C. albicans. We hypothesize that CaPus7 moves from the nucleus to the cytoplasm during heat-induced filamentation to pseudouridylate mRNA, likely increasing mRNA stability. To test this hypothesis, we are creating constructs we can use to generate GFP-tagged CaPus7, which will allow us to track CaPus7 localization. In addition, our GFP construct will be removable. This, along with additional sister vectors containing fluorescent markers RFP and BFP will allow us to track multiple proteins in the same cell. We will examine cells grown at 30 ºC YPD (for yeast cells), 37 ºC YPD (for moderate filaments), and 37 ºC RPMI for highly filamentous cells. This study will allow us to better understand the function of CaPus7 in various forms of C. albicans and its relevance in C. albicans mediated pathogenesis.

Growth kinetics of susceptible and resistant isolates of Staphylococcus intermedius. A look into the growth mechanisms of resistant bacteria. (Poster)

Katie Leonhard, Indiana University Kokomo

Multiple different types of Staphylococcus species are found in a wide variety of environments. Out of all the Staphylococcus species, the coagulase-positive species are deemed the most pathogenic of all of the different species. A Staphylococcus isolate was obtained from human skin and phenotypically determined to be part of the Staphylococcus intermedius group (SIG), a group of bacteria that are found in animals. Human infections from SIG are rare, however, they are commonly pathogenic in animals. SIG infections are usually treated with antibiotics. Unfortunately, we face an ever-growing pandemic of antibiotic-resistant bacteria due to misguidance in the distribution and use of antibiotics. Thus, to simulate a real-world problem, the S. intermedius isolates were exposed to an antibiotic regimen of streptomycin until the bacteria became resistant as determined via a Minimum Inhibitory Concentration assay. The bacteria were then grown under different stress conditions to see if the susceptible ones grew differently than the resistant bacteria. Stressors included temperatures ranging from 25° C to 32° C, 4% to 11% salt (w/v of NaCl), and pH values ranging from 4.5 to 6.5 and from 7.5 to 9.5. The growth medium used was Tryptic Soy Broth, which was inoculated with pure cultures of S.intermedius. Growth was periodically measured for 36 hours (or until the cells reached the stationary phase) using a spectrophotometer at 600nm. Significant differences were seen in the growth kinetics in most of the conditions tested, and trends show that resistant isolates grow better in higher salt and higher pH environments.

Verification of aberrant mRNAs in mantle cell lymphoma using polymerase chain reaction (Poster) (EMSR Poster Competition)

Caiden Lukan, Butler University

Mantle Cell Lymphoma (MCL) is a hematologic malignancy characterized by a t(11,14) chromosomal translocation event which results in expression of the oncogene Cyclin D1 (CCND1). The translocation event is regarded as the initiating lesion for MCL. Other genetic changes including mutations of genes in several pathways have been reported to contribute to the disease. However, despite this cancer having the highest number of chromosomal instabilities, the fusion genes that may arise due to other translocations has not been fully elucidated. The goal of this study is to verify existence of the fusion gene CTBS-GNG5 in MCL. Total RNA was extracted from two MCL cell lines, Jeko-1 and Granta-519 via the Chomcyznski & Sacchi technique. After quality control of the RNA, we performed cDNA synthesis was completed using RevertAid First Strand cDNA Synthesis Kit. Using several specially designed primers spanning the fusion genes, we performed targeted polymerase chain reaction (PCR) using the cDNA. We identified the best primers to detect the CTBS-GNG5 fusion using PCR and were able to validate the presence of the fusion transcript in both MCL cell lines. We are in the process of performing Sanger sequencing on our PCR product for further verification. Our results suggest that there are fusion genes in MCL that can be potentially used for diagnosis using PCR as well as patient disease risk stratification in the future.

Effects of a Pesco-Vegetarian Diet and Supplements on Protection Against Oxidative Stress in Hispanic Populations (Poster)

Kaitline Martin, Indiana University Kokomo

Free radicals are linked to aging and human diseases. Oral consumption of antioxidants has been shown to decrease free radicals in the human body. In this study, we investigated the effect of a pesco-vegetarian-based diet with ginger and turmeric supplements on free radical scavenging capacity of blood. Participants of a mainly Hispanic population between the ages of 18-45 were recruited to be on the diet for one week. Their blood was drawn before and after the diet. The antioxidant capacity of blood serum was assessed by the reaction with a free radical, 2,2-diphenyl-1-picryhydrazyl (DPPH). A fluorescent microscope was used to determine the extent of DNA damage following the application of hydrogen peroxide by measuring the mobility of DNA fragments in low-melt agar. In this presentation our current progress with these two assays will be discussed.

Characterization of C. neoformans isolated from M1- or M2-polarized RAW264.7 macrophages (Poster)

Dr. Erin McClelland, Marian University College of Osteopathic Medicine

Background: Cryptococcus neoformans (Cn) is an encapsulated fungus with pathogenic effects in humans and is isolated from dirt, decaying trees, and bird droppings [1,2]. The first immune cells that come into contact with Cn are alveolar macrophages, which are polarized into two different states: M1, or M2. To determine how the macrophage polarization state affects the phenotype of intracellular Cn, RAW264.7 macrophages polarized to the M1 or M2 state were used as a model.

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Investigating Cellular Pathways Affected by a Novel Pyrrolidine Drug (Poster)

Chris Cole* (1), Dr. Jeff Hansen (2), Dr. Sarah Mordan-McCombs (1) Department of Biology, DePauw University, Greencastle IN; Department of Chemistry and Biochemistry, DePauw University, Greencastle IN

Cancer continues to be a leading cause of death in the United States and around the world. While treatment options for a variety of cancers have improved significantly in recent years, the ability to cause cell cycle arrest and cell death in solid tumors remains a top priority. Recent work in the Hansen Lab at DePauw has resulted in the production of multiple new amino-alcohol and pyrrolidine compounds that have shown potential as anti-tumor drugs through the Brine Shrimp Lethality Assay (BSLA). Current work in our lab suggests that these compounds also have the ability to block cell growth and migration. However, the exact mechanism of action of the drugs is currently unknown. The main objective of this study was to understand the cellular pathways affected by a novel pyrrolidine compound using S. cerevisiae as a model system to narrow the search for affected pathways. A small screen of gene deletion mutants lacking metabolic, oxidative stress, apoptotic, and cytoskeletal pathway proteins (MIG1, PRS5, STF2, LAT1, SVF1 and STF2) indicated the potential for multiple avenues of action. To evaluate the effect of the drug on the apoptotic, cell cycle and cytoskeletal pathways, intact TAP-tagged yeast strains (MCA1-TAP, TWF1-TAP and CDC15-TAP) and strains bearing a variety of deletion mutants were treated for 4 hours with pyrrolidine and expression of the TAP-tagged protein was evaluated by western blot. Preliminary data suggests that the pyrrolidine compound

affects levels of the TWF1 protein, indicating a perturbation of actin polymerization, which is consistent with other results in the lab indicating a failure to migrate in a wound healing assay.

Using CRISPR-Cas to Characterize Gibberellic Acid Secretion and Sex Susceptibility in C. neoformans (Poster) (EMSR Poster Competition)

Nishi Natalia, Marian University College of Osteopathic Medicine

Cryptococcus neoformans has clinical implications for severe cryptococcal meningitis in immunocompromised males. Addition of physiological levels of testosterone to C.neoformans induces gibberellic acid (GA) secretion, increasing production of melanin which protects C.neoformans against degradation. Recently, six genes were correlated with the synthesis of GA.

The objective was to create reconstituted strains of CNAG_05356 and CNAG_03857 using CRISPR-Cas and analyze them and the knock-out strains for GA secretion in the presence of estrogen and progesterone. CRISPR-Cas9 knock-out strains were phenotypically tested for GA secretion in the presence of sex hormones using an ELISA in minimal media (MM)+L-DOPA. Overlapping PCR and Gibson Assembly were used to construct the reconstituted strains using the genes inserted into the pAllet plasmid. The three components for CRISPR-Cas9 included: U6 promoter+guideRNA+scaffold, a construct of 5'UTR+Gene, neomycin, and the 3'UTR, and amplified Cas9. CRISPR-Cas9 editing will incorporate the pAllet construct into the C.neoformans genome in the place of nourseothricin. The transformed cells will then be tested for GA secretion in the presence of sex hormones.

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Upon successful construction of the reconstituted strains, further phenotypic testing will analyze GA and melanin production in the presence of sex hormones. These studies allow greater understanding of the pathogenicity of C.neoformans infection.

The Impact of modifier genes on obesity and Drosophila AKH/glucagon signaling (Poster) (EMSR Poster Competition)

Audrey Nicol, Purdue University Fort Wayne

Obesity is a growing concern as 42.3% of people in the U.S were considered obese in the years 2017-2018. Little is known about the genetic components that contribute to weight gain. In humans, the hormone glucagon is a major contributor to the body's energy demand as it helps break down fat. Therefore, learning more about this pathway could enable a range of therapeutics. In fact, studies have shown that glucagon treatments have helped patients with both weight loss and appetite suppression. In this project, we are analyzing candidate genes that modify the glucagon pathway in Drosophila melanogaster, the fruit fly. We reduced the expression of the fly version of the glucagon receptor (AKHR) in our model. This induces fat

retention in the L3 larvae, which mimics obesity in humans. We then crossed our model to the DGRP, a natural population of flies, and look for variation in fat content using a density assay. The density assay examines the relative fat levels of the larvae by slowly increasing the amount of sucrose in water. This enables us to observe whether we have lean larvae which float later or fat larvae which float early on. We used the variation in floating concentration to identify candidate modifier genes through GWA. We crossed our AKHR model to various candidate modifier genes that may enhance or suppress fat retention. We screened these candidates initially with the same density assay used in the original screen. We further characterized candidates that had an effect on obesity using biochemical assays to analyze stored metabolites such as triglycerides, glucose, glycogen, and protein. Several candidate genes, including THADA, AmyD, GluRIIC, and CG9826, significantly impact fat storage in the flies. These have been further analyzed under control, high sugar, and high fat conditions to see if the larvae are resistant to environmental changes. Our goal is to advance our understanding of the glucagon signaling pathway, obesity, and lipid metabolism. We are also hopeful to provide candidate genes that can be regarded as future therapeutic targets.

Inducing Cell Death in Mantle Cell Lymphoma with Abemaciclib (Poster) (EMSR Poster Competition)

Jacob Rashid1, Dr. C. Patience Masamha2

Department of Health Sciences1, Department of Pharmaceutical Sciences2, College of Pharmacy and Health Sciences, Butler University, Indianapolis, IN

Mantle cell Lymphoma (MCL) is an aggressive subtype of non-Hodgkin's Lymphomas that accounts for ~6% of all lymphoma neoplasms with a median survival rate of 1.8 to 9.4 years. The genetic hallmark of MCL is the chromosomal translocation t(11:14)(q13:q32), which leads to overexpression of cyclin D1 which activate cyclin dependent kinases (CDK4/6) resulting in unregulated cell cycle progression. Although most patients initially respond to treatment, MCL is characterized by frequent relapse. Most treatment regimens for MCL consist of a combination of immunotherapies combined with toxic chemotherapy drugs. Due to overexpression of cyclin D1, use of third generation CDK inhibitors such as Abemaciclib, may be of potential benefit to MCL patients, offering much lower toxicity than standard treatment for this disease. These CDKs work by inhibiting CDK4 and CDK 6, preventing phosphorylation of retinoblastoma (Rb) which causes antiproliferative effects by arresting the cell cycle progression through G1-S phase. Due to its selectivity, Abemaciclib is a potentially low toxicity treatment for MCL that can be combined with other therapies to treat MCL. The purpose of this research was to assess the impact of the effects of Abemaciclib in MCL. Jeko-1, a MCL cell line was treated with different concentrations of Abemaciclib. MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl-2H-tetrazolium bromide) cell proliferation assays were used to measure the impact of the treatments. Our results show that there was a dose dependent decrease in cell proliferation after treatment with Abemaciclib. This suggests that Abemaciclib and other third generation CDK inhibitors are potential therapeutic agents in treatment for MCL. Hence, third generation CDKs alone or combined with other standard care regimes may improve patient outcomes.

The Impact of the Training Future Scientist Ambassador Program on High School and Undergraduate Students in Delaware County (Poster)

Rona Robinson-Hill, Ball State University

The aim of the Ball State University (BSU) TFS Ambassador Program is to show students that they can do science despite the systemic poverty across all ethnic groups these students have suffered. The activities this proposal will fund are: 1) six underserved BSU TFS Ambassadors will perform mentored research in BSU STEM research labs; 2) Ambassadors will meet weekly with the PI to further their professional development; 3) A TFS symposium held to showcase the Ambassadors' research; and 4) Ambassadors will be provided with access to additional opportunities to present and/or disseminate their research. The objectives are: 1) provide underserved high school and BSU undergraduates authentic summer research experiences; 2) increase their understanding of science; 3) provide access to science enrichment to demonstrate and enhance their understanding of science; and 4) provide a mentorship connection with all TFS Ambassadors to monitor academic progression in high school and college. The methods utilized will be to: 1) recruit students through email communications and personal visits to schools in Delaware County, IN; 2) recruit BSU STEM Research mentors through email communications and sign-up sheets; 3) conduct a two-day student orientation to receive program laptop, tour campus and research lab location; 4) train Ambassadors how to perform and use the research tools; and 5) supervise preparation of PPT presentations for the BSU TFS showcase at the culmination of their summer internship. The preliminary results from two successful summers of implementation of the TFS Ambassador program include: 1) participation of six Ambassadors (one undergraduate and five high school students) in STEM research in biology and chemistry labs with a mentor; 2) creation and implementation of six Ambassador presentation of STEM research at the TFS Symposium in Summer 2017 and 2018 to BSU science faculty, parents, family, friends and Delaware County community members; 3) extended research experience for two Ambassadors with their mentor to finish collecting data for a manuscript for submission to a dairy science journal; and 4) finally one Ambassador will be the first from Muncie Community Schools (MCS) to submit a science fair project to the BSU East Central Indiana Science Fair 2023 in the senior division based on the results from her summer TFS research project. The impact includes: 1) PI: to continue research agenda, share findings with the science community and encourage other researchers to model this program for other underserved students; 2) BSU TFS Ambassadors: access to authentic research experiences that will enhance their resumes and their understanding of science; and 3) BSU TFS mentors: an opportunity to enrich underserved students' lives and fulfill their dreams of being scientists.

Examining wound-induced protein signaling between unifoliate leaves in transgenic soybean (Poster)

Jennifer Robison, Manchester University

Soybeans are the second largest crop in the country, spanning 85 million acres across the United States, and the third largest crop in the state of Indiana. As extreme weather events continue to increase, understanding how soybeans react to wounding is an important step to developing techniques to improve yield. This research investigates the timing of local and systemic signal transduction in soybean leaves. Transgenic soybeans containing the stress responsive AtRD29A promoter driving the reporter protein GUS were used. Because GUS

protein production is triggered through the wounding of the leaf, it is assumed that more GUS production corresponds to a higher wounding response in the soybean. One unifoliate leaf was mechanically wounded using a hole-punch while the distal leaf was untouched. Following wounding, both unifoliate leaves were collected every other hour for 24 hours to construct a timeline establishing the amount of GUS production at the local and systemic level. According to TukeyHSD, the local leaf had significant GUS accumulation after 14 hours, while the distal leaf required 22 hours for significant GUS accumulation. This suggests the presence of a 8-hour signal delay. Finding these time-points is promising in finding the timing of the signal delay, however due to experimental variation in detected GUS levels, more sampling is needed to provide clearer results.

The role of Dhx36/G4R1 in coronary angiogenesis and heart development (Poster) (EMSR Poster Competition)

Evan Rogers, Ball State University

Coronary vessels are blood vessels that deliver oxygen and nutrients to the heart muscle, and they develop by angiogenesis, the process of new blood vessel formation. Since coronary vessels feed the heart muscle, proper formation of these blood vessels is essential for heart development. Dysfunctional or damaged coronary arteries are the primary cause of cardiac failure, the leading cause of death in adults, so it is vital to understand the molecular underpinnings of coronary vessel formation. The embryonic heart is an excellent model to study this because it allows us to capture the molecular details of how coronary vessels are first established in the heart. Using an embryonic mouse heart as a model system, we study the developmental mechanisms of coronary vessel formation. In our most recent investigation into the molecular mediators of this process, we identified Dhx36 as a potential regulator. Dhx36 (aliases: G4R1 and RHAU) encodes an RNA helicase that unwinds G-quadruplex structures in DNA and RNA. Previously, substantial cardiovascular defects have been shown to arise when Dhx36 is knocked out in mice embryos, however its exact role in coronary vessel formation is still unknown. Our preliminary study from a Dhx36 conditional knockout in the vasculature of a mouse embryo revealed significant delay in coronary vessel expansion and coronary endothelial differentiation. In addition, we observed a reduced thickness of the myocardium. Our future studies are aimed at characterizing this exact role and the underlying molecular mechanisms by which Dhx36 regulates coronary angiogenesis. An improved understanding of the mechanisms of coronary vessel formation could be beneficial to strategizing the repair and regeneration of damaged coronary vessels within the adult heart.

Generation of pug1Δ, pug1Δcha1Δ & pug1Δmet2Δ in C. albicans to assess pseudouridine degradation (Poster)

Emeline Scott, Ball State University

C. albicans is an opportunistic human fungal pathogen that can cause mucosal and systemic infections, particularly in immunocompromised individuals. Unlike humans, C. albicans are thought to degrade pseudouridine, the most prevalent RNA modification. The rationale behind my project is to characterize genes such as PUG1 that play roles in this degradation process and may have the potential to be targets for antifungals. PUG1, is proposed to encode a pseudouridine monophosphate glycosidase the enzyme family thought to degrade pseudouridine. We found MET2 and CHA1 genes were two of the three genes to be downregulated in PUG1 knockouts. MET2 and CHA1 are proposed to be required for amino acid catabolism. We used CRISPR to insert stop codons to PUG1, MET2, and CHA1. We

created a pug1, pug1met2 and met2 and found that there are differences in filamentation, a critical virulence attribute, in pug1. We are in the process of examining the mutant's filamentation, rate of growth, and virulence in a planarian model.

Impacts of Pesco-Vegetarian Diet with Herbal Supplements on Cytokine Production (Poster)

Olivia Terry, Indiana University Kokomo

Diet affects the overall health of an organism. Consumption of meat is associated with an increased risk of diseases such as cardiovascular disease and cancer. In contrast, positive impacts of some herbs and spices on mammalian immune systems have been shown. This property is suggested to be linked to a high concentration of antioxidants. In this study, we investigated the effect of curcumin/turmeric and ginger on healthy human adults between the ages of 18-45. Participants were on the pesco-vegetarian diet with varying amounts of supplements for one week. RNA from participants' blood was extracted and the expression of genes were analyzed by reverse transcription qPCR. The levels of three inflammatory cytokines, IL-1α, IL-6, and TNF-α, were analyzed with a hope to determine possible correlations between diet, supplements, and cytokine gene expression. Our current findings will be presented.

The Evasion of Cell Death By Cancer Cells Detached From the Extracellular Matrix (Poster) (EMSR Poster Competition)

Luke Reynolds, Marion High School, Science Talent Search First Place Winner

The evasion of anoikis and ferroptosis by cancer cells heightens the lethal effect of cancer. This project tests different treatments to induce cell death in cancer cells, both through anoikis (death due to detachment from the ECM) and ferroptosis (a type of iron-dependent cell death). This study was carried out using alamarBlue assays, which test cellular viability. The different treatments used are as follows. BSO, which inhibits Glutathione synthesis by preventing gamma-glutamylcysteine synthetase, is one. BSO combined with ferric ammonium citrate (FAC) was another treatment. FAC heightens intracellular iron concentrations, which can induce ferroptosis. Erastin, a third treatment, inhibits the uptake of Cystine within a cell. The inhibition of Glutathione synthesis causes lipid peroxidation to occur, thus inducing ferroptosis. Finally, RSL3 inhibits Glutathione peroxidase and works similarly to Erastin by inducing lipid peroxidation within the cell. Each of these treatments were tested in various concentrations in two cell lines: MDA-MB-231 and A549. RSL3 showed the greatest potential in reducing cell viability in attached conditions, especially in MDA-MB-231 cells. However, BSO combined with FAC proved most promising in suspended conditions for A549 cells. Both RSL3 and BSO+FAC treatments will be used in further testing and the development of future therapies for cancer patients. BSO and Erastin will also be tested further on different cell lines and doses. My research provided insight into how these two cell lines react to different treatments and why.

Characterizing pug1Δ, tna12Δ, and pug1Δtna12Δ in the human fungal pathogen C. albicans (Poster) (EMSR Poster Competition)

Rheanna Walther, Ball State University

Candida albicans is an opportunistic human fungal pathogen that alternates between 3 morphologies, yeast, pseudo-hyphae, and hyphae. These morphologies are dependent on its environment. C. albicans has developed resistance to current antifungal treatments making treating C albicans infections difficult. Understanding metabolic mechanisms unique to C. albicans could lead to the benefit of designing new antifungal drugs. Pseudouridine is a common RNA modification that stabilizes RNA structure. Pseudouridine degradation, while observed in C. albicans and E. coli, is not observed in many other yeasts and higher eukaryotes like humans. Understanding the mechanism of pseudouridine degradation poses potential for targeting this pathway to combat infection without harming the human host. PUG1 is thought to produce the enzyme responsible for pseudouridine degradation in C. albicans. TNA12 is a gene thought to be involved in membrane transport and was upregulated when mRNA was sequenced in pug1Δ. CRISPR Cas9 mediated gene editing was used to generate strains pug1Δ, tna12Δ, and pug1Δtna12Δ . We find pug1Δ and pug1Δtna12Δ grows at a slower rate than WT at a variety of temperatures and pug1Δtna12Δ grows slower than pug1Δ at 15°C. Data from filamentation assays supports that filamentation in pug1Δ and pug1Δtna12Δ is decreased at both 25°C and 40°C with pug1Δtna12Δ not filamenting at 25C° until after 10 days. Overall, these phenotypic findings suggest the importance of PUG1 in healthy growth and division of cells and suggests pseudouridine build-up within C. albicans is harmful.

PHYSICS AND ASTRONOMY

Python Package for Eclipsing Binary Stars (Oral Presentation)

Kyle Koeller, Ball State University

With recent advances of technology, the prospect of using large survey data has become more prominent and readily accessible through programming. We have created a Python package (released on GitHub/PyPi EclipsingBinaries) to improve the efficiency of the analysis for our research group. The package looks at a variable star's raw data and reduces these images utilizing Astropy's ccdproc. Our research group uses the band-pass filters of Johnson B (B), Johnson V (V), and Cousins R (R_C) for our photometric analysis. The package finds comparison stars automatically by searching through the AAVSO (American Association of Variable Star Observsers) Photometric All-Sky Survey (APASS) catalog which reports calibrated B and V. All calibrated R_C values are determined using well defined published conversion. To determine the effective temperature of these systems, the package determines the folded color light curve to produce color indexes. This package analyzes the O'Connell Effect for the three band-pass filters and analyzes the orbital period using observed minus calculated (O-C) times of minimum light. Our package will additionally search large-area sky survey missions like the Transiting Exoplanet Survey Satellite (TESS) for additional data. Further times of minimum light

and corresponding (O-C) values will be determined from TESS and used to supplement our (O-C) period analysis. In the future, we want to incorporate even more large surveys such as Gaia to confirm or scrutinize our own findings.

Electrostatic charging of lipid membranes by neuromodulators (Oral Presentation)

Dr. Horia Petrache, Indiana University-Purdue University Indianapolis

Neural systems signaling is based on electrical and chemical interactions and relies on energy from a molecule called adenosine triphosphate (ATP). However, the conversion of chemical energy into useful work is still a challenging question in biophysics. We use spectroscopic and scattering methods to study how ATP and a neurotransmitter (dopamine) interact with lipid membranes. We find that both ATP and dopamine have an affinity for membrane surfaces and modify membrane surface potentials with changes on the order of 1 to 10 mV. The surprising result is that the sign of the surface potential is opposite to expectations. These results can contribute to understanding the transmission of electrical signals in neurons and can inspire the development of new materials.

A Reanalysis of PHOEBE Models for W Ursae Majoris Variable NSVS 6099331 (Poster)

Madeline Shepley, Ball State University

We present multi-band aperture photometry for the W UMa eclipsing binary NSVS 6099331 from the Northern Sky Variability Survey (NSVS). All data were obtained using the Ball State University Observatory 20-inch telescope during August 2019 in Johnson B, Johnson V, and Cousins R filters. All images were reduced using the ccdred image reduction package in the Image Reduction Analysis Facility (IRAF). Multi-aperture photometry was performed using AstroImageJ (AIJ) and analyzed using the PHysics Of Eclipsing BinariEs (PHOEBE) 2 software suite, which provides a convenient interface to the Wilson Devinney code and is used to determine the best-fit model parameters for the system. The PHOEBE 2 software suite is a redesign of the PHOEBE 0.31a (legacy) version that improves both model and computational fidelity through improved physics. Best-fit models from PHOEBE 2 will be compared to a prior fit obtained using legacy PHOEBE models, and period analysis using observed minus calculated (O-C) values of times of minimum will be performed.

Analysis of Short-Term Eclipsing Binary System ASASJ061151-4519.7 (Poster)

Caleb Whitcomb, Ball State University

We present a photometric study of the eclipsing binary star system ASASJ061151-4519.7. Observations were made during December 2013 and January 2014 as well as during January 2020 and February 2020 using the 0.61-m SARA-CT telescope at the Cerro Tololo Interamerican Observatory (CTIO) in Chile. Observations were made using three band pass filters, Johnson B, Johnson V, and Cousins R. Multi-aperture photometry was done using the AstroImageJ (AIJ) software, and the generated light curves were analyzed using the PERANSO software to determine the orbital period. The observed light curves were analyzed with the Physics of Eclipsing Binaries (PHOEBE) software to create a synthetic fit light curve and obtain a best fit model of the system and determine stellar and orbital parameters. Light curve data from the Transiting Exoplanet Survey Satellite (TESS) data release was added to the previous data. The generated light curves were used to create a plot of the Observed minus Calculated (O-C) times of minimum light. Our system showed a bimodal light curve, which indicates a

change in the system between the two sets of data. Each data set was modeled separately in PHOEBE to provide insight into the change in the system that caused the bimodal light curve.

PLANT SYSTEMATICS & BIODIVERSITY

Changes in population ecology of Beechdrops at Hougham Woods Biological Field Station over 10 years (Oral Presentation)

Terry Cox, Jr., Taylor Tatlock, and Alice Long Heikens, Franklin College

Beechdrops is a holoparasitic plant that grows exclusively on American Beech tree roots, typically in relatively undisturbed mesic woods. This parasitic plant produces two types of flowers, small, open, and typically sterile (chasmogamous) flowers near the top and closed, fertile (cleistogamous) flowers lower on the stems. Population metrics collected in 2013, 2021, and 2022 include number of plants, height, number of flowers and seeds, and distance to host. Over the ten years of this study, the population has varied in number of plants from 886 to 547 with extreme changes in one year. Number of flowers (61, 28, and 32, respectively) varied greatly but plant size remained somewhat constant. These changes may be a result of different environmental conditions or natural population fluctuations. The site has experience disturbances from adjacent development outside of the 12 ha forest as well as storm damage within the forest. However, the decrease in population metric in 2021 is perhaps due to weather because the population in 2022 shows a return to a large population similar to 2013.

Anniversary of the Discovery of the Federally Threatened Small Whorled Pogonia Isotria medeoloides (Orchidaceae) in Illinois and Potential for Its Occurrence in Indiana (Oral Presentation)

Michael A. Homoya

This year marks the 50th anniversary of a remarkable discovery of the Federally Threatened small whorled pogonia (Isotria medeoloides) in the Midwest. Its story involves a series of serendipitous events leading to a totally unexpected encounter with it in Randolph County, Illinois on October 20, 1973. The habitat where this mostly eastern North American species occurred consists of a forested north-facing slope above a sandstone cliff. Similar appearing sites in Indiana could harbor the species, as could moist sandy flatwoods, especially in the far northern counties where an historic occurrence of the orchid was noted in nearby Michigan. It is no longer extant in Illinois or Michigan.

An Update on the Modern Analysis of the Vascular Plant Flora of the Indiana Wabash River Corridor (Oral Presentation)

Richard Hull, Dr. Eric Knox, Department of Biology at Indiana University-Bloomington

The lower Indiana Wabash River is a natural north-south corridor that extends from the upland prairies in Warren and Tippecanoe Counties to the bottomland forests of the Ohio and Wabash River basins. Historical records from the region represent 1,887 of the state's 2,706 vascular plant species, making it an area of botanical importance. The current vascular plant flora of the Wabash River corridor is being documented via full-site surveys at 46 locations within the corridor during 2021–2024. These data will be used to 1) Establish how the vascular plant flora of the Wabash River corridor has changed since it was documented by Charles C. Deam from 1896–1952; 2) Determine what factors are driving biodiversity trends in the region; and 3) Provide information necessary for the development of species redistribution models for rare vascular plant species. Each of these tasks will provide valuable conservation information that

will be shared with the Indiana Department of Natural Resources (INDNR), the Indiana Plant Conservation Alliance, and cooperating land trust organizations. To date, I have collected 4,733 voucher specimens representing 126 vascular plant families, 456 vascular plant genera, and 885 vascular plant species. These voucher specimens also include 145 exotic vascular plant species, 34 invasive vascular plant species, and 55 rare vascular plant taxa, as defined by the INDNR. Additionally, 234 vascular plant county records are represented in this collection. Further field research will add 10,000–12,000 voucher specimens from 2023–2024, enabling robust statistical analyses aimed at determining how the vascular plant flora of the Wabash River corridor has changed during the past century. This information will then be used to construct predictive models of the Wabash River vascular plant flora at future time intervals of 25, 50, 75, and 100 years under three different climatic scenarios.

The Vascular Flora of Burket Bog, Kosciusko County, Indiana (Oral Presentation)

Scott Namestnik and Wyatt Williams, Indiana Natural Heritage Data Center, Indina DNR Division of Nature Preserves

Burket Bog is an approximately 78-acre floating peat bog situated in a glacial kettle basin in Kosciusko County, Indiana. This natural area includes what is believed to be the largest leatherleaf (Chamaedaphne calyculata) bog in Indiana. The Indiana Natural Heritage Data Center currently considers this type of bog an acid bog, a globally vulnerable and state imperiled (G3/S2) natural community. Field surveys were conducted primarily during the spring and summer of 2021 and the spring of 2022, with data from past field surveys incorporated into the results. A total of 116 vascular plant species (112 native) are currently known to occur in Burket Bog. Analysis of the flora yields a Floristic Quality Index (FQI) of 59.2 (60.3 native FQI) and a mean Coefficient of Conservatism (C) value of 5.5 (5.7 native mean C value). At least four state-endangered and five state-threatened vascular plant species are extant and naturally occurring in Burket Bog. The footprint of the bog is currently owned in part by five landowners, one of which is The Nature Conservancy. Given that this is a unique site, the quality of the natural area, and the presence of a number of rare plant species, the bog is a target for additional protection.

Grass, Sedge, and Rush Identification (Workshop)

Nathanael Pilla and **Scott Namestnik**, Orbis Environmental Consulting

Grass-like plants are often one of the most challenging groups within our flora for plant enthusiasts and naturalists. This workshop will teach basic morphological features that separate plants in the Poaceae (grass), Cyperaceae (sedge), and Juncaceae (rush) as well as addressing common features within larger groups and genera within each family. Terminology, field characteristics, and habitats will also be discussed. The workshop is limited to 20 individuals. Please bring a hand lens.

SCIENCE EDUCATION

Disease Mapping: Innovative way demonstrating secondary diagnoses can arise from primary diagnoses through interrelated risk factors, using endometrial cancer as a model. (Hot Topic)

Dr. Shalini Persaud, Saint Mary of the Woods College

Identifying risk factors is important for healthcare professionals (1). Disease mapping with multiple diseases based on interrelated risk factors for patients can enhance their ability to understand disease association and progression. Disease mapping identifies modifiable risk factors and can promote behavior change for patients (1).

Endometrial cancer (EC), the most common gynecologic cancer (2), and although diagnosed as a primary disease it is commonly diagnosed as a comorbidity or secondary disease to diabetes, obesity, and other cancers (3-4). Physical inactivity, being overweight, and overconsumption of energy rich foods are major contributors to obesity in industrialized countries and associated with cardiovascular abnormalities, type 2 diabetes, and increased cancer risks (including EC) (5-12). These risk factors can link multiple disease profiles together as subsequent comorbidities develop (4, 13).

Researchers have proposed adjunctive physical activity to assist in reducing the effects related to these modifiable risk factors (14-16). Physical activity, although widely recognized is still largely underutilized. With disease mapping, realizing the detrimental impact diseases can have on the development of another; and how effective exercise/physical activity can be on reducing the impact of the associated risk factors; provides healthcare its best line of defense.

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The Science of Trust: Does Language Choice Matter When Sharing Scientific Findings?
(Oral Presentation)

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Scientists remain among the most trusted professionals in the United States. Yet, the COVID-19 pandemic has highlighted that some people may be skeptical of science and scientists. The reasons for these discordant beliefs are likely complex and multifaceted. We hypothesize that one factor may be the language scientists use to communicate their work.

When communicating scientific results, scientists often use “cognitive language” (e.g., “X is true of the world”). Sometimes, they add “normative language” to make recommendations about what should be done (e.g., “because X is true, we encourage policy Y”). But these statements have very different implications. For example, we can trust that X is true without agreeing that policy Y is in our best interests. In public discussion of science, these differences are rarely addressed (e.g., general entreaties to “trust the science”).

To explore this idea, we recently studied cognitive and normative language and implications for the extent to which people find scientists and their work to be trustworthy and credible. In a large, preregistered, randomized controlled trial (n=1,500 US adults) conducted with an online panel that was representative of the US population by age, race/ethnicity, and gender, we tested a single 30-second exposure to a control message (cognitive language only) against an intervention message (normative + cognitive language). We found no evidence that any of the measures of trust and credibility were affected by adding normative language for the sample as a whole. However, political orientation may have had a small mediating effect on whether people were willing to trust scientific information from the author of the message, depending on the type of language used. Further study and replication are needed to confirm or disprove this idea.

Join us as we discuss our study, its conclusions, and the “science of talking about science!”

Disclosure: This presentation covers a pair of papers, one of which is the preregistration protocol (https://doi.org/10.2196/41747) and the other of which is a paper currently in review at Journal of Medical Internet Research. This presentation is designed to introduce these ideas and findings to a diverse audience of scientists but is very much grounded in the ideas and findings available in these papers.

BIO 101: An EPIC Beginning for Beacon Biologists (Oral Presentation)

Dr. Kristi Bugajski

Biology is responding to a change in student needs post-COVID by implementing a seminar for all first-year students. BIO 101 will be taught in the fall semester by Dr. Jane Kenney-Hunt and Dr. Kristi Bugajski in the Biology Department. This course is designed to integrate new biologyvstudents into the Biology Department. It will be the first course in a four-year cohort building series. The course will focus on academic and social integration activities to help students in their development as successful biologists. A substantial amount of time during the summer 2023 will be devoted to developing materials for the course. The stipend from this fellowship will be used to help support Jane and Kristi with the planning and implementation of

this new foundational course. Some of the money will be used for student materials, such as t-shirts, to help promote cohort building.

An Evaluation of the Perceptions of Sunscreen Use in Preventing Skin Cancer (Poster) (EMSR Poster Competition)

Troi Graves, Marian University College of Osteopathic Medicine

According to the American Academy of Dermatology, skin cancer is the most common cancer diagnosed in the U.S. with ~3.5 million cases per year. Of these, roughly 200,000 are melanoma, the most lethal form. Non-Hispanic Black populations are more frequently diagnosed with late-stage melanoma and have a lower survival rate than non-Hispanic whites, possibly due to a lack of education about skin cancer and the misconception that patients with skin of color are less at risk than non-Hispanic whites. This study sought to examine whether knowledge of various types of skin cancer and severity affected a user's willingness to wear sunscreen. Using a Qualtrics survey distributed via social media, anonymous data was collected on demographics, skin cancer knowledge, and sunscreen use. The data was used to determine if there were any correlations between, age, sex, race, and sunscreen use. Of the 713 eligible participants, 219 were male, 491 were female, and 3 preferred not to say. 435 were White, 242 were African American or Black, 57 were Asian, 29 were American Indian or Alaskan Native, and 3 were Native Hawaiian or Other Pacific Islander. 689 participants knew what skin cancer was, but only 294 of those participants knew what the "ABCDEs of Melanoma" were, the most common characteristics of melanoma. 627 participants reported using sunscreen overall, but only 250 participants reported always using it. Consistent with other literature, 5.66% of African American or Black-identifying respondents did not know what skin cancer was, compared to 2.43% in Asian-identifying respondents, and 2.84% in White respondents. This research highlights the gap in skin cancer and sunscreen education in the US, especially in African American and Black populations. Future research is needed to determine the best way to educate the greater population about the risk of skin cancer and prevention with sunscreen use.

Justice, Equity, Diversity and Inclusion in Environmental Science Education: Science Strikes Back (Poster)

Dr. Robert Hougham, University of Wisconsin

Since 2016, the University of Wisconsin-Extension collaborated with stakeholders in the greater Milwaukee community to bring together environmentally conscious organizations to support student-led inquiry projects and field experiences for urban youth through Extension programs. The union of these objectives empowers youth to collect data, apply them to local issues, and communicate their findings to affect change. Escuela Verde, a charter high school, along with the Urban Ecology Center, Reflo Sustainable Water Solutions, Milwaukee Metropolitan Sewerage District and Wehr Nature Center unify to build relationships and share content that stimulates and enriches professional growth that supports community science in Milwaukee. Students use the Digital Observation Technology Skills (DOTS) approach, which promotes the scientific process using field-based technology with reflection through storytelling. Mentors

support student research in classrooms through the Research Accelerators. Participants share their projects and stewardship at community events like Science Strikes Back, a community science fair. This project was maintained through the pandemic and continues to serve students in the city.

This poster will cover key ideas for broadening participation in environmental science education and discuss opportunities to explore these approaches in our own work in EE. Further, and towards the conference theme, the work of JEDI in youth development truly builds on community connections that strengthen the work. Presented here, as well, will be a collection of connections and resources that can broaden and directly apply to JEDI work and initiatives across the science education community.

This project has had several rounds of funding and funders, currently including USGS SOES Project Number: WR20E001 and NOAA Sea Grant, U.S. Department of Commerce through the Wisconsin Sea Grant College Program: E/ELWD-23. Science Strikes Back has also been featured in the National Science Foundation STEM for All video showcase in 2022.

Mapping the Characteristics of Gestational Diabetes Prevention Lifestyle Interventions (Poster)

Armando Pena, Indiana University School of Public Health

Introduction: The literature on gestational diabetes mellitus (GDM) prevention lifestyle interventions is conflicting with heterogeneity across study characteristics. The purpose was to map the sample and intervention characteristics of randomized control trials (RCT).

Methods: Article inclusion criteria: lifestyle intervention RCTs (no medications), trials powered on GDM incidence, and all ages and phenotypes. We searched PubMed and Web of Science using key term combinations including lifestyle, physical activity, nutrition, exercise, dietary, intervention, program, gestational diabetes, diabetes during pregnancy, pregnant, pregnancy, nulliparous, gestation, prevention, prevent. Three reviewers considered 87 unique abstracts for full text review. Sample, intervention, and diabetes-related physiologic outcomes characteristics were mapped.

Results: Ten (n=10) studies were included for review. Half of the studies demonstrated significantly reduced GDM incidence compared to respective control groups. Sample sizes ranged from 63 to 1,555 and were characterized as adults with obesity (M□SD, Age 31.3□1.8 y, BMI 29.3□4.3 kg/m2) and gestational age <20 wk. Four studies prioritized Chinese populations, while Blacks (n=1) and Latinos (n=0) were underrepresented. Four studies were multi-site trials. Mode of physical activity across all 10 studies was unsupervised. Nutrition sessions were delivered in person in 3 studies with remaining studies (n=7) including hybrid/technology delivery. Thirty percent (n=3) of studies used multi-disciplinary teams. Dietitians (50%) and nurses (30%) were most common implementers. Two interventions (20%) were grounded in theory. GDM criteria most used were set forth by the American Diabetes Association (90%) compared to the World Health Organization (10%). None (n=0) of the studies were conducted in the US.

Conclusion: GDM prevention lifestyle interventions should prioritize high-risk racial/ethnic groups, multi-level frameworks, and multi-disciplinary delivery.

Small single-board computers (SBCs) for Science Education in the K-12 classrooms. (Poster)

Sridhar Ramachandran, Indiana University Southeast

The recent Covid-19 pandemic driven changes in the global and local workforce demands for more STEM-specialized employees has inevitably pushed the onus and need to promote better (hands-on with real-world connections) Science Technology Engineering and Math (STEM) education to the pre-college levels – the K-12 classrooms. In addition, Indiana Department of Education (IDOE) has also responded to this changing workforce need by expanding the IDOE Science standards that typically included topics like physical science, earth and space science, life science to now also include new standards like computer science and engineering standards. To keep-up with these renewed societal expectations, all K-12 students need to have easy, affordable and sustainable access to science, technology, engineering, and mathematics (STEM) tools that readily integrate with the existing curriculum and lesson plans so as not to overburden the students or the teachers. Moreover, the tools should be sustainable and integrative while also simultaneously facilitating an interdisciplinary, hands-on approach to teaching and learning of STEM concepts and computational thinking (CT). With this design challenge in hand, our project explores the use of small single-board computers (SBCs) in conjunction with Project Based Learning (PBL) to make available unique data collection opportunities for K-12 students that can add new dimensions to the concepts already being discussed in the curriculum. Utilizing the SBC has the added benefit of also using Just-In-Time (JIT) introduction of computational thinking (CT) that ties the existing science curricular concepts to the new computer science and engineering standards seamlessly.

ZOOLOGY & ENTOMOLOGY

The Silence of the Clams (Hot Topic)

Leva Roznere, Ohio State University and the Science Director of the Columbus Zoo & Aquarium Freshwater Mussel Conservation and Research Center.

Freshwater mussels are the most endangered group of animals in North America. Over the past couple hundred years, populations of these animals have decreased dramatically due to habitat destruction and alteration, pollution, overharvesting, invasive species, and the more recent enigmatic declines. Of the 300 species found in the rivers, ponds, and lakes of the United States and Canada, two thirds are classified as endangered, threatened, or vulnerable. The plight of freshwater mussels has sparked increased interest in conservation efforts to protect existing populations. Over the past 20 years, a dozen freshwater mussel conservation facilities have become operational in the United States. The Freshwater Mollusk Conservation and Research Center in Columbus, OH was founded in 2002 to provide refugia for threatened individuals, support propagation efforts to bolster populations, and to conduct research that informs conservation and management practices. Freshwater mussels are obligate parasites as larvae and must transform into juveniles using a fish host. Much of the work done at the facility focuses on fish host identification techniques. Alternatively, larvae can also be transformed in petri dishes in the laboratory, completely bypassing the fish host stage to yield greater numbers of propagated juveniles. Other conservation projects include translocating individuals from one habitat to another, propagating mussels for mitigating population loss, and developing health assessment techniques. Molecular tools such as metabolomics and transcriptomics have proved useful in identifying changes in freshwater mussel physiology in response to various environmental stressors. The combined efforts from various conservation projects, water quality and habitat improvements, and management of existing populations are necessary to prevent further extinctions of freshwater mussel species.

Differential Predation Risk on Two-Line Salamander Larvae (Eurycea cirrigera) by Two Species of Stream Crayfish (Oral Presentation)

Samantha DiBiasio, Hanover College

Crayfish are important predators on both vertebrate and invertebrate communities in many freshwater ecosystems. We examined predation risk for larval Two-Lined salamanders (Eurycea cirrigera) when exposed to two native stream crayfish (Cambarus tenebrosus and Faxonius rusticus). Larvae were first exposed to each crayfish species and survival rate recorded over 13 days. In a second set of studies, interactions between the larvae and each crayfish species were assessed in microcosms with substrate, cover objects, and abundant alternative food. Both crayfish species consumed larvae, with C. tenebrosus consuming more larvae & doing so more rapidly than F. rusticus. Larvae in microcosms with crayfish were also consumed, however F. rusticus ate considerably fewer larvae relative to C. tenebrosus. Larvae also shifted microhabitat use with crayfish, preferring positions in the open, while larvae in control pools were observed more frequently under shelter. These results indicate that both crayfish species are regulators, both directly (through predation) and potentially indirectly (via competition), on larval Two-Lined salamander populations in fishless streams.

Compensatory Gonadal Hypertrophy in the Male Marsh Rice Rat (Oryzomys palustris) (Oral Presentation)

Kent Edmonds and Natalie Stewart, Department of Biology, Indiana University Southeast

Compensatory gonadal hypertrophy (CGH) is a phenomenon in which the surgical removal of one gonad results in a significant increase in the size of the remaining gonad relative to gonadally-intact animals. The marsh rice rat is a reproductively photoperiodic species that responds to long photoperiods with enhanced reproductive activity. CGH was examined in juvenile and adult male rice rats (Oryzomys palustris) to determine if the phenomenon occurs and is age-specific. Juvenile male rice rats housed on 14L:10D from weaning at 3 weeks of age were left intact, unilaterally castrated (ULC), or bilaterally castrated (BLC). At 8 weeks of age, males were weighed and euthanized. The right testis, seminal vesicles (SV), right epididymis (RE), Harderian glands (HG), and spleen were removed and weighed. Significant CGH occurred in juvenile males. In addition, SV mass was reduced in BLC males and the RE mass was greater in ULC males. To examine whether CGH occurs in adult males (6-20.5 months of age at euthanasia), animals were housed on 14L:10D and sham unilaterally castrated (sham ULC), ULC, or BLC. Animals were housed for 6 weeks post-surgery, weighed, and then euthanized. Significant CGH failed to occur in ULC males compared to sham ULC controls. However, in BLC males, the masses of the SV and HG (smaller) and spleen and brain (larger) were significantly different compared to control animals. These data suggest that the occurrence of CGH in rice rats is age-dependent and that the growth (or lack thereof) of various organs is significantly dependent on gonadal steroids. It is unknown why juvenile males undergo significant CGH, while adult males fail to exhibit CGH. (Supported by funds from IUS to KE.)

Updated Report on Green Treefrog (Hyla Cinerea) Range Expansions in Indiana 2013-2023 (Oral Presentation)

Nathan Engbrecht, Indiana Department of Natural Resources

The Green Treefrog (Hyla cinerea) is an anuran of the southeastern United States that was not historically known to occur in Indiana. The state's first population was discovered in Evansville in 2003, and since that time, the species has been expanding into new areas along the Ohio and lower Wabash River valleys. In a previous report, we described events surrounding the frog's initial colonization of Indiana and its subsequent expansion from 2003 to 2013. Here, we provide a supplemental report on H. cinerea range expansions between 2013 and 2023. During this decade, H. cinerea has continued colonizing new areas along Indiana's southern margin, establishing itself in four new counites including a locality 164 kilometers from the original Evansville collection site. The frog is currently advancing up the Wabash and Ohio River valleys and has begun reaching "inland" sites through smaller tributary corridors and networks of upland farm ponds and strip mine lakes. The rapid range expansion of H. cinerea is unique amongst Indiana's herpetofauna and stands in stark contrast with amphibian declines occurring globally.

Land Ho! Polarized Light Serves as a Visual Signal for Landward Orientation in Displaced Spiders (Oral Presentation)

Dr. Brian Gall, Hanover College

An organism's ability to identify goals within their environment, orient towards those goals, and successfully navigate to them are critical to all aspects of survival. Long-jawed orb weavers (Tetragnatha elongata) occupy riparian zones and perform orientation behaviors when displaced from this habitat onto the water. Spiders prefer to move toward the closest shoreline, regardless of release location, likely to avoid predation from fish. In this study, we conducted a series of investigations to determine the mechanism by which these spiders rapidly achieve zonal recovery. Occlusion experiments indicate that spiders use visual information to identify characteristics of the riparian habitat and navigate to shelter. While environmental characteristics such as color, contrast, and the suns position do not factor into this orientation behavior, polarized light appears critical. A subsequent choice experiment in which a polarized shadow was created over the water's surface deceived exactly half of the spiders to move in the wrong direction. We propose that polarized light reflecting off the water's surface acts as a "water detector" and the absence of such at the edges of the pond (or via experimental induction) serves as a visual reference for the closest suitable habitat.

Avoidance Strategies of Southern Two-Lined Salamander Larvae (Eurycea cirrigera) in response to Two Species of Predatory Stream Crayfish. (Oral Presentation)

Madeline Mann, Hanover College

Crayfish are important regulators within freshwater ecosystems on invertebrate and vertebrate prey, including larval salamanders. We examined the predator avoidance response of Southern Two-Lined Salamander (Eurycea cirrigera) larvae when exposed to two species of stream crayfish (Cambarus tenebrosus and Faxonius rusticus). First, we exposed salamander larvae to kairomones of C. tenebrosus or F. rusticus, as well as blackworms (food) and a control (water). The larvae's change in movement and latency to move were recorded. In a second study, an exclusion study evaluated salamander larvae shelter use and predator avoidance behavior in response to live or model crayfish for 15 days. Larvae significantly reduced movement and increased latency to move when exposed to both species of crayfish kairomones. In the exclusion study, larvae avoided both species of live crayfish but did not show avoidance behavior in response to model crayfish. When combined with previous results suggesting both crayfish species actively prey upon salamander larvae, these results suggest Two-Line Salamander larvae employ predator avoidance strategies to decrease their risk of predation by predatory crayfish.

Countless Creatures of the Caverns: Spelunking into Virginia's Cave Spider Diversity (Oral Presentation)

Casey Venable, University of Indianapolis

Caves are a hot spot for species diversity because they act as biogeographical islands, isolating the troglobitic fauna from the epigean. This isolation is often further expedited within caves due to deeper subterranean fragmentation, causing multiple allopatric speciation events. Cave fauna, including spiders, are understudied, largely due to the difficulty of collecting these organisms. Beginning in 2015, we partnered with the Virginia Department of Conservation and

Recreation (VDCR) to identify spiders collected from Virginia caves in the hopes of better understanding spider diversity within these subterranean spaces. We identified 2286 spider specimens over the past eight years. Within this collection were 17 families, 40 genera, and 47 species. Among these species, eight are undescribed from the Linyphiidae genera Islandiana, Centromerus, Lepthyphantes, and Agneta. We also discovered previously undescribed females of Islandiana speophila and Oedothorax maximus. We continue to identify spiders from this region with the help of VDCR in hopes of better understanding the biodiversity within this expansive cave system. In the future, we hope to describe many of these new species to protect the rare wonders that Virginia caves possess.

An Assessment of Learning Modalities in Wild-Caught Freshwater Flatworms (Dugesia Tigrina) (Oral Presentation)

Kasey Watterson, Hanover College

An organism's ability to learn characteristics of its environment in the presence or absence of certain stimuli is a vital aspect of its survival. However, the level at which certain species can learn is thought to vary along the phylogenic tree. We assess free living freshwater flatworms (Dugesia tirgrina), ability to learn via classical conditioning, operant conditioning, and social leaning social learning. Flatworms' ability to learn via classical and operant conditioning was assessed using an electric shock and red light inside an arena, while social learning was assessed using marbles that had been previously exposed to groups of flatworms. Our results indicate that flatworms possess the ability to learn though classical conditioning by associating a red light with a negative stimulus. They also showed the ability to learn though operant conditioning by actively avoiding a negative stimulus after being paired with red light. Flatworms also showed a preference for marbles that conspecifics had previously interreacted with, indicating the capacity for local/stimulus enhancement, a simple form of social learning. Despite a primitive brain, wild-caught freshwater flatworms (Dugesia tigrina) exhibit both classical and operant conditioning as well as social learning. This demonstration of behavior could assist in furthering the understanding of learning and the intellectual abilities of various animals along the phylogenetic tree as well as clarify the debate regarding the learning capacity within Platyhelminthes.

Blatchley's Butterflies (Oral Presentation)

Dr. Christopher Wirth, Purdue University

To the "ichtho-bota-orni-geo-concho-entom-etc.-gist" Willis S. Blatchley, butterflies (Lepidoptera: Papilionoidea, excluding Hesperiidae) were an entrée to the insect fauna of Indiana. In 1892 Blatchley published the first catalog of the "Diurnal Lepidoptera" for Indiana, which became a foundation for future works on the State's fauna. Of the 108 species Blatchley reported for Indiana, three-quarters of these records were based on specimens in his collection. Upon his entomological retirement Blatchley sold this collection to Purdue University and today portions represent the oldest Indiana material in the Purdue Entomological Research Collection. However, over the ensuing years Blatchley's works on and specimens of Coleoptera, Hemiptera: Heteroptera, and Orthoptera overshadowed his early work with the Lepidoptera and the significance of these butterfly specimens has been overlooked. Here we present the results of our recent work to locate and conserve Blatchley's butterflies, link to publications, and capture multiple high-resolution images of each specimen.

Analysis of dorsal skin patterns as unique identifiers of Xenopus laevis frogs (Poster)

Claudia Chaverri, University of Indianapolis

African clawed frogs (Xenopus laevis) are a classic model organism, used worldwide by research laboratories to study developmental and cell biology, genetics, physiology, and immunology. Identification of individual research animals is important for both research productivity and overall animal well-being. Of the many methods used for tracking Xenopus animals, imaging of dorsal skin patterns is among the least invasive and inexpensive. We have implemented a curatorial system for identifying 126 frogs in a research facility. We confirm that individuals can be easily recognized by unique dorsal skin patterns, particularly when additional identifiable tank information is available. However, the long-term reliability of skin patterns is unclear. Whether or how much such skin patterns change over an individual's lifetime is not known. In order to assess the rate at which skin patterns change, images of mature adult individuals acquired over a three year timespan were compared. Skin patterns remained generally stable over this period with no major disruptions of existing patterns or emerging patterns occurring. Minor posterior shifting of the overall pattern was observed in some individuals, but patterns remained consistent nonetheless. We conclude that dorsal skin pattern imaging is a practical and highly effective method for identification of Xenopus laevis.

An Analysis of Startle Behavior in Red-Eyed Tree Frogs (Agaalychnis callidryas) (Poster) (EMSR Poster Competition)

Katelyn Enginger, Hanover College

Prey possess diverse mechanisms to reduce predation risk and survive physical interactions with predators. These antipredator mechanisms may be utilized at any stage of a predation event, but those at the beginning of a predation event generally present the greatest opportunity of escape and survival. Startle behavior, or the rapid exposure of bright colors, sounds, or chemicals, is a frequently cited but little studied antipredator behavior. Many textbooks and online references use the bright coloration in the Red-Eyed Tree Frog (Agaalychnis callidryas) as an example of startle behavior, yet to our knowledge this has not been tested. We assessed Red-Eyed Tree Frog's reaction to simulated predator attacks. Probes and forceps were used to simulate a predator investigation and the responses of the frogs, including flashing coloration, body repositions, and flight behaviors were recorded. These data aid our understanding of startle behavior and clarify the role of startle behavior and bright coloration as an antipredator behavior in the Red-Eyed Tree Frog.

The Effect of Plastic Bags on Necrophagous Fly Composition (Poster) (EMSR Poster Competition)

Maranda Powell and **Kaylee Huyser**, Valparaiso University

Forensic entomology uses insects to help estimate the post-mortem interval (PMI) based on blow fly colonization. The PMI provides an estimate of the time between death and discovery and is of extreme relevance due to its large role in forensic investigations. Nine fetal pigs were thawed from frozen 24 hours before the start of the experiment. Six fetal pigs were covered with plastic bags: three with thin plastic bags (average bag weight of 5.43 g) and three with thick plastic bags (average bag weight of 11.9 g). The remaining three pigs served as the control group. These pigs were placed outside, monitored for 6 days, and checked three times daily to

look for the presence of blow fly eggs, adults, and maggots. Third instar maggots were collected for later observance. ANOVA tests were conducted to look for differences in the timing of blow fly oviposition between treatments. There was no significant difference found for any of the life stages in either trial. P-values ranged from 0.22 -1. The maggots were identified to species to look for differences in species composition between treatments. Lucilia coeruleiviridis was the dominant species found. Sarcophagidae flies were found only on bagged pigs. Sarcophagidae larvae have been found very rarely in this field site over the past decade, so this is an interesting finding. Scavenging of the pigs was a problem and future research should aim to reduce the effects of vertebrate scavenging. This research was repeated in the Fall 2022 and results from that field season will also be presented.

Embryonic Learning in Lake Sturgeon (Acipenser fulvescens) Under Warming Conditions (Poster) (EMSR Poster Competition)

Brooke Karasch, Ball State University

Lake sturgeon (Acipenser fulvescens) are a culturally, economically, and ecologically important fish to the Great Lakes region. Sturgeon populations face threats from a variety of pressures over the last century, including habitat destruction, invasive species, and climate change, but little is known about how these stressors influence the behavior of sturgeon at early life stages. In this study, we evaluated the potential for warming waters to influence embryonic learning and acquired predator recognition in sturgeon embryos. Studies in multiple species have shown that oviparous aquatic embryos can learn to identity of local predators based on a variety of sensory cues, thereby increasing survival and fitness after hatching. Because the duration of embryogenesis is dependent on temperature, warming waters due to climate change can limit such opportunities for embryonic learning. We conditioned sturgeon embryos to recognize and respond to an invasive predator, the rusty crayfish (Orconectes rusticus) via paired olfactory presentations of conspecific alarm cue and predator cue at three different temperatures (14°C, 18°C, and varied from 12°-22°C). We then evaluated embryonic behavioral responses to the predator cue alone 24 h before hatching (i.e., same stage of development). Our results indicated that sturgeon embryos demonstrate embryonic acquired predator recognition, similar to other species. Embryos in warmer treatments hatched earlier, but similar evidence for embryonic learning was observed in all temperature treatments. This study adds to a growing body of literature on the mechanisms underlying embryonic learning in fish, suggesting that learning may more strongly influenced by developmental stage than embryonic duration. In addition, these data provide insight into the behavioral responses of vulnerable aquatic species to respond to emerging environmental pressures.

Diversity pattern of arthropods in different landscapes (Poster) (EMSR Poster Competition)

Waqar Majeed, Purdue University

The ways that species' taxonomic and functional diversity respond to land management in different areas should be considered and inform land management and conservation decisions. This study examined arthropod species diversity over space and time in four different regions of Punjab, Pakistan. We sampled the arthropod fauna and environmental conditions fortnightly for two years in each region. Diversity and abundance were greatest in Faisalabad and lowest in Layyah, while Vehari and Sahiwal communities had similar diversity, likely because of similar environmental conditions. Species diversity and abundance in Layyah is likely mainly influenced by severe weather with low temperatures and variable humidity. The species richness varied

along the latitudinal gradient and lower abundance was found at higher latitudes. An NMDS ordination showed clear clusters of regional assemblages that varied along a clear gradient. This study will serve as a baseline for Pakistan arthropod abundance and diversity to help guide management and conservation in future.

Aggression and Feeding Behavior with Respect to Competition and Hunger Status in Rusty Crayfish (Faxonius rusticus) (Poster) (EMSR Poster Competition)

Emmeline Mann, Hanover College

Rusty Crayfish (Faxonius rusticus) are important keystone predators and invaders within fishless streams in much of the Northeastern United States, and often aggressively compete with crayfish and other stream predators for food. The potential benefits of meeting competition with aggression include increased food availability and survival, which is essential for a good invasive species. We examined aggression in Rusty Crayfish with respect to competition by assigning a crayfish a food status level of either food-deprived or well-fed, and then exposed each individual to food and either a model crayfish or worm. Food-deprived crayfish contacted the food more quickly and performed more aggressive behaviors compared to well-fed crayfish, regardless of the presence or absence of a competitor. This shows that hunger status, specifically food deprivation, generates more aggression and reduces latency to contact food in Rusty Crayfish. With their powerful abilities of aggression and quick reaction, it is no wonder why the Rusty Crayfish has become a prominent crustacean invader in many fishless freshwater streams.

Flight Behavior by Two-Line Salamander Larvae in Response to Two Predatory Crayfish (Poster) (EMSR Poster Competition)

Cassaundra Winn, Hanover College

Two-lined salamander (Eurycea cirrigera) larvae have been documented to be important prey for several species of stream-dwelling crayfish species. Both Rusty crayfish (Faxonius rusticus) and Cavespring crayfish (Cambarus tenebrosus) consume larvae and induce predator avoidance behaviors in the larvae, with Cavespring crayfish serving as a more aggressive predator. We conducted a study to test the flight initiation distance of two-lined salamander larvae in response to the physical approach of both Rusty crayfish and Cavespring crayfish. Larvae were placed inside a linear raceway and a live crayfish was slowly coaxed toward the larvae. The number of flights and the distance of each flight were recorded, as well as the distance from the crayfish when the larvae initiated the flight. A larvae's flight initiation distance (distance between predator and prey when they fled) was not different in response to the two species of crayfish. However, the distance of the initial flight and the average distance of all flights were significantly longer when exposed to the Cavespring crayfish relative to Rusty crayfish. Neither crayfish or larvae size appeared to influence flight initiation distance, flight distance, or number of flights. These results indicate that two-lined salamander larvae recognize the Cavespring crayfish as a more prominent threat in comparison to the Rusty crayfish, resulting in longer flights when the two species interact.

GENERAL INTEREST

The Future of Emerging Infectious Diseases

Dr. Virginia Caine, Marion County Public Health Department

In this twenty-first century, emerging infectious diseases are occurring with increasing frequency. Polio, Tuberculosis, HIV, Ebola, Zika virus, and most recently the Covid-19 virus has caused substantial morbidity and mortality around the world. Currently, 1 in 20 deaths in the United States is attributed to an infectious cause. Culture climate, overburdened health systems, decline in antimicrobial agent developments, dwindling infectious diseases workforce, and a under resourced public health infrastructure can present an tsunami threat to society. Learn what we must do to save our planet and future.

Long Live Diversity: How to engage in sustainable and meaningful diversity

Dr. Brandy Mmbaga, Butler University

Diversity being centered as a focal point and area of concern has most recently transpired as of the last few years. Strategic direction, new positions and more have been established to address related concerns. Though this is promising, are the efforts to ingrain diversity as a pillar of organizational direction permanent or fleeting? This largely depends on how intentional and committed the organization is as well as the measures the organization has taken to embed long-term sustainability. In this interactive session, attendees will learn how to engage in sustainable diversity.

Following are the names of individuals who served on the various Indiana Academy of Science committees this year; generously sharing their expertise and time. It is with such dedication, the Academy is able to realize its mission, and is grateful.

Elected Standing Committees:

Academy Foundation Committee:
Thomas Dolan (Chair)
Clare Chatot
Michael Finkler (ex officio)
Patrick Motl

Research Grants Committee:
Zhihai Li (Chair)
Azeem Ahmad, Philip Villani,
Irene Reizman, Mary Konkle,
Douglas Bernstein

Diversity, Equity and Inclusion Committee:
Samina Akbar (Chair)
Luis Palacio (Vice Chair)
Patrick Motl
Eric (VJ) Rubenstein
Jen Kowalski (At-Large Council Member), Kaitlyn Glavee- Student

……..

Appointed Standing Committees:

Awards Committee
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Marcia Gillette, Marcia Moore, Alice Long Heikens,
Luke Jacobus

Biodiversity and Natural Areas Committee
Glene Mynhardt (Chair)
Brant Fisher, Paul Rothrock, Jeremy Sheets,
Scott Namestnik, Nate Engbrecht,
Mark Jordan, Marc Milne, Joanna Stebing-Student,
Kamal Islam, Kyryll Savchenko

Budget Committee
Bruce Kingsbury (Chair and President-Elect)
All Council Members
All Committee Chairs

External Communications Committee
Bruce Kingsbury (Chair & President Elect)
Luke Jacobus, Sarah Mordan-McCombs (Webmaster), Paul Doss (Immediate Past President), Social Media Manager

Indiana Community Grants Committee
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Jessique Haeft, Luke Jacobus, James Mendez

Membership Committee
Dennis Brown, Marcia Gillette, Joanna Stebing-Student, Delores Brown (Executive Director)

Nominations and Elections Committee
Delores Brown (Chair)
Michael Finkler, Eric (VJ) Rubenstein

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