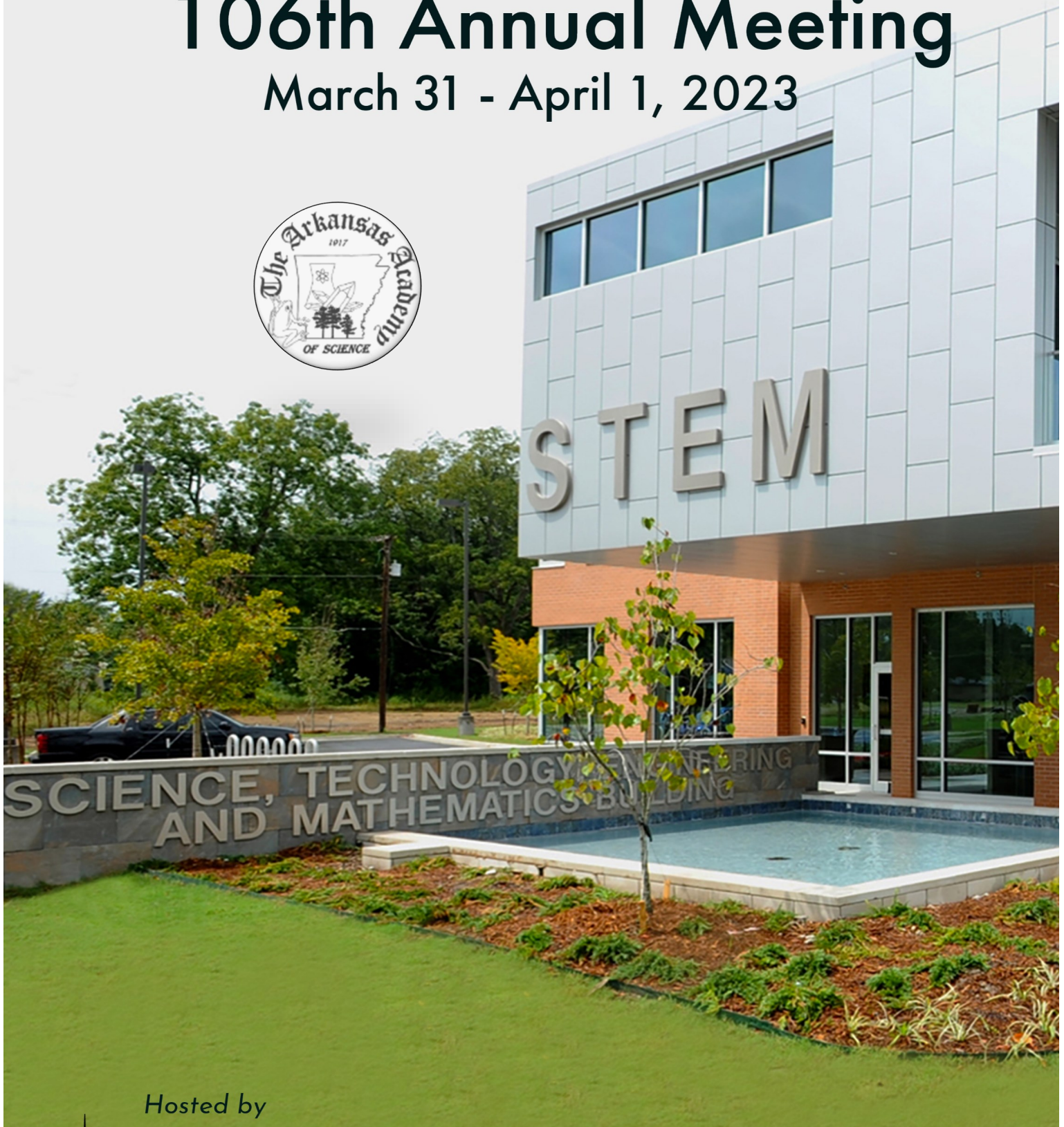


The Arkansas Academy of Science

106th Annual Meeting

March 31 - April 1, 2023



Hosted by



UNIVERSITY
of ARKANSAS
AT PINE BLUFF

1873

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ANNUAL STUDENT AND FACULTY
RESEARCH FORUM

March 31, 2023

Greetings:

We are pleased and excited to welcome you to the University of Arkansas at Pine Bluff for the 106th Annual Meeting of the Arkansas Academy of Science (AAS) and the UAPB Research Forum. It gives me great pleasure to share our campus with you for this special occasion.



This event provides an opportunity to highlight many of our research areas. As you may be aware, research is a major part of who we are and what we do at UAPB. Our mission requires us to provide cutting edge research and integrate it with instruction and student learning experiences. Research is important in developing and enhancing our students' analytical skills while advancing their knowledge for graduate education and the workforce. It not only plays a major role in the development of our university, but also in the progression of our society. It adds to the stock of global knowledge and provides the source of new ideas, methods, techniques, and innovation across a whole range of disciplinary and multi-disciplinary areas. As we continue to pursue our research agenda, we can look to a vast range of opportunities to build on the existing strengths and support for research at this university. The goal is to discover or create new or innovative approaches to help grow the economy while also helping to improve the quality of life, health, and well-being of citizens of the United States and beyond.

It is with sincere gratitude that we recognize our administrators, faculty, staff, students, stakeholders, and supporters who have been instrumental in their efforts to progressively enrich this institution. Through our collaborative endeavors, we will help build a stronger state and nation through research and innovation as we continue to shape the minds that one day will reshape the world.

Sincerely,



Laurence B. Alexander, J.D., Ph.D.
Chancellor



March 31, 2023



Office of Research and Sponsored Programs

It is with a great deal of pleasure that I welcome you to the **106th Annual Meeting of the Arkansas Academy of Science** and the **33rd Annual UAPB Student-Faculty Research Forum**. Your participation ensures that these two traditions continue to flourish into the future. The Annual Research Forum is returning for the first time since 2019 due to the COVID-19 pandemic. However, what is more significant is that this year is the second time in the history of the Academy (since 1995) to have selected UAPB as the host institution. This couldn't have come at a more auspicious time.



The year 2023 marks the **sesquicentennial** (150th) anniversary of the founding of the University of Arkansas at Pine Bluff, formerly **Arkansas AM&N College**. Throughout those years, this institution has remained true to its founding mission of providing quality education to underserved populations. It is in that context that we are excited to make this conference one of the centerpieces of our 150th celebration. So, in some sense, this annual meeting is already a historic event. We welcome you to join us in this milestone celebration as well.

As we gather these two days for intellectual stimulation, we do so with the understanding that it is not enough to be just excellent teachers, or for our students to be just avid consumers of knowledge, but rather, both faculty and students must be active participants in the production of the knowledge that is being imparted as well as being consumed by our students and the public at large.

Furthermore, we should endeavor in our pursuit of knowledge, to engage in "**impactful research**." This underscores the theme for this year's conference: "**Innovation**." The theme serves as the basis for the selection of this year's banquet speaker, Ms. Rebecca Todd, who will speak on innovation research and technology transfer as foundations for developing and implementing impactful research.

Again, we welcome you to our campus. We want everyone, especially the students, to enjoy the various activities we have in store for you during these two days.

With best regards,

Ebo Tei, PhD.
Director
Office of Research and Sponsored Programs

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UAPB is an Equal Opportunity/Affirmative Action Institution

106th Annual Meeting of the Arkansas Academy of Science

And

33rd UAPB Annual Student-Faculty Research Forum

Theme: Innovation

STEM Building Conference Center, 1530 L A “Prexy” Davis Drive
Pine Bluff, AR 71601

Schedule-at-a-glance

Friday, March 31, 2023

10:00 AM – 12:00 PM	Executive Committee Meeting	STEM Building Conference Room 213
11:00 AM – 06:00 PM	Networking with Vendors	STEM Building Conference Center 1 st Floor
12:00 PM – 05:45 PM	Registration	STEM Building Conference Center Lobby
12:30 PM – 12:45 PM	Welcome Session: <i>The Chancellor</i>	STEM Building Conference Center 1, 2, & 3
01:00 PM – 05:00 PM	Oral Presentations	STEM Building Conference Center
05:00 PM – 06:30 PM	BREAK for Hotel Check-in and Networking	
06:30 PM – 08:00 PM	Banquet & Keynote Address	H.O. Clemmons Arena (HYPER Complex)
08:00 PM – 10:00 PM	Student Social & Entertainment	H.O. Clemmons Arena (HYPER Complex)

Saturday, April 1, 2023

07:30 AM – 08:30 AM	Setup: Poster Presentation	STEM Building Conference Center 1st Floor
08:30 AM – 09:00 AM	Registration	STEM Building Conference Center Lobby
09:00 AM – 11:00 AM	Poster Session	STEM Building Conference Center 1 st Floor
09:00 AM – 12:00 PM	Art and Culture Show	Lawn of University Museum, Childress Hall
10:00 AM – 12:00 PM	B R U N C H	
11:00 AM – 12:00 PM	Judges Meeting Tour of campus: Art and Culture; University Museum	STEM Building Conference Center Rm 213
12:00 PM – 01:30 PM	Exec Com Business Meeting/ Awards Ceremony	STEM Building Conference Rms 1-3

*106th Annual Meeting of the Arkansas Academy of Science
And*

UAPB Annual Student-Faculty Research Forum

Banquet Guest Speaker

Rebecca Todd



Presentation Title

The Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) program – a resource to develop and implement impactful research.

This program awards \$4B annually to small businesses and their partners to conduct research and development work that brings new and needed products and services from idea stage all the way to commercial-readiness level. The SBIR/STTR program encourages participation by all people, including women, people of color, people with disabilities, and entrepreneurs located in all 50 states and U.S. territories. This program grows sustainable companies and high-tech jobs across the nation.

Rebecca Todd serves as the grant writer for BioVentures, LLC. BioVentures is the technology commercialization arm of the University of Arkansas for Medical Sciences (UAMS). Todd assists the BioVentures executive team in all facets of creating competitive extramural funding proposals. She identifies opportunities and works with the executive team to craft applications and create reports for post-award monitoring. Todd assists in completing writing, editing, research, submission, and reporting tasks for written documents ranging from grant proposals, manuscripts, abstracts, presentations, nominations, biographies, profiles, and other assignments that support UAMS/BioVentures grant applications. Todd has 14 years of experience with helping innovative small businesses explore and respond to federal funding opportunities in the Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) program. In her previous role as innovation specialist with the Arkansas Small Business and Technology Development Center, she assisted research-based companies across the state with winning 91 SBIR/STTR awards totaling more than \$37 million dollars.

Conference-at-a-Glance

Oral Presentation

Friday, March 31, 2023

<i>Time</i>	<i>Conference Center 1</i>	<i>Conference Center 2</i>	<i>Conference Center 3</i>	<i>STEM Building Room 103</i>	<i>STEM Building Room 109</i>	<i>Conference Room 213</i>	<i>STEM Building Room 214</i>
<i>10 - 12:00 p.m.</i>						Executive Committee Meeting	
<i>1:00 p.m.</i>	S. Addison	S. Bhattarati	M. Blevins	D. Alexander	K. Willis		S. Basyal
<i>1:15 p.m.</i>	P. Chakraborty	A. Chaudhary	S. Boone	G. Gaines	D. Burn		S, Critchlow
<i>1:30 p.m.</i>	M. A, Islam	U. Deb	G. Graves	R. Griffin	E. Elamami		M. Hoard
<i>1:45 p.m.</i>	BREAK						
<i>2:00 p.m.</i>	B. Crutchfiel	A. Fields	S. Mathews	S. Hampton	L. Maitre		B. Iweegbu
<i>2:15 p.m.</i>	D. Eom	J. Filbrun	C. McAllister	S. Lockett	T. McCray		D. Khanal
<i>2:30 p.m.</i>	P. Chakraborty	S. Gudapati	S. Trauth	K. Robinson	J. O’Grady		R. Mutethia
<i>2:45 p.m.</i>	BREAK						
<i>3:00 p.m.</i>	D. Mayo	H. Knuckles	C. McAllister	N. Seahorn	I. Raykov		M. White
<i>3:15 p.m.</i>	N. Raath	A. Segree	A. Price	C. Smith	C. Brackens		
<i>3:30 p.m.</i>	M. Rahaman	A. Selman	E. Purvis	A. Wesley	S. Rana		
<i>3:45 p.m.</i>	BREAK						
<i>4:00 p.m.</i>	M. Rhodes	A. Sharma	C. McAllister	R. M. Will	S. McGhee		
<i>4:15 p.m.</i>	R. Yadav		S. Trauth	P. Wui			
<i>4:30 p.m.</i>	K. Kervin		S. Yarbrough				
<i>4:45 p.m.</i>	L. Barnes		S. Trauth				
<i>5:00 p.m.</i>	End of Presentations						
<i>8-10 p.m.</i>	<i>Banquet</i>						

ORAL PRESENTATION

Friday, March 31st, 2023

STEM BUILDING, ROOM 214

Agricultural Sciences

	Time	Presenter
1	1:00 p.m.	S. Basyal, Department of Agriculture, University of Arkansas at Pine Bluff, Use of Modified Crawfish Shell Biochar for Microplastic Retention and Sulfamethoxazole Adsorption G
2	1:15 p.m.	S. Critchlow, Department of Agriculture, University of Arkansas at Pine Bluff, Survey and Investigation of Sweet Potato Viral Diseases in Three Regions of Guyana Using Reverse Transcriptase-Polymerase Chain Reaction G
3	1:30 p.m.	M. Hoard, Department of Agriculture, University of Arkansas at Pine Bluff, Estimation of Sweet Potato Viruses in the Four Different Generations UG
	1:45 p.m.	BREAK
4	2:00 p.m.	B. Iweegbu, Department of Agriculture, University of Arkansas at Pine Bluff, The Importance of Self-Sustainability Practices on the University of Arkansas at Pine Bluff Agricultural Research Facility (Farm) in Pine Bluff G
5	2:15 p.m.	D. Khanal, Department of Agriculture, University of Arkansas at Pine Bluff, Evaluating the Impacts of High Night Temperature on Rice Grain G
6	2:30 p.m.	R. Mutethia, Department of Agriculture, University of Arkansas at Pine Bluff, Overexpression of the Candidate Pita2 in Rice (<i>Oryza sativa</i> L. ssp. <i>japonica</i> cv. Nipponbare) for Resistance Against Blast Fungus (<i>Magnaporthe Oryzae</i>) G
	2:45 p.m.	BREAK
7	3:00 p.m.	M. White, Department of Agriculture, University of Arkansas at Pine Bluff, AgDiscovery 2022, Preparing the next generation of Animal Plant Health Inspection Services (APHIS) Professionals UG
	3:30 p.m.	END

ORAL PRESENTATION

Friday, March 31st, 2023

STEM BUILDING, Conference ROOM 2

Aquaculture and Fisheries

	Time	Presenter
1	1:00 p.m.	S. Bhattarati, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff , Isolation and In-Vitro Culture of Primary Cell Population Derived From White and Black Crappie Ovarian Tissue G
2	1:15 p.m.	A. Chaudhary, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff , Catfish Clca5.2 mRNA Secreted into Mucus Along With p53 G
3	1:30 p.m.	U. Deb, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff , Comparative Advantage and Competitiveness of the United States in Fish and Fishery Products Trade 2000-2021 F
	1:45 p.m.	BREAK
4	2:00 p.m.	A. Fields, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff , Examining Barriers to Outdoor Recreation, Hunting, and Recreational Fishing Participation of Minority Populations G
5	2:15 p.m.	J. Filbrun, Department of Biology, Southern Arkansas University , Testing the Effects of Daphnia lumholtzi Predator Experience on Capture Success by Fish F
6	2:30 p.m.	S. Gudapati, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff , Peptidoglycan Hydrolases to Treat Staphylococcus aureus Infections G
	2:45 p.m.	BREAK
7	3:00 p.m.	H. Knuckles, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff , Short-Term Feeding of Commercially Available High Protein and Lipid Diets Pre-Spawning at Goldfish (Crassius auratus) Farms as a Method to Improve Fecundity and Spawn G
8	3:15 p.m.	A. Segree, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff , Peptidoglycan Hydrolases as Alternatives to Antibiotics to Treat Streptococcosis G
9	3:30 p.m.	A. Selman, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff , Applications of Black Soldier Fly (Hermetia illucens) Larvae Frass on Growth and Mineral Composition in Basil (Ocimum basilicum) UG
	3:45 p.m.	BREAK
10	4:00 p.m.	A. Sharma, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff , Effect of Probiotics and Immunostimulant Supplementation on Growth, Gut Microbiome, and Gene Expression of White Leg Shrimp G
	4:15 p.m.	END

ORAL PRESENTATION

Friday, March 31st, 2023

STEM BUILDING, CONFERENCE ROOM 3

Biological Sciences, Wildlife Science and Ecology

#	Time	Presenter
1	1:00 p.m.	M. Blevins, Biology and Health Sciences Department, Hendrix College, Distribution and Habitat Selection of the Georgia satyr (<i>Neonympha areolatus</i>) UG
2	1:15 p.m.	S. Boone, Biology and Health Sciences Department, Hendrix College, Habitat Partitioning of Coyotes and Domestic Cats in Green Spaces Along an Urbanization Gradient UG
3	1:30 p.m.	G. Graves, Department of Vertebrate Zoology / Birds, National Museum of Natural History, Smithsonian Institution, Habitat Selection of a Vagrant Mountain Bluebird (<i>Sialia currucoides</i>) in the Arkansas Ozarks F
	1:45 p.m.	BREAK
4	2:00 p.m.	S. Mathews, Biology and Health Sciences Department, Hendrix College, Bring on the Urbanization: American Robins Don't Mind the Sounds of City Life UG
5	2:15 p.m.	C. McAllister, Science & Mathematics Division, Eastern Oklahoma State College, New Geographic Distributional Records for Two Lampreys (<i>Petromyzontiformes: Petromyzontidae</i>) in Arkansas, with Notes on Histopathology F
6	2:30 p.m.	S. Trauth, Department of Biological Sciences, Arkansas State University, No Sperm Morphometric Differences between Two Snapping Turtle Species F
	2:45 p.m.	BREAK
7	3:00 p.m.	C. McAllister, Science & Mathematics Division, Eastern Oklahoma State College, Helminth Parasites of Northern Cottonmouth, <i>Agkistrodon piscivorus</i> (<i>Ophidia: Viperidae</i>), from Arkansas F
8	3:15 p.m.	A. Price, Biology and Health Sciences Department, Hendrix College, Ecological Responses of Nocturnal Mammals to Artificial Light at Night in Urban Ecosystems UG
9	3:30 p.m.	E. Purvis, Department of Biology, University of Central Arkansas, The Effects of Fertilization on Defoliation Recovery in River Birch and Northern Red Oak G
	3:45 p.m.	BREAK
10	4:00 p.m.	C. McAllister, Science & Mathematics Division, Eastern Oklahoma State College, Hemoparasites (<i>Apicomplexa: Hepatozoon; Kinetoplastida: Trypanosoma</i>) of Two Anurans (<i>Hylidae; Ranidae</i>), from Polk County, Arkansas F
11	4:15 p.m.	S. Trauth, Department of Biological Sciences, Arkansas State University, Spermiogenesis in the Western Lesser Siren, <i>Siren intermedia nettingi</i> (<i>Caudata: Sirenidae</i>) F

12	4:30 p.m.	S. Yarbrough, Biology and Health Sciences Department, Hendrix College, Assessing the Potential for Image Analysis to Study Whether Urbanization Contributes to Contemporary Evolution of Coat Color in the Eastern Gray Squirrel (<i>Sciurus carolinensis</i>) F
13	4:45 p.m.	S. Trauth, Department of Biological Sciences, Arkansas State University, Histomorphology of the Distal Urogenital Ducts in the Male Northern Crawfish Frog, <i>Lithobates areolatus circulosus</i> (Anura: Ranidae)
	5:00 p.m.	<i>END</i>

ORAL PRESENTATION

Friday, March 31st, 2023

STEM BUILDING, Conference ROOM 1

Cell/Molecular Biology, Chemistry, Geology & Geography, Health Sciences,
Physics & Engineering, Renewable energy

#	Time	Presenter
1	1:00 p.m.	S. Addison, Department of Physics & Astronomy, University of Central Arkansas , The Rayleigh Problem (Random Flights) is Everywhere Redux F
2	1:15 p.m.	P. Chakraborty, Department of Engineering and Physics, Southern Arkansas University , Temperature Dependence of Coherent and Incoherent Phonon Transport: a Molecular Dynamics and Machine Learning-Based Study F
3	1:30 p.m.	M. A. Islam, Department of Mechanical Engineering, Arkansas State University , Structural Configuration of SiO ₂ Surface with Different Terminating Groups Using Classical and Ab Initio Molecular Dynamics G
	1:45 p.m.	BREAK
4	2:00 p.m.	B. Crutchfield, Department of Mechanical Engineering, Arkansas State University , Understanding the Mechanical Behavior of Nanoporous Amorphous Silicon by Molecular Dynamics Simulations UG
5	2:15 p.m.	D. Eom, Department of Biology, University of Central Arkansas , Overexpressing and Knocking Down the FtsZ Homolog, FszA, to Determine its Effect on ROS (reactive oxygen species) in Dictyostelium discoideum UG
6	2:30 p.m.	P. Chakraborty, Department of Engineering and Physics, Southern Arkansas University , Modification of surface topology to enhance convective heat transfer in nanochannels F
	2:45 p.m.	BREAK
7	3:00 p.m.	D. Mayo, Department of Physical Science, University of Arkansas at Fort Smith , Circular statistics of joint orientations in the Middle-Pennsylvanian McAlester Formation, Fort Smith, Arkansas F
8	3:15 p.m.	N. Raath, Department of Mechanical Engineering, Arkansas State University , A Novel Approach to Sustainable Plastic Recycling on Campus UG
9	3:30 p.m.	M. Rahaman, Department of Computer and Information Science, Arkansas Tech University , Programming Sequence Improvement Program G
	3:45 p.m.	BREAK

10	4:00 p.m.	M. Rhodes, Arkansas State University , Design and Analysis of a Multi-Degree of Freedom System Model to Analyze the Lateral Vibrations of a Scale-Model Saturn V Rocket UG
11	4:15 p.m.	R. Yadav, Department of Physical Sciences, University of Arkansas-Fort Smith , Understanding Protein Adsorption to Biotic and Abiotic Surfaces: Implications for Bacterial Adhesion and Biofilm Formation F
12	4:30 p.m.	K. Kervin, Chemistry Department, Arkansas Tech University , A comparative study of specific enthalpy of aromatic hydrocarbons with simple carbohydrates UG
13	4:45 p.m	L. Barnes, Department of Biological Science, University of Arkansas Fort Smith , Least Flycatchers (<i>Empidonax minimus</i>) Under Reported in Fall Migration in Arkansas--A Citizen Conundrum UG

END

ORAL PRESENTATION

Friday, March 31st, 2023

STEM BUILDING, ROOM 109

*Academic Affairs, Biodiversity and Education, Mathematics & Statistics, Psychology
& Social Science, STEM Ed Curriculum & Instruction*

#	Time	Presenter
1	1:00 p.m.	K. Willis, Arkansas State University , NASA Sustainability Research with K-12 Citizen Scientists Developing Biology and Engineering Project-based Curriculum UG
2	1:15 p.m.	D. Burn, Department of Social and Behavioral Sciences, University of Arkansas at Pine Bluff , Social Media Use and its Impact on Social/Psychological Well-Being Among College Students UG
3	1:30 p.m.	E. Elamami, Department of Mathematics and Computer Sciences, Southern Arkansas University , An Augmented Approach for Solving 3D Elliptic Interface Problems F
	1:45 p.m.	BREAK
4	2:00 p.m.	L. Maitre, Department of Mathematics and Computer Science, University of Arkansas at Pine Bluff , Julia Programming as part of Education UG
5	2:15 p.m.	T. McCray, Department of Social and Behavioral Sciences, University of Arkansas at Pine Bluff , Problematic use of smartphones among college students - Predictors and consequences UG
6	2:30 p.m.	J. O'Grady, Department of Mathematics and Computer Sciences, Southern Arkansas University , Determining the Relationship Between Student-Teacher Ratio and Retention Rates UG
	2:45 p.m.	BREAK
7	3:00 p.m.	I. Raykov, Department of Mathematics and Computer Science, University of Arkansas at Pine Bluff , Numerical Algorithms for Types of Global Minimization Problems F
8	3:15 p.m.	C. Brackens, Department of Mathematics and Computer Science, University of Arkansas at Pine Bluff , Visualizing Multivariable Calculus in Julia UG
9	3:30 p.m.	S. Rana, Haas Hall Academy , Citizen Science: Role of iNatural in Biodiversity Documentation and Education in Arkansas UG
10	3:45 p.m.	S. McGee, John Brown Watson Memorial Library System, University of Arkansas at Pine Bluff , The Challenges of Data Curation in Academic Libraries F

END

ORAL PRESENTATION

Friday, March 31st, 2023

STEM BUILDING, ROOM 103

Business Administration, Human Sciences

#	Time	Presenter
1	1:00 p.m.	D. Alexander, Department of Business Administration, University of Arkansas at Pine Bluff, DEI in Corporate America G
2	1:15 p.m.	D. Gaines, Department of Business Administration, University of Arkansas at Pine Bluff, What Kind of Challenges Do Startups and Small Business Face in the USA? G
3	1:30 p.m.	R. Griffin, Department of Business Administration, University of Arkansas at Pine Bluff, The Evolution of Money and its Progression through Time... (The Digital Era)! G
	1:45 p.m.	BREAK
4	2:00 p.m.	S. Hampton, Department of Human Sciences, University of Arkansas at Pine Bluff, Learning Strategies in Science Education: A Gardening Approach UG
5	2:15 p.m.	S. Lockett, Department of Business Administration, University of Arkansas at Pine Bluff, The Lack of Diversity and Inclusion in Management in the Hospitality and Tourism Industry G
6	2:30 p.m.	K. Robinson, Department of Business Administration, Arkansas at Pine Bluff, Sports Analytics G
	2:45 p.m.	BREAK
7	3:00 p.m.	N. Seahorn, Department of Business Administration, University of Arkansas at Pine Bluff, Best Practices to Maintain a Photography Business G
8	3:15 p.m.	C. Smith, Department of Business Administration, University of Arkansas at Pine Bluff, Casino Gaming Management Regulations and Compliance within Casino Gaming Industry G
9	3:30 p.m.	A. Wesley, Department of Business Administration, University of Arkansas at Pine Bluff, The Importance of Diversity and Inclusion within Sports Management G
	3:45 p.m.	BREAK
11	4:00 p.m.	R. M. Will, Department of Human Sciences, University of Arkansas at Pine Bluff, Complications of Childhood Obesity UG
12	4:15 p.m.	P. Wui, School of Business Management, University of Arkansas at Pine Bluff, Evaluating the Consumption Impacts of Legalized Marijuana F
	4:30 p.m.	END

POSTER PRESENTATION

Saturday, April 1, 2023

STEM Building, First Floor Hallways

and

Conference Room 3

Agricultural Sciences, Aquaculture and Fisheries

- 1 **Airin P., Islam S., Jahurul M.H.A., University of Arkansas at Pine Bluff, Agriculture**
Antimicrobial Activity of Sweet Potato (*Ipomoea batata*) Leave Extracts against *Escherichia coli* ATCC 25922
- 2 **Jahurul Akanda and Shahidul Islam, University of Arkansas at Pine Bluff, Agriculture**
Mineral, vitamin C, and oxalate contents in 24 sweet potato (*Ipomoea batatas* L.) cultivars in Arkansas, USA
- 3 **Jerin Rahima, S. Islam, M.H.A. Jahurul, University of Arkansas at Pine Bluff, Agriculture**
Potential Antineoplastic Action of fruits and Vegetables in Relation to Polyphenol Contents
- 4 **K. Manzil and H. Chen, University of Arkansas at Pine Bluff, Agriculture**
Immobilization of Cadmium in Soil Under the Influence of Biochar
- 5 **L. Macie Carter , Kaylee Beck, Rafael Gomez Mendoza, Maribel Falcon Bautista and Arturo Quintero Ferrer, University of Arkansas Monticello, Agriculture**
Use of Micropropagated *Solanum tuberosum* as a Model for the Establishment of a Tissue Culture Laboratory and Greenhouse at UAM
- 6 **M, Rahman, Rahmatullah, M, Islam, S, University of Arkansas at Pine Bluff, Agriculture**
Garlic (*Allium sativum*): a high-efficacy antidote or protective agent against generalized anxiety disorder (GAD), possible hyperactivity, and hyperthyroidism in children caused by golden yellow dye
- 7 **Lurie L. Anderson and Shahidul Islam, University of Arkansas at Pine Bluff, Agriculture**
Assessment of *Gladiolus* Genotypes for Cut Flower Production in the Southeast Arkansas Region
- 8 **S. Tasbida, S. Islam, M.H.A. Jahurul, University of Arkansas at Pine Bluff, Agriculture**
Potential Use of Underutilized Cucurbitaceae Family Leaves as healthy vegetables.
- 9 **T. Wills, C. C. Mathis, Jr., and L. Carson, University of Arkansas at Pine Bluff, Agriculture**
A Partnership Between Pvamu & uapb (mea) to Gaining Competitive Edge Through Innovation and Collaboration
- 10 **Dalton Chennault, Ayushma Sharma, Yatish Ramena, Kailash Bohora, Elijah Dwumfuor, and Grace Ramena, University of Arkansas at Pine Bluff, Aquaculture & Fisheries**
Immunostimulant Supplement Enhances the Growth of *Litopenaeus Vannamei* Post Larvae
- 11 **Uttam Deb and Caleb I Adewale, University of Arkansas at Pine Bluff, Aquaculture & Fisheries**
Production and Consumption of Fish and Fishery Products in Uganda: Trends, status, and implications for food and nutrition security

Biological Sciences

- 1 **Carli Tackett, Claire Greene, Hannah Seats, Arkansas State University Biosciences Institution, Biological Sciences**
Assessing mass-to-mass ratios in waxworm diets for plastic waste management by biodegradation
- 2 **Harley Hines, Raven Newton, Justin Contreras-Portillo, and Surya Jyoti Banerjee, Arkansas Tech University, Biology**
Role of Tsh & CtBP molecular interaction on *Drosophila* eye development

- 3 **Kayla Medina, Morganne Browning, Raven Newton, Erika Avalos-Reyes, Harley Hines, Suparna Chatterjee, Arkansas Tech University, Biology**
Physical mutation induced on E.coli for enhancing chromium (VI) reduction
- 4 **Cameron Heslip, University of Central Arkansas, Cell/Molecular Biology**
The Relationship Between the Presence of the Cytoskeleton and Mitochondrial Fission and Fusion
- 5 **Hyoju Kim, Kari Naylor, University of Central Arkansas, Cell/Molecular Biology**
The Effects of DJ-1 Protein Mutants on Mitochondrial Dynamics in Dictyostelium discoideum
- 6 **Sophia Rushing and Kari Naylor, University of Central Arkansas, Cell/Molecular Biology**
Exploring the Relationship Between the Cytoskeleton and Mitochondrial Dynamics in Dictyostelium discoideum

Geology & Geography

- 1 **Cassandra Huggins and Emily Ross Metcalf-Mero, University of Arkansas Fort Smith, Geology & Geography**
Hydrothermal alteration in carbonate rich igneous complex of Magnet Cove, Arkansas as analog to Nili Fossae and Gusev, Mars
- 2 **Emily Ross Metcalf-Meroe and Cassandra Huggins, University of Arkansas Fort Smith, Geology & Geography**
X-Ray diffraction and petrographic analysis of Magnet Cove carbonatite core, Arkansas
- 3 **Mariah Thomas, Alex Burns, Johnny Pruitt, Payton Karr, and Dave Mayo, University of Arkansas at Fort Smith, Geology & Geography**
Investigation of a Recent Landslide in Fort Smith, Arkansas
- 4 **Mariah Thomas, Abby Kelly, Lesa Huff, Maurice Testa, Lisa Cady, Heath Cady, Cody Holt, University of Arkansas Fort Smith, Geology & Geography**
3D Model Project of the Second Fort Walls at the Fort Smith National Historic Site Recreating the Fort Smith National Historic Site
- 5 **Matthew Neal, Jon Turco, Jordan Mader, Maurice Testa, University of Arkansas Fort Smith, Geology & Geography**
Determining the Impact of a Flocculant or Surfactant on Microplastic Recovery
- 6 **Payton Karr, Lisa Cady, Maurice Testa, University of Arkansas Fort Smith, Geology & Geography**
Virtual Storyboard Creation of the Navajo Sandstone Geologic Formation
- 7 **Travis Rameden-Tipton, University of Arkansas, Geology & Geography**
Modeling Landslide Susceptibility of Greers Ferry Lake, AR

Health Sciences

- 1 **Allison Abney, Kinlee O'Neal, Andrew Roser, University of Arkansas at Monticello, Health Sciences**
The influence of sodium chloride supplementation during heat activation on germination of Bacillus anthracis spores.
- 2 **Archana Mishra, University of Arkansas Fort Smith, Health Sciences**
Probing the Interaction of Pesticides with Human Serum Albumin using Molecular Docking and Molecular Dynamics Simulation
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106th
*Annual Meeting of
Arkansas Academy of Science*

Oral Presentation

Abstracts

By Division



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Academic Affairs

**S. McGhee*, John Brown Watson Memorial Library
System, University of Arkansas at Pine Bluff**

The Challenges of Data Curation in Academic Libraries

The paper discusses the challenges posed by data curation to library acquisition and preservation processes. Such as, technical issues along the lines of organizational structure, the use of equipment and training; legal issues about to copyright and licensing; financial challenges for staffing, equipment and long-term funding support. It indicates that the collection, readability, and long-term access of digital information cannot be taken for granted. It mentions that data curation demands that people keep the valuable assets feasible and shareable across fields and for future generation. It states that librarians have to improve existing skills in creating and implementing data management in libraries. It suggests informational professionals working to increase their own data literacy and awareness, and equipping themselves to provide educational and consultative services related to data management.

Agricultural Sciences

S. Basyal* and H. Chen

Dept. of Agriculture, University of Arkansas at Pine Bluff

Modified Crawfish Shell Biochar for Microplastic Retention and Sulfamethoxazole Adsorption

Microplastics are one of the most concerning environmental risks worldwide due to rising plastic production and consumption. Various sources of microplastic particles, including consumer packaging and industrial waste, wither, and fracture in an open environment due to UV irradiation, photodegradation, mechanical degradation, and chemical degradation from exposure to chemical compounds. Due to their small size, wastewater treatment plants cannot entirely remove microplastics; as a result, they enter the water system and soil with the application of biosolids originating from wastewater treatment plants on agricultural land. One of the pollutants becoming more prevalent in wastewater and harming water sources through pharmaceutical and industrial effluent is sulfamethoxazole, a drug frequently used to treat bacterial infections. Sulfamethoxazole resistance is a growing issue because of bacterial resistance. Numerous studies have found that microplastics carry antibiotics and have a combined impact. Due to its larger surface area, porous structure, and surface functional groups, biochar can retain microplastics and antibiotic compounds like sulfamethoxazole. In this experiment, cellulose and lignin will modify the crawfish shell, which will not cause secondary pollution when employed. The transport mechanism will be examined using biochar produced at various pyrolytic temperatures and modified using Lignin and Cellulose as modifiers. The fixed bed column tests will demonstrate the biochar made from crawfish shells' capacity to move, hold onto, and adsorb sulfamethoxazole and microplastics on a porous medium as individual transport and co-transport of both contaminants.

S. J. Critchlow*, A. Alleyne and S. Ponniah

**University of Guyana, Dept. of Agriculture. Turkeven
Campus, East Coast Demerara, University of the West**

**Indies at Cave Hill, Barbados, and University of Arkansas
at Pine Bluff**

Survey and Investigation of Sweet Potato Viral Diseases in Three Regions of Guyana Using Reverse Transcriptase-Polymerase Chain Reaction

Sweet potato (*Ipomoea batatas* (L.) Lam) is rich in essential nutrients. These include vitamins, iron, calcium, and protein. Sweet potato is susceptible to viral diseases which are expressed as single or co-infections. These diseases significantly reduce taste, natural appearance and yield worldwide. The objectives of this study were to describe virus-like symptoms observed on the leaves of selected varieties in different locations in Guyana; to detect the presence of the viral agents of disease on selected varieties; and determine farmers' knowledge of sweet potato viral disease symptoms in the field. A field survey was conducted to identify virus-like symptoms that informed random selection of symptomatic and asymptomatic cultivars grown in environments with a history of whitefly (*Bemisia tabaci*), known vectors in virus transmission. Reverse transcription-polymerase chain reaction was used to investigate the presence of two RNA viruses, namely: Sweet Potato Feathery Mottle Virus and Sweet Potato Chlorotic Stunt Virus. Questionnaires were used to obtain data on farmers' knowledge of diseases in the field and the presence of white flies. The qRT-PCR detection method was used to amplify the nucleic acid associated with any detected infecting agent, specifically with RNA primers: PMB 11 and 12 that were used to detect SPMFV and Hsp-70 primer pairs for the detection of SPCSV. PCR results did not show positive amplification of these viruses. However, based on the recorded field symptoms and observations made, it is suggested that further molecular analysis by sequencing is necessary to determine the presence of these virus transcripts in Guyana.

**M. Hoard*, and S. Ponniah, Dept. of Agriculture,
University of Arkansas at Pine Bluff**

Estimation of Sweet Potato Viruses in the Four Different Generations

Sweet potatoes are vegetatively propagated and susceptible to viruses that accumulate with each planting cycle (generation) and lead to a variety decline. In Beauregard sweet potato (a widely grown commercial variety in Arkansas), the cumulative effect of infection of various naturally occurring viruses can cause reductions in yield by more than 30 to 40 percent. In addition, the viral accumulation cause changes in skin color and shape that reduce the quality and marketability of the crop. We used one-step Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) to identify the four different viruses such as sweet potato feathery mottle virus (SPFMV), sweet potato virus C (SPVC), sweet potato virus G (SPVG), and sweet potato virus 2 (SPV2). The RT-PCR assay is a reliable, simple, and cost-effective method to detect the viruses in sweet potatoes. The study aims to quantify the level of viral infection in four generations (G0, G1, G2, and G4) at two times in the growing season (Summer-2022). Our study compared the level of viral infections between the generations. The study observed the rate of virus infections from G0 to the older generations. The results will help the sweet potato growers decide on selecting the correct age of sweet potato plants for growing in the field.

Agricultural Sciences

B. Iwegbu*, E. Asiamah, and V. Wiley; Dept. of Agriculture, Agricultural Research Facility (Farm), University of Arkansas at Pine Bluff

The Importance of Self-Sustainability Practices on the University of Arkansas at Pine Bluff Agricultural Research Facility (Farm) in Pine Bluff

Self-sustainability farming is producing most or all of your food on own land with little to no external inputs or help from other individuals or organizations. A self-sufficient farm does little or no trading with the world outside of their farm. Having to assist in managing over 50 acres of farmland at the University of Arkansas at Pine Bluff (UAPB), with multiple small ruminants requiring care; the practice of self-sustainable farming is beneficial to both the university and its surrounding area. As a graduate student in the Masters of Regulatory Science program, this type of education immediately helps springboard an entire neighboring population considered a "Food Desert" into a city that can provide for its citizens. The goals and objectives of sustainable agriculture are to: (1) to take better advantage of on-farm resources, (2) employ natural and biological controls for pests and disease, (3) sustain the economic viability of farming, and (4) enhance the quality of life of farmers and society as a whole. Hence, promoting this practice on our UAPB farm would include growing not only the animals and selling them when they come to market size/past their time of usefulness; but also, the growing of enough vegetables to feed all of these animals based on specific species nutritional value needs. In addition, allowable to conduct several tests (fecal, body scoring, and blood analysis) on each animal to determine its overall growth and health condition before and after the addition of fresh produce given as a food choice.

R. Mutethia*, Y. Jia, and S. Ponniah, Dept of Agriculture, University of Arkansas at Pine Bluff, Dale Bumpers Rice Research Center, Arkansas

Overexpression of the Candidate Pita2 in Rice (*Oryza sativa* L. ssp. *japonica* cv. Nipponbare) for Resistance Against Blast Fungus (*Magnaporthe oryzae*)

Blast disease is caused by filamentous fungus *Magnaporthe oryzae*. It's responsible for a 30% reduction in rice production globally annually. Once the rice is attacked by this fungus receptors on the cell surface recognize the pathogen-associated molecular pattern, and it produces PAMP-triggered immunity. This is weak; hence fungus produces effectors to break resistance response. Plant recognizes effector protein from fungus and in response, it produces Effector Triggered Immunity. This is a highly specialized disease resistance mechanism against blast fungus, and it's mediated by resistance R genes. R genes include Pita2, Pita, and Ptr, all conferring resistance to blast disease; but Pita2 confers broader spectrum resistance. This study overexpresses the candidate Pita2 gene in rice (Nipponbare variety) for resistance against blast fungus and prove the resistance of rice to *Magnaporthe oryzae* confirms Pita2 gene is resistant to blast fungus. Callus was developed and infected them with *Agrobacterium* containing Pita2 gene and used selection media containing 50mg/ml hygromycin selecting transformed calli and 400mg/ml timentin to kill overgrown *Agrobacterium*. A total of 172 hygromycin-resistant calli were obtained from 292 infected calli. Transformation efficiency rate was 6.16%, using Pita2 specific primers and hygromycin primers. Enabling to confirm the presence of Pita2 genes in transgenic plants. The team sequenced the DNA of transgenic plants and confirmed the Pita2 gene was present. Our future work is to develop T1 plants and confirm the presence of the Pita2 gene using Pita2 specific primers and through DNA sequencing.

D. Khanal*, B. Joshi, M. Esguerra, P. Counce, V. Srivastava, S. Ponniah, Dept of Agriculture, University of Arkansas at Pine Bluff, Pine Bluff, Crop, Soil and Environmental Sciences, University of Arkansas
Evaluating the Impacts of High Night Temperature on Rice Grain

Rice grown in high night temperature produces chalky grains (opaque portion in the white translucent rice endosperm). The chalky rice shows altered cooking quality, and poor milling yield, eventually negatively impacting its market value. The study aims to understand the mechanism of chalkiness induced by high night temperatures in rice grains. In this study, twelve locally grown rice varieties in Arkansas with variations in chalkiness were germinated in a greenhouse up to the R2 stage (collar-leaf formation on flag leaf) and then in a growth chamber with normal or high night temperature conditions until the harvesting stage. The temperature for high night temperature conditions was 30°C between 7:30 PM and 8:00 PM and 28°C between 8:00 PM and 6:00 AM. In the case of the normal condition, the temperature was 27°C between 7:30 to 8:00 PM and 23°C between 8:00 PM to 6:00 AM. Two plants per variety were tested with two independent replications for the normal and high night temperature conditions at Rice Research and Extension Center (RREC) in Stuttgart, Arkansas. The experiment was replicated at the University of Arkansas at Pine Bluff, Arkansas. The yield parameters, such as the total number of filled and unfilled grains per plant, number of branches per panicle, number of panicles per plant, hundred-grain weight, and panicle length, were recorded. In terms of the total number of filled grains per plant, the variety CLL15 showed the lowest yield (30 grains per plant) under high night temperature conditions, while the variety Lynx showed the highest yield (195 grains per plant) under high night temperature conditions. The rice grains from each treatment will be scanned using WinSEEDLETM to measure the chalk area. The data analysis is in progress and will be presented in the poster.

M. Rahaman*, S. Islam, U. Deb, Dept of Agriculture, University of Arkansas at Pine Bluff
Antioxidant, Phenolic, and β -Carotene Contents in Sweetpotato (*Ipomoea batatas* (L.) Lam) Leaves

Sweetpotato (*Ipomoea batatas* (L.) Lam) leaves offer many health benefits and contain valuable compounds such as carotenoids and phenolic compounds with pharmaceutical values. This study established the antioxidant, phenolic compound, and β -carotene content from leaves of 14 sweetpotato genotypes grown in the UAPB research field in Pine Bluff, Arkansas. The total antioxidants were assessed using ABTS methods, total phenols were defined through Folin-Ciocalteu methods, and β -carotene content was quantified through high-performance liquid chromatography (HPLC). The results showed that the leaves of sweetpotato genotypes significantly varied in total antioxidants, phenols, and β -carotene content. We noted that SP-39 contains the highest (124646.70 $\mu\text{g/g}$ dry weight) and SP-45 has the lowest quantity of phenols (62973.33 $\mu\text{g/g}$ dry weight) among all the genotypes studied. Among the varieties, SP-9 has the maximum amount of antioxidant capacity (3550.0 $\mu\text{g/g}$ dry weight), and SP-45 has the lowest amount of antioxidants (1888.10 $\mu\text{g/g}$ dry weight) among all the genotypes tested. The genotypes SP-18 has the highest (514.69 $\mu\text{g/g}$ dry weight) content of β -carotene, and SP-36 has the lowest (56.97 $\mu\text{g/g}$ dry weight) content. The results were statistically significant at a 5% level. Therefore, sweetpotato leaves are a good source of antioxidants, phenolic compounds, and β -carotene, significantly impacting human health.

Agricultural Sciences

M. White*, J. Hampton, C. Mathis, Jr., D. White, and B. McGowan, Dept of Agriculture, Fisheries, and Human Sciences, University of Arkansas at Pine Bluff The AgDiscovery 2022, Preparing the Next Generation of Animal Plant Health Inspection Services (APHIS) Professionals

The United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) partners with 21 colleges and universities nationwide to deliver their two-weeks AgDiscovery Summer Enrichment programs. Many of the Federal Government's plant scientists, veterinarians, biotechnologists, and wildlife biologists work at APHIS, travel to campuses to do a in-person or virtual presentation pertaining to their area of expertise's. The University of Arkansas at Pine (UAPB), AgDiscovery Summer Enrichment program was a combination that incorporated animal, plant, soils, and agribusiness disciplines. The goal of our 2022, program at UAPB was "to provide instruction and hands-on experience in APHIS program areas provided through laboratory experiments, workshops, presentations, and field trips." This year, all nineteen (19) of our selectees participated in our in-person program on campus. The program was very successful, with a group of students, coming from nine (9) states: (AR, TX, OK, MS, GA, KS, HI, KY, and VA). There was a healthy diversity of backgrounds and stories shared among the group of students and counselors at this year's program "ice breaker" meeting. Students and counselors were given the opportunity to introduce themselves and share any information they chose, including background, ethnic background, favorite foods and activities, future goals, and many other things. This year's group of students began to bond within hours of meeting each other. Thus, we were fortunate to have such an attentive, thoughtful, and respectful group of students, who were eager to learn about agriculture, and so this year's program was a huge success.

A. Chaudhary*, K. Bohara, G Sriramoju, and G. Ramena. Dept of Aquaculture and Fisheries, University of Arkansas at Pine Bluff
Catfish Clca5.2 mRNA Secreted into Mucus Along With p53

The stringent regulations on antibiotics call for new solutions to treat bacterial infections. Mucus is the first line of defense that fights pathogens in fish. Mucus consists of humoral factors that include metalloproteases that act as antibacterial peptides. CLCA genes are well conserved across species, including fish. We have identified catfish EST similar to zCLCA5.2 isoform, a putative soluble protein secreted in the fish mucus. CLCAs are known to be stress-inducible genes in other species and are shown to induce cytokines in the *Staphylococcus aureus* disease model. The CLCA protein family is intimately tied to mucus secretion and goblet cells. P53 is known to bind the CLCA promoter and induce its expression in response to stress. This study investigates the channel catfish CLCA regulation after *Aeromonas hydrophila* infection in a time-dependent manner. Interestingly, we find that cCLCA 5.2 and P53, and P21 mRNA are packaged in mucus secretions. The CLCA expression is significantly higher in gills and mucus at 8 and 12 hrs, directly correlated with P53 and P21. Also, we found that the expression of all three genes increased in the head kidney compared to the tail kidney suggesting a role in an immune response. Overall, we speculate that cCLCA5.2 in the mucus is a potential antibacterial peptide that can inhibit bacterial pathogenesis.

Aquaculture and Fisheries

S. Bhattarati*, D. Perera, Dept of Aquaculture and Fisheries, University of Arkansas at Pine Bluff
Isolation and In-Vitro Culture of Primary Cell Population Derived From White and Black Crappie Ovarian Tissue

Developing methodologies for the isolation and in vitro culture of ovarian cells would be a significant breakthrough for germ cell transplantation in fish. Investigations were conducted to develop a protocol for isolating and in vitro culture of ovary-derived cells from Black Crappie (*Pomoxis nigromaculatus*) and White Crappie (*P. annularis*). Ovarian tissues were obtained from one-year-old Black and White Crappies. Five different digestive enzymes: 500U/mL Collagenase type I, 500U/mL Collagenase type IV, 0.05% Trypsin-EDTA, 0.25% Trypsin-EDTA (Gibco), and TrypLETM Express were evaluated for live cell isolation from ovarian tissue. In addition, four incubation temperatures (15, 20, 25, and 30 °C) were evaluated to determine optimal culture temperature for these ovarian cells. The number of live cells obtained from the 0.25% Trypsin-EDTA and TrypLETM Express treatments were significantly higher than other treatments. Cell growth and division was seen at all incubation temperatures. Cells isolated using 0.25% Trypsin and TrypLE TM reached 80-90% confluency in 12.5 cm² cell culture flask within five days of inoculation in 20, 25, and 30 °C incubation regimes. Cells were sub-cultured up to passage 2. Based on these findings, we conclude that 0.25% Trypsin and TrypLETM enzymes are optimal for cell disassociation and isolation, while an incubation temperature of 20-25 °C is favorable for primary cell culture.

U. Deb*, F. Abdal, Dept of Aquaculture and Fisheries, University of Arkansas at Pine Bluff
Comparative Advantage and Competitiveness of the United States in Fish and Fishery Products Trade 2000-2021

The United States is the world's largest importer and a major exporter of fish and fishery products (fish and crustaceans, mollusks, and other aquatic invertebrates). In 2021, the country imported fish and fishery products worth \$26.7 billion, accounting for 15 percent of the global import value. On the other hand, it exported fish and fishery products amounting to \$ 4.7 billion in 2021. In 2021, the top ten export destinations were Canada, European Union, China, Japan, South Korea, Hong Kong, Thailand, Mexico, Vietnam, and the United Kingdom. This study analyzes the trends in export-import and estimates the United States' comparative advantage and competitiveness in fish and fisheries products trade to 10 major export destinations from 2000 to 2021. It has used the revealed symmetric comparative advantage (RSCA) index to quantify the United States' comparative advantage in exporting fish and fishery products and the Vollrath index to measure the revealed competitiveness of the country's fish and fishery products trade. We collected relevant data at Harmonized System (HS) four-digit level from the UN Commodity Trade (UN Comtrade) database. Detailed analyses were conducted for eight fish and fishery products: live fish (HS 0301), fresh or chilled fish (HS 0302), frozen fish (HS 0303), fish fillet and other fish meat (HS 0304), dried/salted/in-brine and smoked fish (HS 0305), crustaceans (HS 0306), mollusks (HS 0307), and other aquatic invertebrates (HS 0308). The study has also quantified the impacts of the COVID-19 pandemic on the United States' trade (export-import) of these products. Finally, the study has articulated the research results' implications for further promoting fish and fishery product export from the United States.

Aquaculture and Fisheries

A. Fields*, S. Lochmann, Dept of Aquaculture and Fisheries, University of Arkansas at Pine Bluff **Examining Barriers to Outdoor Recreation, Hunting, and Recreational Fishing Participation of Minority Populations**

Traditionally, recreational fishing and outdoor activities have been dominated by white males. Recent declines in the participation rate of licensed freshwater anglers and outdoor recreation have underscored the importance of understanding changing demographics in the United States and how that change affects fishing participation. Ethnic minorities and other marginalized groups perceived more constraints to outdoor recreation than their counterparts. Moreover, African Americans were more constrained from outdoor recreation than others due to inadequate transport, personal safety, inadequate facilities, poor maintenance, pollution, outdoor pests, inadequate information, feeling unwelcome, language barriers, and fear of natural settings. African Americans represented only 9.4% of outdoor recreation participants, which is lower than any other group. This lack of participation is an indicator of a likely future gap in outdoor participants. We partnered with the Arkansas Game and Fish Commission to conduct Trout Fishing Clinics to evaluate whether you get a better outcome when managers are cognizant of the composition of the audience and the facilitator. Does the race of the facilitator matter when recruiting and retaining minority populations in natural resource programming? This information can be used to build partnerships between natural resource agencies and minority populations.

S. Gudapati*, D. Donovan, M. Smeltzer, D. Nelson, and G. Ramena, Dept of Aquaculture and Fisheries, University of Arkansas at Pine Bluff, Dept of Biology, Morgan State University, Dept of Microbiology and Immunology, Dept of Orthopedic Surgery, University of Arkansas for Medical Sciences, Dept of Veterinary Medicine, University of Maryland **Peptidoglycan Hydrolases to Treat *Staphylococcus aureus* Infections**

Staphylococcus aureus is a gram-positive bacterial pathogen that causes various infections. Treating those infections is increasingly compromised due to the persistent emergence of multidrug-resistant strains, including methicillin-resistant *S. aureus* (MRSA). Osteomyelitis is one of the infections caused by *S. aureus*. It is an inflammatory disease that leads to progressive bone destruction in humans. Approximately 40% of osteomyelitis treatments fail due to the increased resistance of *S. aureus* against antibiotics. This raises a global challenge for alternative therapeutic strategies that can be used alone or in combination with conventional antibiotics to treat the disease. One such alternative is bacteriophage therapy, which has shown promise on an individual case basis but remains limited by the strain specificity of phage infection. Phage endolysins are cell wall degrading peptidoglycan hydrolases (PGHs), enzyme antimicrobials that digest peptidoglycan, the major structural component of the bacterial cell wall. We identified two PGHs that can potentially treat *S. aureus* infections. We used the pET21a (+) vector to express PGH-6x His tag in BL21 (DE3) *E. coli*, purified the proteins and tested against *S. aureus* clinical strains. Our preliminary data suggests new potential alternatives to antibiotics to treat osteomyelitis. pathogenesis.

J. Filbrun*, L. P. Pruitt, Dept of Biology, Southern Arkansas University **Testing the Effects of *Daphnia lumholtzi* Predator Experience on Capture Success by Fish**

Most fishes are zooplanktivorous during early life. Thus, disturbances to zooplankton food webs may alter fish community dynamics, including populations of desirable sport fishes. *Daphnia lumholtzi* were unintentionally introduced to Texas reservoirs during the 1980s through a series of African sport fish stockings. *D. lumholtzi* rapidly spread east and northward and now persist in reservoirs and lakes throughout the eastern U.S., from Florida to the Great Lakes. This species shows remarkable plasticity in relative lengths of carapace spines that may be induced by exposure to predator kairomones. However, it is unclear if *D. lumholtzi* developing in a "fearful" kairomone-rich environment have a survival advantage over naïve clones. To answer this question, we conducted two experiments using the same laboratory clonal population of *D. lumholtzi* generated from one wild mother collected in Lake Columbia, Arkansas. In the first experiment, we simply tested if environmental exposure to a predator affected spine lengths of clones. We found that clones reared in the presence of a predator (guppy, *Poecilia reticulata*) had dramatically larger helmet and tail spines within two weeks (2–3 generations; independent samples t-tests, $P < 0.05$). In the second experiment, we reared clones with and without guppies present to generate predator-experienced and naïve populations. We then compared the number of guppy strikes on *D. lumholtzi*, successful captures, and prey rejections during 10 min video recordings. We are currently scoring the guppy behaviors in videos and will finish in time to present these findings. Presumably, wild populations of *D. lumholtzi* live in environments rich with fear-inducing chemical cues. These experiments help elucidate the effects of *D. lumholtzi* on fishes in Arkansas reservoirs. Moreover, they provide excellent insights into the ecological consequences of inducible defenses by prey.

H. Knuckles*, D. Perera, J. Jones, S. Bhattarai, Dept of Aquaculture and Fisheries, University of Arkansas at Pine Bluff **Short-Term Feeding of Commercially Available High Protein and Lipid Diets Pre-Spawning at Goldfish (*Carassius auratus*) Farms as a Method to Improve Fecundity and Spawn**

Goldfish (*Carassius auratus*) is an Asian cyprinid commonly used as bait and ornamental fish in the United States. Most of the Goldfish produced as bait comes from the state of Arkansas. Spawning and production at commercial farms occur in the summer, and the fish are spawned four to five times, three weeks apart. Traditionally brood diets have not been used to improve fecundity and spawn in baitfish, and a standard 27% - 28% protein catfish diets have been used. In 2019 in collaboration with a commercial producer, we started experimenting with commercially available 32% and 36% protein diets to improve Goldfish's fecundity. Pilot studies in 2019 and farm studies in 2020 and 2021 indicated an improvement in fecundity in Goldfish when fed high protein, high lipid diets for 1-3 weeks prior to spawning. In 2022 goldfish brooders were fed a 28% protein 6% lipid diet followed by a 32% protein, 10% lipid treatment diet for one week prior to raceway spawning. The control group received the standard 28% protein and 6% lipid diet throughout the spawning season. After spawning, egg counts were obtained for the control and treatment groups to determine spawning success. So far, results have indicated that a 32% protein, 10% lipid diet fed for one week before spawning results in higher fecundity and spawning success. These findings can significantly benefit commercial Goldfish farmers and help increase and improve the production of Goldfish as baitfish in Arkansas.

Aquaculture and Fisheries

**A. Segree*, D. Donovan, J. Abernathy, C. Shoemaker,
G. Ramena, Dept of Aquaculture and Fisheries
University of Arkansas at Pine Bluff, Dept of Biology,
Morgan State University, United States Department of
Agriculture, Auburn, AL**

Peptidoglycan Hydrolases as Alternatives to Antibiotics to Treat Streptococcosis

Infectious diseases are the chief cause of production loss in aquaculture and have severely limited the growth and sustainability of this industry. While antibiotics are effective against many bacterial infections of fish, there are fears that their use in aquaculture may cause serious environmental and human health problems. Furthermore, the use of antibiotics in aquaculture has led to resistance in targeted pathogens, which could reduce their effectiveness. These potential complications have led to an intensive effort to develop safer alternatives to traditional antibiotics. Gram-positive streptococci are costly pathogens to the aquaculture industry. *Streptococcus iniae* is an emerging pathogen of wild and cultured fish, with ~30 species of fish susceptible to this pathogen. The worldwide economic impact of streptococcosis on the global aquaculture industry is hundreds of millions of dollars annually. Although antibiotic treatment is effective, multi-drug resistant strains may lead to a potential for farm-to-clinic antibiotic-resistance transfer. There is a need for novel (non-antibiotic) antimicrobials refractory to resistance development. Phage endolysins are cell wall degrading peptidoglycan hydrolases (PGHs), enzyme antimicrobials that digest peptidoglycan, the major structural component of the bacterial cell wall. Using bioinformatic tools, we identified ten PGHs that can potentially prevent and/or eradicate systemic and topical *S. iniae* from fish. We used pET21a (+) vector to express PGH-6x His tag in BL21 (DE3) *E. coli*, purified the proteins, and tested against *S. iniae* strains. Our preliminary data suggests new potential alternatives to antibiotics to treat streptococcosis.

**A. Selmen*, N. Romano, and A. Sinha, Center of
Excellence in Aquaculture & Fisheries, University of
Arkansas at Pine Bluff**

Applications of Black Soldier Fly (*Hermetia illucens*) Larvae Frass on Growth and Mineral Composition in Basil (*Ocimum basilicum*)

Black soldier fly larvae (BSFL) sustainably convert various organic waste streams into high quality proteins and lipids that impart health benefits to animals. As the industry grows, this leave behind substantial amounts of 'frass', which is the excrement of BSFL. This frass is rich in essential minerals, but the composition depends on the initial food provided. In this study, BSFL frass produced from high nitrogen (spoiled fish feeds) or low nitrogen (fruits/vegetables) sources were used as a soil amendment on basil (in triplicate). After 5 weeks the growth and mineral composition of the basil were measured in the frass treatments in the control receiving weekly applications of a synthetic fertilizer. Basil growth was similar after 3 weeks, but by week 5 the height of basil became significantly less in the high N frass compared to the control. Stem diameter and total biomass was significantly lowest in the low N frass and high N frass treatments. Findings indicate a deficiency in mineral(s). Indeed, the basil leaves were significantly lower in manganese, calcium, zinc and iron in either frass treatments, but magnesium was significantly higher in the frass treatments compared to the control. Results indicates more frequent applications of the BSFL frass are likely necessary, that the low N frass enhanced overall basil production compared to the high N frass. This growth difference was not linked with any of the measured minerals and indicates another factor(s) contributed. Research should expand on ways to enhance efficacy of BSFL frass as a soil amendment.

Biodiversity and Education

**Y. Ramena, A. Sharma*, K. Bohora, G. Ramena Dept of
Aquaculture and Fisheries University of Arkansas at
Pine Bluff**

Effect of Probiotics and Immunostimulant Supplementation on Growth, Gut Microbiome, and Gene Expression of White Leg Shrimp

Shrimp culture is one of the world's fastest-growing aquaculture industries, producing 5 Metric tons per year. Shrimp culture is being intensified as a result of the rising global demand for shrimp. The primary factors contributing to the spread of infectious diseases resulting in severe economic losses are the host's susceptibility to diseases, unmanaged physicochemical parameters, and pathogen virulence. Probiotics and immunostimulants have recently received increased attention in the aqua sector for improving host immune responses. Immunostimulants are naturally occurring substances that alter the immune system by increasing the host's resistance to microorganism-caused infections. Probiotics are live microbial supplements that assist in maintaining the host's intestinal flora. The current study aimed to evaluate the health indicators, host adaptability, and gut health of *Litopenaeus vannamei* (white leg) post-larvae fed different probiotic and immunostimulant doses. *Litopenaeus vannamei* Post larvae (PL15) were stocked and co-fed with increasing doses of probiotics and immunostimulants, as well as a particle diet. There were seven treatments in total, with the control diet receiving the particle diet and the other dietary treatments obtaining the particle diet along with probiotics at 0.5, 1, and 2 ppm for treatments 2, 3, and 4, and immunostimulants at 0.5, 1 and 2 ppm for treatments 5, 6, and 7. Growth, gut histology, health, gut microbiome, and target genes that are responsible for host immune response were evaluated in this study. Post-larvae fed a probiotic supplement at 1 ppm and an immunostimulant at 2 ppm had a higher growth rate, absolute bacterial abundance, relative abundance, and greater alpha diversity. The *alf* and *peneidin* genes have been upregulated in the tanks that received a higher dosage of immunostimulant supplement."

**S. Rana*, K. Baker, L. Barnes, R. Kannan,
Haas Hall Academy, Citizen Science: Role of iNaturalist
in Biodiversity Documentation and Education in
Arkansas**

iNaturalist is a global online citizen science biodiversity database to help the public develop an interest and appreciation of living organisms. It is also a crowd-sourced species identification platform to record occurrences of organisms. Its mission is to build a global community of 100 million naturalists by 2030 in order to connect people to nature and advance biodiversity science and conservation. Here we provide an overview of the role played by this online social network in the mostly photographic documentation of biodiversity of Arkansas. We also highlight projects done by educational and research institutions to promote biodiversity awareness and appreciation, and to document biota of their campuses or taxonomic subjects of interest. We compare the number of verifiable or research grade observations in Arkansas with other states to highlight the scope for further improving this database to educate our citizenry and document our Natural State's biota.

Biological Sciences

**S. Trauth*, R. Neal, Dept of Biological Sciences,
Arkansas State University**

Histomorphology of the Distal Urogenital Ducts in the Male Northern Crawfish Frog, *Lithobates areolatus circulosus* (Anura: Ranidae)

We examined the microanatomy of the distal urogenital ducts in the male Northern Crawfish Frog (*Lithobates areolatus circulosus*) from a small sample (n = 5) collected in February and March from central Arkansas over a 5-year period (2017-2022). Specifically, we sought information on the following structures: 1) the paired Wolffian (urogenital) ducts caudally from the kidneys to their merging with the urodeum of the cloaca, 2) the paired seminal vesicles (sperm storage structures), and 3) the paired Müllerian ducts and glands. This study provides new information on these urogenital ducts and promotes a clearer understanding of this anatomical region for this North American ranid frog.

**J. Konvalina, S. Trauth*, Dept of Biological Sciences,
Arkansas State University**

No Sperm Morphometric Differences between Two Snapping Turtle Species

We examined sperm morphometrics between *Chelydra serpentina* and *Macrochelys temminckii*. When both species are combined, we found significant correlations between total sperm length and sperm head length as well as sperm tail length and sperm head length. In addition, we observed significant correlations between total sperm length and sperm tail length. T-tests revealed no significant differences in any of the sperm morphometrics between the two species. Both snapping turtle species had greater values for every sperm morphometric when compared to another freshwater turtle. The strong correlation between total sperm length and sperm tail length is concurrent with what has previously been found in other reptiles and terrestrial vertebrates.

Business Administration

**S. Trauth*, Dept of Biological Sciences, Arkansas State
University**

Spermiogenesis in the Western Lesser Siren, *Siren intermedia nettingi* (Caudata: Sirenidae)

I investigated spermiogenesis in the Western Lesser Siren, *Siren intermedia nettingi*, from salamanders collected periodically over a span of 21 yr (1994-2015) in northeastern Arkansas. My primary objective in this study is to present histologically and ultrastructurally, for the first time, the novel sequence of spermatological events of the spermiogenic process in this species. I describe the transformational stages from secondary spermatocytes to mature biflagellated spermatozoa, all of which occur within the lumen of testicular lobules. These new-to-science processes begin with nuclear displacement and expansion within secondary spermatocytes, which occur after their detachment from Sertoli cells lining the lobular germinal epithelium. Formation of a dextral twisting, pleated plasma membrane comprised of 8 linear folds extends the length of each developing spermatid and contributes to the eventual structure of 2 undulating membranes in each mature biflagellated spermatozoon. Spermiogenesis in sirens, therefore, reveals an entirely different sequence of events when comparing it to the release of mature spermatozoa from their attachments to Sertoli cells—the spermiation stage found in acystic tubular spermatogenesis in testes of higher vertebrates. Finally, these remarkable cellular stages do not conform to spermiogenesis in any other vertebrate species and are a part of an extraordinary assemblage of maturation stages associated with acystic lobular spermatogenesis found only in members of the family Sirenidae. This species, along with another genus (*Pseudobranchius*) within the sirenid family, are the only known vertebrates to possess this unique type of spermatogenesis.

**D. Alexander*, D. Govan, P. Wui, Dept of Business
Administration, University of Arkansas at Pine Bluff**
DEI in Corporate America

Many decades have passed since the implementation of affirmative action, however, there still seems to be a lack of diversity among the executive level positions in corporate America today. The purpose of affirmative action was to ensure that minorities would be given the same respect and eligibility without experiencing biases based on gender, race, sexual orientation, religion, other qualities. DEI is still needed to ensure that all are given a fair opportunity. From this research, I hope to give a sense of how cooperate professionals gauge the effectiveness of DEI in their work environment. I also hope to be able to give recommendations on how to ensure that DEI is respected and followed, not only in hiring processes, but also to ensure a workplace in which everyone that there is fair treatment in the workplace. Overtime, the policies of affirmation were challenged as a form of reverse discrimination and subsequently weakened by court decisions. More recently, the efforts of corporations to provide opportunities to employees of all backgrounds evolved into policies that advanced diversity, equity, and inclusion. The study will use several personal interviews to determine whether professionals have experienced DEI policies.

Business Administration

D. Gaines*, T. Farrier, P. Wui, Dept of Business Administration, University of Arkansas at Pine Bluff
What Kind of Challenges Does Startups and Small Business Face in the USA?

Many Americans desire to become business owners but have yet to start. Every business founder knows from the outset that there will be obstacles, whether they anticipate them or not. You may not always know how to respond or have the resources to address them adequately. For many years business owners within the United States have faced some of the same disadvantages when starting a business. Fund deficiency is a significant area for improvement within the entrepreneurship industry. Unless you're fortunate and financially stable, money will be an issue sooner rather than later. For a business to flourish, you must have the right people set in place for your business to thrive. Knowing the exact skills to possess and not having essential people on board might be detrimental to your startup's success. Like life, when starting a business, there will never be enough time. There are so many decisions that have to be taken into consideration within a day. Even though there's a need for more personal businesses in the US, it is still a crowded marketplace. New rivals join the playing field daily, making development difficult. Starting a small business is hard work in any environment, but it's even more challenging in a tough economy. Credit markets are tight, and it causes challenges for financial assistance. Overcoming these challenges will help you achieve success. I intend to educate upcoming business owners with disadvantages within the US to start a business.

R. Griffin*, J. Park, P. Wui, Dept of Business Administration, University of Arkansas at Pine Bluff
The Evolution of Money and its Progression through Time... (The Digital Era)!

This paper uses an evolutionary approach to explain the origin of money and focuses on the development of one currency's real and conceptual properties as a notion that facilitates what is to occur in money's next, transformative role. In ancient times, economists noted the function of money as a medium of exchange to enhance stability and credibility as a value of importance. Determining the value of money reveals its complex nature. The significance of money allows people and businesses to obtain what they need to live and thrive. In recent times, money became technologized as the new era emerged. The digital era forces our profession to rethink the basic phenomenology of money. Technology advanced in a way that currencies throughout the world became more fluid and accessible to those who use them. Digitization emphasizes the irrelevant purpose of money as a standard of value, which increases its function as a medium of exchange. The evolutionary model will propose cryptocurrencies as a skill used to simplify the transport and exchange of money between the physical and digital worlds. After concentrated research, the impact on the progression of money continues as a form of connectedness.

S. Lockett*, Dept of Business Administration, University of Arkansas at Pine Bluff
The Lack of Diversity and Inclusion in Management in the Hospitality and Tourism Industry

The hospitality and tourism industry is one of the fastest-growing industries in the world. It was expected to reach over 300 million jobs in 2022. The hospitality and tourism industry is a diverse field that employs millions worldwide and generates billions of dollars in revenue. Regardless of the industry's size, there needs to be more diversity and inclusion in management. The inclusion of diversity in this industry is essential because hospitality and tourism is a global industry with diverse customers. The people who serve in the industry must be able to match the customer clientele. The number of women and minorities on the hotel industry's front line comprises 60% and 40% of the employees, while only 10% of the General Managers are minorities. This paper seeks the reasons for the lack of diversity in hospitality and tourism and discovers a constructive strategy for diversity. The lack of training or education, the lack of mentors for minorities, and the glass ceiling are the main reasons for the lack of diversity in management in the Hospitality and Tourism industry. To assist with this issue of the lack of diversity, the sector can schedule interviews at Historically Black Colleges and Universities to hire minority students. There is also the opportunity for on-the-job training and incentives for employees to return to school for a degree. The internship positions can lead to mentors for the employees.

K. Robinson*, Dept of Business Administration, Arkansas at Pine Bluff
Sports Analytics

Sports analytics have changed the game of sports enormously. We now can analyze the game faster from whether plays are working in crunch time, risky movements that could possibly cause injury or how coaching/ staff and team dynamics can affect overall play. This report goes into detail how sports analytics has impacted and changed how teams are being developed into what should be superstar programs. The question is whether analytics is proving to be a successful tool in choosing the perfect team or can it have inconsistencies.

Business Administration

**N. Seahorn*, Dept of Business Administration,
University of Arkansas at Pine Bluff**

Best Practices to Maintain a Photography Business

The photography business has grown extensively over the last few years. The increase in use of social media, blogs and other digital platforms have prompted this growth as more people are interested to document and share their lives with others. Some individuals take their own pictures but many prefer to use professional photographers to ensure the most memorable moments in their lives are captured in the best scenes using palettes and compositions that are viewed and shared across digital platforms because of their artistic beauty even if the people included in the photographs are not known to the viewer. Given this preference for "instagram-worthy" photographs, countless numbers of photographers, from self-employed part-time consultants to full-fledged photography businesses, have made a broad spectrum of photography services available to anyone seeking professional images. This paper investigates best practices used by professional photographers. Digital photography, currently the most popular type, is the primary medium of interest. Two sets of information, a literature review and a set of survey responses collected from a sample of professional photographers, are analyzed to provide a set of current practical recommendations to maintain a wedding photography business.

**C. Smith*, Dept of Business Administration, University
of Arkansas at Pine Bluff**

Regulations and Compliance within Casino Gaming Industry

Regulations and compliance within the casino gaming industry play a critical role in ensuring the integrity and transparency of the industry. With the growing popularity of casino gaming, regulations have become increasingly stringent, covering areas such as anti-money laundering, data protection, and responsible gambling. Compliance with these regulations is crucial for casino operators to maintain their license, avoid penalties, and maintain their reputation. The cost of compliance can be substantial, including the cost of implementing and maintaining compliance programs and the cost of potential penalties for non-compliance. Despite the challenges and costs, compliance is essential to ensure that the casino industry operates in a fair and responsible manner and protects the interests of consumers. In conclusion, regulations and compliance within the casino gaming industry are critical components of a well-functioning and responsible industry.

**A. Wesley*, Dept of Business Administration, University
of Arkansas at Pine Bluff**

The Importance of Diversity and Inclusion within Sports Management

The aim of this thesis is to bring awareness and speak about the importance of diversity and inclusion and gender pay scale in sports management. The main focus of this report will be to inform you of the history of diversity and inclusion in sports management and to speak about three major professional leagues which will include Major League Baseball (MLB), National Basketball Association (NBA) and National Football League. Although all three of these professional leagues are played by minorities, the person making these decisions are to be stereotyped as an older white male. Not only has the middle-aged white man been categorized to make these important decisions for these young men, but they are also not giving their female coworkers the same respect to make these decisions and part of that is shown in the amount of money that is being paid to these hard working women. Based on statistics less than 50% of women work in management level roles in all three professional leagues. In results of these issues there is a need for change in diversity and gender equality in management roles and pay scale for professional leagues like the MLB, NBA, and the NFL.

**P. Wui*, Z. Che, Dept of Business Administration,
Arkansas at Pine Bluff**

Evaluating the Consumption Impacts of Legalized Marijuana

In 1996 the state of California legalized medical marijuana for the first time in the USA. Since then, 21 states and Washington D.C. have legalized marijuana for adult recreational use, and 37 states and Washington D.C. have legalized marijuana for medical use. Legal sales increased to \$25 billion in 2021 and are still expected to grow. On this point, the authors measure the impact of consumption of legalized marijuana in the USA using the National Survey on Drug Use and Health (NSDUH) annual survey data from 2014 through 2020. The panel data was analyzed using a fixed-effect OLS regression. The three stages of legalization were tested with estimated coefficients of the two dummy legalization variables. Over time, marijuana consumption increased by 0.7% per year under marijuana regulation. Consumption under marijuana medical legalization is not significantly different from regulation. However, marijuana recreational legalization shifted the consumption up to 1.7% per year above the consumption under regulation.

Cell/Molecular Biology

**D. Eom*, M. Frazier, K. Naylor, Dept of Biology,
University of Central Arkansas**

Overexpressing and Knocking Down the FtsZ Homolog, FszA, to Determine its Effect on ROS (Reactive Oxygen Species) in Dictyostelium discoideum

Mitochondria carry out many functions in the cell, including ATP production, calcium homeostasis, apoptosis regulation, and ROS (reactive oxygen species) maintenance. Mitochondrial function is dependent upon morphology, which in turn is dependent on mitochondrial dynamics. Dictyostelium discoideum is a social amoeba with two FtsZ proteins that are predicted to regulate mitochondrial dynamics. For this study, we are altering the expression of one of the FtsZ proteins, FszA, and want to determine if there is any effect on one specific mitochondrial function, the regulation of ROS. ROS is produced during oxidation phosphorylation, so we anticipate that the dysregulation of mitochondrial dynamics of D. discoideum, which alters mitochondrial function, should change the levels of ROS compared to wild-type D. discoideum. We have overexpressed a GFP-tagged FszA and are currently creating a strain to knock down FszA expression. Contrary to our hypothesis, ROS levels in wild-type cells are similar to ROS levels in cells overexpressing FszA ($p=0.7250$). We plan to measure ROS in cells overexpressing the second FtsZ, FszB, and will continue creating the knockdown strain of FszA. With these strains in hand, we will also determine the effect of altered FszA expression on mitochondrial structure and dynamics.

Chemistry

**K. Kervin*, S. Pratihari, Chemistry Dept, Arkansas Tech
University**

A comparative study of specific enthalpy of aromatic hydrocarbons with simple carbohydrates

In 1996 the state of California legalized medical marijuana for the first time in the USA. Since then, 21 states and Washington D.C. have legalized marijuana for adult recreational use, and 37 states and Washington D.C. have legalized marijuana for medical use. Legal sales increased to \$25 billion in 2021 and are still expected to grow. On this point, the authors measure the impact of consumption of legalized marijuana in the USA using the National Survey on Drug Use and Health (NSDUH) annual survey data from 2014 through 2020. The panel data was analyzed using a fixed-effect OLS regression. The three stages of legalization were tested with estimated coefficients of the two dummy legalization variables. Over time, marijuana consumption increased by 0.7% per year under marijuana regulation. Consumption under marijuana medical legalization is not significantly different from regulation. However, marijuana recreational legalization shifted the consumption up to 1.7% per year above the consumption under regulation.

Geology and Geography

**D. Mayo*, J. McLain, C. Iwaki, Dept of Physical
Science, University of Arkansas at Fort Smith**
Circular statistics of joint orientations in the Middle-Pennsylvanian McAlester Formation, Fort Smith, Arkansas

Joints are ubiquitous fractures in the deformed rocks of orogenic foreland fold-and-thrust belts. Documentation of joint orientations is important for several reasons. 1) Joints serve as paleostress indicators. 2) Joints conduct subsurface fluids such as groundwater, geothermal waters, and hydrocarbons and make reservoir permeability strongly directional. 3) Joints serve as zones of weakness that must be accounted for in civil engineering projects. In this study, we present our initial statistical analysis of 361 joint orientations measured in sandstone members of the Middle Pennsylvanian McAlester Formation in the vicinity of Fort Smith, Arkansas, located in the fold-and-thrust belt of the Ouachita Orogeny. Observations were made at seven different outcrops. Common practice is to display joint orientations on rose diagrams, but choice of bin size and location of bin boundaries on these diagrams can lead to very different visual representations of the same distribution. For this study, we used circular packages in R for statistical analysis of joint distributions, and in place of rose diagrams, we display data on a combination of dot diagrams and linear histograms overlain by nonparametric density estimates. The distribution of joints in the Fort Smith area is distinctly bimodal. The dominant Modal Group 1 has a mean azimuth of $167^\circ \pm 1^\circ$ ($n = 303$, 95% CI) and is oriented approximately parallel to compression associated with the Ouachita Orogeny. The mean azimuth of Modal Group 2 is $082^\circ \pm 6^\circ$ ($n = 58$, 95% CI), approximately orthogonal to Group 1 and parallel to the Ouachita fold-and-thrust belt.

Health Sciences

**R. Yadav*¹, N. Fitzkee², 1. Dept of Physical Sciences,
University of Arkansas-Fort Smith; 2. Dept of
Chemistry, Mississippi State University**
Understanding Protein Adsorption to Biotic and Abiotic Surfaces: Implications for Bacterial Adhesion and Biofilm Formation

Bacterial biofilms on medical devices and implants pose a serious health challenge, and the adsorption of bacterial surface proteins onto the biotic/abiotic surfaces is an important initial step toward bacterial colonization and biofilm development. The biophysical and structural study of protein adsorption to surfaces is often challenging due to technical limitations, however, nanoparticles have been successfully used to study protein-surface adsorption. Here we have employed biophysical and structural methods to study and characterize Staphylococcus epidermidis surface protein autolysin (amidase and R2ab domains) adsorption to the nanoparticle-based biotic (serum-coated) and abiotic surfaces. Autolysin functions in bacterial cell wall homeostasis and is known to play a direct role in biofilm formation. Our data indicate a higher propensity of Autolysin amidase toward biotic surfaces, in contrast, Autolysin R2ab shows more propensity toward abiotic surfaces. Moreover, Isothermal titration calorimetry data indicate interaction is enthalpy driven for both proteins. Further, paramagnetic relaxation enhancement experiments were used to identify the residues involved in surface adsorption, which indicates the surface adsorption site on amidase protein away from the active site. Finally, the biofilm growth assay shows reduced biofilm on amidase and R2ab-precoated bare and serum-coated surfaces. Taken together, our results shed light on the thermodynamic aspect of protein-surface adsorption and introduce new tools to study this interaction.

Human Sciences

S. Hampton*, D. Culp-Alexander, H. Shavers, K. Harris, Dept of Human Sciences, University of Arkansas at Pine Bluff

Learning Strategies in Science Education: A Gardening Approach

Science is advancing in our society. Science supports innovation, worldwide competitiveness, and human advancement. Therefore, exposing Pre-k children early to science, technology, engineering, and mathematics (STEM) is critical for the future of STEM fields. School garden projects have gained popularity in recent years. These programs benefit not only the students but also the environment. Research has shown that school gardens can enhance students' attitudes toward eating vegetables and fruits, gaining more knowledge about the environment, eating healthy, knowing where their foods come from, and gardening in general. This study engages students in science learning, where Pre-k students had the opportunity to ask questions, make predictions, try new things, draw conclusions, and report their findings. This study will impact how gardening is practiced and how curricula approaches are designed and used in STEM fields. Additionally, it can help advance Pre-k school children learning and help them engage in science indoors and outdoors.

R. Will*, K. Harris, Dept of Human Sciences, University of Arkansas at Pine Bluff
Complications of Childhood Obesity

The purpose of this study was to examine childhood obesity and its effects. Childhood obesity has increased worldwide and is a major public health concern. Obesity affects the cost of the health care system, and being obese in childhood can cause an increase in morbidity in adult life. It also contributes to childhood consequences that lead to insulin resistance, type 2 diabetes, dyslipidemia, polycystic ovarian syndrome, pulmonary and orthopedic disorders, and psychological problems. Researchers have shown that in the United States, Hispanic as well as non-Hispanic Black children are more affected by obesity disease than any other group. Also, a child with a high Body Mass Index (BMI) has a high risk of being overweight or obese at 35 years of life, and the risk will increase with age, and being obese is connected to more deaths than being underweight. Therefore, it is vital that childhood obesity is detected early and interventions and measures are provided to prevent and treat obesity for the health of future generations because it is a very critical disease.

Mathematics & Statistics

C. Brackens*, Dept of Mathematics and Computer Science, University of Arkansas at Pine Bluff
Visualizing Multivariable Calculus in Julia

Because multivariable calculus uses several variables, it may be difficult to visualize and conceptualize the topics discussed. Using Julia as a computational and visual aid will help more students be successful in their academic endeavors. Julia is a free to use, easy to learn, programming language. Julia is even more beneficial to use because it is open source, which means mathematicians and coders from all around can contribute. We aim to show that Julia can easily and efficiently be used to solve multivariable calculus problems.

E. Elamami*, Dept of Mathematics and Computer Sciences, Southern Arkansas University
An Augmented Approach for Solving 3D Elliptic Interface Problems

A fast, second-order accurate iterative method is proposed for the elliptic interface problems in a cubic domain in 3D using Cartesian grids for three dimensional elliptic interface problems in which the coefficients, the source term, the solution and its normal flux may be discontinuous (may have jumps) across an irregular interface. The idea in our approach is to precondition the differential equation before applying the immersed interface IIM method proposed by LeVeque and Li [SIAM J. Numer. Anal., 31(1994), pp. 1019-1044]. In order to take advantage of fast Poisson solvers on a cubic domain, an intermediate unknown function of co-dimension two, the jump in the normal derivative across the interface, is introduced. Our discretization is equivalent to using a second-order difference scheme for a corresponding Poisson equation in the domain, and a second-order discretization for a Neumann-like interface condition. Thus second-order accuracy is guaranteed. Weighted least square method is also proposed to approximate interface quantities from a grid function. Numerical experiments are provided and analyzed in this paper.

Mathematics & Statistics

**L. Maitre*, A. Harris, Dept of Mathematics and
Computer Science, University of Arkansas at Pine Bluff**
Julia Programming as part of Education

In this presentation, I will share what Julia programming is, how I used it in my Calculus II class, and why I used Julia programming. Using Julia coding helped me to understand the concepts and retain the knowledge. I will also share some Julia coding examples about infinite series.

**J. O'Grady*, Dept of Mathematics and Computer
Sciences, Southern Arkansas University**
**Determining the Relationship Between Student-
Teacher Ratio and Retention Rates**

Demonstrating Paired T hypothesis testing on an extensive data set of college student-teacher ratios and retention rates. It was possible to prove both data sets' standard distribution and the lack of correlation between pairs.

**I. Raykov*, Dept of Mathematics and Computer
Science, University of Arkansas at Pine Bluff**
**Numerical Algorithms for Types of Global
Minimization Problems**

We use the specificity of the functions to create simplified algorithms by eliminating from consideration some local solutions and/or by reducing the numbers of the independent variables.

**J. Gray and S. Addison*, Dept of Physics & Astronomy,
University of Central Arkansas**
**The Rayleigh Problem (Random Flights) is Everywhere
Redux**

The phase noise problem or Rayleigh problem occurs in all aspects of radar. It is an effect that a radar engineer or physicist always has to take into account as part of a design or in attempt to characterize the physics of a problem such as reverberation. Normally, the mathematical difficulties of phase noise characterization are avoided by assuming the phase noise probability distribution function (PDF) is uniformly distributed, and the Central Limit Theorem (CLT) is invoked to argue that the superposition of relatively few random components obey the CLT and hence the superposition can be treated as a normal distribution. By formalizing the characterization of phase noise for an individual random variable, the summation of identically distributed random variables is the product of multiple characteristic functions (CF). The product of the CFs for phase noise has a CF that can be analyzed to understand the limitations CLT when applied to phase noise.

Physics & Engineering

**P. Chakraborty*, Dept of Engineering and Physics,
Southern Arkansas University**

Modification of Surface Topology to Enhance Convective Heat Transfer in Nanochannels

It is essential to develop effective strategies for cooling small-scale high-power-density devices. In this work, we conducted molecular dynamics simulations to demonstrate the potential of two approaches to enhance nanochannel cooling performance significantly. Firstly, we have shown that surface roughness can substantially increase the heat transfer between the wall and fluid in the nanochannels. Secondly, we have shown that a coating material having an intermediate vibrational frequency of the substrate and flowing fluid can act as a bridge for enhanced heat transfer in nanochannels. Our strategies should facilitate the investigation of the enhancement of nanochannel cooling performance to ensure the safe operation of small-scale devices.

**P. Chakraborty*, Dept of Engineering and Physics,
Southern Arkansas University**

Temperature Dependence of Coherent and Incoherent Phonon Transport: A Molecular Dynamics and Machine Learning-Based Study

There are conflicting observations regarding the temperature dependence of the thermal transport properties of periodic and aperiodic superlattice structures. In this work, we conducted molecular dynamics simulations on conceptual materials to investigate this seemingly conflicting nature. We adopted a two-phonon model to demonstrate that incoherent phonon contribution to the overall thermal transport of superlattice increases with temperature due to inelastic interfacial transmission. In contrast, coherent phonon transport contribution decreases with the increment of temperature is due to elevated anharmonic scattering. The relative contribution of coherent and incoherent phonons and their very different temperature dependence will dictate the overall thermal transport properties of superlattices as the temperature changes. Our study should be sufficient to understand the conflicting observations of the temperature-dependent thermal transport properties of superlattices. Moreover, we have shown that a convolutional neural network-based machine learning model can well capture the coherent-incoherent transition in superlattices.

**B. Crutchfield*, R. Fleming, Dept of Mechanical
Engineering, Arkansas State University**

Understanding the Mechanical Behavior of Nanoporous Amorphous Silicon by Molecular Dynamics Simulations

Nanoporous materials have many applications when developing materials that have a high strength relative to a low density. Thus, there is much interest in finding the most optimal porosity for different materials to obtain the highest strength-to-weight ratio. In this project, molecular dynamics (MD) simulations have been performed to better understand how porosity affects the stress-strain behavior of nanoporous amorphous silicon (a-Si). Structural models of the material were created in the Large-scale Atomic/Molecular Massively Parallel Simulator (LAMMPS) using melt-quench dynamics, followed by uniaxial tension to determine the stress-strain response. This data was then used to find the elastic modulus as a function of strain rate and porosity. The porosity was found using the final volume of the void space over the total volume at the end of each trial. Then obtaining the density, the specific modulus was able to be calculated. Finally, the specific modulus was found as a function of the porosity to determine the optimum strength-to-weight ratio. These results can be used to improve the understanding of structure-property-processing relationships for nanoporous materials.

**M. A. Islam*, R. Fleming, Dept of Mechanical
Engineering, Arkansas State University**

Structural Configuration of SiO₂ Surface with Different Terminating Groups Using Classical and Ab Initio Molecular Dynamics

Silica has numerous applications across various sectors of technology, including concrete production, glass production, food additives, and semiconductor technology. The surface interaction properties of amorphous silica are crucial, yet many aspects of these interactions, particularly with passivating groups, are still not fully understood because of the non-periodic nature of amorphous silica. In this study, we use computational simulations to understand the bonding mechanism and atomic structure of the amorphous silica surfaces with different passivating groups. Amorphous silica surfaces are generated by melt-quench dynamics using classical molecular dynamics (MD). Then, subdomains of these surfaces containing an undercoordinated surface atom are selected for ab initio density functional theory calculations. Relaxed surface geometries including hydroxyl, methyl, and fluoromethyl passivating groups are determined from DFT-based structural relaxation calculations, along with Born-Oppenheimer MD at 300 K to determine the bond dissociation energy, bond length, and angle. This study provides a deeper understanding of the interactions between silica surfaces and this information can be used to improve the production and processing of silica-based materials, leading to improved product quality, reduced costs, and increased efficiency. Additionally, this research can provide a foundation for future studies on the surface interactions of amorphous silica, leading to further advances in this field.

Physics & Engineering

M. Rahaman*, B. Cunningham, I. Dutta, T. Ensari, R. Ghosh, Dept of Computer and Information Science, Arkansas Tech University
Programming Sequence Improvement Program

Every semester, students from various STEM (Science, Technology, Engineering, and Mathematics) majors at Arkansas Tech University take the programming sequence (PS) courses (over 650 students in the 2020–21 academic year). The Engineering and Computing Sciences Department has struggled to retain students in the PS courses. Minor efforts have been made to increase retention, but they have had little success. The Programming Sequence Improvement Program (PSIP) aims to increase retention and student success in three PS courses: Foundations of Computer Programming I (COMS 2104), Foundations of Computer Programming II (COMS 2203), and Data Structures (COMS 2213), reducing the rate of D, F, Withdraw, and Incomplete grades by 10% annually from the current average baseline of 32%, 35%, and 27%, respectively (2015-2019). The main goal of this PSIP project is to change the face of the PS program within the first two years of study by enhancing programming techniques for students. The project's interventions are likely to influence ATU students' academic performance and retention, leading to higher degree completion rates. This program used four different methods to reach its objective: creating a tutoring lab for students enrolled in a programming course, implementing communication and collaboration tools such as Discord and Webex for students, researching current pedagogies for teaching programming, and better aligning the curriculum with platforms like GitHub, Hackerrank & LeetCode.

M. Rhodes*, Arkansas State University
Design and Analysis of a Multi-Degree of Freedom System Model to Analyze the Lateral Vibrations of a Scale-Model Saturn V Rocket

In launch vehicle analysis for aerospace purposes, modal testing is a vital component of preliminary design to ensure that the Guidance, Navigation and Control (GNC) models are accurate to their respective environments. The ability to quickly, affordably, and accurately predict these models will ensure a faster and more economical path towards space travel. When designing the Saturn V rocket, a 1/10th scale model was used to test base-drive vibrations, which while useful, was slow to build, and difficult to rig and test, requiring a large team to complete the task over the course of months. With these factors in mind, this project aims to design models through Computer-Aided Design and use mathematical modeling and physical testing to evaluate conventional vibration analysis methods to a more modern approach to the field. The results from this project should compare well with results published by NASA on similar models and tests; the advantage of this project is that comparable work was accomplished with less manpower, time and money invested.

Psychology & Social Science

D. Burn*, R. Smith, Dept of Social and Behavioral Sciences, University of Arkansas at Pine Bluff
Social Media Use and its Impact on Social/Psychological Well-Being Among College Students

Social media is most prevalent among young adults as a tool to "share information, opinions, and interests" (Swar and Hammed, 2017). A growing number of young Americans spend their times on Facebook, Instagram, TikTok, and YouTube among others for entertainment and social interaction opportunities, which raises a concern for its possible negative effects on young adults' social/psychological well-being. Research investigating the social/psychological effects of social media use has generated conflicting results, with some suggesting a positive effect on social connection, whereas others suggesting a more isolation and disconnection among users. In this study, an online survey was conducted among college students to explore college student's motives for using social media and test a series of hypotheses relating social media use to several indices of social/psychological well-being, such as perceived loneliness, symptoms of depression, anxiety, and life satisfaction. The results from the data analysis of the survey data revealed a series of correlations between the independent variables and the dependent variables, indicating that certain uses of social media use, namely entertainment, has negative impacts on young adult's well-being. The study's results lend an empirical support to the existing body of work and also shed new light on how communication technology influences its users in an unexpected way.

T. McCray*, R. Smith, Dept of Social and Behavioral Sciences, University of Arkansas at Pine Bluff
Problematic use of smartphones among college students - Predictors and consequences

Research on problematic technology use has found a strong association between uncontrolled use of communication technology and various forms of psycho-social problems, such as loneliness, depression, and anxiety. As a dominant form of communication technology, smartphones have gained much attention for research for their potential harmful effects. Due to their sensory-rich and intimate nature combined with ubiquity and accessibility, smartphones can be very addictive. Moreover, the recent integration of online games and social media sites into smartphones has raised concerns about their negative impacts on users. The aim of this study is threefold: 1) to determine the extent (whether) of smartphone use to determine problematic and addictive use among college students and 2) to explore interrelationships between problematic use and psycho-social traits, smartphone use motives, academic performance, and relationships. The problematic and addictive use is defined as "compulsive and excessive use associated with negative outcomes." The data were collected by distributing an online survey to college students that measured the amount of smartphone use, smartphone use motives and gratifications, smartphone use activities, such as playing games and watching videos, addictive use behaviors consisting of 6-items reflecting core addiction elements (salience, conflict, mood modification, withdrawal, tolerance, and relapse), and psycho-social traits. Results are expected to show common symptoms of addictive traits as they are correlated with abusive uses. Analyses also provide empirical evidence to support the argument that addictive use leads to several psycho-social problem measures and negative life-consequences, such as poor academic performance and relationship. The results are discussed for their implications for the literature on the problematic technology use behaviors.

Recycling & Renewable Energy STEM Ed Curriculum & Instruction

N. Raath*, M. A. Islam, R. Sharma, Dept of Mechanical Engineering, Arkansas State University **A Novel Approach to Sustainable Plastic Recycling on Campus**

Plastic recycling on college campuses - and other large institutions - is a challenging and complex logistics and ergonomics issue. This process is not as streamlined as it could be due to several factors: 1) Students discarding other waste such as food waste into plastic recycling bins, thereby disrupting the sorting process; 2) Plastic bottles have a low density, taking up a large amount of bin space while providing minimal material mass for recycling initiatives, thus requiring constant upkeep. A 40-gallon recycling bin is only able to hold +/- 200 bottles - taking 0.750 liter per bottle as the average volume per bottle. These 200 bottles provide a mere 3 kg of plastic when the bin nears capacity. If plastic bottles are thrown into the recycling bin at a rate of 20 bottles per day the bin would have to be emptied and maintained every week and a half; 3) The industrial plastic recycling process is more expensive from cradle to grave than manufacturing new bottles due to collection, sorting, transportation, and reprocessing costs. This recycling process conducted on a large scale is also counterproductive to the achieving "net carbon zero" aim of renewable energy initiatives. This study conducted a life-cycle analysis of plastic recycling on campus and devised a multi-pronged approach to tackle this problem. The first step of this approach was to retrofit recycling bins with image recognition technology to prevent unwanted mixing of waste materials. This was followed by the design and installation of shredder systems in the recycling bins to break down plastic bottles of different shapes and sizes into smaller fragments. This exponentially increased the time between bin emptying, plastic collection, and the storage capabilities of recycling bins. The last-step of this approach would be to use these recycled plastic shreds as feedstock in the campus recycling initiative - either in a plastic molding machine or in 3-D printers to manufacture products to meet local community needs. These additions cut down on downstream transportation, logistics and collection costs associated with industrial recycling processes by cutting out the middleman. This further reduces the total carbon emissions related with large scale recycling by making campus plastic recycling self-sufficient.

K. Willis*, Arkansas State University **NASA Sustainability Research with K-12 Citizen Scientists Developing Biology and Engineering Project-based Curriculum**

Plastic waste disposal is a serious environmental challenge important to incorporate into K-12 sustainability curriculum. While the 3R's (Reduce, Reuse, Recycle) are commonly taught at this level, empowering K-12 students to contribute meaningful and authentic research data in addressing this global problem is novel. A potential plastic waste solution is *Galleria mellonella* (waxworm), a common beehive pest, and a great model organism for K-12 classrooms. Waxworm larvae are capable of biodegrading low-density polyethylene (LDPE) films, like sandwich bags, into a reusable product, ethylene glycol. The A-State SPOCS (Student Payload Opportunity with Citizen Science) team was awarded NASA grant to determine the plastic biodegradative properties of waxworm larvae in a microgravity environment. A major component of this grant prior to launching the experiment payload to the International Space Station (ISS), was Citizen scientists (CS) from two Arkansas K-12 intermediate schools actively involved in conducting preliminary experiments to help the A-State SPOCS team optimize waxworm larvae plastic ingestion and minimize their mortality. During the 2021-22 academic year CS partnered with the A-State team to collect data to understand food consumption rates and determine waxworm ability to survive on minimal food stock (beeswax only). This was crucial to meeting constraints for the ISS experiments. Also, CS contributed important data in establishing waxworm larvae' preference for the plastic type, Ziploc. In addition, CS participated in engineering activities utilizing NASA constraints and participated in designing and manufacturing the 3D-printed waxworm larvae habitats for space travel. In July 2022, our team completed a successful launch of the experimental module aboard NASA resupply mission CRS-25. This project support efforts to find innovative and sustainable waste management solutions for long-term space travel as well as find innovative ways to create project-based learning opportunities in K-12 to better increase awareness of this important environmental challenge.

Wildlife Science & Ecology

M. Blevins*, K. Patterson, O. Bice, S. Scheiman, M. McClung, J. Garrie, Biology & Health Sciences Dept, Hendrix College **Distribution and Habitat Selection of the Georgia satyr (*Neonympha areolatus*)**

The Georgia satyr (*Neonympha areolatus*) is a small butterfly that could warrant increased conservation efforts due to its scarcity in Arkansas. An increased understanding of the habitat variables affecting its presence could be advantageous to the management of the butterfly and its habitat. Our research investigated the different habitat variables that affect the presence of the Georgia satyr. We conducted Pollard walks where we recorded butterfly abundance, canopy cover, vegetation types, and burn history in areas surveyed in Southern Arkansas from May-June and August-September 2022. Satyrs were present at 11 of 35 sites that were surveyed. Eighty-eight unique butterflies were seen throughout 104 total surveys. Logistic regression models show that presence was positively associated with grasses, sedges, and time since burn. Presence was negatively associated with forbs, presence of flowers, and more canopy cover. Most detections occurred at Moro Big Pine Natural Area where the butterfly was relatively abundant. No populations were detected at Warren Prairie Natural Area, which has historically hosted the satyr and in recent years was frequently burned. Fire interval could explain the current lack of butterfly presence in Warren Prairie. However, it is also possible that these butterflies were extirpated from Warren Prairie and have not had a chance to recolonize due to their poor dispersal abilities. Habitat at Warren Prairie seems suitable for the butterfly, and therefore we recommend potential reintroduction efforts to help expand this butterfly's range in the state. Our findings are vital to inform land managers how to facilitate and manage habitats to assist in Georgia satyr conservation and to increase its population.

L. Barnes*, J. Jackson, R. Kannan Dept of Biological Science, University of Arkansas Fort Smith **Least Flycatchers (*Empidonax minimus*) Under Reported in Fall Migration in Arkansas - A Citizen Science Conundrum**

The Least Flycatcher is a small transient neotropical migrant bird that regularly passes through Arkansas during spring (northbound) and fall (southbound) migration. The former movement occurs mid-April to early June and the latter happens from the end of August to late September. The birds are vocal during spring passage but relatively quiet and unobtrusive during fall migration. This behavioral difference is at least in part responsible for the many fewer reports of the species by birdwatchers in fall than spring. Here we use eBird maps and data to present evidence to support this discrepancy between fall and spring observations. We also show that the species is under reported in Arkansas during the fall relative to neighboring states. We propose that this may in part be due to some birders' reluctance to provide the minimal evidence required to substantiate their observations to satisfy eBird reviewers' queries.

Wildlife Science & Ecology

S. Boone^{1*}, C. England¹, S. Mathews¹, A. Price¹, L. Simpson¹, S. Yarbrough¹, K. Bartlow², C. Middaugh², K. Sparks², M. McClung¹ **1. Biology & Health Sciences Department, Hendrix College; 2. Arkansas Game and Fish Commission**

Habitat Partitioning of Coyotes and Domestic Cats in Green Spaces Along an Urbanization Gradient

Free-roaming domestic cats (*Felis catus*) pose a significant threat to native populations of wildlife through predation, disease, and confrontations with other urban carnivores. One such urban carnivore is the coyote (*Canis latrans*), which utilizes food resources in the urban areas where cats roam and have been known to kill and depredate domestic cats. While previous studies have suggested habitat partitioning by urban cats and coyotes in these areas, few have focused on how urbanization impacts the likelihood of habitat overlap. During the months of July 2021, October 2021, January 2022, and April 2022, we placed motion-triggered game cameras at 30 sites across urban green spaces in and around Little Rock, Arkansas. We used presence/absence data collected by these cameras and measures of development intensity at each camera site to assess the impact of percent impervious surface on habitat use and overlap of coyotes and domestic cats in these green spaces. Across all seasons, co-occurrence of cats and coyotes ($M = 2$, $SE = 0.41$) was observed at fewer sites than individual presence of cats ($M = 6.50$, $SE = 0.96$), coyotes ($M = 8$, $SE = 1.47$), and absence of both species ($M = 13.50$, $SE = 1.94$). Percent impervious surface at the 500-meter scale predicted coyote presence in the fall 2021 ($p = 0.042$) and winter 2022 ($p = 0.037$) seasons. Percent impervious surface at the 500-meter scale predicted cat presence in the spring 2022 season ($p = 0.025$), and percent impervious surface at the 100-meter scale predicted cat presence in the summer 2021 season ($p = 0.013$). Co-occurrence and absence of both species were not predicted by percent impervious surface. Overall, our data suggest habitat partitioning by cats and coyotes in Little Rock green spaces, with the two species more commonly inhabiting territories independent of one another than shared home ranges and with percent impervious surface playing a role in the habitat selection of each species. Understanding where and why coyotes and domestic cats encounter one another in urban areas can help researchers and pet owners alike take steps to reduce the harm to both species caused by these conflicts. population.

G. Graves^{*}, Department of Vertebrate Zoology / Birds, National Museum of Natural History, Smithsonian Institution, Habitat Selection of a Vagrant Mountain Bluebird (*Sialia currucoides*) in the Arkansas Ozarks

Mountain Bluebird (*Sialia currucoides*) breeds in western North America and winters east to the Great Plains. Vagrants are occasionally reported in eastern North America, but relatively few wintering records have been documented in the lower Mississippi Valley east of 96° W longitude and south of 37° N latitude. Two previous Arkansas records have been documented. Here I report the third state record, a female photographed on 1 November 2021 on Norfolk Lake in Baxter County. Documentary accounts of vagrant songbirds seldom discuss habitat, but descriptions of foraging and resting sites, even those briefly frequented, offer insight on habitat selection and site fidelity of species outside their normal geographic ranges. The Norfolk Lake occurrence suggests that vagrant Mountain Bluebirds may seek out microhabitats that bear physiognomic similarities to their typical foraging sites in western North America.

S. Mathews^{1*}, C. England¹, S. Boone¹, A. Price¹, L. Simpson¹, S. Yarbrough¹, K. Bartlow², C. Middaugh², K. Sparks², M. McClung¹ **1. Biology & Health Sciences Department, Hendrix College; 2. Arkansas Game and Fish Commission**

Bring on the Urbanization: American Robins Don't Mind the Sounds of City Life

Human activities have increased noise pollution in urbanized areas, and these changes are increasingly being felt in natural areas because of expanding transit networks. Though noise can have negative impacts on wildlife, some species continue to settle in areas with relatively high noise levels. One such species is the American Robin (*Turdus migratorius*), which is commonly found around human development. Our research examined whether noise levels could predict the presence of American Robins along an urbanization gradient as well as a more standard metric of urbanization, that is, the amount of impervious surface in an area. During the months of July 2021, October 2021, January 2022, and April 2022, we placed motion-triggered cameras in 30 parks along an urbanization gradient around Little Rock, Arkansas. We then recorded whether robins were present in photographs at least once at these sites throughout each month to establish a detection record. Logistic regression models incorporating GIS data for both noise levels and percent impervious surface within a 500-m buffer at each site showed a positive relationship between robin presence and noise in July ($R^2 = 0.34$, $p < 0.001$) and impervious surface in April ($R^2 = 0.42$, $p < 0.001$). Robin presence was positively associated with both noise and impervious surface in winter ($R^2 = 0.13$, $p = 0.02$), but neither variable was important in predicting robin presence in fall. Our results suggest that noise levels can be helpful in predicting robin presence, but this trend is not consistent across seasons. They also indicate that robins are robust to what are commonly considered the negative consequences of urbanization, such as the loss of natural habitat due to development and a rise in noise levels. It could be that urban development generates more habitat for robins through nesting sites and manicured lawns for foraging, and that these benefits outweigh the costs of urban noise.

C. McAllister^{1*}, C. Bursey², H. Robison³, 1. Science and Mathematics Division, Eastern Oklahoma State College; 2. Department of Biology, Pennsylvania State University, Shenango Campus; 3. 3602 Big Creek Drive, Sherwood, AR 72120

Helminth Parasites of Northern Cottonmouth, *Agkistrodon piscivorus* (Ophidia: Viperidae), from Arkansas

The Northern Cottonmouth, *Agkistrodon piscivorus* (Lacépède) is a large, semiaquatic viperid snake found statewide in Arkansas. Although a great deal has been published on parasites of *A. piscivorus* from other parts of its range, little is known about those occurring in cottonmouths of the state. In our survey, we examined seven adult *A. piscivorus* from the Ouachita Mountains Biological Station, Polk County ($n = 6$) and Locust Bayou, Calhoun County ($n = 1$). Several helminth parasites were found, including 3 trematodes, *Styphlodora magna*, *Renifer ellipticus*, and *Paralechthiorchis syntomentera*, 2 nematodes, an unknown larval ascarid and *Physaloptera abjecta*, an oligacanthorhynchid acanthocephalan cystacanth, and a pentastome, *Porocephalus crotali*. We document new host and geographic records for these parasites from a small sample of *A. piscivorus* collected from Western Arkansas.

Wildlife Science & Ecology

C. McAllister^{1*}, H. Robison², E. Leis³, D. Cloutman⁴, A. Camus⁵, 1. Science and Mathematics Division, Eastern Oklahoma State College; 2. 602 Big Creek Drive, Sherwood, AR 72120; 3. La Crosse Fish Health Center–Midwest Fisheries Center, U. S. Fish and Wildlife Service, Onalaska WI; 4. P. O. Box 197, Burdett, KS 67523; 5. Department of Pathology, College of Veterinary Medicine, University of Georgia
Hemoparasites (Apicomplexa: Hepatozoon; Kinetoplastida: Trypanosoma) of Two Anurans (Hylidae; Ranidae), from Polk County, Arkansas

Arkansas supports 29 species/subspecies of anurans and only one (3%) species, the green frog, *Rana clamitans*, has been previously reported with hemoparasites. Here, we collected blood samples from three anurans, five American green treefrogs, *Dryophytes cinereus*, five American bullfrogs, *Rana catesbeiana*, and two southern leopard frogs, *Rana sphenoccephala utricularius* from the Polk County, Arkansas, and examined them for hemoparasites. American green treefrogs and American bullfrogs harbored hemoparasites, including two (40%) *D. cinereus* with trypanosomes, and four (80%) and one (20%) each *R. catesbeiana* with a *Hepatozoon* sp. and trypanosomes, respectively. This is the first time these two anurans have been reported with hemoparasites from Arkansas. In addition, a movie will be shown of these hemoparasites in blood of these frogs.

C. McAllister^{1*}, H. Robison², E. Leis³, D. Cloutman⁴, A. Camus⁵, 1. Science and Mathematics Division, Eastern Oklahoma State College; 2. 602 Big Creek Drive, Sherwood, AR 72120; 3. La Crosse Fish Health Center–Midwest Fisheries Center, U. S. Fish and Wildlife Service, Onalaska, WI 54650; 4. P. O. Box 197, Burdett, KS 67523; 5. Department of Pathology, College of Veterinary Medicine, University of Georgia;

New Geographic Distributional Records for Two Lampreys (Petromyzontiformes: Petromyzontidae) in Arkansas, with Notes on Histopathology

The recent update (second edition) of the Fishes of Arkansas includes what is known, to date, on the geographic distribution of five species of lampreys that occur in the state. Here, we provide new distributional records on two of those species, chestnut lamprey, (*Ichthyomyzon castaneus*) and southern brook lamprey (*I. gagei*) as well as documenting host-parasite information on the former lamprey.

A. Price^{1*}, S. Boone¹, C. England¹, Mathews¹, L. Simpson¹, S. Yarbrough¹, K. Bartlow², C. Middaugh², K. Sparks², M. McClung¹ 1. Biology & Health Sciences Department, Hendrix College; 2. Arkansas Game and Fish Commission

Ecological Responses of Nocturnal Mammals to Artificial Light at Night in Urban Ecosystems

Over the last six decades, levels of artificial light at night (ALAN) have increased globally 6% each year, causing many mammal species to experience higher levels of ALAN within their ranges. Considering the high number of nocturnal mammalian species, which have evolved to be active in low light conditions, the rise of ALAN is particularly concerning. In this study, we assessed the effects of ALAN on nocturnal mammal communities using game camera data from 30 urban green spaces around Little Rock, Arkansas, during January 2022. Using presence/absence data from our cameras, we compared the species richness of nocturnal mammals and presence of two representative nocturnal predator and prey species, coyote (*Canis latrans*) and cottontail rabbits (*Sylvilagus* spp.), with different levels of ALAN. We controlled for covariates including anthropogenic sound, forest cover, and proportion impervious surface all within a 500-meter radius of the cameras. Though there was a trend for nocturnal species richness to decrease as ALAN increased, linear regression showed that none of the environmental variables modeled were important for predicting richness. Conversely, logistic regression showed that the probability of coyote presence decreased with increasing ALAN ($R^2 = 0.12$, $p = 0.027$) and impervious surface ($R^2 = 0.20$, $p = 0.004$) while the probability of cottontail rabbit presence decreased with increasing forest cover ($R^2 = 0.18$, $p = 0.008$) and increased marginally with increasing impervious surface ($R^2 = 0.08$, $p = 0.070$). In general, our findings suggest that though overall nocturnal mammal species richness is not impacted by ALAN or the other urbanization metrics we used, individual species presence may be negatively (coyote) or positively (cottontail rabbit) associated with urbanization. Our research draws attention to the aversion of some species and the affinity of others to urbanization, and it has the potential to reveal how future city growth can influence a nocturnal mammal community in an urban setting. Furthermore, our data can provide information to guide urban planning with wildlife ecology in mind.

E. Purvis*, J. Dunlap, E. Wiley, Dept of Biology, University of Central Arkansas

The Effects of Fertilization on Defoliation Recovery in River Birch and Northern Red Oak

Defoliation is a common stressor in forests that requires trees to remobilize nonstructural carbohydrate (NSC) reserves to regrow leaves. The refoliated canopy is often smaller than the original canopy, resulting in decreased growth, reduced carbon storage, and even death, however it is currently unclear what limits leaf reflush and longer-term recovery. While carbon (C) is often presumed to be limiting, incomplete NSC remobilization and its faster recovery relative to growth suggest other factors like nitrogen (N) availability may limit growth instead. But because N is a vital component of cell walls and Rubisco, if it does limit growth, it is unclear if N does so directly or indirectly by reducing leaf N concentrations and limiting carbon gain. To better understand the impacts of defoliation, we explored how fertilization impacted the short- and long-term growth and NSC storage of *Betula nigra* (river birch) and *Quercus rubra* (northern red oak) after experimental defoliation. We sought to determine 1) if and how N availability limits reflush and growth after defoliation, and 2) if NSC remobilization and allocation are largely controlled by limited C demand. 1-yr old potted saplings from each species were divided into four treatments—control/low fertilizer; control/high fertilizer; defoliation/low fertilizer; defoliation/high fertilizer. Trees were harvested after three weeks (short-term) and four months (long-term). Final biomass, diameter change, stem and root NSC, and foliar N were measured; percent leaf mass recovery was calculated for defoliated trees. Three weeks after defoliation, both species showed less than 100% leaf mass recovery, with fertilization significantly increasing reflush for birch but not oaks. For both species, fertilization increased foliar nitrogen concentration, potentially increasing photosynthetic capacity. Fertilization did not impact oak NSC concentrations after reflush but may have increased remobilization in birch. Four months after defoliation, there were no differences in foliar N concentrations, and fertilization had significantly increased leaf mass recovery in both oaks and birch. In this study, growth after defoliation was generally N-limited, but oak reflush may initially have been limited by their semi-determinate growth pattern or by NSC storage. Birch reflush may have been less C-limited due to their higher initial root starch concentrations. We discuss the long-term effects of defoliation on NSC and the potential for fertilization to increase growth at the expense of NSC storage, potentially reducing resilience to future disturbance and stressors.

Wildlife Science & Ecology

S. Yarbrough^{1*}, S. Boone¹, C. England¹, Mathews¹, A. Price¹, L. Simpson¹, K. Bartlow², C. Middaugh², K. Sparks², M. McClung¹ **1. Biology & Health Sciences Department, Hendrix College; 2. Arkansas Game and Fish Commission**

Assessing the Potential for Image Analysis to Study Whether Urbanization Contributes to Contemporary Evolution of Coat Color in the Eastern Gray Squirrel (*Sciurus carolinensis*)

The Eastern gray squirrel (*Sciurus carolinensis*) has two color morphs: gray and black. This species has been impacted by human activities, specifically hunting, which has influenced the frequency of color morphs, ultimately reducing the black morph's prevalence, presumably because it is visibly more detectable against a forest background. However, in some areas of the United States, urban green spaces might be contributing to recovery of the black morph, perhaps because it is more visible on roadways, which could lead to lower road mortality. This phenomenon warrants more research into how urbanization could be driving contemporary evolution of the Eastern gray squirrel. In the present study, we assess the potential use of a standard image analysis software called ImageJ for measuring variation in squirrel coat color in game camera images collected along an urbanization gradient as part of the Central Arkansas Urban Wildlife Project. This project, which is a collaboration between Hendrix College, the Arkansas Game and Fish Commission, and the Urban Wildlife Information Network, involves placing game cameras at 30 urban green spaces around Little Rock, Arkansas, during four months of the year. We analyzed 3 images of squirrels for each of 29 sites from the July 2021 season by collecting the mean gray value from a selection of the body covering the neck to the base of the tail. Our results indicate that while there was not a strong connection between our urbanization metrics (percent impervious surface at each site and distance to nearest road) and mean gray values of squirrel coat color, software like ImageJ could be used for a relatively straightforward assessment of coat color, especially if certain approaches are used to control for variables that influence photograph parameters. The use of game cameras is on the rise in wildlife research, and expanding approaches to analyzing images would increase the types of questions that can be asked with these data.

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UNIVERSITY
of ARKANSAS
AT PINE BLUFF
—1873—

Jahurul Akanda* and Shahidul Islam

Mineral, vitamin C, and oxalate contents in 24 sweet potato (*Ipomoea batatas* L.) cultivars in Arkansas, USA

Sweet potatoes (*Ipomoea batatas* [L.] Lam) and their leaves have become interesting research topic recently. They represent bioactive carbohydrates, proteins, minerals, phenolic compounds, flavonoids, procyanidins, anthocyanins etc. These bioactive compounds have revealed several potential health benefits in vitro and vivo studies and shows antioxidant, cardioprotective, anti-inflammatory, anti-cancer, anti-diabetic, antimicrobial, anti-obesity, and prevention of vitamin A malnutrition. It is essential to monitor oxalate levels because increased levels can cause kidney stone formation. Minerals and vitamins are essential for the biochemical processes which are naturally found in foods. They are necessary for the regulation of body fluid and normal body function. They are also capable to prevent the development of micronutrient deficiency-related diseases. In order to explore inexpensive plant food sources, the present study was to evaluate and compare the mineral, vitamin C, and oxalate contents of twenty-four sweet potato varieties cultivated in UAPB. This nutritional information of various SPLs will facilitate awareness among consumers in their daily diet, with the ultimate goal of ensuring a healthy, active, and disease-free life. We found that sweetpotato leaves are good sources of minerals according to the nutritional quality index, especially P, Ca, Al, Fe, Mn, S, and Na. In an effort to reduce malnutrition, particularly in developing countries, sweet potato leaves containing several nutrients and bioactive compounds should be consumed as leafy vegetables. These nutritional results are important on a national and international level for health and food policy program planning.

Lurie L. Anderson* and Shahidul Islam

Assessment of *Gladiolus* Genotypes for Cut Flower Production in the Southeast Arkansas Region

This study utilized five genotypes of *Gladiolus* bulbs, such as 'Red Flair,' 'Ice Cap,' 'Plum Tart,' 'Pink Event,' and 'Violet' for two years, to investigate the production and vase life of the flower. The corms were sprouted in a four-inch bulb pot. Upon the beginning of the spike, the corms were transplanted at the University of Arkansas Research Farm at Pine Bluff (UAPB). Bulbs were replanted six inches deep, with a spacing of seven inches apart. The spikes were examined in the three different sugar/carbohydrate solutions: sucrose, fructose, and glucose. The tips were placed in 5, 10, and 15 mg concentrations of each solution, respectively, and observed at 10, 20, 40, and 60 minutes to evaluate the effect of carbohydrates on the flower vase life. Data was collected using the following measurements: length of the spike, the weight of the corm at post-harvest, total biomass, harvest index, leaf area Index, the number of sprouts per corm, circumference and height of plant, length, and placement of florets, number of opened fresh florets at a time, longevity, yield and vase life of spike, and a total output of corms. The results concluded that these cultivars produced data suitable to develop profitable genotypes for the Southeast Arkansas region. Furthermore, cut flower production can help local growers maximize profit and plan for market dates.

Macie Carter (1) , Kaylee Beck (1), Rafael Gomez Mendoza (2), Maribel Falcon Bautista (2) and Arturo Quintero Ferrer (1)

Use of Micropropagated *Solanum tuberosum* as a Model for the Establishment of a Tissue Culture Laboratory and Greenhouse at UAM

The potato, *Solanum tuberosum*, is one of the world's most important crops. To illustrate, it serves as a staple food item in the diets of over 50% of the global population. When a crop has a demand this high, usual method of growth, which come with high rates of disease and low rates of multiplication, do not satisfy the levels of global consumption. One of the most versatile and cost-effective ways to combat the ever-growing need for crops such as *S. tuberosum* is plant tissue culture. One of the main techniques used is micropropagation. Micropropagated plantlets are made from crop varieties that have desirable traits such as disease resistance, improved shelf life, and higher yields. The invitro plantlets we establish are placed exviro to test the quality of the micropropagated material. Our main objective for this project is to use *S. tuberosum* as a model to produce tissue culture through micropropagation and shift to grown seed material in the green house at UAM.

K., Manzil, and H. Chen. Department of Agriculture, University of Arkansas at Pine Bluff, AR 71601.

Immobilization of Cadmium in Soil Under the Influence of Biochar

Several studies have reported that biochar facilitates remediation of soil contaminated with heavy metals. The properties like large surface area, surface functional groups, porous structure, cation exchange capacity, and so on are some of the key properties of biochar aiding in heavy metal remediation. We investigated the effect of lignin biochar, crawfish shell biochar, and crawfish shell and lignin biochar for the immobilization of Cadmium (Cd) in an artificially contaminated soil using column leaching experiment. Cd contamination in agricultural soil is a serious issue and a matter of concern. Activities like sewage irrigation, mining, smelting, fertilization, etc. are among the key factors for soil infestation with Cd. The ecosystem, soil health, and food quality may all suffer if Cd remains in the soil for an extended period. Additionally, due to Cd's mobile nature, other necessary minerals for plants may be replaced in the soil, which could result in higher bioaccumulation and detrimental effects on human health. The main goal of this study is thus to have a clear understanding of the effect of biochar on Cd mobility in a contaminated soil. This study anticipates immobilizing Cd in soil and the application of biochar will have a positive role towards it.

Airin, P., Islam, S., Jahurul, M.H.A.

Antimicrobial Activity of Sweet Potato (*Ipomoea batata*) Leave Extracts against *Escherichia coli* ATCC 25922

Antimicrobial action (in vitro) of 70% acetone of different variant of sweet potato leaves extract was analyzed against gram negative bacteria *Escherichia coli* ATCC 25922. The experiment was conducted by using Mac Conkey and Mueller Hinton culture plates by using EUCAST disc diffusion methods at different concentrations. The results revealed that 70% acetone extraction of sweet potato leaves shows low to medium antimicrobial activity against *Escherichia coli*. Sweet potato (*Ipomoea batatas*) is a global food crop, now being recognized as a functional food due to several of its nutraceutical components. Several experimental studies have reported that sweet potato can generally be beneficial in the prevention or treatment of chronic diseases through its antioxidant, anti-inflammatory, immunomodulatory, anticancer/antitumor, antimicrobial and antiulcer activities. Sweet potato contains a lot of beneficial phytochemicals, some of which are peculiar to certain varieties. Therefore, a need for the continuous evaluation and selection of cultivars with the appropriate phytochemical composition and bioactivities to be able to fully explore the medicinal value of sweet potato. Nowadays, antibiotics used in healthy animals and humans are crucial for long term success. The sector is being concerned about infectious diseases. United States spend billions of dollars on disease management program. Because most strains of microbial agents develop antimicrobial resistance against commercially available antibiotics. Freshly made antibiotics from plants could reduce the extent of resistance. The aim of the study was to evaluate the antimicrobial susceptibility testing of various variety of crude sweet potato leave extracts.

Jerin Rahima, S. Islam, M.H.A. Jahurul

Potential Antineoplastic Action of fruits and Vegetables in Relation to Polyphenol Contents

Fruits and vegetables are a group of plant foods that are very significant in the content of nutrients. They are substantial sources of many vitamins, fiber, and folate, which help blood pressure and bowel function, and decrease disease. Antioxidants are nature's way of preventing our body from certain dangerous sicknesses like cardiovascular aging, cancer, and additional illnesses. Indoles and isothiocyanates have been found to inhibit the development of cancer in several organs in rodents as well as the breast, bladder, liver, colon, stomach, and lung. Fruits contain similar aspects, healing wounds and keeping gums, teeth, and skin healthy. This study aims to evaluate the phenolic substances and anticancer properties of frequently consumed fresh fruits and vegetables to determine their total phenolic contents. Total phenolics, antioxidant activity, and soluble solutes were determined using Folin-Ciocalteu, ABTS Assay, and Refractometer. The highest phenolic contents were found in the different vegetables compared to fruits. The highest antioxidants are found in vegetables as well as fruits. The sugar percentage is highest in fruits compared to vegetables. According to the result of the experiment, higher phenol antioxidants as well as in fruits and vegetables has potential value as anticancer materials for human health.

M, Rahman, Rahmatullah, M, Islam, S

Garlic (*Allium sativum*): a high-efficacy antidote or protective agent against generalized anxiety disorder (GAD), possible hyperactivity, and hyperthyroidism in children caused by golden yellow dye.

Garlic (*Allium sativum*) is a type of bulbous plant that belongs to the Liliaceae family. It is a hardy bulbous perennial used for thousands of years worldwide for its medicinal and culinary values. In this study, we examined garlic powder for its protective effects, if any, against different diseases caused by Golden Yellow textile dye, which is commonly used in garments as well as pharmaceuticals and food industries across the globe. It is reported that Bangladesh is the second largest RMG producer in the world. The country has more than 4,600 garment industries. In addition, the government has 265 companies listed with the DGDA as producing medicines. The country also has around 246 medium-sized food processing industries. Due to the large number of garment industries, textile dyes are readily available in Bangladesh. Thus, the use of textile dye instead of acceptable food colors has been reported in newspapers. It is a considerable concern because of its carcinogenic potential and harmful health effects. Most shockingly, artificial food colors adversely affect behavior and weight loss in children, both with and without pre-existing behavioral disorders. One of the objectives of this research was to investigate the protective effects against GAD and possible hyperactivity and hypothyroidism in children. In this experiment, textile dye, when added to a rat diet in three different doses (0.1% dye), with the presence of garlic powder, showed significant results in cases of locomotor activity, anxiolytic activity, and weight loss caused by Golden Yellow textile dye.

S. Tashida, S. Islam, M.H.A. Jahurul

Potential Use of Underutilized Cucurbitaceae Family Leaves as healthy vegetables

This research explores the potential application of the leaves of three Cucurbitaceae family vegetable plants: Bottle gourd (*Lagenaria siceraria*), Pumpkin (*Cucurbita pepo*), and Bitter melon (*Momordica charantia* L.), which are typically underutilized. These plants are usually grown in tropical regions of Africa, Asia, and Europe for their fruit, which is consumed as a vegetable. The study analyzes these plant leaves' antioxidant and antibacterial properties and compares the outcomes. A sequential extraction method used various solvents such as acetone, methanol, ethanol, and hexane to extract the compounds from the leaves. The crude extracts were subjected to antimicrobial susceptibility testing using the EUCAST disk diffusion method against two fungal species, one gram-positive and two gram-negative bacterial strains. The total polyphenols content was measured using the Folin-Ciocalteu method, while the antioxidant capacity was assessed using the ABTS method. The outcomes revealed high total phenolic content and antimicrobial activity in all three plants. The ABTS and TPC findings suggest notable antioxidant activity in these plant leaves. The study indicates that pumpkin and bottle gourd plant leaves have the most potent antimicrobial activity against bacteria and yeast. The study concludes that pumpkin plant leaves have the highest biologically active fraction due to their higher phenolic content. Therefore, they are promising materials for extracting biologically active compounds with economic prospects in various fields, including as an antioxidant in foods and chemicals.

T. Wills, C. C. Mathis, Jr., and L. Carson, Prairie View A&M University, Prairie View, TX, and the University of Arkansas at Pine Bluff, Pine Bluff, AR, 71601
A Partnership Between Pvamu & Uapb (Mea) to Gaining Competitive Edge Through Innovation and Collaboration

A majority of ethnic minorities students have pigeonholed Agricultural careers to just “working on the farm”, limiting their scope of career and professional options. Therefore, Prairie View A&M University (PVAMU), and the University of Arkansas at Pine Bluff (UAPB) both 1890 Land Grant universities ~ formed its MEA Center, with goals of helping close the gap and collectively increase the diversity of the U.S. agricultural workforce pipeline spanning careers in food, agriculture, natural resources and human (FANH) sciences. Dedicated to encouraging and supporting young people from underrepresented minority groups to pursue studies and careers in (FANH) sciences fields. Hence, the (MEA) Center funding has helped the College of Agriculture and Human Sciences (CAHS) at PVAMU, and the School of Agriculture, Fisheries and Human Sciences (SAFHS) at UAPB, to address and increase its recruitment, retaining, mentoring and graduating of underrepresented students. This was accomplished, by providing various Zoom workshops/training, and giving summative and formative assessment to students attending. Results were used to improve the overall program, and a continuous improvement plan was instituted. Relating to workforce development experiences for students to enhance the pipeline of schools’ undergraduate programs, to their graduate programs and careers; as well as, increase students’ engagement in science, technology, engineering and mathematics. Additionally, the project provided college students with experiential learning opportunities related to soft skills, research skills, conference attendance, leadership training and technology skill development. Furthermore, both universities utilize its (MANRRS) chapters to recruit their Ag Ambassadors, to assist in carrying out its objectives and mission.

Uttam Deb and Caleb I Adewale
Production and Consumption of Fish and Fishery Products in Uganda: Trends, status, and implications for food and nutrition security

Fish and fishery products provide a variety of essential vitamins, minerals, and fatty acids in addition to their high-quality protein. Fish is a significant source of animal protein in Uganda, accounting for about 50% of animal protein intake. They also play an important role in enhancing household income and food and nutritional security in Uganda. Uganda has abundant freshwater resources such as River Nile, Lake Victoria, and extensive wetlands, which could serve as key resources for producing and consuming fish and fishery products. This study examines the trends and status of Uganda's production and consumption of fish and fishery products. Fish production has increased steadily over the years, with an annual growth rate of 5.5% between 1990 and 2020. Fish consumption in Uganda has also increased over the years. Per capita fish and fishery product consumption increased from 13.71 kg in 1990 to 14.34 kg in 2020. However, there are significant disparities in fish consumption across regions and socioeconomic groups. The study highlights the importance of sustainable fish production and consumption practices to ensure food and nutrition security in Uganda. Based on the research findings, the study puts forward some suggestions for promoting fish production and consumption in Uganda.

Dalton Chennault*, Ayushma Sharma, Yatish Ramena, Kailash Bohora, Elijah Dwumfuor, and Grace Ramena
Immunostimulant Supplement Enhances the Growth of Litopenaeus Vannamei Post Larvae

Increased global demand for high protein consumption forces high-intensity shrimp cultures, leading to the urgent need to develop immunostimulant diets. There has been increased interest in the aquaculture feed industry to develop new diets to enhance growth and immunity in the early life stages of *Litopenaeus vannamei*. Immunostimulant that is either natural or synthetic induces an innate immune response. The probiotics that are live, nonpathogenic bacteria help gut microbiome balance. In this study, we have tested the effect of various doses of probiotics and immunostimulants on *Litopenaeus vannamei* postlarvae. *L.vannamei* PL 15 were stocked, 100 in each tank, 6 replicates, co-fed with increasing amounts of probiotics, immunostimulants, and particle diets for 38 days. The post larvae were reared at 28 degrees C to 30 degrees C, PH 7.8 to 8.2, and salinity of 30 ppt. The treatments included a control diet, the particle diet, 0.5 ppm, 1 ppm, and 2 ppm probiotics, 0.5 ppm, 1 ppm, and 2 ppm immunostimulant. We evaluated the growth of the PL and their gut health by mucosal folds and length, lamina propria, and R-Cells and B-cells. We found that 1 and 2 ppm immunostimulant diets had higher growth rates, while the health aspects are under evaluation. Our results suggest that the immunostimulants used in this study have enhanced the growth and gut health of *Litopenaeus vannamei* relative to the probiotics.

Emma DeVries, Fletcher Kice, and Laniese Penner
An Investigation into NMR as a Tool for the Study of the Kinetics of LDH

The oxidoreductase enzyme lactate dehydrogenase (LDH) is a well-studied enzyme due to the crucial role it plays in the anaerobic metabolic pathway. LDH is present in nearly every yeast, plant, and animal cell to catalyze the conversion of lactate into pyruvate by the reduction of NAD⁺ into NADH following glycolysis in low oxygen conditions. For this study, LDH was extracted and purified from rabbit muscle tissue. The presence of LDH from the sample was assessed using UV-Vis spectroscopy by the presence of NADH. The concentration of LDH was quantified using spectrofluorometry. The kinetics of the enzyme were investigated using prediction software and nuclear magnetic resonance (NMR). Gaussian® was used to predict unique NMR peaks in lactate and pyruvate. Using a benchtop NMR, the spectra of lactate, pyruvate, and LDH were analyzed in an attempt to identify the predicted unique peaks for pyruvic acid and lactic acid to track their concentrations in the presence of LDH. The purpose of the study is to determine whether NMR can be used as a cost-efficient tool for kinetic studies of LDH and similar enzymes.

Cameron Heslip

The Relationship Between the Presence of the Cytoskeleton and Mitochondrial Fission and Fusion

The goal of this research is to determine the dependence of the mitochondrial fission and fusion mechanisms on the presence of the cytoskeleton. To accomplish this goal, we visualized tubulin using a GFP-Tubulin construct and visualized actin with a LimEACC-GFP construct, and determined the distance from the cytoskeleton of fission and fusion events. Early results showed that most mitochondria were 1 μm from a microtubule, more fission events occurred closer to the microtubules than 1 μm , and more fusion events occurred on a microtubule or within 0.5 μm . However, 60.56% of mitochondria were farther than 1 μm from an actin filament for localization, and in both fission and fusion, more events occurred 1-2 μm from an actin filament. These results suggest that microtubules have direct contact with the mitochondria during most fission and fusion events, that mitochondria do not interact with actin filaments, and that mitochondria do not need direct interaction with actin for fission and fusion in our system. To ensure these results were specific to the visible cytoskeletal filament we repeated the experiment after destabilizing actin with Lat-B, or tubulin with nocodazole. Here we present our results from the analysis of LimEACC-GFP cells treated with Lat-B or the vehicle control, EtOH. As expected, most cells had either a partial actin structure near the cell cortex or no visible actin. The mitochondria remained evenly dispersed through the cell and spherically shaped. Most mitochondria were found greater than 2 μm from visible actin filaments, and correspondingly, most fission and fusion events occurred 2 μm or more away from a filament. In the future, we will repeat this experiment with GFP-tubulin Lat-B treated cells. Mitochondria play many vital roles in the cell, including production of ATP and influencing apoptosis. Due to this, there are detrimental consequences to mitochondrial dysfunction, which is suspected to be the cause of many human diseases. Mitochondrial dynamics of fission, fusion, and motility are thought to be the source of this dysfunction. Through this research, the relationship between these important mitochondrial functions and the cytoskeleton is examined, and may reveal a correlation between the presence of the cytoskeleton and human disease that has yet to be found.

Harley Hines, Raven Newton, Justin Contreras-Portillo, and Surya Jyoti Banerjee

Role of Tsh & CtBP molecular interaction on *Drosophila* eye development

Transcription factors and coregulators regulate the eye precursor cell division, followed by photoreceptor specification in the larval eye precursor tissue called the eye disc of *Drosophila*, the fruit flies. In the third instar larval eye disc, a morphogenetic furrow (MF), demarcates anterior dividing cells from the posterior differentiating cells. Teashirt (Tsh), a transcription factor induces cell division, and C-terminal Binding Protein (CtBP), a transcription coregulator, limits cell division in the eye disc. We show that Tsh and CtBP molecules interact in vitro and in vivo in the eye discs. We further want to evaluate the role of such interaction on the eye development using the fly genetics. The result can help to identify the molecular processes of eye development regulated by the conserved Tsh and CtBP together in the metazoans.

Hyoju Kim, Kari Naylor

The Effects of DJ-1 Protein Mutants on Mitochondrial Dynamics in *Dictyostelium discoideum*

Mitochondrial dysfunction plays a role in the progression of Parkinson's Disease (PD), thus understanding mitochondrial dysfunction is one of the important keys to finding PD treatment. Mitochondrial dysfunction is directly linked to mitochondrial structure. Our lab studies the processes that establish mitochondrial structure, including mitochondrial fission, fusion, and motility. We have shown that in our model, *Dictyostelium discoideum*, insufficient fission can cause a tangle of interconnected mitochondria, and insufficient fusion can cause mitochondrial aggregates that lead to a decrease in mitochondrial motility and potentially damaged organelles. To continue to understand the relationship between mitochondrial dynamics and PD, we are trying to understand the role DJ-1 plays in these processes. DJ-1 is a protein linked to PD and mitochondria, yet its function is poorly understood. Thus, we are determining the rates of fission, fusion, and motility when DJ-1 is overexpressed or under-expressed in *D. discoideum*. Our results will help clarify its function and the relationship between DJ-1, dynamics, and mitochondrial dysfunction. Thus far we have analyzed seven DJ-1 mutant strains and calculated the average number of fission and fusion events/min/cell in 30 cells. Our preliminary data suggest that overexpression of DJ-1 has little effect on the rates of fission and fusion compared to wild-type cells (AX2), while loss of DJ-1 increases fission. These results suggest that DJ-1 is an inhibitor of fission with little effect on fusion. Our future work includes an analysis of mitochondrial motility. Ultimately, this work will contribute to a better understanding of the DJ-1 function and pathogenesis of PD.

Kayla Medina, Morganne Browning, Raven Newton, Erika Avalos-Reyes, Harley Hines, Suparna Chatterjee

Physical mutation induced on *E. coli* for enhancing chromium (VI) reduction

Chromium (VI) released as a result of industrial processes is highly toxic and causes mutation and cancer. (WHO, 2018). Bioremediation uses natural biological processes to degrade toxic pollutants. Our previous research showed bacteria reduced Cr (VI) to less toxic Cr (III) from synthetic solution and tannery effluents. *Escherichia coli* has been mutated to induce heritable change in the DNA sequence. Ultraviolet radiation is used as a physical mutagen to cause mutation and produce strains that have the ability to enhance metal removal ability. Two mutants, UV1 and UV5 showed significantly more effectiveness for Cr (VI) reduction. We will discuss our findings of the percentage of Cr (VI) removal by the two mutants compared to the wildtype under laboratory conditions.

Sophia Rushing and Kari Naylor

Exploring the Relationship Between the Cytoskeleton and Mitochondrial Dynamics in Dictyostelium discoideum

Mitochondria are dynamic organelles that divide, fuse, and move around the cell. Mitochondrial dynamics are known to be influenced by the presence of the cytoskeleton, particularly microtubules and actin filaments. Dictyostelium discoideum is an amoeba that is widely used for studying cellular processes. However, the relationship between cytoskeletal filaments and mitochondrial dynamics in D. Discoideum is not fully understood. In order to analyze the relationship between the cytoskeleton and mitochondrial dynamics in this model organism, D. discoideum cells were treated with nocodazole, a drug that inhibits the polymerization of microtubules. Confocal microscopy and time-lapse images were used to assess morphology, examine how far away mitochondria are from cytoskeletal filaments, and quantify the distances between remaining cytoskeletal filaments and fission and fusion events. Preliminary results suggest that fission and fusion events may be more likely to occur at farther distances away from actin filaments in D. discoideum. This is relevant for understanding how mitochondrial dynamics evolved from prokaryotes to eukaryotes, and researching this topic may contribute to an understanding of the mechanism of mitochondrial diseases.

Carli Tackett, Claire Greene, Hannah Seats

Assessing mass-to-mass ratios in waxworm diets for plastic waste management by biodegradation

Previous experiments from the Arkansas State NASA SPOCS team have verified that Galleria mellonella (waxworm) larvae consume low-density polyethylene (LDPE) in microgravity without negative impacts on consumption rate nor mortality. Follow-up experiments aim to improve our understanding of the waxworms' biodegradation ability for plastic waste management globally in space and here on Earth. Optimizing waxworm studies and measurements is important to recognize what environmental factors, such as temperature and humidity, affect biodegradation processes. This project explores the precise mass to mass ratio between beeswax and LDPE so that we can better explain data from previous experiments and contribute to biodegradation studies that may solve the plastic problem on Earth. Preliminary data will aim to explain a simple trend in the diet of waxworms. Incorporating citizen scientists will allow students to develop professional relationships and communication skills and enhance the experience of the citizen scientists as they answer authentic scientific questions alongside college scientists.

Brooke Rainwater, Dr. Subha Pratihari

Activity of Invertase in Conditions of Varying pH and Temperature

In the study of enzymes, the work of and equations derived by Michaelis and Menten serve as a bedrock to all modern research in the field. In this study, the activity of original enzyme used in the Michaelis - Menten experiments, invertase, is measured in conditions of varying pH and temperature. The activity of invertase is measured by using a polarimeter to determine the optical rotation over time. From previous research, it is known that invertase has optimum activity at a pH 4.5 and a temperature of 55 °C. By measuring the activity of invertase in ideal conditions and comparing the change in activity when these factors are varied, it can be confirmed that optimum activity is reached at these conditions.

Cassandra Huggins and Emily Ross Metcalf-Mero

Hydrothermal alteration in carbonate rich igneous complex of Magnet Cove, Arkansas as analog to Nili Fossae and Gusev, Mars

While Mars is no longer volcanically active, it once was home to many active volcanoes, implying the presence of magma chambers below its surface. Magma chambers are a common source of heat necessary for hydrothermal activity, such as hot springs. One such location is Magnet Cove, an igneous complex in central Arkansas. Petrographic and X-ray powder diffraction analysis were performed on core samples taken from Magnet Cove and the carbonate-rich rocks are likely carbonatite, a calcium-rich igneous rock, indicative of volcanic activity. Near the center of the core the composition changes drastically; natrolite and epidote, along with other trace minerals, were found. These minerals are commonly found in environments where hydrothermal alteration occurs. Hydrothermal alteration is the process in which hot fluids flow through preexisting rock and chemically alter the rock. Compositions of both the fluid and rock, temperature, and pressure all contribute to the alteration process. Because the pluton was highly calcitic, the formation of epidote would require the fluid to contain both Al^{3+} and Fe^{3+} and natrolite needs both sodium and aluminum silicate. This area of probable hydrothermal alteration in a preexisting pluton suggests volcanic activity may be a driving force for the geothermal heating of water in central Arkansas. Utilizing the data collected along with CRISM spectrometer data of Nili Fossae and Gusev, central Arkansas could be analogous to carbonate-rich areas of Mars, providing evidence for once-active geothermal springs driven by volcanic activity.

Payton Karr, Lisa Cady, Maurice Testa
Virtual Storyboard Creation of the Navajo Sandstone
Geologic Formation

The Navajo Sandstone (of the Glen Canyon Group) is a geologic formation that spreads across the Western United States and was deposited in the early Jurassic period. Over the last 180 million years groundwater flow has altered the color of the Navajo Sandstone. The Navajo Sandstone makes up many national parks and national monuments and there are diagonal cross-beds patterns in the sandstone that are related throughout each of the National Parks. The purpose of this project is to create a virtual storyboard for the National Park Service. Because the Navajo Sandstone can be found in five national parks, it is an excellent landmark to teach geological history. The Navajo Sandstone has been studied to better understand the Earth's climate and has been used as an analog for sections of Mars.

Emily Ross Metcalf-Meroe and Cassaundra Huggins
X-Ray diffraction and petrographic analysis of Magnet
Cove carbonatite core, Arkansas

Geothermal activity such as hot springs are known to precipitate calcium carbonate (CaCO_3) minerals, producing rocks such as tufa, travertine, and carbonatite. The precipitation of CaCO_3 is caused by the reduction of CO_2 , which is less soluble in warmer waters. Geothermal heating of water in natural springs drives this precipitation of CaCO_3 in areas of Arkansas including Magnet Cove. Several geologic reports of Magnet Cove claim the presence of carbonates stemming from the geothermal processes of the region; however, the identification of the carbonate material varies among the reports, including tufa, travertine, and carbonatite. After examining a Magnet Cove core sample from a calcite deposit, the petrographic analysis and X-ray diffraction revealed that between the depth of 33 feet to 43 feet, it contained natrolite and epidote. These minerals are not usually associated with carbonatite nor tufa. Utilizing existing information on the formation of natrolite and epidote may reveal how these minerals formed in Arkansas hot springs.

Matthew Neal, Jon Turco, Jordan Mader, Maurice Testa
Determining the Impact of a Flocculant or Surfactant on
Microplastic Recovery

Microplastics are defined as either synthetic solid particles or polymers smaller than five millimeters. These particles are insoluble in water, which allows them to accumulate in water sources. Their size allows them to be ingested by wildlife such as fish and other food sources which can lead to bioaccumulation up the food chain. Additionally, microplastics can act as vectors to heavy metals, increasing the concentration of these toxins in those exposed. This project started as a preliminary investigation into the effects of adding flocculants or surfactants on microplastic recovery and removal from water samples. From this, a novel methodology for aggregating and quantifying microplastics within water samples was developed by University of Arkansas Fort-Smith undergraduate researchers. This project's current focus now is on expanding the understanding of the concentration effect of surfactant (Tween80 or Span80) and methodology of surfactant solution preparation on microplastic recovery. A standardized mixture of common commercially used plastics has been purchased for this project. Varying concentrations of surfactant (0.1, 0.5, and 1 v/v%) and surfactant solution preparation methodology were tested to determine the outcome on sample aggregation.

Travis Rameden-Tipton
Modeling Landslide Susceptibility of Greers Ferry Lake, Ar

In 2021 natural disasters caused about 252.1 billion US dollars in economic and property damage worldwide (the cost of storm damage's accounting for 137.7 billion US dollars) followed by flooding which accounted for 74.4 billion US dollars in 2021 (Statista 2022). In Arkansas natural disasters can vary from flooding, wildfires, earthquakes and even landslides. Landslides in Arkansas can be quite costly. The Arkansas Department of Transportation (ArDOT) reportedly spent more than 50 million in highway repairs, giving need for a suitable landslide inventory and susceptibility maps. In this study, we are interested in creating a landslide inventory for Greers Ferry Lake (located in between Cleburne and Van Buren counties). The landslide inventory map was created from the use of 1-m lidar data, satellite imagery from Google Earth and field observation. Using ArcGIS Pro, we created a complete inventory for Greers Ferry Lake but for our analysis we only examined landslides that had a confidence interval (CI) over 30 (a total of 628 sites affected by landslides). A density map was then created to determine areas with a higher density of high (CI) of landslides, for hazard mapping purposes. Validation for the landslide inventory came from data previously gathered by the Arkansas Geologic Survey (AGS), in field observations and Google Earth. Ultimately the aim is to use the landslide inventory map to create a broader landslide susceptibility map using machine learning methods (Random Forest) and analyzing key factors like slope, aspect, flow direction, flow accumulation, lithology, soils, precipitation, land use land cover (LULC), and Euclidean distance to determine what effect they have for triggering landslides.

Mariah Thomas, Alex Burns, Johnny Pruitt, Payton Karr, and Dave Mayo

Investigation of a Recent Landslide in Fort Smith, Arkansas

A morphologically youthful slope failure was identified in a remote section of the City of Fort Smith Landfill, and permission was obtained to conduct an investigation. The slide is on a deforested, NW-facing 27% slope beneath a linear head scarp > 200 m long. One end of the head scarp curves abruptly downhill and transforms into a distinct lateral scarp > 100 m long. The surface of the slide is about 24,000 m² (6 acres) in area, and easily distinguished from adjacent intact slopes by its hummocky morphology and transverse ridges and valleys. The slide is interpreted as a translational failure of unconsolidated, poorly sorted colluvium above a shale-rich part of the McAlester Formation (a member of the Des Moinesian Krebs Group). The slide mass, exposed in the walls of two deep gullies, is composed of angular fragments of the underlying McAlester Formation in a moist, clay-rich matrix. The UAFS Unmanned Aerial Systems program obtained permits, created a flight plan, and acquired 791 images over the landslide with a drone-born RGB camera. DroneDeploy software was used to stitch the images together and produce a topographic map and profiles. Analysis of the profiles indicates downslope translation > 7.5 m, maximum depth to the failure surface of 3 to 4 m, and volume of slide material approximately 60,000 m³. Historical Google Earth images indicate that most of the slide movement occurred between 2006 and 2016. Weather records indicate that Fort Smith's average annual precipitation of 42 inches was exceeded during 12 of the 16 years from 2006 to 2021, with the 2015 total of 74 inches the highest on record since 1887. We conclude that the slope failure was triggered by a combination of tree removal, road construction, and abnormally high rainfall on thick clay-rich colluvium.

Mariah Thomas, Abby Kelly, Lesa Huff, Maurice Testa, Lisa Cady, Heath Cady, Cody Holt
3D Model Project of the Second Fort Walls at the Fort Smith National Historic Site Recreating the Fort Smith National Historic Site

Participants from various areas of discipline including Geoscience, GIS, Animation, and CADD students and faculty will be working to digitally model and recreate the old Second Fort wall, found located at the Fort Smith National Historic Site. Currently, only a few of the original buildings (or reconstructions) remain, the commerce building and courthouse still stand, and the second forts' stone walls have been altered cut down leaving only the foundation ground outline and remains of bastions an outline where it was located once stood. GPS points will be acquired are taken along the existing foundation line of the fort walls using Onyx application and elevation data will be acquired from existing data and research material is gathered using land survey equipment. This information will be uploaded into ArcGIS to approximate the accurately place and position the fort walls. Polycam is being tested to help recreate the fort wall using 3D digital images taken from mobile devices. From the photos, 3D modeling software is used to reconstruct the fort walls within the map space. This project will also create 3D models of the fort that can be viewed in a virtual space or printed using a 3d printer.

Kennedy C. Abanihe; Joel Ruzindana; Wisdom Ariagbofo; Manoj K. Shah; Mansour Mortazavi

Ordering-Disordering Analysis of GeSn Films using Raman Spectroscopy

Background: To explore the GeSn film material quality we studied the atomistic configuration through an investigation of the order-disorder analysis via Raman spectroscopy. **Method:** The temperature-dependent Raman measurement from Ge_{0.95}Sn_{0.5} to Ge_{0.831}Sn_{0.169} was performed over a temperature range of 90K to 450K using 785nm and 532nm lasers. The photon energy of the laser-line was kept larger than the bandgap energy of GeSn films. A conventional Raman system, LabRAM-HR was used for the measurement. The Raman measurement was started at a low 90K then the temperature was increased gradually at the rate of 3K per minute and spectra were measured at an interval of 30K. The sample temperature was maintained for 3 min to ensure stable temperature during the measurement. A weak laser power was used to avoid the local heating caused by the laser and a 50x long working distance lens was used for the measurement. **Results:** The measured spectra were fitted for the Ge-Ge order, Ge-Ge disorder, Ge-Sn, α -Sn, and β -Sn modes. The main Ge-Ge peak shifts left from 300 cm⁻¹ showing the incorporation of Sn in the Ge lattice. The 785nm laser Ge-Sn and Sn-Sn peaks are unclear due to their high penetration depth. The 785nm laser resonance is better with Ge-Sn and Sn-Sn peaks. For the 532nm laser line Ge-Sn and Sn-Sn peaks are not suppressed and show a clear shift with Sn incorporation. The shift induced by temperature is larger than the Sn incorporation, which is mainly attributed to phonon-phonon coupling and thermal expansion. The intensity of the lower concentration Sn is comparatively lower than the higher concentration Sn. **Conclusions:** The main Ge-Ge peak intensity decreases, linewidth increases, and other peaks are not clear for the samples above and below room temperature.

Kinlee O'Neal (Co-presenter), Andrew Roser (Advisor)
The influence of sodium chloride supplementation during heat activation on germination of Bacillus anthracis spores.

Bacillus anthracis is a gram-positive rod-shaped bacterium capable of forming dormant endospores in response to environmental stressors. Spores are the infective particles of anthrax disease and cause damage in hosts after transitioning into metabolically active vegetative cells through a process called germination. Germination can be stimulated artificially via molecules called germinants. For B. anthracis spores, a combination of an amino acid (L-alanine) and a nucleoside (inosine) trigger the most robust germination response. Historically, spores are exposed to a sublethal heat treatment, called heat activation (HA), to increase the extent and rate of germination. Though the physiological processes involved in spore germination are well studied, the underlying mechanism of how the sublethal heat primes spores to germinate is unclear. Manipulation of the ionic concentration during a germination assay has a similar impact on germination to HA for spores of other Bacillus species but has not been thoroughly studied in B. anthracis. Preliminary data suggests that supplementing the heat activation process, then the spores will have g NaCl during germination of unheated B. anthracis Sterne spores results in an increased extent and rate of germination similar to HA. Our goal now is to determine if the sodium ion concentration within the cortex of the spore is involved in the mechanism of heat activation. To determine the impact of NaCl during heat activation, we will measure the germination of spores that were treated with varying concentrations of NaCl in water during heat activation at 65°C for 30 minutes. Germination will be initiated with 1mM inosine and 1mM L-alanine in 20 mM Tris pH 8.0. Spore germination will be measured via the loss of OD at 580nm as the dormant phase bright spores transition into the phase dark, newly hydrated germinated spores. If sodium ion concentration does influence reduced germination extent and rate. The findings of this experiment could shed light on whether sodium ion concentration of the cortex is a part of the underlying mechanism of HA in B. anthracis spores.

Kinlee O'Neal (Co-presenter), Andrew Roser (Advisor)

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Peyton Adams and Dr. Antoinette Odendaal
Investigating the Potential Protective Effects of Antioxidants on UV-Exposed *Daphnia magna*

We are investigating the potential protective effects of selected antioxidants on the survival and development of UV-exposed *Daphnia magna*, a model organism used in the field of environmental toxicology. Elevated UV radiation is associated with the formation of harmful free radicals, which can have deleterious effects on organisms and their environments. Antioxidants are free radical scavengers shown to help combat the destructive nature of free radicals. We will be reporting on our progress in assessing the potential photo-protection of selected antioxidants on UV-exposed daphnids and daphnid eggs

Gisselle Hernandez, Dr. Mindy Farris

Effect of glucose exposure on *C. elegans* models of Huntington disease with varying ages of stress

With neurodegenerative diseases (NDs) affecting over 50 million Americans each year, neurodegeneration research is a rapidly growing field that attempts to find potential treatments, cures, or risk factors associated with NDs. *Caenorhabditis elegans* provide an excellent model organism for neurodegeneration research, as they grow/replicate quickly, require little maintenance, and can be genetically modified to exhibit common human NDs, including Alzheimer disease, Parkinson disease, and Huntington disease. The goal of the research project is to determine the effect of glucose exposure on *C. elegans* models of Huntington disease with varying ages of stress. For each experiment, two types of worms will be used: wild type (acting as the control) and the Huntington disease models. The worms will be grown on plates with either sorbitol (acting as the control) or glucose and the experiments will include a heat stress assay, either performed on day one or day seven. A heat stress assay provides insight into the worm's physical state, as response to stress is indicative of overall health. The worms will then be counted and scored every other day until no living worms remain. The data from each experiment will be analyzed to determine any correlation between the worm's lifespan, exposure to glucose, and age of stress. Finding a correlation between any of these factors may provide insight into various aspects of the progression of Huntington disease in humans. Understanding what influences the disease, either hastening or slowing its progression, is invaluable knowledge that could slow or even reverse the prognosis of an individual.

Chason Duck and Ben Rowley

Examination of 1918 Pandemic Influenza in Vermont

Influenza viruses (especially type A) are known to cause influenza pandemics. These viruses are enveloped and possess a small, segmented genome. What typically causes these epidemic events to occur is the process of antigenic shift. Antigenic shift occurs when an organism is infected with multiple types of influenza viruses, which then shuffle and trade their genome segments. This can lead to an eventual and dramatic change in a virus's surface proteins. This can essentially make a "new" influenza virus which is more virulent because the change in surface proteins can lead to immune evasion (a lack of protective responses in place). This strain may eventually become the dominant circulating influenza virus because of its virulent effects. Four influenza pandemics have occurred since the 1900s (1918, 1957, 1968, 2009). The 1918 pandemic was the deadliest of the four. It is estimated that 30 to 50 million people died globally in this single pandemic, with an estimated 675,000 deaths occurring in the United States. What is still lacking is a closer analysis of influenza deaths on a county-by-county basis in different states in the 1918 pandemic. At the time, due to the extent of the pandemic and the timing surrounding World War I, some US information on influenza deaths was extrapolated indirectly rather than directly obtained. In this study, death records for the state of Vermont in and around the 1918 influenza pandemic were examined. Demographics for recorded deaths were collected and compared. By evaluating these demographics, we more accurately understand how the virus spread, and new information can be obtained on how and why significant differences or similarities in influenza death patterns occurred in the state of Vermont.

Destiny Guillory; Sarah DuRant; Erin Sauer; Madeline Sudnick
Effect of maternal disease severity on transfer of antibodies to offspring

Individual variation in susceptibility to pathogens can be driven by many biotic and abiotic factors, including parental effects⁸. Parents provide the foundation for an individual's immune system through genetic inheritance and continue shaping offspring immunity during prenatal and postnatal development¹². For example, the vertical transfer of maternal antibodies can differ due to many different nongenetic maternal factors, including environment, disease history, and behavior. Understanding the nongenetic ways parents contribute to offspring will allow us to better understand variation in disease susceptibility among individuals. Here we examine the effect of maternal infection severity on the concentration of vertically transmitted antibodies in the developmental environment (i.e., egg yolk). We collected unfertilized domestic canary eggs from 13 clutches of mothers with prior exposure to *Mycoplasma gallisepticum* (MG) and 13 naive mothers. Using the yolks from these eggs, we quantified total egg yolk antibodies with an enzyme-linked immunosorbent assay, or ELISA². We found no significant effect of MG-exposure, disease pathology, or MG-load on egg yolk antibody levels. Yolk antibody levels were also not affected by egg yolk mass. Further research is needed to determine whether MG-specific antibodies differed among treatments, other factors of maternal disease shape vertical transfer of antibodies, and how vertical transfer of antibodies varies with time post maternal infection.

Elizabeth T. Martin, Harley L. Hines, Amber M. Parnell, and Chiraz-Soumia M. Amrine
Chemical and Biological Investigation of *Sambucus canadensis* anthocyanins

New treatments for cancer and bacterial infections are needed, especially because most patients acquire resistance to conventional first-line treatments. Many natural product metabolites exhibit potent activity, *Sambucus* sp., or elderberry, is a well-known shrub for its therapeutic benefits. This study aims to analyze how anthocyanins are extracted from the native American Elderberry, *Sambucus canadensis*. It also aims to investigate the process of vinegar baking of the elderberries to enhance the chemical space and increase the biological properties. Frozen elderberries baked in vinegar and non-vinegar baked elderberries were used to test this theory. A Soxhlet extractor was used to extract anthocyanins. For many liquid-liquid extraction steps, a rotary evaporator and a separatory funnel were required. The samples are subjected to gas chromatography coupled to a mass spectroscopy GC-MS in the hope of identifying secondary metabolites. Our preliminary results show an improvement in the antibacterial activity of the elderberries baked in vinegar extract compared to the raw organic extract.

Edwin Martinez, Dr. Arturo Ferrer, Dr. Keith Blount, Dr. Philip Hudson Williams
Phylogenetic Study of Heartland Virus Recombinants in the United States

Identified in Missouri in 2014, the Heartland virus (HRTV) is a tickborne virus with fewer than 50 documented cases. Cases have been identified in Arkansas, Georgia, Illinois, Indiana, Iowa, Kansas, and Tennessee. It is closely related to severe fever with thrombocytopenia syndrome virus (SFTSV). Belonging to the Phlebovirus group, HRTV presents very similar symptoms to SFTSV, which is exclusive to most of Asia. Because of its resemblance to SFTSV cases tend to be misdiagnosed. However, HRTV variants have been detected throughout the United States. HRTV presents severe symptoms, though the mortality rate is relatively low. Through the project, the intentions are to utilize bioinformatic tools to characterize variants, and through this process uncover their phylogeny. This will assist in creating effective molecular tools for analysis, in order to not only distinguish between STFSV and HRTV, but also for detection of HRTV variants within the United States. As a new uncommon virus, awareness and prevention for any viral particle should not be disregarded.

Archana Mishra
Probing the Interaction of Pesticides with Human Serum Albumin using Molecular Docking and Molecular Dynamics Simulation

Human Serum Albumin (HSA) is the most abundant, multi-domain blood protein, which acts as a carrier/reservoir for various endogenous biomolecules such as steroids, fatty acids, bilirubin, and vitamins. HSA can also readily bind to various blood-circulating exogenous molecules including drugs thereby affecting the pharmacokinetics of the drug. These endogenous and exogenous molecules mostly bind at the two most prominent ligand binding sites (Sudlow-I and Sudlow-II) in the HSA. The pesticides fenpropathrin and aldicarb sulfoxide fall under the extremely/highly hazardous category ($LD_{50} < 50$ mg/kg) in the World Health Organization pesticide environmental pollutants list. These pesticides are commonly used in the farming industry and, therefore, pose a risk of chronic or acute exposure. Here, I have studied the molecular interaction of fenpropathrin and aldicarb sulfoxide pesticides with HSA. These pesticides were also chosen because of their differing molecular properties. Molecular docking was first performed to determine the pesticide's affinity for two ligand-binding sites in HSA. Further, molecular dynamics simulations (MD) of HSA with and without pesticide in the binding pocket were performed using GROMACS using CHARMM force field. The results obtained from the docking and MD simulation study show the structural characteristics of two molecularly different pesticides that interact with the Sudlow-I and/or Sudlow-II binding site of HSA.

Paola Ibarra, Dr. Mindy Farris

Effect of glucose supplementation on longevity and stress resistance in wildtype and insulin-signaling mutants of *C. elegans*

Due to many reasons such as its short lifespan, its fully sequenced and thoroughly researched genome, ease in culturing, and rapid regeneration time, the free-living nematode *Caenorhabditis elegans* has long been used as a model organism in biological aging research. *C. elegans* and humans have many closely related genes as well, making it an ideal organism for experimentation for potential human application of results. Insulin has long been a subject of longevity in research, in particular the insulin-like growth factor (IGF) signaling (IIS) pathways. Signaling through these pathways has also shown to be a major factor in the risk of forming diseases such as cancer and diabetes in later life stages. The effect this pathway has on *C. elegans* longevity and stress resistance can be examined through the addition of glucose to their growth media. Past studies utilizing *C. elegans* with mutations in the *daf-2* gene (encoding an insulin receptor-like protein), or *age-1* (encoding the catalytic subunit of PI3K), have shown that these worms show greater longevity and greater resistance to stressors. These mutations can also cause an arrest in development, a dauer larval stage, which is optimal for survival of *C. elegans* under harsh conditions. This increased lifespan and resistance to stressors may be through the *daf-2* mutant's ability to phosphorylate and effectively block DAF-16 signaling, a conserved FOXO transcription factor that is a main target of insulin and insulin-like signaling. When signaling through the *daf-2* pathway is turned off, DAF-16 translocates into the nucleus to promote target gene expression, expressing different phenotypes thought to be associated with longevity and greater stress resistance in *C. elegans*. Past research has indicated that glucose can cause a reduction in lifespan and stress resistance of wildtype (N2) *C. elegans*. However, our research shows that glucose can benefit worms exposed to heat stress, but only early in life (1-day-old adults). Glucose has a neutral or negative effect later in life. Sorbitol will be used as a control in this experiment, to determine whether these effects are due to the added glucose itself, or possibly from an osmotic effect from sugar being in the growth media.

Robert Redditt, Sam Duvall, Dr. Mindy Farris

Effect of glucose exposure on *C. elegans* genetic models of dietary restriction with varying ages of stress

Caenorhabditis elegans is a free-living soil nematode that has become a widely used model organism in laboratories around the world. It is small, ~1mm as an adult; easy to maintain on Petri dishes spotted with their favorite food, bacteria (*E. coli*); and it is transparent, making physiological analyses possible. The cell lineage of all 959 cells of the hermaphrodite (and all 1031 cells of the rarer male) is known, and while it is one of the simplest multicellular organisms available for study, it is also remarkable in its ability to recapitulate human physiological function and disease. In addition to their use in studying disease progression, *C. elegans* is useful for studies of normal biological processes in animals. It has become particularly helpful in the study of aging, owing to its relatively short lifespan (~3 weeks) and the ability to grow and use large numbers of them in a single experiment. Not surprisingly, a strong link has been shown between longevity and resistance to various types of stressors: severe stress shortens lifespan, and many, if not all, interventions that extend lifespan appear to also confer resistance to severe stresses. Measurements of stress response can thus be a highly predictive measure of longevity. Also, measuring stress resistance at different ages can tell us when in an organism's lifespan a variable (like a specific nutrient or hormone) is most important. In this project, we want to determine the overlap of stress resistance at different ages with dietary restriction (DR) using the *eat-2* genetic model of DR. Glucose has been shown to shorten overall *C. elegans* lifespan. Glucose effects on stress resistance, however, are complex. Data from our lab show that added glucose has a protective effect on worms exposed to heat stress, although only early in life (stressed as 1-day-old adults). Added glucose has neutral or negative effects on worms stressed as 7-day-old or 13-day-old adults. This appears to be the case for both wild-type (N2) and *daf-2* worms which have a mutation in their insulin-like-ligand receptor. We will be studying the effects of glucose the stress resistance of N2 and *eat-2* worms. In addition to our standard procedure, where worms are exposed to glucose from Day 0 until death, we also want to determine the effects of short-term (~1 day) glucose exposure on older (7-day-old and 13-day-old) animals.

Noah Reed, Kenzie Cowan, and Adrian Showalter, Ph.D

Magnesium and Zinc Nanoparticles Effectively Treat Triple-Negative Breast Cancer In Vitro.

Breast cancer is one of the most common forms of cancer, with the triple negative (TNBC) variant being the most severe. TNBC cells lack receptors for estrogen, progesterone, and human epidermal growth factor 2 (HER2). Each receptor regulates cell division, growth, and metastasis. Without these receptors, TNBC cells will not respond to treatments involving any of these hormones and will quickly metastasize. Current breast cancer treatments essentially bulldoze through the body by attacking all rapidly dividing cells. We chose nanoparticles (NPs) to represent a more selective treatment for the TN variant. Various types of NPs offer protection to healthy breast tissue while killing cancerous tissue. A wide variety of research exists throughout the world with the goal of inducing apoptosis in TN breast cancer cells. In our laboratory at Southern Arkansas University, we use magnesium oxide (MgO) and zinc oxide (ZnO) NPs in varying dosages as treatments for MDA-MB-231 TN breast cancer cells. To analyze our experiments, we use Live/Dead fluorescent flow cytometry and imaging. We use the fluorescent dye exclusion assay to measure cell viability through flow cytometry while avoiding potential reactions with ROS generated by the treatments, which would alter our results. In addition, we use fluorescent dye imaging, which allows us to visually look at the difference between live and dead cells. Live cells stain green after the calcein dye interacts with intracellular esterases while dead cells stain red after BOBO-3 Iodide binds to nucleic acids when the plasma membrane is disrupted. Our results indicate both ZnO and MgO NPs induce cell death, although at different dose ranges. We continue to study the ideal dose range for killing cancer cells with minimal effects on healthy tissue. In the future, we will confirm if the nanoparticles work with a wider variety of breast cancer subtypes as well as other types of cancer. We will also explore metallic nanoparticles as a delivery system for substances, such as natural products or certain drugs, that may have potential for inducing apoptosis without damaging healthy tissue.

Mackenzie Rodger, Djamali Muhoza

Binding Studies of Small Molecule Inhibitors to KRAS G12C Mutant Protein

Mutations of proto-oncogenes are one of the leading causes of cancer. Kras G12C is one mutation that is responsible for 25% of common cancers including pancreatic, colorectal, and colon cancer. The KRas mutation is responsible for the proliferation and cells that ultimately leads to the metastasis of cancer cells due to the lack of conversion of GTP bound active to GDP bound inactive. Using PDB database of millions of small molecules, a similarity search was conducted using existing inhibitors. From the similarity search, new molecule inhibitors were found that had all the characteristics of a good small molecule, denoted by the Lipinski Rules of Five and other ADMET characteristics. The results from the similarity search and docking simulations show that the binding scores of the new molecules are comparable to FDA approved Kras Inhibitors. Using these results, molecules with better drug properties and binding scores and other drug properties can be designed.

Morgan Schuster and Dr. James Hyde
Hormone Analysis in Organotypic Cultured Pituitary Glands Exposed to Simulated Microgravity

The pituitary gland is a small organ located at the base of the brain, near the optic chiasm, that controls, monitors, and regulates the secretion of at least 6 major hormones in the body. The goal of this project is to study and identify how microgravity affects the structure and functional activity of the pituitary gland. Previous research conducted on both rodents and humans shows that both the structure and secretory functions of the pituitary gland were altered due to space flight. However, it is difficult to accurately measure these functions during spaceflight. These disruptions could alter the endocrine function and result in profound physiological changes to the human body. Research conducted in our lab shows that it is possible to maintain whole pituitary glands in a humidified 5% CO₂ incubator using organotypic culture techniques for up to a month. We built a simplified random positioning machine for simulating microgravity in our incubators. Accelerometer analysis showed that the summed gravitational vector inside the machine drops to less than 0.03 m/s² after 12 hours. We took our previous organotypic pituitary culture protocols and redeveloped the petri dishes and microwell plates to allow rotation in three dimensions without spilling culture media and maintain an interface environment. Adult mouse pituitary glands were extracted and cultured using previously developed organotypic culturing methods. The glands were maintained in a small petri dish in an interface environment on a semipermeable membrane. The 12 glands were placed into the RPM while 12 were kept under standard gravitational conditions for 14 days. Multiplex ELISA analysis was used to measure hormone levels in the tissue samples. Analysis demonstrated a significant ($p = 0.004$) decrease in female TSH by 54%. Other results were not considered significant but demonstrated a need for further investigation. Male GH increased by 12% ($p = 0.06$). Male FSH decreased by 28% ($p = 0.08$) and TSH decreased by 30% ($p = 0.08$). This pilot study demonstrates fascinating sex-dependent between males and females which may be useful for long-term life in space.

Rayan Shuja, Daniel Barrett, Cristobal Garcia, Weston Northington, Jamya Pinkney, Hannah Stovall, and Andres A. Caro
CYP2E1 overexpression protects COS-7 cancer cells against ferroptosis

Ferroptosis is a recently described form of regulated cell death initiated by the iron-mediated one-electron reduction of lipid hydroperoxides (LOOH). Cytochrome P450 2E1 (CYP2E1) induction, a consequence of genetic polymorphisms or/and gene induction by xenobiotics, may promote ferroptosis by contributing to the cellular pool of LOOH. However, CYP2E1 induction also increases the transcription of anti-ferroptotic genes that regulate the activity of glutathione peroxidase 4 (GPX4), the main ferroptosis inhibitor. Based on the above, we hypothesize that the impact of CYP2E1 induction on ferroptosis depends on the balance between pro- and anti-ferroptotic pathways triggered by CYP2E1. To test our hypothesis, ferroptosis was induced with class 2 inducers (RSL-3 or ML-162) in mammalian COS-7 cancer cells that don't express CYP2E1 (Mock cells), and in cells engineered to express human CYP2E1 (WT cells), and the impact on viability, lipid peroxidation and GPX4 was assessed. CYP2E1 overexpression protected COS-7 cancer cells against ferroptosis, evidenced by an increase in the IC₅₀ and a decrease in lipid ROS in WT versus Mock cells after exposure to class 2 inducers. CYP2E1 overexpression produced an 80% increase in the levels of the GPX4 substrate glutathione (GSH). Depleting GSH in WT cells reverted the protective effect mediated by CYP2E1, causing a decrease in the IC₅₀ and an increase in lipid ROS after exposure to ML-162. Inhibiting Nrf2 in WT cells also reverted the protective effect mediated by CYP2E1, causing a decrease in the IC₅₀, an increase in lipid ROS and GSH depletion after exposure to ML-162. These results show that although CYP2E1 can promote ferroptosis via LOOH accumulation, competing anti-ferroptotic pathways probably mediated by Nrf2-dependent GSH induction shifted the pro-anti ferroptotic balance towards anti-ferroptosis in CYP2E1-overexpressing Cos-7 cells.

Tallely, B, H. Myers, and E. J. Bacon
Biodiversity and Community Structure of Aquatic Insects in the Little Missouri River

Biodiversity and community structure of aquatic insects were investigated in the Little Missouri River above the confluence with the Ouachita River at Tate's Bluff from 2017 to 2022. Total taxa of aquatic insects exceeded 100 species with 20 species of Ephemeroptera (mayflies), 17 species of Plecoptera (stoneflies), and 25 species of Trichoptera (caddisflies). Six species of burrowing mayflies were collected from the riffles, pools, and banks of the river. Aquatic insect densities were sampled in the riffles with a modified Hess sampler. Insect densities ranged from 770 to 2,830 individuals per square meter. Stoneflies and mayflies accounted for 55 % of the total number of individuals in the quantitative samples.

Zurab Sabakhtarishvili, Sijan Panday, Clayton Jensen
Crime Prediction Using Machine Learning: The case of the City of Little Rock

The city of Little Rock, Arkansas has seen an increase in crime thus requiring the ability to predict crimes before they happen. We plan to use predictive policing methods using machine learning and other data science techniques the overall crime rate in Little Rock while preventing the number of resources required to do so from increasing. Predictive policing has a precedent in Boston, Massachusetts and may be justifiable for Little Rock. Using this precedent and new techniques, we hope to strengthen our communities in Arkansas and potentially forward our learnings unto other researchers to fulfill the potential of a predictive policing system being more widely available. Using data analysis techniques and a dataset - spanning the years 2017 to Q3 2022 - provided by the Little Rock police department, we understood what crimes were occurring in Little Rock, including the time and location of these crimes, by creating graphical reports and an interactive map of the Little Rock city limits. Additionally, we plan to allow a machine learning algorithm to take these findings and begin the predictive portion of our research. As stated, the potential for predictive policing to become a system that other cities can use throughout Arkansas is significant as it will reduce crime rates for cities that implement the system as well as provide city legislature year-to-year insights on city crime.

Jonathan Bunnell, Mahbub Ahmed, Md Islam
Study and Design of a Walking Robot

This study focuses on developing and analyzing walking robots with diverse applications, including rescue operations and battlefields. Specifically, the current work presents a gait and kinematic analysis of a quadruped robot capable of navigating rough terrain by emulating real-life quadruped animals. Furthermore, the study introduces a walking robot based on Jansen's mechanism, initially designed for efficient walking on beaches. Using 3D modeling software, the mechanism's components are designed, and a Lego Mindstorm microcontroller powers the fully functional walking robot. In addition, ultrasonic sensors are added to enhance the robot's capabilities, enabling autonomous operation as an explorer robot. The experience gained from this project provides valuable insights into the mechanism and operation of walking robots, making it an enriching endeavor.

Cody Capocelli, Timothy K. Davis, Ashokkumar M Sharma
Determination of feasible backpressure on the flapper valve to achieve sustainable performance of the hydraulic ram pump

The goal of the present study is to upgrade the current techniques for precise measurements of the performance parameters of the hydraulic ram pump system. The current methods to collect and measure the quantity of wastewater at the flapper valve are ineffective, resulting in measurement errors. Also, various traditionally available water measurement devices are not suitable for the existing ram pump system as it needs a customized design configuration fitting the current system. The testing of an initial custom-built wastewater collection unit exhibited some backpressure creation above the flapper valve exit. Currently, the necessary revisions and initial testing of the wastewater collection and measurement unit are in progress to determine the feasible range of the backpressure on the exit of the flapper valve to sustain the smooth functioning of the hydraulic ram pump system. Based on the preliminary data, a maximum columnar height of about 53 inches above the 3/4-inch flapper valve is found to be feasible at which the existing ram pump sustained its operation at nearly 5 psi system pressure. The development of an innovative wastewater collection and measurement unit is in progress. The top of the waste valve column will integrate a 3-way T-port ball valve with two routes for wastewater. In position 1, the water recirculates using the recyclability system. With a turn of the ball valve, water will be redirected to a measurement line, leading to a range of volumetric beakers. Since the ball valve uses a simple control mechanism, precise control timing will be possible. Using a pipeline to transport water to a beaker, it is assumed no losses will occur. The main experiments with the upgraded system will be carried out and the results will show the overall performance of the ram pump in terms of system pressure, the quantity of the pumped water, and the pump's volumetric and energy efficiencies.

Timothy K. Davis, Cody Capocelli, Ashokkumar M. Sharma
Design, development, and testing of a wastewater recycling system of hydraulic ram pump

The traditional configuration of the hydraulic ram pump system typically generates nearly 80-90% of wastewater at the flapper or waste valve, which is located at a low elevation, while delivering only about 10-20% of the supplied water to a higher elevation. The primary objective of the present study is to provide a recyclability system to reduce the amount of wastewater generated at the waste valve by adding a turbine generator or solar-powered pump to reuse the wastewater back in the source tank. The secondary objective is to develop a portable system by making the cart smaller and/or foldable. Preliminary testing using the existing ram pump system revealed promising results that the pump operation can be maintained with some built-in water column of a maximum of up to 53.25 inches just above the waste valve. Remarkably, the initial data showed that practically most of the wastewater can be recycled back to the source tank, making the hydraulic ram pump system waste-free. The modification in the existing hydraulic ram pump system is in progress to incorporate the solar pump and/or turbine generator-based water recycling unit for the proposed work. The recycling unit will utilize clear, flexible/semi-rigid polymer piping. The results from this study will show the recycling efficiency and overall pump performance.

David P. Heinrichs, Vitali V. Maldonaldo, I Kade Gita Ardana, Rebekah M. Samsonraj
Assessing the Effects of Dasatinib on Mesenchymal Stem Cell Potency

Cellular therapy and regenerative medicine are rapidly growing fields of research due to successes in clinical trials of stem cell therapy. Progressive aging, or senescence, of Mesenchymal Stem Cells (MSCs) is a major obstacle faced when trying to culture potent stem cells for use in therapy because older cells stop dividing and stop performing critical functional effects that contribute to their potency. It is not yet known how to slow down senescence or how to reduce the number of non-viable MSCs in culture. Our study sought to test the effects of dasatinib, a senolytic agent on senescent (MSC passages 12-18) and non-senescent (MSC passages 3-6) MSCs in culture by testing changes in osteogenic and adipogenic differentiation, proliferation, and immunosuppression or potency. Our results demonstrated significant changes in all three of these categories, indicated by evidence gathered from proliferation and indoleamine dioxygenase activity assays, with dasatinib reducing the population of senescent MSCs and allowing non-senescent MSCs to continue differentiating and proliferating without interference from older cells. Our results showed evidence of an increase in cell potency in the senescent populations assessed from an immunosuppression assay as the higher population of young cells were able to continue performing their functional duties. Together, our results on functional assessments from the reduction of senescence to MSCs subjected to extensive culturing add new knowledge to the field of stem cell biology holding significance in development and optimization of MSC-based cellular therapies for treating degenerative and immune-related disorders.

Andrea Herrera

RadioTelescope Project Observation

Just as optical telescopes collect visible light, bring it to a focus, amplify it, and make it available for analysis by various instruments, so do radio telescopes collect weak radio light waves, bring them to a guide, strengthen it, and make them available for analysis. By observing measurements from the appropriate radio telescope that will use (Spider 230C); 3 projects: (Mapping the Spiral arms of the Milky Way, Identifying the Hydrogen emission line, and Observation of Solar Periodicity), we will take appropriate measurements that will fit the Spider 230C. These measurements include radio disk dimensions for angular resolution, frequency, and wavelength effects and their relationship to the measurements. This process can be used to predict the usage of other individual radio telescopes and what future measurements and work can be used for specific or certain instrumentations.

Vitali V. Maldonado, I Kade Karisma Gita Ardana, Rebekah M. Samsonraj

Phenotypic and quality assessments of continuously expanded human bone marrow-derived mesenchymal stem cells from multiple donors.

Cellular therapy is a rapidly growing field as evidenced by success in preclinical and clinical studies. Of particular relevance are mesenchymal stem cells that have the ability to self-renew, differentiate down multiple lineages, and secrete bioactive factors that render them ideal candidates for tissue repair and regeneration. However, cellular heterogeneity between donors, and intra-donor heterogeneity with repeated subculturing are major bottlenecks in translation to successful cellular therapies. It is not yet known how routine in vitro subculturing can impact overall cellular health and functional integrity of the cells. We sought to identify phenotypic differences based on cumulative growth, osteogenic and adipogenic differentiation capacity, secretion of immunomodulatory factors, metabolic parameters, and senescence marker expression on both actively proliferating cells (young MSCs, passages 3-6) and steadily senescing cells (old MSCs, passages 12-18) upon replicative expansion. Our results demonstrate significant differences in osteogenic and adipogenic differentiation capacity of these donors supported by both histological staining and real-time polymerase chain reaction (PCR)-based gene expression studies. Old MSCs exhibit increased senescence-associated beta-galactosidase activity, accompanied by altered immunomodulation capacity as assessed with indoleamine 2,3 dioxygenase secretion and immunosuppressive properties in co-cultures with T cells. We also correlate metabolic marker expression with total time in culture and passage frequency. Together, our results on phenotypic and functional assessments on MSCs subjected to extensive culturing add new knowledge to the field of stem cell biology holding significance in development and optimization of MSC-based cellular therapies for treating degenerative and immune-related disorders.

Jacob Oster, Dr. Robert A. Fleming

Design of an Environmentally Regulated Chamber for G. mellonella Biodegradation Studies

An experimental testing chamber has been designed to perform science experiments on a species of moth known as Galleria mellonella, or the wax worm. Wax worms are known to biodegrade low density polyethylene (LDPE) plastic via digestion. Certain environmental variables, such as temperature, greatly affect the plastic consumption ability of the wax worms. Sustained high temperatures have been shown to be create high-stress environments for the wax worms, potentially resulting in death. To address this, the chamber allows for a more systematic approach to wax worm testing than has previously been possible and allows for better characterization of the wax worms' microbiome. The chamber is built to keep a constant temperature and humidity throughout any length experiment cycle as well as providing high quality air filtration for the incoming air. The chamber also constantly logs temperature and humidity to better assist the post experimental analysis.

Landon Perdue

Effect of Biodegrading Plastic in Microgravity on Long Term Space Sustainability

The use of low-density plastics is a prevalent part of our everyday life, and space travel. From bottling devices to radiation shielding there are many convenient uses for these polymers. This proves detrimental to our environment, however, as it takes hundreds of years for these plastics to degrade naturally, leading to an overpopulation of landfills and stray debris in our oceans. As we travel further into the expanse of our solar system, inevitably, the use of these plastics will follow, as well as the accumulation of waste. Galleria Mellonella, or the "wax worm", has been shown to consume and biodegrade low density Polyethylene (Plastics) into Ethylene Glycol, due to the microbiome in the wax worm's stomach. As our knowledge of this process on earth grows an opportunity is presented to apply this to the long-term sustainability of space travel. With the ability to biodegrade low density plastics to Ethylene Glycol, which has many uses from antifreeze to laxatives, extended space flight can become more economical due to the ability to reuse waste plastics. Utilizing plastics in this way allows for a decrease in the accumulation of plastic waste on mars and on the moon. The first step in making this leap is determining whether the wax worm's microbiome can degrade low density Polyethylene in microgravity. Our team was able to send a payload to the International Space Station in order to determine if microgravity has any effect on the biodegradation process. With one month of imaging documentation it qualitatively appears, with quantitative data in the works, that wax worms were not only able to survive their prolonged exposure to microgravity, but also able to produce Ethylene Glycol. This shows that long term use of the Galleria Mellonella microbiome could provide a more sustainable future in our solar system.

Brandon Ravenscraft, Md Rashedul Islam, Lionel Hewavitharana, Abdel Bachri, Mahbub Ahmed
Analyzing the performance of wood ash modified asphalt concrete under wheel Tracking Test

The rutting performance of asphalt concrete pavement relies on the asphalt mixture, temperature at which it performs and design thickness. Installation of flexible pavement with compacted sub-base extend the service life of the roadway. Addition of recycled material as a filler can reduce the cost of construction and improve the mechanical property. Wood ash as a filler material was added at different percentage to asphalt concrete and effect of adding wood ash was monitored on its rutting performance. Wood ash was successfully blended with asphalt concrete mix to produce standard sample using gyratory compactor. Sample produced with the compactor showed nice dense product with desired 3-4 % air void and low water absorption. A series of sample were produced and analyzed with wheel track testing machine. Three different asphalt binder was used in this research project (PG 64-22, PG 70-22 and PG 76-22).

Joel B. M. Ruzindana; Kennedy Abanihe; Wisdom Ariagbofo; Manoj K. Shah; Mansour Mortazavi
Modeling of III-V-on-Sapphire Waveguides for Sapphire-based Photonic Integrated Circuits Platform

Background: Photonic integration circuits (PICs) have the potential to deliver a chip with reduced size-weight-power-and-cost. PICs have been demonstrated in various material systems such as III-V, Si, Si₃N₄, LiNbO₃ with varying levels of functionality. The thermal expansion mismatch between epitaxial film and substrate is the dominant factor responsible for the generation of large number of defects and eventually, device failure. From a material growth perspective and closely matching linear coefficient of thermal expansion of sapphire to that of GaAs and GaSb, sapphire is a favorable substrate for the growth of III-V materials. Thus, a sapphire-based platform has the potential to be used for large-scale integration platforms just like silicon-based photonic integrated platforms. Methods: We studied a GaSb/AlSb-on-Sapphire waveguide for Sapphire-based photonic integrated circuit platform by finite-element-method (FEM) using commercial software Ansys. The materials GaSb, AlSb, and Sapphire were used for core, buffer, and substrate layers respectively to design rib and strip waveguides. Using FEM, we numerically investigated multi-mode, single-mode and cut-off conditions and single-mode propagation loss in the GaSb/AlSb-on-sapphire straight waveguides over a broad optical wavelength. Results: We presented the cut-off, single-mode and multi-mode operation conditions of rib and strip waveguides. The higher index contrast between core and substrate layer allowed us to design compact, low-loss waveguides in the mid-infrared regime. Conclusion: The presented low-loss, GaSb/AlSb-on-sapphire photonic integrated platform would enable a range of applications in defense systems, and numerous civilian applications such as big data machine learning, fiber optic communication, instrumentation, RF photonics, space exploration, and in nuclear applications. Keywords: Group III-V materials, optical waveguides, photonic integrated chips, finite-element-method.

Zurab Sabakhtarishvili, Clayton Jensen, Sijan Panday
[Mentor: Dr. Robin Ghosh]
Crime Prediction Using Machine Learning: The Case of the City of Little Rock

The crime problem is pressing for the city of Little Rock, Arkansas. In this study, we aim to use machine learning algorithms to predict criminal activities in the city and identify meaningful insights into crime patterns. Our research examines predictive modeling methods that can be used to establish better-informed decisions and minimize the number of resources used by LRPD. For our study, we examined publicly available datasets from LRDP with crimes reported in Little Rock from 2017 to 2022, creating digestible analyses and visualizations for presentation. With machine learning, we hope to strengthen our communities in Arkansas and potentially forward our learning to other researchers to fulfill the potential of a predictive algorithms being more widely available. Throughout our research, we employed the Prophet model for time series forecasting to produce an outlook on the amount and distribution of crimes occurring daily. Currently, the evaluated performance of the existing model is giving promising results for future improvements. In addition, our unified Prophet ML model could be deployed in any city based on data availability.

Jordan Smith and Ganna Lyubartseva, Ph.D.
One Hundred Twenty-Two Years of Nobel Prize in Physics: Study of Laureates' Age and Gender

Nobel Prize in Physics is the most distinguished annual award in physics. In his will of 1895 Alfred Nobel designated the prize to "those who during the preceding year have conferred the greatest benefit to humankind." In this work, we surveyed age at the time of award and gender of Physics Nobel laureates. We studied trends from 1901 to 2022 divided into two time periods 1900's (twentieth century) and 2000's (twenty first century) and analyzed similarities and differences. We focused on three parameters: average age of all physics laureates, age of men and women award winners and representation of women among Physics Nobel Prize winners. Our analysis indicates that the average age of all Physics Nobel Prize winners is increasing from 1900's to 2000's. We also observed that women physics laureates are younger than men on average. However, overall age increase of Physics Nobel Prize winners is more prominent for men compared to women. Our study indicates that the percentage of women Physics Nobel Prize winners, although still small, is increasing in the twenty first century compared to the twentieth century. We are hopeful that our findings will motivate girls and women to pursue physics research, in which women are historically underrepresented.

Sierra Strickland

Hubble Archives Spectroscopy Analysis

The Hubble Telescope Archives contain data obtained from various stars. The flux of a star is determined by its luminosity, and the wavelength of an individual photon is calculated using the energy that it contains. The flux and wavelength of each star is input into a software to analyze the given data then format that data into a one-dimensional spectrum that will be input into a code called MOOG, which contains multiple subroutines that will help analyze the data gathered. The synth subroutine will compute synthetic spectra to compare with the observed spectra, and the abfind subroutine will force fit abundances of elements to formulate results that agree with the observed data gathered by the Hubble. This process will calculate the approximate amount of each element a certain star contains based on its flux and wavelength alone. Based on each star's classification, the star will be placed at a point in its lifetime where the amount of elements it contains will be appropriate. These results will allow a timeline for supernovas, neutron stars, black holes, and white dwarfs to be predicted.

Benjamin Whitfield and Robert A. Fleming

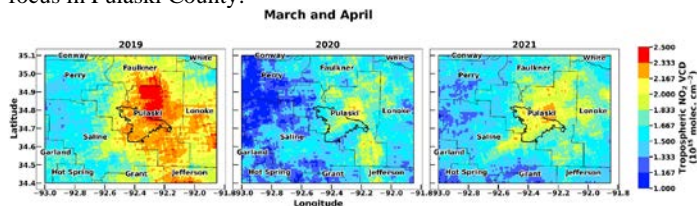
Structural Optimization of Functional Groups on Si Surfaces

Silicon is a widely utilized semiconductor material with applications ranging from computer chips to solar panels. A realistic description of the surface of Si can improve the understanding of Si surface chemistry, especially in the presence of functional groups. In this study, the structural configuration of the Si (100) surface is studied for various terminating groups, including methyl, hydroxyl, and fluoromethyl using density function theory (DFT). First, Validation simulations were performed to confirm a 2x1 surface reconstruction, along with convergence testing for k-points and wavefunction cutoff energy. Then, relaxed surface geometries are calculated using DFT-based structural optimization, along with bond dissociation energies and bond lengths at 0 K. This study provides a deeper understanding of the structure of functionalized silicon surfaces, leading to pathways to produce new advanced silicon-based materials.

Lauren Bollmeyer and Gaumani Gyanwali

The Impact of COVID-19 Lockdown on Nitrogen Dioxide Emissions in Arkansas with Focus on Pulaski County

There are 6 common air pollutants according to the US Environmental Protection Agency (EPA), one of which is nitrogen dioxide (NO₂). Nitrogen dioxide primarily results from fossil fuels being burned in power plants and vehicles. Exposure to high levels of NO₂ can result in irritation to the human respiratory system in the form of coughing, wheezing or difficulty in breathing. Prolonged exposure may also lead to the development of asthma, as well as damage of lungs. In this study, we utilized data from the European Space Agency (ESA) TROPOMI (TROPOspheric Monitoring Instrument) satellite and the US EPA's ground pollution monitoring data to observe and compare NO₂ pollution before and during the COVID-19 shutdown in Arkansas with special focus in Pulaski County.



Areonna Clifton

Examining the Impact Caffeine has on Performance

The consumption of caffeine among college students has risen over the years by 14% as of 2022. Students have a long-term dependence on caffeine during long nights of studying or trying to finish assignments. Students consume a lot of caffeine, but they never think about the long-term effects of the consumption. The purpose of this study is to observe the consumption of caffeine and determine if it has an impact on one's memory. This study is replicated from previous universities, such as John Hopkins, etc. This study has never been done within a historically black college university, so I decided to bring awareness and do a replication of this study within a historically black college university. Participants received two memory tests to examine whether caffeine has an impact on their memory. The two tests that were presented consisted of a set of fifteen numbers and words. Caffeine commands this normal cycle by impersonating adenosine in the cerebrum. It is known that most college students consume caffeine, and I was inspired to examine the outcome regarding their memorization skills.

Mia Dancy & Dr. Tasnuva Enam
Effects of Neglect on College Students

Excelling in my academic career has always been easy for me. I was puzzled as to why this was not the case for my peers either. Upon talking to my peers, I was told they do not perform well academically because they did not plan on pursuing higher education or they did not have anyone motivating them at home to push them to do better or were not present. My purpose of this research experiment is to figure out if negligence correlates to a student's grades not being the best or ending their academic abruptly. To prove whether my hypothesis is correct, the sample size for my experiment is 20 participants, ranging from college freshmen to seniors, and will divide into two groups. Group one will be non-neglected (will be given help with exams) and group two will be neglected (will not receive help with exams) college students. Each group will take an exam comprised of brain teasers ranging from easy to challenging. During the exam, their emotional well-being will be measured in group two. After the exam, calculations will be made based on my findings to see if my hypothesis, college students who were neglected tend to suffer in their academic careers, was correct.

Pashu'ar Grissom and Dr. Tasnuva Enam
Natural Hair Discrimination against African Americans in Work and School Environments

Over the years discrimination against African Americans has become evident in work and school environments. So much so, that laws and initiatives have been implemented to alleviate this prejudice. The purpose of my study is to identify the root of the issue and to uncover a possible correlation between people who discriminate against natural hair styles in work and school environments, and racism. My target audience is specifically African Americans and Caucasians, but the more diverse the race and ethnicity of my data population increases the probability of getting a more accurate result. My study will encompass a sample size of 40 participants of the African American and Caucasian race. The independent variable in my study will be Natural African American Hairstyles (NAAH) worn in school and work environments. The dependent variable will be Caucasians and African American attitudes (CAAA) towards African American Hairstyles worn in these settings (school and work environments).

Nokon Heo
How political candidates use Twitter during the mid-term election: Impacts on audience engagement and votes

Social media is becoming an increasingly popular platform for political discourse. According to a recent poll, around one in four Americans use Twitter, and around 40% of them use it for political discussions (e.g., Hughes & Wojcik, 2019). As a result, many political candidates turn to micro-blogging site like Twitter to promote their political ideologies and engage their electorates. Yet, relatively little research is conducted to examine the political impact of Twitter, particularly at the local level. This study explores the extend of Twitter use by leading political candidates in a gubernatorial election. More specifically, this study analyzes the relationship between candidates' use of Twitter during the election and their electoral performance. To examine the relationships, all tweets posted during the last year's election cycle between January 2022 and the week after the election in November by two leading candidates were obtained by accessing Twitter API. A content analysis the characteristics of those Twitter posts, such as issues, retweets, likes, and other engagement indicators was conducted to reveal their impact on votes using polls and election outcomes. The results of the analysis revealed a significant difference between the two candidates in terms of the amount of usage, content strategies, and the voter engagement. The results discussed in the larger context of social media's contribution to the American politics.

Kendrick Jackson, Dr. Tasnuva Enam
The Effects of Technology on Socialization Skills Between Generations

Technology is at the center point for how today's society operates. As technology evolves and grows rapidly, so does our independency and usage. It plays a major role in how we learn, think, and especially communicate. Although technology has improved our lifestyles and brought about necessary conveniences, excessive use of it has become harmful to the development of future generations. The present study aims to identify that there is a negative correlation between the over usage of technology and socialization skills, especially among younger generations. A survey will be conducted among participants from three different generational age groups, Generation X (people born between 1965-1976), Generation Y (people born between 1977-1995), and Generation Z (people born between 1996-2015) (CGK, 2022). Each participant will be randomly selected based on age requirements consisting of 10 participants for each age group. The survey, a total of approximately 40 questions are aimed at measuring each participants social skills, internet dependence and technology preference over interpersonal communication. Results will indicate that younger participants (Generation Z) prefer communication via online interaction as opposed to face to face, which in turn hinders their socialization skills. Meanwhile, older participants (Generation X) may view technology as more of a tool needed to keep up with the current times than a way of life. It is expected that my findings will show that Generation X have less dependency on internet usage and interpersonal communications still being valued, therefore keeping their socialization skills intact. Generation Y is believed to display a healthy balance between device and in person interactions because they have lived in a time before technology and have grown with it, instead of being born into it like younger generations or forced into it like older generations.

Samaria Jackson, Tasnuva Enam

The Effects of Stress on the Mental Health of College Athletes

Stress is an inevitable response in our everyday life that is experienced by every human being. A very pivotal yet stressful point in our life is college. When some enter college and decide to pursue a career of college athletics, what does that extra stress entail about their mental well-being? The present study investigates the effect of academic and athletic stress on the mental health of college athletes. A survey will be conducted among two groups of participants. The low stress group will consist of 20 lowerclassmen (Freshmen and Sophomores), and the high stress group will consist of 20 upperclassmen (Juniors and Seniors). These participants will be randomly selected from the ten sports offered by our university. A 10-question stress scale will be given first and geared towards measuring the participant's current stress level. A 21-question depression inventory will be given to participants immediately following the stress scale to measure current depression levels. Results will indicate that the high stress group will possess higher scores on the stress scale which will correlate to high scores on the depression inventory. I expect that my findings will show that college athletes face higher stress in the later years of their college experience while trying to balance their academic and athletic responsibilities. My findings will bring awareness to the negative connotations faced by college athletes as well as the toll stress takes on their mental health.

Frenchelle Johnson, Tasnuva Enam

PTSD in women veterans and the effects in can have once they return home.

Post-traumatic stress disorder is a mental disorder that is triggered by a terrifying event. Unfortunately, more women veterans will experience PTSD (post-traumatic stress disorder) while serving in the military than men. Women also find it harder to adapt once they return home because of stressful events including but not limited to Sexual Trauma. This study will test the prevalence of PTSD and the effects it may have on everyday life once they return home. A questionnaire will be given to 20 women veterans. Of the 20 women 10 have been diagnosed with PTSD. By conducting this study regarding the prevalence of PTSD and the possible effects related to adjusting once they return home, we can begin to understand the concept and find a way to target the problem with respect to the soldier.

Derico Marks

Effects of Procrastination

Students go through all types of things physically and most importantly mentally throughout their semesters. Most students have so many different classes that they sometimes forget about certain assignments, or they wait until the last minute to do them. This research experiment is to see whether it is a significant difference in stress levels between those students who procrastinate and those who do not. For this experiment, I am using a survey to question fifteen to twenty University of Arkansas at Pine Bluff students. Each participant will have to answer the same questions. The first couple of questions I ask are short answers then the rest of the questions will be answered with a number zero through seven. I expect the participants who procrastinate to have higher stress levels than those participants who do not procrastinate. Once I get the results, I am hoping that this will help me and the participants who procrastinate change their ways.

Morgan Miller

How is Mental Health Affected by Single vs Two Parent Households

An individual's childhood upbringing can have a major impact on their life. Whether or not, a person comes from a single parent or two parent household, it is still possible for the individual to suffer from childhood trauma, being that mental health has become a major problem today. Most individuals in today's generation suffer from different mental illnesses daily that stem from something within their childhood. Sometimes a person will not believe that it is a mental illness that they are dealing with. Some of the common mental illnesses are anxiety, depression, PTSD (Post traumatic stress disorder), etc. The purpose of this study is to measure the effects on a variety of different participant's mental health from either single or two parent households. The participants will be given a survey that contains thirteen questions that are mainly focused on how each participant mental health has been affected by their childhood environment. The results will show that although some of the participants from two parent households are viewed differently from the single parent household participants, they could still be at risk to face the same problems.

Francesca Nance

Color & Mind: The Relationship of the Way Colors Can Play with Our Emotions

This study describes if the presentation of certain colors can cause a physiological reaction in the body that displays reactions of calmness or anxiousness amongst those that suffer from anxiety as opposed to those that do not suffer from anxiety. In the study, the researcher will conduct two tests: a test of the presentation of cool colors (blue, green, and purple) and a test of the presentation of warm colors (red, orange, and yellow). The cool colors are expected to bring participants to a state of calmness and relaxation; however, the warm colors are expected to bring about a state of anxiousness. Levels of calmness and anxiety will be measured by collecting a blood pressure sample after the presentation of each color in comparison to the initial blood pressure measurement taken before the start of the color presentation. Participants will be divided into anxiety vs. non-anxiety groups based on their results of taking a Generalized Anxiety Disorder (GAD-7) Anxiety Scale test that categorizes them based on severity. The categories include none/minimal anxiety, mild anxiety, moderate anxiety, and severe anxiety.

Shaniyah Smith

Effects of Alcohol Use on College Students Academic Performance

College helps students by preparing them to take the next step towards their future. My research will be focused on the effects of alcohol use in college students' academic performance. No matter what age or sex, some college students have had an encounter with alcohol. In the United States, one in four individuals between the ages of 18 and 23 drinks alcohol on a monthly basis, and the ratio changes to five or more drinks every two weeks. Alcohol consumption among students is generally viewed as a socially important topic and is a reason of concern among many parents and school administrators. In the past some of the research has been conducted that has shown alcohol consumption negatively affects students as they are not able to balance out their academic work and social life causing potential dropouts and failing classes

JoAnna Swygert, Enam Tasnuva

Do Appearances Affect the Way People Judge You

Have you ever heard of the saying called "pretty privilege"? It is when people who are perceived as attractive are given extra benefits in life that others are not given. Attractive people are not only more likely to get hired but they are also seen as more trustworthy. People are also more attentive to an attractive person and receive information differently. The present study is to identify if there is any correlation between attractiveness and intellectual competence. There will be a total of 30 participants, each split into two different groups. In one group the speaker will appear more attractive versus with the second group. Both groups will participate in the listening of a speech and be given a survey with a total of 10 questions on their enjoyment of the speech. It is expected that the speaker will be rated the highest when she presents herself the most attractive.

Miracle Taylor

The Effectiveness of Music Therapy

For my research forum study, I want to test the effectiveness of Music Therapy. I want to conduct a 2-hour session of music therapy on a group of students after going through mid-term week. The main target of this study is nursing and ITMAE majors. Before beginning the study, I will have the individuals take a worry questionnaire to see where their anxiety levels are and once more after the study is over. By conducting this study, I expect the anxiety levels to be different from the anxiety levels that were recorded at the beginning of the study. I expect my results to show that music therapy has some type of effect on one's mental health and can be used when they are feeling stressed or overwhelmed. I also expect from my results since I am testing 5 males and 5 females from each major, that the females from both majors' anxiety levels will be the most effected by the Music therapy session.

**Ganna Lyubartseva, Mahesh Pattabiraman and
Surabhi Chandra**

**Challenges of Science Undergraduate Research at
Four-Year Public Universities**

Current work reflects points of view of faculties, with combined experience of over forty years, about challenges of undergraduate research in science at four-year public universities. Unlike graduate students, for whom the primary focus is research, undergraduate students prioritize coursework to research with respect to effort and time. In addition, typically research is not the major requirement for graduation with a B.S. in science from four-year universities. With recommended fifteen credit hours per semester for a full-time undergraduate student, students often work part-time or in some instances full-time, when taking online courses. Therefore, they can commit only very small number of hours towards research, if any. As a result, recruiting research students and planning research projects, which will be aligned with students' expectations, are crucial for a faculty who wishes to maintain an active and publication producing research group in an undergraduate university.

Matthew B Connior

**Impacts of Mountain Bikes on Amphibian, Reptile,
and Small Mammal Mortality**

Mountain biking is becoming a very popular recreation activity, especially in northwestern Arkansas. Although mountain biking has numerous positive effects on humans, one potential negative aspect of mountain biking is the effects on wildlife. Little is known about the direct effects of mountain biking on the mortality of amphibians, reptiles, and small mammals. Herein, I report on incidences of mortality of amphibians, reptiles, and small mammals on mountain biking trails in northwestern Arkansas (Benton Co.) from April 2018 to August 2021.

Carol Stover

**Neurodiversity in STEM: Calculating an Inclusive Collegiate
Physics Curriculum**

In 2014, a study conducted by the Institute of Education Sciences found a high correlation between students who pursued STEM fields and diagnosed students with an autism spectrum disorder. Despite this, there seem to be several obstacles keeping the students from completing their postsecondary degrees in physics. This study only considers students with an autism spectrum disorder, but other research shows many aspiring physicists display other conditions. Neurodiversity is a movement that aims to not only recognize the existence of neuroatypical learners, but, more importantly, advocates for the equal treatment of such individuals in the classroom, workplace, and other environments. Applying this philosophy to education means tailoring classes to meet the educational needs of as wide a variety of students as possible. Building upon the work of a large body of research including the study above, this capstone project seeks to study examples of current physics curriculum, find areas where improvements could be made, and offer solutions to benefit classes taught in the future. After the construction of new, more targeted syllabi, the project will be shared with local educators to enhance their lesson plans and help them reach out to more students in their physics classes.

**England CD1, Boone SE1, Mathews S 1, Price AJ 1, Simpson LS 1,
Yarbrough SG 1, Bartlow KP2, Middaugh CR 2, Sparks KL 2,
McClung MR1 1Biology & Health Sciences Department, Hendrix
College 2Arkansas Game and Fish Commission**

**Raccoonstagram: Using camera traps to assess disease
transmission by raccoons in urban environments.**

Urbanization contributes to the loss and fragmentation of habitat for wildlife. Often, species are relegated to smaller patches of suitable habitat, which can lead to increased opportunities for contact, and thus disease transmission, between species. We investigated the risk of increased potential for disease transmission using camera traps in urban parks around Little Rock, Arkansas. Because raccoons act as intermediate hosts for the deadly canine distemper virus, we chose to model our study around raccoon (*Procyon lotor*) and domestic dog (*Canis lupus familiaris*) contact. We used data from the Central Arkansas Urban Wildlife Project, which places game cameras at 30 different sites following the Arkansas River along an urban-to-rural gradient during one month of each season (January, April, July, and October) each year. Using R Studio, we calculated the number of encounters (domestic dog captures occurring within one week of each raccoon capture at a given site). We then ran quadratic regressions of the number of encounters at each site against the percent of impervious surface within a 500-meter radius of each site for each month. Across all seasons in 2021, dogs and raccoons co-occurred at 20 of the 30 sites and there were 619 total encounters. For each season of 2021, there was a significant quadratic relationship between impervious surface and the number of encounters (winter, $R^2 = 0.94$; spring, $R^2 = 0.96$; summer, $R^2 = 0.96$; fall, $R^2 = 0.89$; all $p < 0.001$). These results suggest an apparent increased risk of disease transmission between raccoons and dogs, but this risk does not surpass a threshold of about 40% impervious surface. Our findings suggest an increased risk for transmission of canine distemper virus to the dogs who live near or visit more natural areas, which is a risk to be communicated to pet owners by veterinarians, wildlife agencies, and pet adoption organizations.

Gooden, M. and R. Stork

Lack of Cytotoxicity of Rabid Wolf Spider Venom on Mammalian Fibroblast Cells in Vitro Fails to Support Predicted Broad Cytotoxicity in All Mammalian Tissues

Venom has previously produced biologically interesting peptides, molecular mechanisms, and research directions. Previous observations have suggested high cytotoxicity of wolf spider venom in mammalian epithelia. This research was conducted to evaluate the effect of venom from the rabid wolf spider, *Rabidosa rabida*, on mammalian fibroblast viability in vitro. Venom was collected via electrostimulation. Cells were then exposed to 10µg/mL, 5µg/mL, & 2.5µg/mL venom concentrations for 24 hours and viability was assessed using a crystal violet assay and a microtiter plate reader. Decreased cell viability was expected at all concentrations compared to negative controls but no significant decrease was observed at any of these concentrations. Further research is necessary to confirm lack of cytotoxicity in mammalian tissues at increased venom concentrations. If future assays show similar trends, it suggests that rabid wolf spider venom is not adapted for damaging mammalian tissues.

John L. Hunt, Matthew E. Grilliot, Troy L. Best, Cade M. Wilkerson, and Ally F. Huitt

Energy Content of Grasshoppers (Orthoptera: Acrididae) from the Diet of Scaled Quail (*Callipepla squamata*) from Southeastern New Mexico

Grasshoppers (Orthoptera: Acrididae) are common insects that are important food items for many kinds of wildlife, including many species of upland game birds such as scaled quail (*Callipepla squamata*). We analyzed the energy content of grasshoppers obtained from the crops of scaled quail collected from plains-mesa sand scrub in Lea and Eddy counties, New Mexico. Grasshoppers were removed from crops and dried for 48 hours at 60°C to remove moisture and standardize masses. Grasshoppers were then pulverized and analyzed for gross caloric value (i.e., energy content) in an oxygen bomb calorimeter. Energy content of grasshoppers from New Mexico averaged 19.2 J/kg (4.6 kcal/g) and was comparable to that of other, plant-based food items previously reported from the diet of scaled quail.

Sam Little, Dr. Erin Wiley

The physiological response of sweetgum (*Liquidambar styraciflua*) to fire restoration management efforts in Central Arkansas

Largely due to fire suppression, grasslands and savannahs are facing woody encroachment from species that were previously controlled by recurrent fires. In response, land managers utilize prescribed fire to re-establish pre-suppression conditions and promote fire-tolerant species. Sweetgum (*Liquidambar styraciflua*) is a common species invading southeastern grassland habitats, and its ability to vigorously resprout has made it difficult to eradicate. It's unclear how best to apply prescribed fire to control this encroachment. Specifically, it is not well understood if the timing of fire might impact the ability of species to resprout or recover long term. However, fires that coincide with periods of seasonally lower root NSC concentrations and higher metabolic requirements – late spring through summer – could be more effective at reducing resprouting growth. The goal of this study was therefore to investigate how the timing of prescribed fire impacts the resprouting vigor and carbohydrate storage of sweetgum. In this study, we monitored the recovery of top-killed sweetgum trees at two similar prairie sites in Central Arkansas with different disturbance histories – one burned in August 2021 and one burned in March 2022. Resprouting trees were harvested on four dates to compare NSC concentrations, resprout growth, and water relations over time and to determine if initial tree size affected resprouting response. Measurements of the herbaceous vegetation were also made to investigate how differences in the competing vegetation at each site might impact the recovery of sweetgum. Generally, initial tree size prior to the fire disturbance strongly influenced resprout mass and height. In June, summer-burn site trees had greater resprout mass than winter-burned trees; however, by August, this difference in resprouting was only seen among large trees (significant site x size interaction). By the end of the growing season, there was no longer any difference in resprout mass or height between sites. Similar growth between the two sites suggests that the timing of fire may have little effect for sweetgum's persistence on the landscape. However, lower water potentials and stomatal conductance of summer-burned trees during late summer indicate these trees suffered greater water stress than winter-burned trees. Prescribed fire in the summer may be more impactful if followed by drought - directly compounding the increased water stress experienced by the summer burned trees.

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Noteworthy Parasites (Trematoda, Cestoda, Phthiraptera) of Three Birds (Aves: Passeriformes: Pelecaniformes: Piciformes) from Arkansas

Between November 2020 and March 2021, three species of birds, one each of a tufted titmouse (*Baeolophus bicolor*), pileated woodpecker (*Dryocopus pileatus*), and great blue heron (*Ardea herodias*) were salvaged from Lawrence and Polk counties, Arkansas, and examined for ecto- and endoparasites. Found were four taxa of parasites, including a microcoeliid trematode, a cyclophyllidean cestode, and species of philopterid and menoponid lice. We document new host and distributional records for these parasites from select birds of the state.

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Novel Reproductive Data on Blue Sucker, *Cycleptus elongatus* (Cypriniformes: Catostomidae), from Northeastern Arkansas

Nothing has been published in the scientific literature about the reproductive biology of the Blue Sucker, *Cycleptus elongatus* in Arkansas. We examined six female *C. elongatus* collected in late February 2021 and 2022 from the Black River, Lawrence County. Egg mass (g) averaged 15.8% of the total weight of these gravid females. It appears that this sucker can spawn as early as February in this population. This is the first-time information on female reproduction in this species has been published from any population of *C. elongatus* in the state.

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First Report of Haemogregarines (Apicomplexa: Haemogregarinidae; Hepatozoidae) from Midland Smooth Softshell, *Apalone mutica mutica* (Testudines: Trionychidae) and Western Milksnake, *Lampropeltis gentilis* (Ophidia: Colubridae), from Arkansas

Although information has been provided in the last decade on the hematozoan parasites of some reptiles in Arkansas, there remains a need to document more data. Here, we report a *Haemogregarina* sp. and a *Hepatozoon* sp. from a Midland smooth softshell, *Apalone mutica mutica* and western milksnake, *Lampropeltis gentilis*, collected from Lawrence and Polk counties, respectively. The turtle possessed four distinct morphological gamont forms of a *Haemogregarina* sp. Although *A. mutica* has been reported previously as a host, albeit with very limited information with a *Haemogregarina* sp. from Texas, this is the first-time information on the infection has been detailed to include photomicrographs. The snake possessed two morphological forms of gamonts of a *Hepatozoon* sp., and this is the first time *L. gentilis* has been reported with a hematozoan. We also provide a summary of the hematozoans known from North American members of the softshell family Trionychidae and from the reptiles of the state to date.

Jacob Nowlin, Kai Johns, Benjamin O'Connell, Erin Wiley
Effects of Defoliation and Heat Stress on Stomatal Properties

Stomata regulate CO₂ intake and water loss in plants, and their density and size are therefore important determinants of maximum photosynthetic rate as well as maximum and minimum transpiration rates. However, the effects of defoliation on stomatal density and size in trees are currently unknown. In this study, we therefore measured stomatal properties of leaves from two defoliation experiments to address the following questions: (1) How does defoliation stress affect stomatal size and density? (2) Does heat stress alter defoliation effects on stomatal properties? And (3) are defoliation effects driven by changes in leaf size or carbon availability? In the first study, we investigated how defoliation and girdling impacted stomatal traits in mature, field-grown White Ash (*Fraxinus americana*). In the second study, we investigated the effects of a heatwave (+10°C above ambient) on defoliation recovery in potted Pin Oak (*Quercus palustris*) saplings. For both studies, leaf stomatal impressions were made via the nail-polish impression technique, and stomatal length, width, pore length, and density were measured. In addition, we tested for treatment differences and correlations between stomatal properties, nonstructural carbohydrate concentrations, leaf size and gas exchange measurements. In Ash, stomatal density was significantly higher in reflush leaves of defoliated trees. While there was no correlation between leaflet size and stomatal density, a significant negative correlation between initial bark starch concentration and stomatal density was found among defoliated trees. The results suggest that increased stomatal density is therefore not a function of reduced leaf expansion, but rather a response to reduced carbon availability. Increasing stomatal density may help defoliated plants increase photosynthetic rate, but it may come at the cost of increased drought intolerance. In contrast to Ash, defoliation and heatwave treatments had no significant effect on stomatal density in Oak saplings, though both treatments significantly increased minimum water conductance and net photosynthetic rate. The differences between experiments therefore suggest that the effects of defoliation may vary across species and/or developmental stages.

R. Tumilson and R. Kannan

New Species of Birds Reported in Arkansas Since 2009

We update our state of knowledge regarding the 19 new species of birds (and 1 new species based on a change in taxonomy) discovered in Arkansas since the last update in 2009. These are based on records of the Arkansas Audubon Society and those posted on eBird. New species include 3 Anseriforms, 1 Pelicaniform, 1 Falconiform, 1 Gruiform, 4 Charadriiforms, 1 Apodiform, and 9 Passeriforms. Normal distributions of the new species include Atlantic, Pacific, and Gulf Coasts, as well as interior origins. The current count of species of birds observed in Arkansas now stands at 424.

R. Tumilson and R. Kannan
Historical Observations and New Records of Rare
Birds in Arkansas

Diligent members of birding communities are quick to report rare sightings of birds, which often lead to multiple observations and photographic documentation. Verified reports and images of birds in Arkansas are curated by the Arkansas Audubon Society (AAS), which has led to an appreciation of which species are common versus rare. We gathered historic (literature) and more recent unpublished records of rare birds (those with fewer than 10 reports, per AAS) to document the historic and current state of knowledge of those species. Currently, there are a total of 424 species of birds reported in Arkansas, of which 53 are considered rare. A little less than half of these have no new reports since 2009.

R. Tumilson, H.W. Robison, M.B. Connior, D.B. Sasse,
T.S. Risch, K. Edmonds, J.D. Wilhide, and C.R. Allen
New Records of Distribution and Natural History of
Vertebrates in Arkansas: 2020-2023

Small details of natural history often go undocumented to science if those details are not parts of larger studies. However, knowledge of small details can provide insights that lead to interesting questions about ecological relationships or environmental change. We have compiled recent important observations of natural history of vertebrates, including several distributional and size records of fishes, atypical carapace shape in a common snapping turtle, an unusual support structure for a bird nest, healed damage to a broken jaw of a young deer, and numerous distributional records of bats.

*106th Annual Meeting of Arkansas Academy of Science
And
UAPB Annual Student-Faculty Research Forum*

Banquet Program

*Wednesday, March 31, 2023
6:00 p.m. to 8:00 p.m.*

Presiding: Ebo Tei, PhD

Musical Interlude.....UAPB Jazz Combo

Opening Remarks.....Ebo Tei, PhD

Dinner.....Aramark Food Services

Introduction of Speaker.....Rebecca Lochmann, PhD

Banquet Guest Speaker.....Ms. Rebecca Todd

Closing Remarks.....Ebo Tei, PhD

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NOTES