105th Annual Meeting

April 1-2, 2022

Hosted by

Ouachita Baptist University

410 Ouachita St
Arkadelphia, AR 71998


The Arkansas Academy
1917
OF SCIENCE

105th Annual Meeting - UAFS

Contents

Welcome

Welcome to Ouachita Baptist University's campus! We are extremely pleased to be hosting the 105th Annual Meeting of the Arkansas Academy of Science. All conference activities are held in the Jones Science Center and the Walker Conference Center with the exception of the Star Glow Social which will be held outside the Reynolds Science Center Planetarium on the Henderson State University campus. Preregistered participants may pick up their conference packets at 12 PM on Friday, April 1 in the Jones Science Center Lobby. Note that this program can be downloaded from the conference website (www.aasannualmeeting.org) to your favorite device for easy reference. In accordance with Ouachita's efforts to reduce waste across campus, we will only have a limited number of short programs printed to be available upon request.

The Academy always has great meetings, which bring together scholars from across our state and region. This year there are at least 170 scholars registered for the conference, including 125 undergraduate students, and 45 faculty and professional participants. We have representation from 18 colleges and universities, 1 high school, and 1 hospital at the conference.

The core of any such meetings is the series of oral and poster presentations of research in various areas of Science, Technology, Engineering, and Mathematics (STEM). Oral presentations start at 1:00 PM on Friday afternoon with a vendor-networking break at 3:00 PM and poster presentations start at 9:00 AM on Saturday morning. This year we have scheduled 40 oral presentations and 70 poster presentations. I know we are all looking forward to presenting our research and seeing the research of others presented in a face-to-face collegial, supportive environment once again! The AAS annual meeting provides wonderful opportunities for networking, professional development, sharing of ideas, and exposure to new developments in STEM. See subsequent pages for details.

We are particularly glad to welcome student participants, with at least 19 oral and 49 poster presentations from undergraduate students and at least 4 oral and 7 poster presentations from graduate students. We have awards for outstanding student presentations in various areas that are sponsored by the Academy.

Two aspects of the conference that we hope will be memorable are the banquet and the following dessert social. The banquet will be held in Walker Conference Center at 6:00 PM Friday evening and the dessert social will be at the Henderson State University Reynolds Science Center at 8:00 PM. The social is sponsored by an American Chemical Student Communities Engagement Grant – a joint collaborative effort between the Henderson State University Chemistry Club and the Ouachita Baptist University American Chemical Society chapter. There will be refreshments, games, and planetarium shows available, while we have the opportunity to network, catch up with old friends, and make new ones.

A highlight of the conference is always the presentation of the keynote speaker during the Friday evening banquet. This year is no exception as we are happy to welcome Professor Emerita of Chemistry, from the College of New Rochelle, Dr. Mary Virginia Orna as our keynote speaker, sponsored by the Nell Mondy Lecture Series. We are confident her address entitled, "How Color Changed the World" will appeal to a broad audience.

On behalf of the administration, faculty, staff, and students of Ouachita, we offer our academic home to you for this conference, and hope your stay with us is informative, enriching, and enjoyable. If anything comes up that needs attention, please contact a member of the organizing committee or any Ouachita employee or student worker for help.

Welcome to Ouachita and have a great conference!

Sharon K. Hamilton

Sharon K. Hamilton, Ph.D.
Associate Professor of Chemistry
Conference Chair, 105th Arkansas Academy of Science Meeting

Ouachita Administration

Dr. Ben Sells	President
Dr. Stan Poole	Vice President for Academic Affairs
Dr. Lewis Shepherd	Vice President
Dr. Wesley Kluck	Vice President
Dr. Monica Hardin	Associate Vice President
Dr. Keldon Henley	Vice President for Institutional Advancement & Chief of Staff
Ms. Terry Peeples	Vice President for Development
Mr. Jason Tolbert	Chief Financial Officer
Mr. Bill Phelps	Chief Information Officer
Dr. Tim Knight	Dean, JD Patterson School of Natural Sciences

AAS 2022 Conference Committee

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Matt Douglass (Academic Affairs)
Kevin Cornelius (Physics)
Debra Coventry (Mathematics)
Jennifer Fayard (Psychology)
Sara Hubbard (Chemistry)
Jeff Matocha (Computer Science)
Maddie Myers-Burg (Psychology)
Suzanne Neidhart, (Chemistry), Henderson State University
Christin Pruett (Biology)
Adam Wheat (Career & Calling)

AAS Executive Officers 2019-2020

Dr. Andy Sustich	President
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Dr. Stephen R. Addison	Past President
Dr. Ivan Still	Editor-in-Chief, Managing Editor, AAS Journal
Dr. Stephen R. Addison	Secretary
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Sponsors

THE Nell Mondy LECTURE SERIES

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OUACHITA BAPTIST UNIVERSITY

Directions to Ouachita's Campus

GPS/Google Maps Address: 410 Ouachita St., Arkadelphia, AR 71998

From Southwest of Arkadelphia on I-30:

- From I-30 E, take Exit 73 and merge right onto Pine St.
- Follow Pine Street for almost 3 miles to a T intersection at a stop sign.
- Turn left onto N. 6th St., which enters campus a block down the road.
- Turn right onto Ouachita St. - Jones Science Center (JSC) will be the second building on the right.

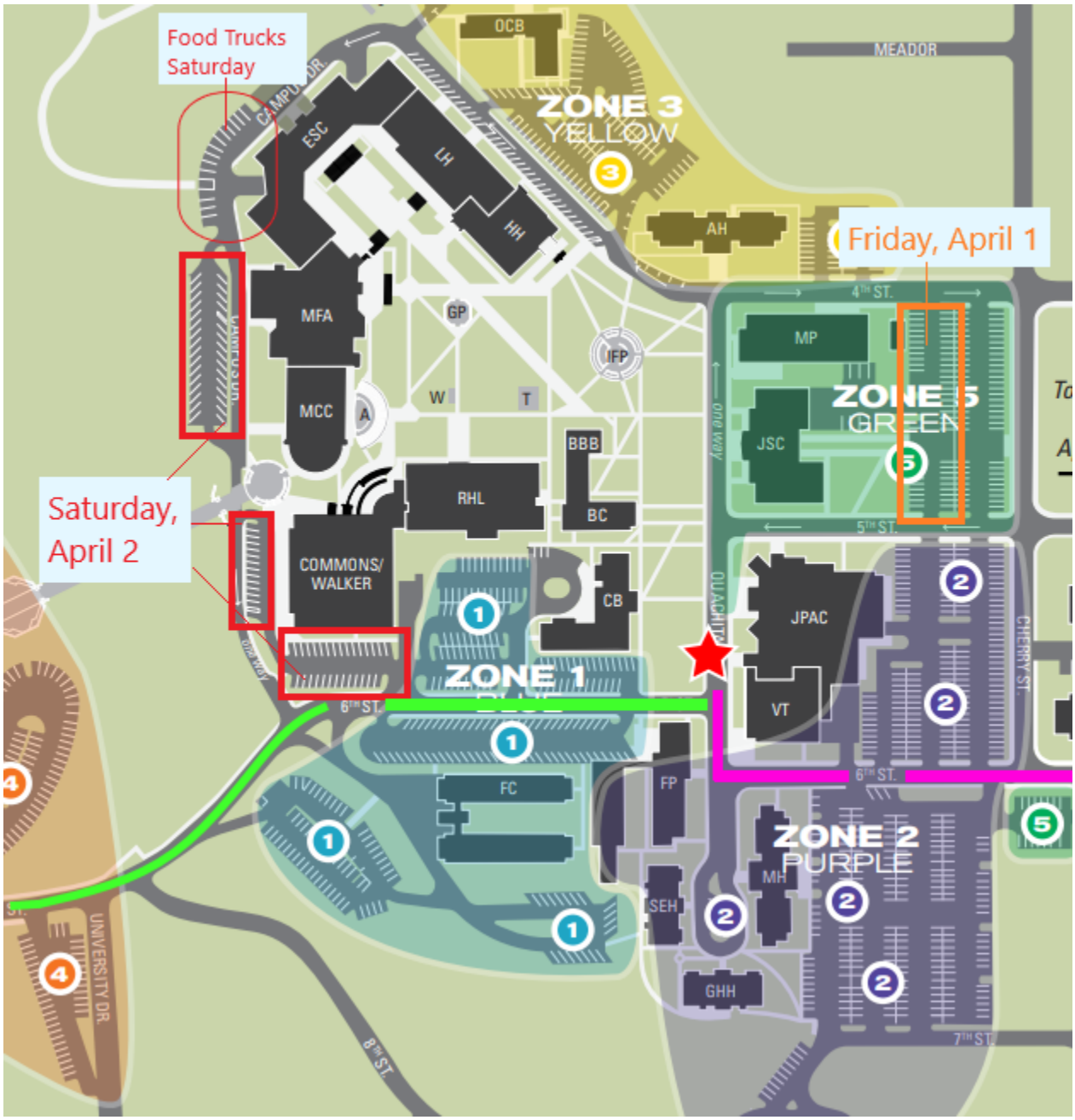
From Northeast of Arkadelphia on I-30:

- From I-30 W, take Exit 78 and turn left onto Highway 7/Valley St.
- Follow Valley St./N. 10th St. about 4 miles and turn left onto Elrod Boulevard, which enters campus.
- To find Jones Science Center, turn right from Elrod Blvd. onto N. 8th St.
- Veer left at University Dr. onto N. 6th St.
- Turn left onto Ouachita St. - Jones Science Center (JSC) will be the second building on the right.

Campus Maps and Building Layouts

Parking for Friday is available behind Jones Science Center (JSC) [Orange box/Zone 3]
Parking for Saturday is available near Walker Conference Center [Red box/Zone 1]

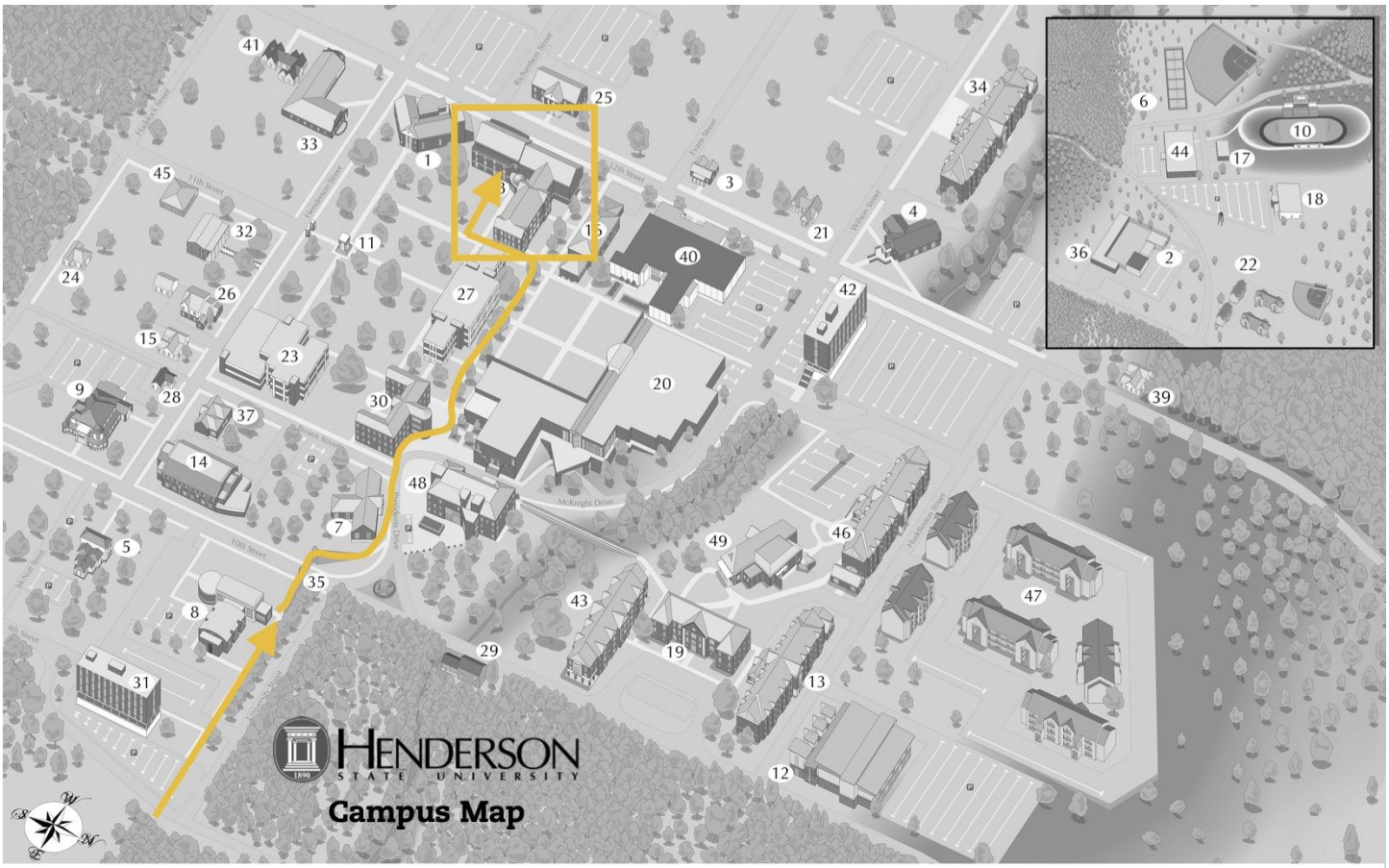
If the primary parking lots are full, parking is available in any other zone, but may require a short walk.
NO parking passes will be required for the AAS conference!



Purple Line (SW entry to campus from I-30)
Green Line (NE entry to campus from I-30)

Pathway to the Friday night Star Glow Social!

You can also follow the volunteers with the glow sticks leading groups of people from Walker Conference Center to Reynolds Science Center.



1 – Arkansas Hall
2 – Art Annex
3 – Art Studio
4 – Baptist Collegiate Ministries
5 – Barkman House
6 – Bettye Wallace Tennis Center
7 – Caddo Hall
8 – Caplinger Hall
9 – Captain Henderson House
10 – Carpenter-Haygood Stadium
11 – Centurium
12 – Dunn Recreation Center
13 – East Hall
14 – Education Center
15 – Edwards House
16 – Evans Hall
17 – Field House
18 – Formby Center
19 – Foster Hall
20 – Garrison Student Center
21 – Harvey House
22 – Reddie Villa Apartments
23 – Huie Library
24 – Huneycutt House
25 – International House
26 – Jane Ross House
27 – McBrien Hall
28 – Meier House
29 – Baptist Student Fellowship
30 – Mooney Hall
31 – Newberry Hall
32 – Newberry House
33 – Nursing Building
34 – University Place
35 – Pedestrian Bridge
36 – Facilities
37 – Proctor Hall
38 – Reynolds Science Center
39 – Police Department
40 – Russell Fine Arts Center
41 – Smith-Garner House
42 – Smith Hall
43 – Sturgis Hall
44 – Wells Center
45 – Wesley Foundation
46 – West Hall
47 – Ridge Pointe Apartments
48 – Womack Hall
49 – Dining Hall

Conference Accommodations in Arkadelphia

The Fairfield Inn and Suites is the preferred hotel in the area and AAS attendees can book rooms at a special rate for the Arkansas Academy of Science annual meeting, April 1-2 in Arkadelphia, AR. These hotels are conveniently located near I-30 and are a short driving distance from the Ouachita campus and area restaurants. Links for each of the hotels can be found at https://www.aasannualmeeting.org under the "Lodging" tab. We ask that you reserve your rooms early to get the best rate.

- **Fairfield Inn and Suites**
  258 Red Hill Rd
  Arkadelphia, AR 71923
  (870) 245-0003

- **Hampton Inn**
  108 Malvern Rd
  Arkadelphia, AR 71923
  (870) 403-0800

- **Holiday Inn Express & Suites**
  7 Frost Rd
  Caddo Valley, AR 71923
  (870) 403-0880

- **Baymont by Wyndham**
  100 Crystal Palace Dr.
  Caddo Valley, AR 71923
  (870) 246-3800

AAS 2022 Keynote Address

How Color Changed the World

We are extremely happy to welcome Dr. Mary Virginia Orna as our keynote speaker. Mary Virginia Orna is Professor of Chemistry, Emerita, College of New Rochelle. She received her Ph.D. in analytical chemistry from Fordham University and has lectured and published widely in the areas of color chemistry and archaeological chemistry. She has researched ancient middle-eastern artifacts in collaboration with the Israel Antiquities Authority, the Israel Museum and the Edelstein Center for the Analysis of Middle Eastern Textiles and Related Artifacts. She is presently President of "ChemSource, Inc.", a major effort in chemistry teacher preparation and enhancement funded by the National Science Foundation, and also of Dwight D. Eisenhower Title IIA chemical education summer programs at the College of New Rochelle. As a hobby, she enjoys constructing crossword puzzles and has been a frequent contributor to the Sunday *New York Times, SciQuest, Clinical Chemistry News, American Laboratory, Today's Chemist* and other publications. She is an ACS tour speaker and has been an invited lecturer to every part of the United States and many countries in Europe, the Middle East, and the South Pacific. Two of her recent books, *The Lost Elements: The Periodic Table's Shadow Side* (Oxford University Press) and *Science History: A Traveler's Guide* (American Chemical Society and Oxford University Press) have had rave reviews. Dr. Orna will be speaking on her work as a color chemist and historian of science.

Color has been an exciting and enjoyable part of human life ever since the color-sensitive eye evolved over a million years ago. However, the junction between color and chemistry, and color and history, is of more recent origin. The first recorded use of chemistry to manufacture a color is the stunning set of cave paintings found in the Grotte Chauvet in Southern France. Executed over 32,000 years ago (20,000 years earlier than Lascaux!), they are a testimony to early humans' ability to create beauty and to engage in abstract thinking. This talk traces the history of color usage as a chemical endeavor from the earliest records to the present day focusing on four major areas: fashion, pharmaceuticals, food, and fun. It is a trajectory peppered with stories to help us understand the mystery of color as a universal experience and phenomenon; its chemical history, as you shall see, even changed the course of history in the 20th century. This talk is based on her book, "The Chemical History of Color" (Springer, 2013).

Sponsored By:

THE Nell Mondy LECTURE SERIES

Schedule-at-a-Glance

Friday, April 1

10:00 AM – 12:00 PM	Executive Committee Meeting	*Alumni Room, Walker Conference Center*
12:00 PM – 5:45 PM	Registration	*Jones Science Center Entrance*
1:00 PM – 3:00 PM	Oral Presentations	*Jones Science Center*
3:00 PM – 3:30 PM	Networking Social with Vendors	*Jones Science Center Lobby*
3:30 PM – 5:30 PM	Oral Presentations	*Jones Science Center*
6:00 PM	Banquet & Keynote Address	*Walker Conference Center*
8:00 PM	"Star Glow" Dessert Social	*HSU Reynolds Science Center*

Saturday, April 2

7:30 AM – 8:30 AM	Ouachita River Bird Walk	*Walker Conference Center*
8:30 AM – 9:00 AM	Registration	*Walker Conference Center*
9:00 AM – 11:00 AM	Poster Presentation Brunch	*Walker Conference Center*
11:00 AM – 11:30 AM	Judges Meeting	*Walker Lounge*
11:30 AM	Business Meeting & Awards	*McBeth Recital Hall*
12:30 PM	Food Trucks! (not included in meeting fee)	

Schedule of Scientific Sessions

Oral presentations will start at the times indicated. Time is allowed for a 15-minute presentation, followed by 3-4 minutes of questions and answers with a few minutes allowed for the next presenter to set up. Participants may freely move between the presentation rooms as desired.

*Indicates to be judged for undergraduate student awards

** Indicates to be judged for graduate student awards

Biological Sciences Session 1
Room JSC 125 - Friday, April 1
Presider: Hope Murphy

#	Time	Presenters	Title
BIO 1	1:00 PM	Stan Trauth	Distal Urogenital Anatomy in the Male Wood Frog, *Lithobates sylvaticus* (Anura: Ranidae)
BIO 2	1:20 PM	Alicen Wilcox*	Microglia Polarize in Response to Transactive Response DNA-binding protein-43 (TDP-43) and Recover After Removal of the Stimulus
BIO 3	1:40 PM	Douglass Barron	School Mask Mandates Decrease Covid-19 Transmission in the Schools and Surrounding Communities
BIO 4	2:00 PM	Allison Litmer**	Influence of Temperature on Passage Rate in *Sceloporus consobrinus*, With Comparison to Congeners
BIO 5	2:20 PM	Stan Trauth	Seasonal Gonadal Histology from a Small Sample of the Frecklebelly Madtom, *Noturus munitus* (Siluriformes: Ictaluridae), from Mississippi
BIO 6	2:40 PM	Grace Tidwell*	Bird Diversity & Abundance in Relation to Habitat Complexity at Jack Mountain Wildlife Management Area

STEM Ed Curriculum & Instruction/Psychology & Social Science
Health & Biological Sciences Session
Room JSC 234 - Friday, April 1
Presider: Hyland Alfonso

#	Time	Presenters	Title
STEM ED 1	1:00 PM	Christin Pruett	Not Just For Mean Tweets: Twitter Posters to Engage Students and Refine Communication Skills
STEM ED 2	1:20 PM	James Fetterly	Impacting Mathematical Creativity: Problem Posing vs. Divergent Thinking
STEM ED 3	1:40 PM	Ruth Plymale	Yes You Can: Design and Implementation of Freshman Course-Based Research Experiences
PSYCH 1	2:00 PM	Isabella Wood*	A Multivariate Comparison of Stigmatization of Individuals with Schizophrenia, Binge Eating Disorder, and Intellectual Disabilities
HEALTH 1	2:20 PM	Cannon Fisher*	A Systematic Review on Malnutrition Assessments and Interventions for Elderly Persons
BIO 12	2:40 PM	Hyland Alfonso*	Comparing Genetic Diversity Among Populations of Rock Sandpiper (*Calidris ptilocnemis*)

Computer Science/Math & Statistics/Physics & Engineering Session
Room JSC 325 - Friday, April 1
Presider: Kyla Williams

#	Time	Presenters	Title
CSCI 1	1:00 PM	Rami Alroobi	Multi-Agent Reinforcement Learning Game Playing
MATH 1	1:20 PM	Ryan Holley**	Validation and Verification of Turbulent Mixing due to Richtmyer-Meshkov Instability of an Air/SF_6 Interface Using Front Tracking method.
PHYS/ENG 1	1:40 PM	Gage Miller*	Creating Collimated and Focused Diode Laser Beams
PHYS/ENG 2	2:00 PM	Dan Kiula**	Solid-State Dewetting Surface and its Application to DNA Detection
PHYS/ENG 3	2:20 PM	Thomas Marshall*	Validation of 3D Printed Stabilization of Paraffin Fuel Grains of Hybrid Rockets
PHYS/ENG 4	2:40 PM	Noah Fitzpatrick*	Acoustic Characterization of 3D Printed Porous Materials

Chemistry & Chemical Engineering Session 1
Room JSC 334 - Friday, April 1
Presider: Josh Spiva

#	Time	Presenters	Title
CHEM 1	1:00 PM	Emily Pickering*	Virtual Ligand Screening and Docking to Identify Possible Antagonists to Be Used as Antidepressants That Target the Kappa Opioid Receptor
CHEM 2	1:20 PM	Jessica Garrett*	System Xc- Inhibitors Provide Effective Neuroprotection in Vitro
CHEM 3	1:40 PM	Taylor Canada*	Extracting Volatile Organic Compounds from Arkansas Honey
CHEM 4	2:00 PM	Aubree Seibert*	The Photodynamic Therapy Potential of a Novel Water-Soluble Gallium Porphyrin
CHEM 5	2:20 PM	Andrew Tarlton*	Alternative to Wound Dressings: Developing a Biodegradable Collagen Analog
CHEM 6	2:40 PM	Chiraz Soumia Amrine	Precursor-Directed Biosynthesis of New Verticillin Analogues

3:00-3:30 PM JSC Lobby Networking Social/Break

Biological Sciences Session 2
Room JSC 125 - Friday, April 1
Presider: Hope Murphy

#	Time	Presenters	Title
BIO 7	3:30 PM	Bre Bishop	Cultured Microglia Exhibit Time-Dependent Recovery After Ethanol Exposure
BIO 8	3:50 PM	Morgan Pelley*	The Influence of Temperature and Body Size on Food Consumption in Prairie Lizards (*Sceloporus consobrinus*)
BIO 9	4:10 PM	Stan Trauth	Seasonal Testicular Histology and Acystic Lobular Spermatogenesis in the Western Lesser Siren, *Siren intermedia nettingi* (Caudata: Sirenidae)
BIO 10	4:30 PM	Jeffrey Shaver	Effect of Soil Microbiome Succession on the Prevalence of Antibiotic Resistance in Massard Prairie
BIO 11	4:50 PM	Emily Brown*	A First Description of Body Temperature Acclimation in Wolf Spiders from Arkansas Reveals a Difference in Acclimation Time to Warm or Cold Temperatures

Wildlife Sciences & Ecology Session
Room JSC 234 - Friday, April 1
Presider: Aidan Doss

#	Time	Presenters	Title
WILD/ECO 1	3:30 PM	Renn Tumlison	Yellow-rumped Warblers (*Setophaga coronata*) Sipping Sap from Sapsucker Wells
WILD/ECO 2	3:50 PM	Jimmie Harper*	A Study of Dental Pathology in River Otters (*Lontra canadensis*) in Arkansas.
WILD/ECO 3	4:10 PM	Kyra Joiner*	Smooth Softshell Turtle (*Apalone mutica*) Burrowing Site Selection in Response to Water Depth and Temperature.
WILD/ECO 4	4:30 PM	Ishita Kanitkar	Is Artificial Color Needed to Attract Hummingbirds to Feeders?
WILD/ECO 5	4:50 PM	Renn Tumlison	Distribution and Breeding of the Black-Bellied Whistling-Duck (*Dendrocygna autumnalis*) in Arkansas, With a Brief Chronology of Distribution and Breeding in Southeastern United States.

Physics & Engineering/Math & Statistics/Chemistry & Chemical Engineering Health Sciences Session
Room JSC 325 - Friday, April 1
Presider: Aiiryel McCoy

#	Time	Presenters	Title
PHYS/ENG 5	3:30 PM	Mohamed Adawi**	Surface Characterization of Particulate Dust Subjected to Dew-Induced Cementation
MATH 2	3:50 PM	Yeil Kwon	Bayes, Empirical Bayes, and Nonparametric Empirical Bayes: Variance Estimation for Multiple populations
CHEM 12	4:10 PM	Qinglong Jiang	Hybrid Halide Perovskites Materials and Nano Materials for Solar Cells, Light Emitting and Other Electric-Optical Devices
CHEM 13	4:30 PM	Charles Mebi	Mimicking Metalloenzyme
HEALTH 2	4:50 PM	Gwyneth Hadasa*	The Effects of COVID-19 on Childhood Obesity: A Quasi-Systematic Review

Chemistry & Chemical Engineering Session 2
Room JSC 334 - Friday, April 1
Presider: Josh Spiva

#	Time	Presenters	Title
CHEM 7	3:30 PM	Cori Clower*	Comparative Analysis of Drug Inclusion Techniques in Nanofiber Mats
CHEM 8	3:50 PM	Sarah Snodgrass*	Arc Induction Assay as a Convenient Method of Monitoring Excitotoxic Levels of Glutamate
CHEM 9	4:10 PM	Kayla Whittington*	Developing Novel Water-Soluble Porphyrins for Potential Use as Photosensitizers in Photodynamic Therapy
CHEM 10	4:30 PM	Taylor Coulson*	Statistical Analysis of Proton NMR of Honey
CHEM 11	4:50 PM	Reagan Neal*	Exploration Into Modern Wound Healing: Synthesis of a Biomimetic Polymer

6:00-7:30 PM Walker Conference Banquet & Keynote Address

8:00-10:00 PM HSU Reynolds Science Center "Star Glow" Dessert Social

Poster Presentation List

Presenters may set up their posters in the Walker Conference Center starting at 8:30 AM. A finger food brunch buffet will be available for attendees starting at 9 AM.

*Indicates to be judged for undergraduate student awards

** Indicates to be judged for graduate student awards

Saturday, April 2 9:00-11:00 AM
Walker Conference Center

#	Presenters	Title
BIO 13	Emily Andrews	Ensemble Perception of Semantic Information from Perceptually Defined Sets
BIO 14	Mindy Farris	Steroid Signaling Mediates Longevity Responses to Dietary Restriction and Nutrient Availability in *C. elegans*
BIO 15	Victoria Perez*	Antimicrobial Properties of Hops Alternative Worts
BIO 16	Kamryn Humphrey*	The MAP kinase effectors, TAOK1, TAOK2, and TAOK3, are Differentially Expressed During Early Embryogenesis in *Xenopus laevis* and May Play Critical Roles in Gastrulation.
BIO 17	Ragupathy Kannan	Antibacterial Properties of Horsehair Fungus (*Marasmius*) in Tropical Bird Nests
BIO 18	Ty Say*	A Survey of Native Ticks and their Pathogens in Arkansas
BIO 19	Brandie Tate	Determining Species Delimitation of Sisyrinchium (*Iridaceae*) in Arkansas Using Genomic and Phylogenetic Approaches
BIO 20	Mark Hairston*	Ticks and Tick-Borne Pathogens in Feral Hogs in Southeast Arkansas
BIO 21	Tyneshia L. Kilgore*	Energy Content of Seeds of Switchgrass (*Panicum virgatum*) from the Diet of Mourning Doves (*Zenaida macroura*) from Southeastern New Mexico
BIO 22	Melanie Joan*	Assessing the Effects of Retinoic Acid on the Development of *Daphnia magna.*
BIO 23	Carly G. Orr*	From Function to Families: The Process of Annotating a Bacteriophage Genome
BIO 24	Elijah Christenson	Actinobacteriophage Isolated in Fall 2021 from Farm Soil Samples
BIO 26	Grace Tidwell*	Bird Diversity & Abundance in Relation to Habitat Complexity at Jack Mountain Wildlife Management Area
BIO 27	Reese Chesshir*	The Effects of Light Wavelength and Gravity on *Physarum polycephalum* Growth
BIO 28	Seth Curl*	Crosstalk Between Vitamin D Receptor Signaling and Glucocorticoids in Musculoskeletal Induced Atrophy
BIO 29	Taylor Barnhart*	The Effects of Light Intensity and Cell Structure on the Cultivation of *Arthrospira platensis*
BIO 30	Thomas Harrington*	The Effects of Gibberellic Acid and Light on *Brassica rapa* Growth and Development
BIO 31	Whit Lawrence	Investigating Kombucha: The Effects of Honey and Green Tea on Microbes

BIO 32	David Bowles	Additional Distributional Records for a Rare Caddisfly in the Ozarks, *Frenesia missa* (Milne) (Trichoptera: Limnephilidae)
BIO 33	Brian Beto*	A Descriptive Analysis of Venom Protein Variation in the Wolf Spider Genus *Rabidosa* in Arkansas Suggests the Need for Further Exploration of Venoms in Common Spiders
BIO 34	Claire Burton*	Exposure to Iron and Copper in *Caenorhabditis elegans* Mutants Produces Elevated Levels of Reactive Oxygen Species
BIO 35	Eliana John*	Free Radicals Promote Prolonged Activation of Epidermal Growth Factor Receptor in Murine Microglial Cells
BIO 36	Emily Fronek*	Qualitative Comparisons of Venom from Individuals of the Wolf Spider *Rabidosa rabida* from Arkansas Suggest the Potential for Protein Variation
BIO 37	Mariel Vargas*	NMES-1 Modulates Microglial Activation in Response to Iron and Amyloid-Beta
BIO 38	Sydney Reynolds*	Levetiracetam Alters the Response of Microglia to Amyloid Beta
CHEM 14	Sarah Vue*	Development of Difunctional Imidazole into Ionic Liquid Monomer
CHEM 15	Alaina Glover	Extraction and Analysis of Medicinal Biomolecules in Witch Hazel
CHEM 16	Keionna Banks*	Nanocomposites for Wearable UV Smart Sensors for Detecting Lupus Photosensitivity
CHEM 17	Lauren Taylor*	Determination of Fatty Acid Concentrations in Algae
CHEM 18	Ganna Lyubartseva	Women in Chemistry: Twenty First Century Trend in Nobel Prize
CHEM 19	Aiiryel McCoy*	Analysis of Basic Materials' Effects on a Polycarbonate Museum Object
CHEM 20	Emma Rouse*	The Development of a New Water-Soluble Zinc Porphyrin, ZnTPP-3AP, and its Potential as Photodynamic Therapy Agent
CHEM 21	Joshua Spiva*	Incorporating a Bioengineered Protein and a Collagen Analog into Modern Wound Dressings
CHEM 22	Keren Fernandez Cruz*	BPA Presence in Daily Use Panty Liners and Its Ability to Disrupt Normal Reproductive Functioning
CHEM 23	Sidney Pigott*	The Potential Advancement of Photodynamic Therapy using a Novel Water-soluble Zinc Porphyrin, ZnTPP-5AP
CHEM 24	Harry Jeffrey*	Biomimetic Poly(Acrylic Acid) Fiber Scaffolds for Biomedical Applications
CHEM 25	Alaina Ivers*	Docking Low-Energy Ligand Conformations to the μ-Opioid Receptor to Verify the Model's Reliability
CHEM 26	Theresa Thomas*	Computational Drug Design to Target the Cannabinoid Type 2 Receptor to Develop Safe and Effective Pain Medication
CHEM 27	Kennedy White*	Development of Cadmium Detecting PADs for the Use of Human Milk
CHEM 28	Lara Kockaya*	Investigating the 3M3SH Absorbance Capacity of β-Cyclodextrins
CHEM 29	Darby Mohon*	Determination of Viability of *Thymus vulgaris* in Martian Regolith
CHEM 30	Harley Hines*	Chemical and Biological Investigation of *Sambucus canadensis* Anthocyanins
CHEM 31	Maria Ines Dow*	Chemical and Biological Investigations of Salvia officinalis

CHEM 32	Vy Nguyen*	The Chemical and Biological Studies of *Bixa orellana* Organic Extract
WILD 6	Kaleigh Thomas*	Tree Canopy Cover Influences Habitat Use of Breeding Birds at Jack Mountain Wildlife Management Area
WILD 7	Kelsey Bester	Insect Presence and Prevalence of Birds at Jack Mountain Wildlife Management Area
WILD 8	Jorista Garrie	Factors Affecting the Sex Ratio of White-tailed Deer (*Odocoileus virginianus*) Fetuses in Arkansas
CSCI 2	Magnus Gray**	Visualizing Physical and Mental Health Patterns of US Children and Adolescents using the National Survey of Children's Health
CSCI 3	Sathvik Prasad Palyam	A Web User Interface Image Processing Tool for Classifying Extent of Dementia Across Alzheimer's
PHYS 6	Hinata Yokoyama*	Study of Optical Properties and Structure of a Cu2O Thin Film by Chemical Bath Deposition With Graphene
PHYS 7	Ole Kjorholt*	Autonomous Robot
PHYS 8	Manoj Shah	Ordering-Disordering Analysis of GeSn Films Using Raman Spectroscopy
PHYS 9	Nilesh Chaudhari**	Fluidization Behavior of Solid Waste Materials
PHYS 10	William Frey*	Modernizing Motorcycle Instrumentation and Display
PHYS 11	Bennett Hasley & Jimmy Castro*	Using Emitted Vibrational Frequencies to Determine Watermelon Sweetness
PHYS 12	Ryan Pickelman & Adrian Salazar-Rivera*	Optimizing a Passive-Tracking Solar Panel System
PHYS 13	Abu Sayed Mohammad Akid**	Influence of Reclaimed Fly Ash and Waste Tire Rubber as Supplementary Cementitious Materials on Properties Of Concrete
PHYS 14	Fares Tarhuni**	Using of Rice Husk Ash (RHA) and Hydrated Lime as Stabilizing Agents for Poor Subgrade Soils and Embankments
PHYS 15	Mohammad Najmush Sakib Oyan**	Evaluation of Moisture Resistance and Chemical Properties of Warm Mix Asphalt
PHYS 16	Nafis Sadik	Analysis of Electric Grid Resilience Using Bayesian Network
PHYS 17	Rupesh Mahat**	Seismic Hazard Analysis for Northeast Arkansas (NEA)
HEALTH 3	Genesis Jackson	How Living in Rural SE Arkansas Increases the Risk of Developing Diabetes
HEALTH 4	Keyshawn Harris & Alex Boone	Perceptions of Quality Care by Patients Utilizing an Urban Emergency Department
HEALTH 5	Re'Nyah Vincent	Evaluating How Living in Highly Polluted Areas Result in Ineffective Asthma Control
HEALTH 6	Morgan Schuster*	Characterizing Adeno Associated Virus Based GCaMP Transfection in Organotypically Cultured Pituitary Glands
HEALTH 7	Johnna Berryhill*	Impact of Maternal Factors on Infant Mortality in Arkansas: Evidence from the Claims Database
STEM ED 4	A M Mashrur Jauwad**	How To Enhance System Skills of STEM Students
ASTRON 1	Hypatia Meraviglia*	Determining Ni-56 Yields and Bolometric Lightcurves of Peculiar Type II-P Supernovae
ASTRON 2	Julia Hambuchen	Europium Abundances w/Varied Halo-Star Parameters

Presentation Abstracts

Adawi , Mohamed and Robert A. Fleming, Arkansas State University

Surface Characterization of Particulate Dust Subjected to Dew-Induced Cementation

Accumulation of soils and other particulate matter on the front cover glass of solar photovoltaic (PV) modules results in transmission losses that detrimentally affect the power output of PV installations. Accumulated soils on the front cover glass of a PV module are susceptible to a process known as cementation, in which inorganic contaminants become chemically bonded to the glass surface. This reaction, which occurs due to interactions between the dust and the class surface in the presence of temperature, humidity, and pH, results in the dust becoming rigidly attached and potentially difficult to remove with conventional cleaning methods. In this study, accelerated soiling tests on glass coupons have been performed using a custom instrumented soiling chamber and several standardized soils (Arizona Test Dust, ARAMCO Test Dust, and China Test Dust) to assess soil adhesion and cementation behaviors. Cementation of deposited soils was induced via an artificial "dew" cycling routine, consisting of alternating condensation (high humidity, low temperature) and bake-out (low humidity, high temperature) processes. After cementation, a notable increase in soil adhesion/cohesion is observed, which can be attributed to different mechanisms depending on soil composition. Supporting X-ray photoelectron spectroscopy (XPS) and water contact angle (WCA) measurements are used to characterize the surface chemistry of the soiled coupons and surface energy evolution of the deposited soils before and after cementation. The end result of this study is a better understanding of the surface properties of cemented soils, which can potentially lead to the development of novel anti-soiling coatings for PV applications.

Adel, Miah Muhammad, University of Arkansas at Pine Bluff

Upstream Water Piracy-Caused Downstream Climate Change

Upstream water piracy made the Aral basin's summer warmer vis-à-vis winter colder than before due to the loss of the heat storing water media. The global warming CO2 is beside the point. India's own treatment to the Ganges can lead to surface water crisis. On the Indian eastern side, the lower Ganges basin has been turned into another Aral Sea basin due to the diversion of the Ganges's course through India and the constructions of dams and barrages upon other transboundary rivers in the form of a ring of dams and barrages upstream of the Indo-Bangladesh border. The heat storing water medium has been replaced by huge sandy heat emitting riverbeds. In the wake of heating, lightning occurrences have increased that takes a heavy toll of lives and properties. India's current government threatened the western neighbor Pakistan of cutting off water supply to her voiding a six-decade old WB-mediated Indus Water Treaty by construction of dams and barrages. India's own irrigation progression shows a correlation for lightning-related fatalities. China's and India's competing plans of building of dams is going to turn the lower Brahmaputra basin into another Aral Sea basin. The same is going to happen in the lower Mekong basin. Climatologists' inconsideration of the upstream water piracy issue lets the upstream riparian countries leverage boundless exploitation of international water resources depriving the downstream countries of their due share. In the research of climate change, climatologists' wholistic study of CO2 emission and surface water exploitation can save the latter's depletion.

Akid, Abu Sayed Mohammad, Zahid Hossain, Arkansas State University

Influence of reclaimed fly ash and waste tire rubber as supplementary cementitious materials on properties of concrete

The incorporation of supplementary cementitious materials (SCMs) in concrete can enhance the mechanical and durability properties and lower the carbon footprint. Fly ash is extensively used as a

partial replacement for cement in the US. However, power plants are changing their fuel sources from coal to natural gas due to environmental reasons, which will eventually lead to less supply and a shortage of fly ash. In this circumstance, it is essential to utilize other alternative SCMs, including harvested fly ash or waste tire rubber. The main objective of this study is to investigate the fresh, mechanical, and durability properties of reclaimed fly ash (RFA) and ground tire modified (GTR) modified concrete. For this purpose, the workability (slump), compressive strength, shrinkage, and alkali-silica reaction (ASR) tests have been carried out for concrete containing 10%, 20%, and 30% RFA. The results indicate that the inclusion of RFA in concrete has substantially improved the workability, ASR, and shrinkage properties. However, the compressive strength has reduced for RFA modified concrete compared to conventional concrete. In addition, the field performance of 50 feet paving road made with RFA and Class F fly ash has been observed in terms of fresh and mechanical properties. A combination of RFA and GTR in concrete as a ternary blend is being investigated as part of this ongoing project. The findings of this study will benefit the concrete professionals to utilize RFA and GTR in preparing longer-lasting and sustainable concrete.

Alfonso, Hyland, Kevin Winker, and Christin L. Pruett, Ouachita Baptist University

Comparing Genetic Diversity Among Populations of Rock Sandpiper (*Calidris Ptilocnemis*)

Rock Sandpipers (Calidris ptilocnemis) are a shorebird species that is only found in the North Pacific Basin. There are 4 subspecies of Rock Sandpipers, C. p. couesi, C. p. Quarta, C. p. tschuktschorum, and C. p. ptilocnemis. The subspecies, C. p. ptilocnemis, are of high conservation concern due to the small population size and isolation on remote Oceanic islands. Previous research has shown that 1) the St. Matthew Island population of C.p. ptilocnemis has a larger population size than the St. Paul Island population, 2). Other species of birds with populations on North Pacific islands have much lower genetic diversity than populations on the Alaska mainland, 3), and genetic differences are found among subspecies of North Pacific birds. All of these findings have implications for the conservation of Rock Sandpipers.

Amrine, Chiraz S., Jessica L. Long, Nicholas H. Oberlies, Arkansas Tech University

Precursor-Directed Biosynthesis of New Verticillin Analogues.

Verticillins are members of the epipolythiodioxopiperazine (ETP) alkaloid class of fungal metabolites and are known as potent cytotoxic agents with IC50 values lower than 10 nM. Studies showed that verticillin A has activity as a selective histone methyl transferases inhibitor with important anticancer properties. However, major challenges slow down moving this class forward such us generating analogues that have better solubility and potency. Precursor-directed biosynthesis was used to produce a series of “non-natural natural” epipolythiodioxopiperazine alkaloids. The biosynthesis of these verticillin analogues was monitored in situ via the droplet liquid micro-junction surface sampling probe (droplet probe), and a suite of NMR and mass spectrometry data were used for their characterization. All analogues demonstrated nanomolar IC50 values vs a panel of cancer cell lines. This approach yielded novel compounds that would be difficult to generate via synthesis.

Anderson, Graham T., Caitlin E Scott, Hendrix College

Virtual ligand screening and docking to identify possible antagonists to be used as antidepressants that target the kappa opioid receptor G-protein coupled receptors

(GPCRs) are a family of membrane proteins activated by various stimuli that are targeted by a large number of drugs currently on the market. The kappa opioid receptor is a type of GPCR that when activated by an agonist can lead to depression. Current antidepressants have numerous flaws such as varying effects among users, long incubation periods, and unpredictable side-effects. Research suggests that the binding of an antagonist to the receptor stabilizes its inactive structure causing antidepressant-like effects. The goal of this project is to design a drug antagonist that strongly binds to the kappa opioid

receptor which can be developed into an antidepressant. Previous work was done using Schrodinger software Protein Prep Wizard and 100 ns molecular dynamics with Desmond software to create a stable model of the kappa opioid receptor bound to the antagonist JDTic. Using the computer software Glide, we docked 15 antagonists to the model that were prepared using LigPrep to generate minimized 3D structures of the ligands and Jaguar to determine the Mulliken charges of the ligands. Docking ligands structurally similar to the crystal ligand JDTic validated our model of the kappa opioid receptor and indicated that ligands in the binding site interact with the residue D138. Morphine-like ligands that are structurally different from JDTic also interacted with D138; so, drugs designed to strongly bind to the kappa opioid receptor should also bind to D138. Glide's energy score predicted ligand conformations that had the best agreement with the crystallized JDTic conformation in the binding site. We found a positive correlation between experimentally determined binding affinity and the computational docking score. Using the best docked poses of each of the 15 ligands, we created pharmacophores with Phase software and ran pharmacophore-based ligand screening. We also ran structure-based ligand screening using the webserver MTIOpenSource. With these two screening methods, we were able to find two possible drug candidates that were not originally designed to interact with the kappa opioid receptor and have never been tested on the kappa opioid receptor. Docking these ligands to our model of the kappa opioid receptor resulted in favorable docking scores. Thus, we have made progress in the creation of an antidepressant that interacts with the kappa opioid receptor, a protein different from what current medicines on the market target.

Barnhart, Taylor, Ouachita Baptist University

The Effects of Light Intensity and Cell Structure on the Cultivation of Arthrospira platensis

Arthrospira platensis, a filamentous cyanobacteria high in proteins and nutrients, is known for its helical structure. In unfavorable conditions, spiral spirulina cells can become straight. Spirulina converts carbon dioxide gas into pure oxygen and cell structure stimulates different responses in oxygen production and cultivation. In these experiments, 2.3 L containers of coiled spirulina and mixed (coiled and straight) spirulina were placed into 3 incubators with different light intensities: 51µmol/m2/s, 25µmol/m2/s, 12µmol/m2/s. Each experiment length was 72 hours and the spirulina cultures' cell concentration, and oxygen production was measured at the 24, 48, and 72 hour mark. The most oxygen was produced by the coiled spirulina in the 25µmol/m2/s incubator on day 3 with an average of 41.6 cm3. The average total oxygen produced over 3 days by the Coiled-25 culture is 109.9 cm3. The Mixed-25 culture produced only an average of 61.8 cm3 , which was the highest total amount produced from any of the mixed spirulina. The coiled spirulina expressed a continuous cell concentration growth, whereas the mixed spirulina steadily declined over the 72 hours. Results of this experiment suggest that coiled spirulina produce more oxygen at an intensity of 25µmol/m2/s and can do so at a lower concentration while growing at a consistent rate. The mixed cultures appear to multiply faster in a lower light intensity, but the oxygen production remains low.

Barron, Douglas G., Arkansas Tech University

School mask mandates decrease Covid-19 transmission in the schools and surrounding communities

Face masks are widely recommended to slow the spread of SARS-CoV-2 (Covid-19), yet we lack controlled in situ studies of their efficacy. Arkansas public schools determined mask policies for 2021-22 classes locally. Policies were assigned independent of local disease prevalence and were evenly split between districts with and without mask mandates. This created a pseudo-cluster randomized trial capable of evaluating the effects of face masks. After one month of classes, districts with mask mandates had substantially fewer per capita cumulative cases, student cases, faculty cases, and active cases. Residents in those communities also experienced a stronger decline in cases and finished the month with lower test positivity rates. These results demonstrate that face masks decrease Covid-19 transmission and highlight the utility of local mask mandates.

Berryhill, Johnna, Sudeepa Bhattacharyya, Arkansas State University

Impact of Maternal Factors on Infant Mortality in Arkansas: Evidence From the Claims Database

Arkansas, being an 80% rural state, has some of the worst reported health outcomes in the country. On top of the list of adverse health outcomes is infant mortality. AR ranks 48th in the US in infant mortality rate (IMR) and the rate is increasing in AR while it is decreasing nationally. Among the AR counties, IMR is worse in the northeast AR Delta (NEAR Delta) region with rates ranging between 8.3–10.4 per 1000 births in the eight counties served by St Bernards Medical Center (SBMC) in comparison to the national average of 5.7 per 1000 births in 2018. Understanding why the IMR is so high in Arkansas is a key part in lowering the rate. Using data from the Arkansas All-Payers Claims Database (APCD), we are linking Arkansas birth and death certificates with medical claims data in order to identify major maternal factors that contribute to infant mortality in AR. Our preliminary research shows that maternal prenatal substance abuse disorder and mental health have significant impact on IMR. Additionally, significant racial disparities exist in IMR in different regions of Arkansas. Currently, our ongoing effort focuses on 1) a time course analysis of the major causes of IMR in AR and 2) gaining a deeper understanding of the toll that maternal substance abuse and mental health has on infant mortality in Arkansas.

Bester, Kelsey, Grace Tidwell, Christin Pruett, Ouachita Baptist University

Insect Presence and Prevalence of Birds at Jack Mountain Wildlife Management Area

Multiple bird species within North America have been declining in recent years and thus the importance of habitat analysis in relation to the relative birds is emphasized. Surveys regarding the biodiversity, habitat use, and abundance of breeding birds have previously been conducted in 2019 and 2020 at Jack Mountain Wildlife Management Area (WMA) under the Ross Foundation. Following this research, further surveys were conducted in the summer of 2021, over the course of June and July, to determine whether the presence of more insects in an area makes the habitat more complex and whether the presence of more insects in various habitat area affects the birds and relative species present in an area. It is believed that bird populations are often limited by the amount of insect food available to them. Insect traps were placed at 38 various pine and deciduous locations on Jack Mountain. These traps were placed at each of these 38 locations in three varying forms namely ground, branch and hanging traps for a period of 24 hours. The three main bird species found on Jack Mountain include the Indigo Bunting, the Red-eyed Vireo and the American Crow which are all primarily insectivorous. When tested, there is a significant difference in insect abundance among sample types (Kruskal-Wallis; $X^2 = 23.73$ df= 2, $P<0.001$). Post-hoc tests show that branch samples collected less insects than sampled from ground and hanging traps (Fig. 4). There was no direct correlation between the total bird number and (Ln) total insect number accumulated at the 38 trap points on Jack mountain besides from a slight linear incline. Insect abundance was also compared to habitat type in both pine and deciduous areas. It was found that the habitat type did not affect the insect abundance accumulated in these two habitat regions. The findings of this research infer that the original hypothesis is not supported and further surveys and investigation, regarding this topic, are needed.

Beto, Brian, Emily Brown, & Ryan Stork, Harding University

A descriptive analysis of venom protein variation in the wolf spider genus Rabidosa in Arkansas suggests the need for further exploration of venoms in common spiders

The World Health Organization (WHO) and the Centers for Disease Control (CDC) have initiated plans to encourage the research and development of novel antibiotics. According to the WHO, pharmaceutical companies have stopped researching new antibiotics. Yet, globally antibiotic resistance is increasing. The need to develop novel antibiotics is very clear. As microorganisms continue to develop resistance it becomes even more important to find new answers. With this new initiative in place scientists are

looking in soil, arthropods, other bacteria and fungi for answers to this new dilemma. Previous studies have indicated that spider venom contains peptides that are antimicrobial in nature. In this study, we explored possible protein variation within the venom of the wolf spider Raboidosa rabida. Spiders of this species and R. punctulate, a different species of the same genus, were anesthetized with carbon dioxide and then taped in a supine position on a dish that had electrodes from a TENS system attached. Using a dissecting scope, glass capillary tubes were used to collect venom while the spiders were electro-stimulated. Venom was analyzed using SDS PAGE and 2D gel electrophoresis, using a 11cm 3-10 pH IEF strip and BioRad 2D gel kits, and analyzed using Chemidoc XRS+ gel imager using Image Lab Analysis software from BioRad. Venom volumes were low, often below 1µL but protein content was high enough to produce visible bands using these volumes. Our first gels suggest the potential for variation between species and potentially even individuals of the same species. These observations are preliminary and further quantification of gels and development of analysis methods is necessary before specific comparisons between species and individuals can be reported quantitatively. We plan to continue searching for antimicrobial potential in the venom of common spiders. A resource that has for too long been ignored in favor of medically important species.

Bishop, Bre, Claire Harmsworth, David Donley, Harding University

Cultured microglia exhibit time-dependent recovery after ethanol exposure

Microglia are central nervous system-resident immune cells that activate in response to dyshomeostasis. Upregulation of phagocytosis and the release of inflammatory cytokines are two markers of activation. Ethanol has been identified as a cause of microglial activation. Therefore, an examination of the microglial responses to ethanol contributes to a better understanding of microglia function during insult. Published research demonstrates that microglial cells exhibit decreased phagocytosis and increased inflammatory cytokine production in response to ethanol exposure. While an increase in cytokine production is consistent with activation, decreased phagocytosis is indicative of microglia damage. Ethanol exposure is typically transient as compared to other activating signals such as misfolded proteins in neurological disorders. The long-term effects of ethanol exposure and their ability to recover after simulation is not well understood. To model the transient nature of ethanol exposure, we treated immortalized mouse microglial cells with 25 mM or 100 mM ethanol for two hours in the same plate as control cells. To measure activation, phagocytosis was quantified by engulfment of fluorescent latex beads, tumor necrosis factor-alpha (TNF-a) production was measured by ELISA, and metabolism was measured using a Seahorse XF-HS metabolic analyzer. Data was analyzed using an ANOVA. We found that microglial phagocytosis is impaired, metabolic capacity is altered, and TNF-a is increased by two-hour ethanol exposure. To address the ability of cells to recover after ethanol exposure, we changed the culture media after the two-hour stimulation and allowed cells a recovery period of 0, 12, or 24 hours. Our data suggests partial, time-dependent recovery upon removal of ethanol marked by a recovery of phagocytosis. We found that markers of inflammation, including TNF-alpha production and glycolytic flux, indicate a low-level activation that resolves over time, but in the absence of changes in cell proliferation. Together, these data suggest that cells are recovering and not being replaced. Future studies aim to explore the mechanism(s) of recovery and will contribute to the understanding of the dynamic responses of microglia during dyshomeostasis.

Bowles, David E., Missouri State University

Additional Distributional Records for a Rare Caddisfly in the Ozarks, Frenesia missa (Milne) (Trichoptera: Limnephilidae)

The Limnephilid caddisfly Frenesia missa is among the rarest caddisflies occurring in the Ozarks of Arkansas and Missouri. New distributional data show it has a wider distribution than previously thought but the species remains rare. Moreover, the preferred habitat of the species in the Ozarks is small

springs and seeps are threatened by droughts related to climate change. It is recommended this species be made a species of conservation concern in both Arkansas and Missouri.

Brown, Emily, Brian Beto, Emily Fronek, and Ryan Stork, Harding University

A First Description of Body Temperature Acclimation in Wolf Spiders from Arkansas Reveals a Difference in Acclimation Time to Warm or Cold Temperatures

Every aspect of ectotherm ecology, behavior, and physiology is affected by temperature. Descriptions of thermal ecology through laboratory and field estimates are important for understanding ecology in changing thermal environments. In previous lab studies of thermal ecology and thermal performance acclimation times were used without any experimental justification. Figuring out how long it takes for a spider's body to acclimate to environmental temperatures would improve experimental design. A variety of common wolf spider species from Arkansas, of varying body sizes, were captured and brought to the lab. After standardizing hunger, we standardized spiders to either room temperature around 20C or cool temperature around 15C for more than a week. We then placed spiders into plastic containers set into either hot or cold water. Environmental and spider body temperature measurements were taken using a FLIR camera in set time increments until spider body temperature changed less than 0.5C over 5 minutes. We made comparisons between size groups, sexes, species, and temperature trial using KW tests and time to stable body temperature divided by body mass to correct for spider size. Experimental data revealed that time taken to reach temperature acclimation differed significantly between whether the spiders were acclimated to hot or cold temperature. This suggests that there is little to no difference between thermal acclimation in differing species. There was a difference in acclimation time to different temperatures possibly due to observed behaviors such as stilting. This data provides evidence of how long medium to large wolf spiders take to acclimate to temperature and suggests several further lines of questioning that need to be explored in thermal ecology and physiology. A better understanding of thermal ecology and physiology will help us have a baseline to compare future observations of spider characteristics that need to be monitored as the thermal environment changes in a changing climate."

Burton, Claire, David Donley, Harding University

Exposure to iron and copper in Caenorhabditis elegans mutants produces elevated levels of reactive oxygen species

The production of, and detoxification of reactive oxygen species (ROS) are important cellular pathways that regulate metabolism and other functions. The buildup of ROS in cells--termed oxidative stress--results in damage to macromolecules that can alter cellular function. Oxidative stress contributes to aging and neurodegenerative diseases like Alzheimer's Disease (AD). Buildup of the amyloid-beta peptide (Aβ) is associated with AD progression, increased ROS, and buildup of metals. The goal of this study was to use Caenorhabditis elegans as a model to determine if Aβ altered the sensitivity to redox active metals including copper and iron. To accomplish this, ROS levels were measured in three C. elegans strains with and without exposure to metals in a factorial design. The transgenic smg-1 mutant produces the human Aβ in C. elegans; the smg-1/rol-6 strain was used as a control for the smg-1 strain because it has low transgene expression, modeling Aβ production in a healthy, non-AD brain. Mutant strains were compared to the wild type (N2) strain of C. elegans. The levels of ROS were measured using 2',7'–dichlorofluorescin diacetate (DCFDA). Each mutant strain was incubated in $CuSO_4$, $FeSO_4$, or phosphate buffered saline (PBS), after which ROS were quantified using DCFDA fluorescence. Both mutant strains were more sensitive to oxidative stress than the N2 strain (main effect $p<0.001$). Furthermore, ROS production was significantly higher in the smg-1 strain with high Aβ production compared to the other two strains in pairwise comparisons (interaction $p=0.0135$; $p<0.05$ vs. smg-1/rol-6; $p<0.01$ vs. N2). These results demonstrate that Aβ production in C. elegans increases the sensitivity to redox active metals and are consistent with a model where ROS production in AD results from altered

cellular sensitivity to ROS-generating compounds. More work is needed to fully elucidate mechanism(s) for these effects and determine point(s) of intervention.

Castro, Jimmy and Bennett Hasley, Ouachita Baptist University

Using Emitted Vibrational Frequencies to Determine Watermelon Sweetness

The current process of deciding on a watermelon for purchase is up to chance, along with multiple different myths to determine if a watermelon is sweet or not. There is little previous research conducted on watermelon sweetness, which provides few sources of information and even fewer conclusions regarding the prediction of watermelon sweetness. This study used audio signals from thumping watermelon to determine if there is any correlation between the sound produced and the sugar concentration of the watermelon. These signals were broken down using the Fast Fourier Transform (FFT) formula and analyzed for any relationship with sugar concentration based on the Brix scale. This research has discovered a possible relationship between sound frequency and sugar concentration. However, there is not enough data yet to confirm this conclusion so more trials will have to be conducted in the future of this study in order to be more confident in such a conclusion. With this data, we have also started implementing our research and data into a mobile phone app to be used by consumers in order to determine if a watermelon is sweet or not. This app is still very rudimentary but can be taken out and tested on trials itself.

Chaudhari, Nilesh and Ashokkumar M. Sharma, University of Arkansas at Little Rock

Fluidization behavior of solid waste materials

The U.S. alone generates roughly 254 million tons of trash per year. Disposal of waste is imperative as certain types of waste can be hazardous to the earth and communities. The goal of the present work is to study the fluidization of a mixture of solid wastes with silica sand. Dry solid waste materials such as paper, cardboard, and plastics along with silica sand will be used as bed materials for the fluidization study. The test setup includes an acrylic made cylindrical fluidized-bed reactor (1.25-inch id x 39.37-inch height), a 100-mesh screen to support bed materials, a compressor to supply air, an anemometer to measure the air flow, and a U-tube manometer to measure the pressure drop across the bed. Experiments with three replications will be performed using sand and a mixture of sand and solid waste. Results will show fluidization behavior in terms of minimum fluidization velocity, bed pressure drop, air flow rate, bed expansion, and bed material segregation. The project will provide useful data required for the design of a sustainable fluidized-bed process for efficient recycling of solid wastes into green energy, reducing our carbon footprint.

Chesshir, Reese, Ouachita Baptist University

The Effects of Light Wavelength and Gravity on Physarum polycephalum Growth

Physarum is a slime mold in the genus of mycetozoan and the family of Physaraceae. It is a single cellular, multinuclear organism that is not classified as an animal, plant, or fungi. The purpose of this experiment is to study the effect of different light wavelengths and the influence of gravity on Physarum growth patterns. The Physarum is grown in a bacteriological agar with distributed oats as its food base. Red, green, blue, red and blue, and no light was studied and expansion was documented. The possible effects of gravity conditions were introduced by a clinostat. In all five light conditions, stationary and clinostat conditions were studied. The experiments showed that different light and gravity environments had no effect on expansion and growth of the Physarum in these conditions. The experimental results were analyzed using a single factor ANOVA test, concluding, all p-values showed statistical indifference between each condition. Therefore, the search for a food source has more influence on Physarum growth than different wavelengths of light and clinostat conditions.

Christenson, Elijah, Ruth Plymale, Ouachita Baptist University

Actinobacteriophage Isolated in Fall 2021 From Farm Soil Samples

Bacteriophage are a large group of viruses that infect bacteria. Most are host specific, and they are very efficient at killing bacteria. Phage are usually found anywhere in nature that bacteria are, commonly in moist soil, compost, and rotting organic material. The goal of this freshman course-based research was to isolate new bacteriophages from soil samples obtained from many locations around Arkadelphia, Arkansas. Soil samples were obtained from locations likely to contain bacteria and their corresponding phage, such as compost piles, animal pastures, and even a chicken coop. Native bacteria were removed from these samples by filtration and the filtrate was combined with selected actinomycete host bacteria Gordonia terrae, Microbacterium foliorum, or Mycobacterium smegmatis to amplify phage able to infect one of these host species. The resulting enrichment solution was screened for the presence of phage using spot titer assays on G. terrae, M. foliorum, and M. smegmatis. Spots positive for phage were picked and the phage was isolated and characterized. Twenty-three phage were found in total, six infecting G. terrae, six infecting M. foliorum, and eleven infecting M. smegmatis. Both temperate and lytic phages were discovered, however there seemed to be a greater proportion of temperate phages. DNA was isolated from most phages and DNA quality was determined through gel electrophoresis. Two phages with high-quality DNA were selected for whole-genome sequencing. All of the phages found will be added to phagesDB, the worldwide phage database, and they will help to grow the understanding of interactions between phages and their host bacteria.

Clower, Cori and Sharon Hamilton, Ouachita Baptist University

Comparative Analysis of Drug Inclusion Techniques in Nanofiber Mats

Drug inclusion in fiber mats is an important aspect of modern wound dressings for healing assistance. Through the infusion of drug molecules in modern bandages, dressings can be loaded with compounds that fight infection and hasten the healing process. Therapeutics are typically infused into nanofibrous mats via electrospinning a solution of a polymer mixed with a drug molecule. While this technique is an effective means of incorporating drugs into constructs, it limits the application of the resulting mats to conditions that call for that specific therapeutic. Alternatively, dipping polymer nanofiber mats into therapeutic-containing solutions is another way drugs could be infused into materials that could prove to be an alternate and more accessible infusion method. The objective of this research is to compare the drug release from electrospun nanofiber mats using two different methods of infusion: dipping and electrospinning. The hypothesis of these preliminary studies is that therapeutic-dipped fiber mats will give a similar drug release profile to that of therapeutic-electrospun fiber mats proving the dipping method of drug infusion can be an equitable and flexible alternative to the current electrospinning method of infusing drugs.

Coulson, Taylor, Briawna Stigall, Dr. Richard Tarkka, Samantha Hewitt, University of Central Arkansas

Extracting Volatile Organic Compounds from Arkansas Honey

The increasing prevalence of antibiotic resistance and the resulting rise in superbugs such as MRSA and C. difficile demand new techniques for treating wound infections. Long before the discovery of synthetic antibiotics, honey was used as a medicinal wound treatment for thousands of years. Its medicinal use could be due to several factors, including compounds like peroxides, methylglyoxal, and polyphenols. Currently, the only FDA-approved honey for wound and burn dressing is Manuka honey, which is rare and expensive. Honey's efficacy for antimicrobial behavior is measured by a low Minimum Inhibitory Concentration (MIC). Our lab is testing for comparable MIC values between cheaper, more accessible Arkansas Wildflower Honey and Manuka Honey, as well as similar fingerprint antimicrobial qualities between Arkansas Wildflower and Manuka Honeys using 1H NMR. Several

experimental methods can be used to extract the anti-microbial, organic materials from honey. We have used primarily the Liquid-Liquid Extraction (LLE) and Ultrasonic Extraction (USE) techniques for isolating volatile organic compounds from Arkansas Wildflower and Manuka honeys. The organic components of samples from around the state were extracted using LLE and USE, and the statistical Principle Component Analysis (PCA) was used to identify overlaps of compound profiles and assess similarities and differences between AR and Manuka honeys. Our lab is continuing to collect data to explore the possible antimicrobial similarities between Arkansas Wildflower and Manuka Honeys.

Coulson, Taylor, Richard Tarkka, Taylor Canada, University of Central Arkansas
Statistical Analysis of Proton NMR of Honey

The continued use of antibiotics has led to increased antibiotic resistance which has created strains bacteria incapable of treatment through traditional means. Manuka honey is the only FDA approved honey for use on wounds and surgical closures to prevent bacterial infection. This honey is extremely expensive and inaccessible on a wide scale as it is only produced in New Zealand. By obtaining a proton NMR spectrum for volatile organic components Arkansas wildflower honeys and comparing them to control spectra for Manuka honeys, this work hopes to identify cheaper, local honeys that can be used for the same medicinal purposes. In addition, this work hope to identify the components that confer antibiotic properties in honey. By using statistical techniques such as principal components analysis (PCA) and linear discriminant analysis (LDA), these NMR spectra can be turned into meaningful data to accomplish these goals.

Curl, Seth, Amy Sato, and Teresita Bellido, Ouachita Baptist University
Crosstalk between Vitamin D Receptor signaling and Glucocorticoids in Musculoskeletal induced Atrophy

Accumulation of glucocorticoids occurs through exposure to chemotherapy drug cocktails, immunosuppressants, stress, and aging, and leads to a loss of bone and muscle mass. Excess of glucocorticoids induces musculoskeletal atrophy and is now the third leading cause of osteoporosis. The goal of this project is to investigate whether increased vitamin D receptor (VDR) signaling interferes with glucocorticoid induced atrophy in bone and skeletal muscle, and to investigate the role of VDR signaling in skeletal muscle within this frame. Four-month-old mice that either expressed VDR in their skeletal muscles or had expression of VDR suppressed through genetic excision with cre recombinase enzyme activity were used in this project. The mice were treated with either a placebo or glucocorticoids, and then the same mice were either dosed with the active metabolite vitamin D (1,25-dihydroxyvitamin D3) or a vehicle control. After 4 weeks of treatment, the lean body mass, gastrocnemius muscle weight, and bone mineral density of each mouse was collected. The lean body mass of the mice was decreased by glucocorticoids, and vitamin D intervention protected from this loss. The gastrocnemius muscle weight was decreased by glucocorticoids, and vitamin D prevented this loss only in mice that have skeletal muscle VDR expression, but not in mice that lack this expression. Glucocorticoids decreased bone mineral density, but vitamin D provided a partial protection from this loss. These findings indicate that vitamin D intervention might simultaneously protect against glucocorticoid induced musculoskeletal atrophy in immunosuppressant patients.

Donley, D., Reynolds, S., Harding University

Levetiracetam alters the response of microglia to amyloid beta

The central nervous system (CNS) is a site of immune privilege. Therefore, the CNS-resident immune cells are important for control of pathological and/or foreign stimuli. The neuroimmune system mediates and protects against neurological damage by way of phagocytic intake of unnecessary and harmful compounds. This mechanism is also important for homeostatic clearance of neuronal synapses. Microglia are brain-resident immune cells whose proclivity towards phagocytic activity directed at

neurons is increased in the presence of foreign and pathological agents. Amyloid beta 42 (AB42), is an aggregate-prone peptide that is generated by proteolytic cleavage of amyloid beta precursor protein in vivo. These peptides aggregate and form plaques of ordered oligomers associated with onset and progression of Alzheimer's disease (AD). Microglia activate in response to AB42 deposition in the brain and are implicated in the exacerbation of AD. Epilepsy is often comorbid with AD and AB42 propagates epileptiform discharges. One anti-seizure medication that is commonly prescribed to more aged populations is levetiracetam (LEV). LEV has previously been shown to decrease phagocytic activity of microglia. The goal of this study was to study the impact of LEV on the microglial response to AB42. To examine this question, we utilized a 2x2 factorial design with the addition of clinically-relevant concentrations of AB42 and levetiracetam that are found in the CSF. Immortalized microglial cells were stimulated with AB42 and/or LEV and then were analyzed by flow cytometry and metabolic analysis. We determined that LEV impacts the microglial response to AB42. These data contribute to our understanding of how levetiracetam affects microglial functions, including phagocytic activity in an environment which also contains AB42. This further helps characterize the impact of anti-epileptic drugs on the neuroimmune environment. A more complete understanding of the mechanism(s) involved have potential to impact the rate of pathological neurodegeneration in AD patients.

Dow, Maria Ines, Chiraz Soumia M. Amrine, Arkansas Tech University

Chemical and Biological Investigations of Salvia officinalis

Salvia officinalis or Sage (The "Salvation Plant") is known to have various health benefits. Salvia officinalis has been known to treat menstrual cycle pains, gastroenteritis problems, improve liver function, as well as in applications for anticancer remedies and neurodegenerative diseases. This fragrant plant is most often found in the Mediterranean, Southeast Asia, and South America. This research aims to test the raw and vinegar-baked medicinal plant to investigate the change in its chemistry and its biological effect. The plant was purchased as dry leaves and stems. It was then grounded, and extracted. The extractions were done via a soxhlet extraction (SE) using ethanol as solvent. Different steps of liquid-liquid partitions were realized before proceeding to normal-phase chromatography (NP). The samples will be subjected to high performance liquid-phase chromatography coupled with mass spectroscopy (HPLC-MS) to investigate further any new secondary metabolite. Three replicates of each extract are being tested for their antibacterial effect against a panel of gram + and gram – bacteria.

Dresselhaus, Timon, Chris Geske, Ole Kjorholt, Corbin Humphrey, Dr. Zhang, University of Central Arkansas

Autonomous Robot

As our senior project we are working on creating an autonomous robot. The ultimate goal is to compete in the National Robotics Challenge in April, 2022. The competition requires us to make our vehicle drive around a course with different obstacles as fast as possible. The more time left on the clock the more points. For our robot we have so far incorporated the use of lidar, camera, GPS/compass system and encoders. The brain of our robot is a Raspberry Pi4 and we are using ROS2 to bring all of these different components together. We have two motors, four wheels with suspension and currently our body is made of lightweight pipes in order to reduce the weight of the robot.

Fetterly, James and Audrey Ferrari, University of Central Arkansas

Impacting Mathematical Creativity: Problem Posing vs. Divergent Thinking

Mathematical creativity will be discussed in this session. Can it be fostered by intentional exposures to problem posing or divergent thinking in the secondary mathematics classroom? For this study the sample of students came from a single teacher who had multiple sections of Algebra I from an all-boys

high school. One section of students was exposed to divergent-thinking treatments while the other section was exposed to problem-posing treatments. These treatments were presented to the students by the same university professor. Each group received six 55-minute treatment sessions, one per week over a six-week span. To determine effectiveness of the two treatments on mathematical creativity pre- and post-evaluations were given to determine significant differences between the treatment groups. In short, this study aimed to understand how mathematical creativity can be developed or fostered with students in the secondary classroom using pedagogical strategies that expose students to experiences with divergent thinking in mathematics or with exposure to problem posing situations within the content area. Some of the findings were statistically significant.

Fisher, Cannon, Jorie Beaumont, Detri Brech, Ouachita Baptist University

A systematic review on malnutrition assessments and interventions for elderly persons

Elderly persons are at significant risk of becoming malnourished. Specific assessment tools that take into account the common difficulties and challenges associated with aging are needed. Nutritional interventions that are successful in treating elderly malnutrition need to be employed in the right circumstances to slow down the increasing rate of malnutrition in the United States (U.S). To systematically review the evidence from intervention and nonintervention studies on current practices for screening for malnutrition and interventions that are applied as well as the outcomes of the malnourished older persons. Four electronic databases were searched (ProQuest, EBSCOhost, PubMed, and JSTOR) for intervention and nonintervention studies published until July 1, 2020. Studies focused on elderly persons with information on screening tools or intervention strategies for malnutrition. The literature search resulted in a successful 24 articles that included the research criteria. Of the 24 articles, 16 included interventions, while eight included malnutrition screening geared towards the older population. The Mini-Nutritional Assessment short-form was identified as a successful screening when implemented with anthropometric measures or lab tests. Interventions that included dietary supplementation for an extended period of time were successful in improving the subjects' health. The systematic review resulted in a plethora of data on the malnourished elderly population in the U.S. Many interventions were identified to improve the targeted population's nutritional status. Articles found that pertained to diagnosing malnutrition often used several approaches to diagnosing, including anthropometric measures, interviewing, and lab testing. However, the review includes diagnoses that include only one type of assessment.

FitzPatrick, Noah, Carl Frederickson, University of Central Arkansas

Acoustic Characterization of 3D Printed Porous Materials

This project is a proof of a method for the use of a low-cost impedance tube, an oscilloscope, and a function generator to determine the acoustic properties of porous materials. The porous materials studied in impedance tubes are usually modeled as having tubes which run from one end of the medium to the other. However, in order to confirm the validity of the method, a high degree of control over the materials is necessary. Therefore, a resin printer is used to create disks which replicate the models of porous materials used in previous experiments. Software was created for this experiment which auto-generates resin disks based on a pore-volume to total-disk-volume ratio and number of pores in order to control the porosity and flow resistivity of the disk. The disks are then placed in a low-cost impedance tube which was built in the lab in a past project. Two microphones are used to collect acoustic data which is analyzed using a fast fourier transform. This data is taken to determine the acoustic impedance of the medium. Acoustic impedance can be used to determine the porous material properties using current models. The acoustically measured properties will be compared with those predetermined through the use of the resin printer.

Frey, William, Steve Menhart, University of Arkansas at Little Rock

Modernizing Motorcycle Instrumentation and Display

In this project a new instrumentation system is described to improve the data available to a motorcycle rider. Generally, motorcycles display quite limited basic information. This means that very minimal information is often displayed via analog gauges, such as engine speed and vehicle speed. Newer motorcycles take advantage of full TFT (Thin Film Transistor) LCD screens to show detailed and expansive information such as lean angle, tire pressures, navigation, radio controls and much more. In this project the deployment of a modern motorcycle instrumentation system is described to enable the user to view most motorcycle attributes as it is ridden.

Fronek, Emily and Ryan Stork, Harding University

Qualitative comparisons of venom from individuals of the wolf spider Rabidosa rabida from Arkansas suggest the potential for protein variation

The World Health Organization (WHO) and the Centers for Disease Control (CDC) have initiated plans to encourage the research and development of novel antibiotics. According to the WHO, pharmaceutical companies have stopped researching new antibiotics. Yet, globally antibiotic resistance is increasing. The need to develop novel antibiotics is very clear. As microorganisms continue to develop resistance it becomes even more important to find new answers. With this initiative in place scientists are looking in soil, arthropods, other bacteria and fungi for answers to this new dilemma. Previous studies have indicated that spider venom contains peptides that are antimicrobial in nature. Rabidosa rabida is a common wolf spider in Arkansas that has a venom that is not medically important and has not been fully explored. One question that needs to be explored is how much variation is found in venom from this spider. Venom was collected via electrostimulation, and samples were analyzed utilizing 2D gel electrophoresis using 11cm 3-10 pH IEF strips, stain free gels, and BioRad protein prep kits. Venom from multiple individuals were qualitatively compared to see if further quantitative research would be justified in this species. The potential for variation in proteins between individuals was observed though improvements in methods and verification and quantification is necessary to further support this idea. Previous research has suggested the presence of potentially antimicrobial peptides in the venom of this species and if variation exists it would suggest a need to search for AMPs from subpopulations of this species rather than assuming that the entire species has a constant set of venom proteins. New technology gives us the ability to compare individual spiders rather than having to pool venom from multiple spiders. New AMPS, new mechanism, and new research questions could be waiting to be explored in a common spider as well as in other unexplored or underexplored species waiting just outside our homes.

Gajewski, Mariusz P., Steven Barger, UAMS, Arkansas Tech University

System Xc- inhibitors provide effective neuroprotection in vitro

Human obligate exchange protein Xc- is involved in numerous functions, processes and abnormalities. This transport protein is associated with both: beneficial and detrimental effects. One of its functions is transport of L-glutamic acid (Glu) outside of microglia, the innate immune cells in the brain. Microglia release significant amounts of Glu upon their activation, typically via an insult, such as infection, or under pathological conditions such as post-stroke. High levels of Glu result in excitotoxicity, a phenomenon that occurs via overstimulation of neurons, eventually leading to their death. Neuroinflammation, defined as an inflammatory response within the brain or spinal cord usually resulting from diseases, injuries, infections or stress, remains one of the most challenging topics in human health. The lack of effective treatments for this condition captured our attention. We previously developed a panel of molecules capable of efficient inhibition of Xc- protein function. We hypothesized that this inhibition might be applied in therapy against neuroinflammation. We selected one representative inhibitor for this study. This work focuses on in vitro assays of this molecule that prove

its usefulness. We present the results of in vitro Glu release inhibition (microglia cultures) proving that the inhibitor blocks Xc- system, and the results of experiments proving that the inhibitor provides protection to neurons under neuroinflammation conditions (microglia-neurons co-cultures).

Gajewski, Mariusz P., Dr. Steven Barger, UAMS, Arkansas Tech University

Arc induction assay as a convenient method of monitoring excitotoxic levels of glutamate

Neuroinflammation is broadly defined as the activation of the brain's innate immune system in response to an inflammatory challenge. Even though the process is supportive of tissue repair and recovery, it can also result in detrimental effects such as neuronal injury and death. The major mediators in the process of neuroinflammation are microglia, the natural immune cells of the CNS, which besides performing beneficial functions, contribute to the damage to the CNS under specific conditions. System Xc- is a dimeric protein expressed in microglia, among other cell types. It is an obligate-exchange transport protein which exports L-glutamate (Glu) and imports L-cystine (Cys)2 across the plasma membrane. Excitotoxic properties of Glu coupled with elevated levels of this neurotransmitter due to the activated microglial action contribute to neuroinflammation and its harmful outcomes. We developed several inhibitors of Xc- transporter and proved their effectiveness in vitro. Extrapolating that activity to in vivo applications (mouse model) proved challenging. Specifically, we could not find a suitable way to measure levels of inflammation in the mouse brain. Analysis of apoptotic neurons population proved not sensitive enough via TUNEL assay in our work. Similarly, assaying synaptophysin as a proxy for synaptic activity associated with Glu surge proved not sensitive enough. This work focused on one specific inhibitor, CPD7, and its application in reduction of inflammation of the brain. Specifically, this work describes development of an assay based on indirect quantification of Glu levels, useful in evaluation of our inhibitors' efficacy.

Garland, Noah, Rami Alroobi, Southern Arkansas University

Multi-Agent Reinforcement learning Game Playing

In Reinforcement Learning (RL), which is challenging branch of Artificial Intelligence, a software entity termed as the agent interacts with an environment and receives feedback based on the action it takes. One major challenge in the RL field is how the agent can learn in order to have better performance at the task assigned to it. Several approaches have been introduced such imitation, curiosity, inter-play, and human feedback. In this work, we try an adaptation to the agents inter-play technique, although agents are not competing against each other in this case, by throwing multiple agents at the same task and try to keep track with the ones that scores higher. We found that running several agents did improve the score but with the cost of more time required. One game was used in this work. We believe that more work is till needed in this area in general, and in this effort in particular."

Garrie, Jorista and Ralph Meeker, Arkansas Tech University

Factors Affecting the Sex Ratio of White-tailed Deer (Odocoileus virginianus) Fetuses in Arkansas

Health of the mother is known to affect the sex-ratio of the offspring in sexually dimorphic mammals. Both density-dependent and environmental factors (conditions at present, or seasonal conditions the year before) could impact the health of the mother. There are however two opposing hypotheses for whether a mother in good health should invest more in a strong son (that can father many offspring) or in a daughter (that can stay in the same area and use good resources). Fetuses from 1,485 female white-tailed deer (Odocoileus virginianus) were collected over a 10-year period (2002-2012), across 75 counties in Arkansas. For each adult female Deer, we estimated age, recorded live and dressed weight, calculated the kidney fat index (KFI), back-calculated the date of conception, and recorded the number and sex of fetuses. Our objective was to investigate whether female Arkansas Deer that are in good health tend to produce male or female fetuses, in addition to investigating which factors affect conception date in these same females. We developed a generalized linear model, with a binomial response (male versus female

fetuses), to examine the effects of conception date, age and mass of the mother, number of fetuses, and KFI on fetal sex ratios. We found that mass of the mother had the greatest impact on fetal sex-ratios, with heavier females producing more male fetuses ($\beta = 0.21 \pm 0.008$, $P = 0.011$). Female body condition (KFI) did not impact fetal sex-ratios. In addition, we developed a generalized model with mass of the doe, age of the doe, and an interaction between the two variables to see how these physical properties influence conception date. We found a significant relationship between mass and conception date ($\beta = -0.656 \pm 0.178$, $P < 0.001$), and age and conception date ($\beta = -6.44 \pm 2.218$, $P = 0.003$), as well as the interaction term ($\beta = 0.127 \pm 0.045$, $P = 0.005$). Older females tended to conceive closer to the average conception date of the area, whereas younger, lighter-mass females, tended to conceive later than average. If heavier females are more likely to produce male offspring, then habitat could be managed accordingly in the lead-up to breeding season. We hope that the results of our study will form a baseline against which Deer herd-health in Arkansas can be measured in the future. Especially, in the face of ever-increasing challenges such as disease-management.

Gray, Magnus, University of Arkansas at Little Rock

Visualizing Physical and Mental Health Patterns of US Children and Adolescents using the National Survey of Children's Health

Evaluations of public health data addressing US children's and adolescents' health issues are necessary not only to document program effectiveness but also to disseminate evidence-based practices (Evans et al., 2018). They are also needed to bring possible improvement and add scientific knowledge to improve our youths' health. Visualization tools based on national data could easily be used to identify common patterns and transitions. This study aims to introduce a data visualization tool that evaluates possible contributing factors that contribute to the US youths' health issues. The National Survey of Children's Health (NSCH), which is conducted annually by the U.S. Department of Health and Human Services, examines the physical and emotional health of children between 0 and 17 years of age and emphasizes factors related to the well-being of children. The publicly-available 2020 NSCH dataset (N = 42,777; 51.7% males, 48.3% females) was used in this study. The distribution of self-identified race was 76.5% White, 8.56% Black/African-American, 7.48% Native American or Alaska Native, 5.69% Asian/Asian-American, while the rest were indicated as 'other.'By performing regression analyses through the use of heatmaps, scatterplots, and node-link diagrams, several significant findings were observed. The heatmap visualizations shows the correlation between depression and anxiety was found (r = 0.5346, p < 0.01). The correlation between anxiety and arthritis (r = 0.4002, p < 0.025), as well as depression and epilepsy (r = 0.4804, p < 0.01), was also observed. By producing node-link visualizations, relational models between groups of variables were formed, including one linking a myriad of both physical and mental health conditions among adolescents when depression and anxiety is severe. With these tools, one can gather and manage structured information of U.S. youth health. Data visualization techniques that efficiently communicate patterns of health issues show predictive patterns that researchers can identify. Those also allow public health professionals to assess similarities and differences in the relative frequencies of health conditions across age groups. Through the creation of such visualization tools, problematic health patterns of US youths across and within age groups have been identified.

Hairston, Mark, Ty Say, and Keith Blount, University of Arkansas at Monticello

Ticks and Tick-Borne Pathogens in Feral Hogs in Southeast Arkansas

Feral Hogs (Sus scrofa) are an invasive species to the United States living throughout Arkansas. They damage agriculture, timber land, and harm other animal populations by outcompeting for food sources. Ticks and their associated pathogens are carried by the hogs and the widespread home range of hogs creates the potential for spread of these diseases. In this study from June 2021-August 2021, feral hogs were killed in traps set by USDA APHIS Wildlife Services and ticks were collected and sampled for their pathogens. Three species of ticks observed in this study, the Lone Star tick (Amblyomma

americanum), American Dog Tick (Dermacentor variabilis), and the Gulf Coast tick (Amblyomma maculatum). 351 specimens were examined in this study, A. americanum (n=224), D. variabilis (n=41), and A. maculatum (n=33). There were also 3 unidentified nymphs in the study. Pathogens observed were Rickettsia amblyommatis, Borrelia burgdorferi, Ehrlichia ewingii, Ehrlichia chaffeensis, Rickettsia rickettsia, Rickettsia parkeri, and the novel agent Rickettsia buchneri by being divided into pools of tick sex, age, and the host sampled from. This study is done in conjunction with an ongoing survey through the University of Arkansas-Monticello dealing with off host ticks.

Harper, Jimmie, Karson Grant, and Renn Tumlison, Henderson State University

A study of dental pathology in river otters (Lontra canadensis) in Arkansas.

River otters (Lontra canadensis) consume a variety of foods, including mussels, fishes, and crayfishes. These foods have hard body parts that cause wear of the teeth as the predator ages, which can lead to exposure of the pulp cavity and possible abscess and resorption of bone around the alveolus. However, strong bites against harder parts of prey sometimes results in mechanical breakage, which can lead to pulpitis and severe pathology leading to tooth loss. We investigated the frequency of different forms of dental issues in a sample of about 175 skulls of river otters collected from Arkansas, stored in the mammal collections at Henderson State University. Besides dental pathology, we also report cases of supernumerary teeth.

Harrington, Thomas, Ouachita Baptist University

The Effects of Gibberellic Acid and light on Brassica rapa growth and Development

This experiment tested several variables on the plant Brassica rapa. These included testing how light wavelength affects growth, how the plant hormone gibberellin affects germination, and how microgravity induced by a clinostat affects growth. The first two experiments involved placing stationary groups into dark, red, blue, green, and blue plus red light. Each light group had three groups that were each soaked in a different liquid. For the first experiment, the soak groups were water, .1g/mL gibberellin, and .01g/mL gibberellin. The second experiment was the same except that the .1g/mL was replaced with .001g/mL since the .1 killed the seeds. Finally, it was determined that the .01g/mL group performed the best and it was used for the remainder of the experiment. In the end it was determined that gibberellin appears to have a positive effect on the growth and germination of the plant. It was also determined that the plants will grow normally in the absence of gravity.

Harris, Keyshawn; Boone, Alex; Poe, Michelle; and Onyilagha, J., University of Arkansas at Pine Bluff

Perceptions of Quality Care by Patients Utilizing an Urban Emergency Department

This study was conducted to assess the perceptions of patients utilizing an emergency department (ED) in an urban hospital. The main objective was for health departments in Arkansas to understand patients' attitudes and to increase the quality of care in EDs. The study utilized the following variables, waiting time, incoming pain level, attentive listening by the doctor, and whether or not the patient has health insurance. Perception was assessed using a mixed population of insured and uninsured patients in the ED survey. In all, 51 persons who had utilized the ED within the last year completed the survey. Results from the present study found that 45% of respondents stated that 'waiting time' was the most important factor in their perception of quality care; 42% felt that the doctor did not listen to them. About 66% of patients who reported 'severe' incoming pain level also felt their lack of insurance had an effect on the quality of care they received. Of those without health insurance, 94% felt that their lack of health insurance had an effect on their care. In the end, it is desired that ED staff should take time to address these factors to raise the perceptions of patients, especially the uninsured.

Holley, Ryan and Dr. Tulin Kaman, University of Arkansas

Validation and Verification of Turbulent Mixing due to Richtmyer-Meshkov Instability of an Air/SF_6 Interface Using Front Tracking method.

Turbulent mixing due to hydrodamic instabilities occurs in a broad -spectrum of engineering, astrophysical and geophysical applications. Theory, experiment, and numerical simulation help us to understand the dynamics of hydro-dynamically unstable interfaces between fluids. In this talk, an increasingly accurate and robust front tracking method for the numerical simulations of Richtmyer-Meshkov Instability (RMI) is used to simulate the growth rate is presented. Front tracking is an adaptive computational method where the front (interface) between fluids is explicitly followed. Front tracking represents interfaces as lower dimensional meshes moving through a rectangular grid. All the states (pressure, density, and velocity) on the center of each grid cell are updated using the classical fifth order weighted essentially non-oscillatory (WENO) scheme of Jiang and Shu along with Yang's artificial compression. The strength of this method is shown through simulation of the single mode Mach 1.11 and Mach 1.2 shock tube experiments of an air/SF$_6$ interface by Collins and Jacobs (2002). We observe a very good agreement of early time amplitude and displacement of the Mach 1.11 experiment and 2\% discrepancy compared to the Mach 1.2 experiment when 512 grid points per initial perturbation wave length is used.

Hubbard, Sara, Ouachita Baptist University

Analysis of Basic Materials' Effects on a Polycarbonate Museum Object

The basis of this experiment is modeled after experimentation and analysis of two polycarbonate plastic lamps that degraded after being in their crates for two years at the Indianapolis Museum of Art. The premise of the analysis of the lamps was to determine why the presence of BPA occurred for one set of lamps while the other set of lamps – outside of the crates – did not experience the same degradation and BPA crystallization. Since BPA crystallization was formed, previous research was able to narrow down that a basic environment was present within the sealed crate which was most likely due to the packaging materials. This experiment sought to investigate how a basic environment would affect the polycarbonate plastic and if one or more of the packaging materials contributed to the release of amines that led to the basic conditions within the sealed crate. I strove to mimic the conditions within the sealed crate by using ammonia as a base-positive control and deionized water as a base-negative control. Varying concentrations of ammonia were tested on small pieces of plastic to reproduce the degradation of the lamps. We were able to identify a possible minimum concentration of ammonia at which degradation could have begun by developing a visual calibration curve of ammonia versus BPA crystal formation. With these results, we will be able to examine possible packing materials that could have caused a basic environment which could have led to the presence of BPA crystals. These results will serve as a stepping stone to better understand the cause of damage and assist in developing better storage plans for modern design objects in the future.

Hubbard, Sara E., Ouachita Baptist University

BPA presence in daily use panty liners and its ability to disrupt normal reproductive functioning

Bisphenol-A is an industrial chemical that is widely utilized in products such as resins, plastic bottles, and thermal receipt paper. A study was recently performed at NYU Medical School, testing several different feminine hygiene products including panty liners, tampons, pads, feminine washes and deodorants. One of the results of this study showed that BPA is found in feminine products, and that panty liners contained the highest amount of BPA. This is concerning because BPA exposure in women can lead to the dysfunction of the endocrine and reproductive systems, especially during reproductive and post-menopausal ages. Panty liners come in direct contact with sensitive skin for an extended time, and panty liners are used daily for many women. Furthermore, the vaginal absorption rate is significantly higher than that of any other dermis of the skin. Our laboratory's research sought to monitor

the leaching of BPA from panty liners at hourly intervals from 0-4 hours. For each sample, the top layer of three panty liner samples were placed into a 1:1 solution of methanol/water, aliquots were removed over time, and fluorescence intensity data were obtained using the FS-5 spectrofluorometer from Edinburgh Instruments. Each sample was prepared in quadruplicate by submerging the top surface of 3 panty liners into 100 ml of M/W. The top surface of the panty liners was selected because it comes in direct contact with the vulva. Due to the complex matrix of the panty liner materials, this research was conducted using the standard addition method, in which a known volume of the analyte was placed in a flask with varying volumes of a BPA stock solution.

Humphrey, Kamryn, Amy Tran, Alexis Vann, Brooke Lipton, Mick Yoder, University of Central Arkansas

The MAP kinase effectors, TAOK1, TAOK2, and TAOK3, are differentially expressed during early embryogenesis in Xenopus laevis and may play critical roles in gastrulation.

Embryonic development requires an intricate symphony of coordinated cell-cell signaling in order to properly execute the morphogenetic program. Errors in any one of these critical signal pathways can lead to a number of birth defects, such as neural tube closure defects and limb abnormalities. One of the critical signaling pathways is the Mitogen Activated Protein Kinase (MAPK) pathway. The MAPK pathway employs a cascade of proteins, starting with MAP kinase kinase kinases (Map3K), leading to phosphorylation of MAP kinases and subsequent activation of downstream targets. Thousand and One Amino Acids Kinases (TAOK) are a family of Map3ks, with three paralogs: TaoK1, TaoK2, and TaoK3. Using Xenopus laevis as a model organism, our goal is to characterize the spatiotemporal expression of the TAO kinases and elucidate their embryonic function through a combination of qPCR, in situ hybridization, and embryology. Our data show that the TAO kinases all exhibit a similar, yet slightly different, spatiotemporal pattern of expression with a strong overlapping presence in the nervous tissues in later stage embryos. TaoK3 is more strongly expressed through the blastula and early gastrula stages than the others and was examined for functionality in the early developmental program. Perturbation of TaoK3 expression results in delayed or failed blastopore closure. These results indicate that TaoK3 is an essential signaling effector for the proper development in X. laevis. Since TaoK3 can act upstream of both p38 and JNK signaling, we are investigating the specific mechanisms of function to determine its place within these complex signaling pathways. This project was supported by the Arkansas INBRE program, with a grant from the National Institute of General Medical Sciences, (NIGMS), P20 GM103429 from the National Institutes of Health.

Jackson, Genesis and Dr. Zeeshan Habeeb, University of Arkansas at Pine Bluff

How Living in Rural SE Arkansas Increases the Risk of Developing Diabetes

According to the Center for Disease Control and Prevention (CDC) diabetes is the 7th leading cause of death in Arkansas. Arkansas 3rd in the nation of deaths caused by diabetes, even though Arkansas ranks 34th in terms of population in the US. Lifestyle habits can affect the onset and management of diabetes as a chronic illness. In rural areas, such as Jefferson County, where there is limited access to healthcare, healthy food options and public health resources for healthy living, diabetes has dominated. According to the American Diabetes Association, since 2018, almost 800,000 Arkansan adults are pre-diabetic and 360,000 are diabetic, resulting in 14% of the population in Arkansas suffering from this silent disease. My research project objective is to bring awareness to residents of SE Arkansas about the misconceptions of diabetes, such as thinking that diabetes only affects older people. Additional goals of this research include the promotion of healthier lifestyles, the benefits of annual doctor visits, and the impact voting has on healthcare policies, especially in underserved rural areas.

Jauwad, A. M. Mashrur, Arkansas State University

How to enhance system skills of STEM students

The new industrial revolution is underway, data connectivity and digitalization-based production have led to tremendous advancement in industry in the past few years. As an example, the concept of industry 4.0 demands skills across a variety of theoretical and practical disciplines. Since job entry and career advancement are directly linked to college education, a multidisciplinary curriculum needs to be blended with the traditional curriculum. In other words, since the nature of the workforce is changing, the reshaping of the educational curriculum needs to be connected to the industrial revolution, transitional mobility, and the concept of digitalization. So, there is a fundamental need to have a cadre of individuals who will be able to fill a demand for a more holistic- thinking workforce of the U.S. market. The purpose of this research is to evaluate and enhance current STEM students' system skills capability using a newly developed research-based instrument, identify and explore various cognitive, demographic, academic, and intuitional factors that influence systems skills capability of the high school students, and evaluate employers' needs to investigate gaps between STEM students' systems skills capacity and employers' needs.

Jeffrey, Harry, Sharon K. Hamilton, Ouachita Baptist University

Biomimetic Poly(Acrylic Acid) Fiber Scaffolds for Biomedical Applications

Current biomaterials used in wound treatment include collagen, a naturally occurring protein found in the body, and chitosan, a deactylated derivative of chitin. Cotton gauze, which is the common method of wound treatment, is known to create a secondary injury upon removal from the wound. The products of collagen and chitosan based electrospun materials have exhibited favorable conditions for prevention of infection, stimulation of cell growth, and a lower probability of secondary injury. Electrospun materials are able to conform to many different shapes and sizes due to its non-woven scaffold like structure. Collagen has many advantages in biomedical applications as it is biocompatible, biodegradable, and weakly antigenic. Collagen has also been known to stimulate new tissue growth, promote angiogenesis, and epithelization. Chitosan is an excellent natural polymer to utilize in new wound dressing, as its cationic nature destabilizes the outer membrane of Gram- negative bacteria. While chitosan is a cost-effective material, collagen is very expensive. The main objective of this project is to further the investigation of a cost-effective synthetic collagen analog through electrospinning an alternative wound dressing and utilizing the biomimic in a variety of cell studies. Our lab has produced a collagen mimic through the modification of poly(acrylic acid) (PAA) via amide coupling which was analyzed via nuclear magnetic resonance spectroscopy. This biomimetic poly(acrylic acid) (bPAA), was electrospun with chitosan and the co-polymer poly(vinyl alcohol) (PVA) to produce fiber mats that were used for in vitro studies using NIH 3T3 cells. Additional mats containing chitosan or collagen and PVA were also prepared, and a commercially available collagen wound dressing was used as a control. Each mat type was analyzed in scratch test assays. In the future, these mats will be examined through cell viability and proliferation tests, and in vitro degradation studies. These results can be compared to those of collagen containing mats analyzed in the same manner. It is anticipated that these results and products will help develop a wound dressing similar to the extracellular matrix in a cost-effective manner while expanding the horizons or polymer and biomedical research.

Jiang, Qinglong, Jerri James, Kelin Camp, Fard Karim, UAPB

Hybrid halide perovskites materials and nano materials for solar cells, light emitting and other electric-optical devices

The first paper about halide perovskite-structured CH3NH3PbI3 as the active layer for solar cell was published in 2009. It has been found application in light emitting, photoluminescence, sensors and so on. This presentation involves the synthesis of new type of CsxPbyBrz materials with application in light

emission. Also, the presentation will talk about the doping of halide perovskite and the application in photovoltaic, electrochromism and other related topics.

John, Eliana, David Donley, Harding University

Free Radicals Promote Prolonged Activation of Epidermal Growth Factor Receptor in Murine Microglial Cells

Regulation of cellular processes is important for proper functioning. Environmental factors, including stress, can interfere with cellular regulation. One of the diseases caused by cellular regulation disturbance is cancer and mutations in EGF-related genes highly correlate with worse outcomes in cancer. The Epidermal Growth Factor (EGF) pathway is involved in the regulation of cell growth and differentiation. Phosphorylation of the receptors activates this pathway, leading to cell growth and regulation. The goal of this study is to study the impact of oxidative stress on EGF pathway activation. Titanium Dioxide induced oxidative damage, altered the cell cycle, and decreased EGFR activation in a cancer cell line. However, these experiments indirectly explore the relationship of oxidative stress to EGFR activation. To directly test the role of free radicals on EGF pathway activation, we measured EGF receptor phosphorylation levels in mouse microglia cells. Phenyl N-t-butylnitrone, a free radical spin trap, decreased EGFR phosphorylation by approximately 50%. In addition, exposure to Hydrogen Peroxide promoted prolonged activation of EGF receptors. These data will help elucidate the impact of ROS and other cellular stressors on EGFR signaling and potential ways to target cell regulation in disease states.

Joiner, Kyra, Dalton Kidder, Olivia Loudermilk, Mason Adams, Conner Hankins, Emily Fronek, Patrick J. Ruhl, Harding University

Smooth softshell turtle (Apalone mutica) burrowing site selection in response to water depth and temperature.

Ectothermic regulation of body temperature and metabolism is directly impacted by environmental factors. Thus, sensitivity to, and selection of microhabitat characteristics such as water depth or temperature is commonly observed in aquatic ectotherms. Much of what we currently know about aquatic turtle habitat preferences is based on adult life history, and limited research on hatchling microhabitat selection has been done in vitro. Prior research suggests that temperature is the most important factor influencing hatchling turtle habitat selection. To study the influence of environmental factors in a more natural setting, we observed Smooth Softshell hatchling (Apalone mutica) burrowing site selection with respect to water depth and water temperature in a small, outdoor, experimental pond. We monitored burrowing locations of 10 hatchlings for 20 days using radio frequency identification (RFID) tags. Water depth at burrowing locations was significantly shallower than water depth at non-burrowing locations, however, water temperature was not a significant predictor of burrowing site selection. Our results have conservation implications as anthropogenic activities, such as damming and channelization result in the loss of gradually sloping sand bar habitats preferred by this riverine species.

Joslin, Seth, Arkansas State University

Cost-Effective Distributed Computing Using User Devices

A distributed system made up of user devices could be a low-cost alternative to High-Performance Computing. Although user devices typically do not have specs for high-performance computing, the far greater quantity of existing user devices could make up for their lack of quality, allowing for high computing power. This idea presents several distinct challenges. Since user devices make up the nodes in this distributed system, it is critical that the implementation is lightweight in both dependencies and storage. These restrictions are crucial as they will allow more user devices to participate in the distributed system. Additionally, conditions such as low power, excessive CPU utilization, and lack of

internet connection will cause some nodes to become unavailable. As a result, the status of a node must be checked and notated on a regular basis. The operating system and architectural information of each node must also be considered. A separate executable version of the same task segment must be developed for each node type. A combination of the OpenMPI library and SSH and NFS protocols is used as a lightweight and minimally dependent way to connect all nodes and send out tasks. To establish an SSH connection, the Raspberry Pi, our master node, must use RSA to generate public-private key pairs. This will allow the Pi to send tasks without having to enter the password for each node for each execution. A database is implemented to keep track of which nodes are deemed available. The nodes must update the database using a separate program located in the shared NFS folder. SSH is once again utilized to deliver database commands, removing the need for nodes to install MySQL. To have an executable file for each type of node, a node of each operating system–architecture combination is used to compile and store a program into the shared NFS folder. This approach ensures that the selected node does not take up storage and that all available nodes can access it quickly. Finally, OpenMPI segments a program into tasks and distributes them among available nodes. It was found that the distributed system of user devices completed a sample computing task 85% faster than a single computer. This means that a cost-effective distributed system of user smart devices is viable. With this low-overhead option, smaller enterprises and research centers would be able to acquire much-needed computational capability without having to invest in dedicated High-Performance Computers.

Kannan, Ragupathy, Greenwood Junior High School

Is artificial color needed to attract hummingbirds to feeders?

There is some evidence in the literature that artificial food colors may be harmful to wildlife, especially small animals like hummingbirds. Even if approved for human consumption, these dyes may be toxic to smaller animals. I tested the hypothesis that there is no significant difference in hummingbird use of feeders with colored versus uncolored nectar. I hung two identical nectar feeders 12 feet apart and 10 feet above ground on two cedar trees in my backyard in Fort Smith, Arkansas. I used a 25% concentration of sugar water as nectar. I added a drop of red food color in one feeder (experimental treatment) and left the other feeder uncolored (control treatment). I changed the nectar every 3 days and exchanged the positions of feeders once every week. I quantified Ruby-throated Hummingbird (Archilochus colubris) visitation in both feeders in the summer of 2021. I recorded a total of 1096 hummingbird visits, of which 548 visits (exactly 50%) were to the feeder with colored nectar, and 548 visits (50%) were to the feeder with uncolored nectar. These preliminary results from the first year of observations indicated that there was no difference in visitation rates to each type of feeder. The results strongly supported my hypothesis. I plan to repeat the study next summer to increase my sample size. I also plan to use a different brand of feeder. After two years of data, I plan to do a simple statistical test to see if any difference observed is significant. I hope to use the results of this study to convince people that coloring is not needed to attract hummingbirds.

Kannan, Ragupathy, Henderson State University

Yellow-rumped Warblers (Setophaga coronata) Sipping Sap from Sapsucker Wells

Anecdotal observations of Yellow-rumped Warblers opportunistically sipping sap from Yellow-bellied Sapsucker (Sphyrapicus varius) wells are presented with photographic evidence. The incidents happened during extreme winter weather, with ice and/or snow on the ground or trees. These warblers are among the most ecologically generalized of the warblers, utilizing a wide array of foraging maneuvers. They also use a variety of foraging substrates, including ice and ocean water. But their habit of sapsucking from sapsucker wells has only been reported once in the literature. Yellow-rumped Warblers are also among the most cold-tolerant warblers. Their ability to digest wax from bayberries (Myrica spp.) gives them the ability to winter farther north than other warblers. The fact that both our observations were made during extreme cold weather events leads us to hypothesize that opportunistic sapsucking from

sapsucker holes may be another strategy employed by the species to meet its nutritional requirements during harsh winters, when insects are scarce.

Kilgore, Tyneshia L., John L. Hunt, Matthew E. Grilliot, Troy L. Best, Faith A. Johnson, Tyneshia L. Kilgore, and Cade M. Wilkerson, University of Arkansas at Monticello

Energy Content of Seeds of Switchgrass (Panicum virgatum) from the Diet of Mourning Doves (Zenaida macroura) from Southeastern New Mexico

Switchgrass (Panicum virgatum) is a common grass that grows over much of the United States. It has drawn interest as a possible feedstock for biofuels, is used as forage for livestock, is planted for soil conservation, and is a component of the diet of some species of wildlife. We analyzed the energy content of seeds of switchgrass obtained from the crops of mourning doves (Zenaida macroura) collected from plains-mesa sand scrub in Lea and Eddy counties, New Mexico. Seeds were removed from crops and dried for 48 hours at 60°C to remove moisture and standardize masses. Seeds were then analyzed for gross caloric value (i.e., energy content) in an oxygen bomb calorimeter. Energy content of seeds of switchgrass from New Mexico averaged 18.4 J/kg (4.4 kcal/g) and was lower than that of most other food items previously reported from the diet of mourning doves.

Kilula, Dan, Maureen Dolan, Ilwoo Seok, Arkansas State University

Solid-State Dewetting Surface and its Application to DNA Detection

The solid-state dewetting process is generated when the film is very thin. The surface energy minimization is a driven force, and surface diffusion occurs below a thin film's melting temperature. This research reports the fabrication of patterned-nanostructured surfaces using this dewetting process to identify bio-species, particularly DNAs. The quartz glass was used as a substrate material and thermal-energy driven methods fabricated nano-patterned surfaces successfully onto the substrate. The fabricated pattern's shape is island-like of hemisphere ranging 80 to 120 nanometers in diameter. Various metals such as gold, silver, and copper were used as surface materials and validated the size of each nano-sized island with the spectroscopy method. Peaks in wavelengths confirmed the dimension of the patterned nano-surface and its effect on generating the localized electromagnetic field. In spectroscopy, incoming light with ultra-violet and visible wavelengths is either absorbed on the patterned surface or transmitted through the glass substrate. Light's absorption on the surface means its trap on the surface and turns in the electromagnetic field/force generation at specific wavelengths of resonance. For silver, resonance was observed in 450 – 500 nanometers. This research applied the fabricated patterned surface in biosensor technology. It is used for differentiating DNA samples to the length or single/double strands. Since DNA is negatively charged in nature, the strong relationship between the electromagnetic field generated on the nano-patterned surface and the specific size or type of DNA was hypothesized. Experimental validation with two different DNA - one for single, the other for double strands – was tested. The DNA solution was infused in the channel of the fabricated surface, and spectroscopy data was obtained. Interestingly, single-strand DNA was captured and bound selectively on the patterned surface while double strands passed through the channel.

Kockaya, Lara, Suzanne Neidhart, Martin Campbell, Henderson State University

Investigating the 3M3SH absorbance capacity of β-cyclodextrins

With more human space exploration on the horizon, one undeniable truth is that body odor can become a problem on these travels. Since all astronauts produce body odor, and traditional methods to relieve the smell, i.e., taking a shower or opening a window, are not always available, it is inevitable that body odor can become an issue. So, we need a creative solution to eliminating the smell. This is where cyclodextrin (CD) can be helpful. CDs are biodegradable, non-toxic, low-cost, cyclic oligosaccharides isolated from starch digestion. CDs have been utilized to capture dyes for water remediation purposes, encapsulate

volatile organic compounds (VOCs), and are vital in the technology behind Febreze. With this research, we will utilize 3M3SH, the vital compound behind our body odor, to test β-cyclodextrin functionalized cotton's ability to neutralize body odor.

Kwon, Yeil, University of Central Arkansas

Bayes, Empirical Bayes, and Nonparametric Empirical Bayes: Variance Estimation for Multiple populations

We consider the problem of empirical Bayes estimation of multiple variances when provided with sample variances. Assuming an arbitrary prior on the variances, we derive different versions of the Bayes estimators using different loss functions. For one particular loss function, the resulting Bayes estimator relies on the marginal cumulative distribution function of the sample variances only. When replacing it with the empirical distribution function, we obtain an empirical Bayes version called F-modeling based empirical Bayes estimator of variances. We provide the theoretical properties of this estimator and further demonstrate its advantages through extensive simulations and real data analysis.

Le, Ngoc, Caroline Dacus, Kassandra Lee, University of Central Arkansas

Ensemble perception of semantic information from perceptually defined sets

Problem: A relatively new area of visual perception research has shown that we can not only attend to specific details about individual items, but also rapidly analyze groups of items in our visual field simultaneously. For example, it is not necessary to examine each individual blade of grass in a field in order to quickly perceive the average orientation of the blades of grass. Such ensemble perception has been observed for low-level stimulus features, like circle size, and more complex stimuli, such as facial emotions. Previous work suggests that ensemble coding may even occur at a semantic level; in our recent studies participants accurately reported whether the average value of sets of digits was less-than or greater-than 5 without an increase in reaction times, and performance improved with greater numbers of digits in the set. However, it is still unclear whether ensemble representations based on semantic information are generated automatically or require attention to specific items. Chong & Treisman (2005) showed that estimates of the average size of subsets of circles defined by color were equally accurate when cues to the relevant color occurred either before or after the display was presented. The current study asks whether the average value of subsets of digits that are defined by color can be extracted without attention to a specific subset. Methods: 12 volunteers successfully completed a set of tasks identifying a subset of digits (150 trials total) or the average value of the entire 5- or 10-digit display (56 trials each). For the subset condition, arrays of ten digits contained two separate subsets of five digits each, distinguished by color (red or green). Participants were either prompted by a pre- or post-cue (75 trials each) to indicate with a key press whether the average was less-than or greater-than five for the digit subset of a specific color. Results: Accuracy (proportion correct) for the 5- and 10-item "whole display" conditions was higher compared to the pre-/post-cue tasks $F(3, 30) = 8.606$, $p < .001$. However, there was no difference between either the 5- or 10-item conditions, or the pre- ($M = 0.91$, $SD = 0.03$) and post-cue ($M = 0.90$, $SD = 0.05$) conditions $t(10) = .537$, $p = .60$. Discussion: Participants were able to estimate the average value of the whole display more accurately than for a subset, but reported the average for a subset defined by color with similar accuracy across the pre- and post-cued conditions. These results suggest not only that we can generate ensemble representations based on semantic information such as numerical value, but that these representations are extracted automatically from perceptually defined stimulus sets. Additional experiments will utilize eye tracking to compare eye movement patterns associated with the pre- and post-cued conditions.

Litmer, Allison R. and Steven J. Beaupre, University of Arkansas

Influence of temperature on passage rate in Sceloporus consobrinus, with comparison to congeners

Variation in energy acquisition, genetics, and environment determine life history traits among individuals, populations, and species. Therefore, influence of climate change may differ by population or even individual. Sceloporus lizards are used as model organisms for thermal biology, and climate modeling. However, it is often assumed that locally-measured thermal and bioenergetic responses apply among broadly similar species, and throughout intraspecific geographic range. The objective of this project was twofold: 1) to quantify the influence of temperature on passage rate in Sceloporus consobrinus from Arkansas, and 2) compare the influence of temperature on passage rate between S. consobrinus, and published data on S. undulatus. Sceloporus consobrinus were assigned to a temperature treatment (30°C, 33°C, or 36°C) and fed crickets ad libitum. Passage rate was assessed by feeding lizards a cricket with a fluorescent marker, and checking feces every 4-6 hours for the marker. Comparisons of S. consobrinus were made to S. undulatus populations from New Jersey and South Carolina, reported in Angilletta (2001), who used similar methods. Treatments span the range of body temperatures all three populations experience. Results suggest that passage rate is similar among populations, with S. consobrinus being slightly slower. While the three populations are comparable in gut retention time, digestive assimilation may vary. A future study objective is to determine metabolizable energy intake at each temperature for comparison among populations. Such data are important for understanding the role of environmental factors and organismal properties, as well as variation among species, when determining response to climate change.

Lusk, Jeremy, Hypatia Meraviglia, Chris Geske, Dakota Leslie, Zach Humphrey, Erik Stinnett, University of Central Arkansas

Determining Ni-56 yields and bolometric lightcurves of peculiar Type II-P supernovae

As a supernova fades from peak brightness, its luminosity is powered by the radioactive decay of nickel-56 (Ni-56.) This isotope is a by-product of the reactions which take place as the explosion forces its way toward the surface of the progenitor star. As this radioactive element decays, it releases energy into the expanding supernova debris, keeping the supernova visible longer than expansion and cooling would ordinarily allow. Computational models of supernovae predict the amount of Ni-56 synthesized in the explosion, but need to be tested against observationally-determined Ni-56 masses. This requires computing a bolometric lightcurve -- a plot of the total radiated power of the supernova versus time -- from telescope observations of the supernova. constructing a bolometric lightcurve requires us to work backwards – from the observed magnitudes available to an estimate of the total radiated power. The goal of this project is to make supernova bolometric luminosity software easily usable by other researchers, and apply it to the determination of Ni-56 yields from a sample of supernovae related to the famous and well-observed SN 1987A. It is our hope that a well-tested tool will enable more consistent bolometric lightcurve calculations, treat missing observations in a consistent manner, and automate uncertainty estimation. Building a large repository of observationally-determined bolometric lightcurves and Ni-56 masses by leveraging datasets like the Open Supernova Catalog will also constrain theoretical models of progenitor stars and supernova explosion mechanisms.

Lyubartseva, Ganna, Southern Arkansas University

Women in Chemistry: Twenty First Century Trend in Nobel Prize

Nobel Prize is the world's most recognized and prestigious award in science, including chemistry. In this work, we surveyed the gender and age at the time of award of Chemistry Nobel Laureates. We studied trends from 1901 to 2020 divided into two time periods 1900's (twentieth century) and 2000's (twenty first century) and analyzed similarities and differences. We primarily focused on three parameters: (1) representation of women among Chemistry Nobel Prize winners, (2) average age of all chemistry laureates and (3) age of men and women award winners. Our study indicates that the number of women Chemistry Nobel Prize winners, although still small, is increasing in the twenty first century compared to the twentieth century. Also, the average age of all Chemistry Nobel Prize winners is

increasing from 1900's to 2000's. From our data we also noticed an interesting fact that on average women chemistry laureates are younger than men. However, overall "aging" of Chemistry Nobel Prize winners is more prominent for women compared to men. Taken together, we hope our findings will inspire women to pursue chemistry research, which is historically a male-dominated area of science.

Mahat, Rupesh, Zahid Hossain, Arkansas State University

Seismic hazard analysis for Northeast Arkansas (NEA)

The Northeast Arkansas(NEA) is seismically vulnerable region and hence potential to liquefaction due the presence of New Madrid Fault Zone and Mississippi Embayment, which has been proven by past histories of sand boiling and major earthquakes. There has been many research studies of the seismic hazard vulnerability in NEA region but it is challenging to predict the exact nature of seismic liquefaction potential due to presence of soft soil layers extending to greater depths in the region. This required extensive study, which is tedious and expensive. From preliminary studies, code based bridge design value in maintenance of old or construction of new bridge works of the Arkansas Department of Transportation (ARDOT) seems considerably risky or over costly as found by previous studies in the region. So, the estimation of seismic hazard damage potential of the region is important to reduce probable losses and for economic design. In reference to previous projects, which helped in estimating the seismic hazard probability in the region, this project will make use of earthquake magnitude and routine geological data along with seismic site coefficient values in liquefaction analysis of multiple counties of NEA. The generated liquefaction hazard maps will help to assess seismic hazards vulnerability to prevent probable losses. Finally, the outcome of this project will be useful for ARDOT in improving the designs of new construction or maintenance of old bridges and foundations in NEA.

Marshall, Thomas, Gage Miller, Evan Walls, James Libby, Derrek Jones, Wade Lamberson, Edmond Wilson, Harding University

Validation of 3D Printed Stabilization of Paraffin Fuel Grains of Hybrid Rockets

Validation of 3D printed matrices for containment of Paraffin in Hybrid Rocket Fuel Grains has been investigated by conducting hot-fire motor test burns of a Hybrid Rocket Motor driven by Gaseous Oxygen (GOX). The fuel grains consisted of Paraffin wax that has been stabilized using 49 mm diameter 3D Printed Acrylonitrile Butadiene Styrene (ABS) skeletal structures that were 150 – 215 mm long. The use of Paraffin wax as a Hybrid Rocket Fuel shows promising results, as it's monomeric molecular structure can outperform polymeric fuels such as HTPB but is hindered by its low melting temperature resulting in fuel loss and instability due to paraffin sputtering. This study implemented the use of ABS polymer matrices to stabilize the paraffin fuel to restrict the early liquefication of paraffin when used as a hybrid rocket fuel grain. To test the effectiveness of the ABS/Paraffin fuel matrix, a series of hot-fire rocket test burns of a Hybrid Rocket were conducted on a horizontal test stand. Current results have shown these fuel grains to produce thrusts up to 3.9 lbf with average specific impulses up to 1690 m/s using an oxidizer pressure of 215 psi. Residual paraffin sputtering and/or buildup due to early liquification has been observed to be minimized and will be verified in future experiments through monitoring chamber pressure instabilities.

Mebi, Charles A., Arkansas Tech University

Mimicking Metalloenzyme

[FeFe]-hydrogenases efficiently catalyze the reduction of protons to molecular hydrogen which is a clean and primary energy carrier of the future. The active site of [FeFe]-hydrogenases consists of an H-cluster connected by a cysteinyl ligand to tetrairon clusters. The H-cluster, the catalytically active center, is a diiron cluster containing a bridging dithiolate cofactor and ligated by diatomic CO/CN− ligands. Our research involves the design and synthesis of diiron-carbonyl complexes containing poly-aromatic

thiolate groups in order to mimic the structural and functional attributes of the H-cluster. We will present on a series of complexes that have been structurally (X-ray crystallography) and spectroscopically (IR, UV-visible and NMR) characterized, and examined as catalysts for the electrochemical reduction of protons to molecular hydrogen.

Miller, Gage, Edmond Wilson, Harding University

Creating collimated and focused diode laser beams

Using commercial off-the-shelf optics, an attempt was made to focus the optical beams of six diode lasers of various wavelengths to a spot size of 10µm or less. Four of the lasers (405 µm, 660 µm, 763 µm, 785 µm) were single mode lasers and two (462µm, 830µm) were multimode lasers. Three of the diode lasers (462 µm, 785 µm, 830 µm) emitted through 50 µm diameter optical fibers. The range of optical power emitted by the diode lasers measured ranged from 0.5 mW to 1000 mW. In order to prevent saturating the sensor, laser beam intensity was reduced by use of either reflectance or transmission optical filters. In some cases, both types of filters were used. The laser to be measured was mounted on a linear actuator stage and its distance from an optical array sensor was controlled by a Raspberry Pi microcomputer through a stepper motor. The software used was RPiBeamProfilerApp stored on GitHub. The sensor was obtained by removing the lens from a Raspberry Pi Camera and using the camera sensor array to record spot sizes directly. A variety of plano-convex lenses of different diameters, different focal lengths, coated, uncoated, spherical and aspherical were systematically employed. The smallest focused spot size for the single mode lasers was 18.6 µm while the multimode lasers averaged 134 µm using the 1/e2 definition of peak width.

Mohammed, Muatez, Aref, A., Xiong, L., Yan, N., Abdulkarem, A., & Yu, Y, Nair, M. T. S., Guerrero, L., Arenas, O. L., & Nair, P. K., University of Central Arkansas

Study of optical properties and structure of a Cu2O thin film by Chemical Bath Deposition with graphene

Copper oxide (Cu2O) thin films with graphene purchased from SkySpring Nanomaterials, Inc, were deposited on a substrate of glass and silicon by the method of chemical bath deposition(CBD). Graphene was sprayed on a substrate of Cu2O and silicon and also was mixed with Cu2O in the process of the CBD. The samples were characterized by Scanning electron microscopes, Ultra Violet spectroscopy (UV-spectroscopy), Energy Dispersive-X Ray spectroscopy (EDX) in order to determine the optical features , nanostructures of Cu2O thin films, and their band gaps. This result indicated that graphene boosts the optical properties of Cu2O thin film. This study may be useful for Cu2O based devices to create high efficiency of energy conversion.

Mohon, Darby, Rebekah Rampey, Harding University

Determination of viability of Thymus vulgaris in Martian regolith

The National Aeronautics and Space Administration's (NASA) goal to have humans on Mars by the 2030s requires renewable resources for many of their essential vitamins and nutrients. Ascorbic acid, or Vitamin C, consumed via citrus fruits on Earth, will be impossible to obtain in deep space missions, like the journey to and from Mars. Thymus vulgaris, common thyme, is a significant source of Vitamin C, with one ounce reportedly containing 50% of one's daily value of Vitamin C. The plants were grown in 5 soil types to compare its ability to proliferate in Martian regolith. The T. vulgaris plants were quantitatively analyzed with Folin-Ciocalteu reagent and trichloroacetic acid methods for their ascorbic acid content.

Neal, Reagan, Sharon Hamilton, and Josh Spiva, Ouachita Baptist University

Exploration Into Modern Wound Healing: Synthesis of a Biomimetic Polymer

One area of the medical field that has potential to make great strides is the area of wound dressings. Conventional wound dressings do not promote cell growth and if not treated with care can cause more injuries when taken off improperly. Modern wound dressings should promote tissue growth and model the extra cellular matrix. Collagen is needed because it influences tissue growth and the restoration of the epithelium. However, Collagen is expensive and is not easily acquired. Our bPAA synthetic collagen mimic has similar properties to human collagen because of the amino acid mimics functional groups that we have added on are like those found on normal collagen. The collagen mimic can be spun with PVA and Chitosan which help with electrospinning capability and anti-microbial properties which are important in the wound healing process. Electrospinning also helps model the extra cellular matrix by spinning the fibers in a random fashion rather than having a pattern or order like traditional wound dressings. Collagen not only has properties that promote tissue growth, but also helps control bacterial growth. Chitosan is useful in wound healing because of its antibacterial properties. Although Chitosan and Collagen have great properties for wound healing, they can be difficult to electrospin. Therefore, in most cases they are spun with a co-polymer such as poly(vinyl alcohol) to help stabilize charges. With the intention of making a cost affective synthetic collagen, functional groups were added to poly(acrylic acid) was modified via amide coupling that closely resemble the amino acids found in Collagen.

Nguyen, Vy, Chiraz Soumia M. Amrine, Arkansas Tech University

The chemical and biological studies of Bixa Orellana organic extract

Bixa orellana, also commonly known as Annatto seed, has been used in several countries as a traditional herbal treatment for centuries. Multiple studies have been conducted focusing on its chemical and biological activities, and how it can be potentially used as an active ingredient for therapeutic application. This study is aim to investigate Bixa orellana‘s secondary metabolites and their cytotoxic, as well as the antibacterial properties in order to develop a new therapeutic approach since most patients have been building up resistance to first-line therapies. Annatto seeds were grounded then divided into portions, one was used as a control and the others were baked in different vinegars. These latter were extracted using a Soxhlet. The Bixa orellana extracts will then be subjected into normal phase chromatography to study its chemical compositions. This analysis aims to identify the metabolites that contribute or increase the medicinal activity of Bixa Orellana. The organic extract fractions will bed investigated for their biological activity in cytotoxicity and antibacterial tests in vitro.

Odendaal, Antoinette Y., Southern Arkansas University

Assessing the Effects of Retinoic Acid on the Development of Daphnia magna.

The purpose of the present study was to evaluate the potential adverse effects of Vitamin A (trans retinoic acid) on the development of Daphnia magna, a freshwater microcrustacean. Extracted eggs and oviparous females were exposed to retinoic acid at various stages during development and abnormalities were recorded. Neonatal developmental parameters (features) that were assessed included shell spine length, body length, and antennae development.

Orr, Carly, Nathan S. Reyna and Ruth Plymale, Ouachita Baptist University

From Function to Families: The Process of Annotating a Bacteriophage Genome

The freshman bioinformatics class at Ouachita Baptist University is analyzing and annotating the genomes of bacteriophages that infect Gordonia terrae. The phage “chop”, found and isolated by students during the fall semester (2021), is the primary genome annotated. Chop has a 50,919 bp genome with approximately 76 open reading frames (ORF). While ORFs are predicted, the class goal is to manually verify the coding regions in a process called gene annotation. Annotation can be time-consuming; however, using the Phage Evidence Collection and Annotation Network (PECAAN), a cloud passed software that compiles data from databases like Phamerator, Starterator, HHpred, and NCBI-BLAST. We will present the process and rules for annotating a complete genome. This project

was done as part of the newly NSF-funded Host-Virus Evolutionary Dynamics Institute (HVEDI) and the HHMI-SEA-PHAGES program.

Outten, Brenna, Lauren Jones, Dr. George C. Shields, Dr. Caitlin E. Scott, Hendrix College

Docking low-energy ligand conformations to the μ-opioid receptor to verify the model's reliability

Opioids are commonly-used medications that manage chronic pain, which affects approximately 50 million individuals in the U.S. Opioids are agonists that activate the μ-opioid receptor, a type of G-protein coupled receptor (GPCR). When the μ-opioid receptor is bound to the Gi protein, analgesia occurs without tolerance and addiction, but when opioids bind to β-arrestin, tolerance, addiction, and respiratory dysfunction occur. Our goal is to eventually design an agonist that activates the μ-opioid receptor when it is bound to the Gi protein. However, the mouse μ-opioid receptor has been crystallized in the activated state in the presence of the agonist BU72, but the conformation of the bound BU72 is in the high-energy state. First, we used the Induced Fit and Glide Docking software programs to dock poses that are similar to the crystal structures to the crystallized receptors to show that the docking program is reliable. Then, we docked low-energy conformations of BU72 and β-FNA (modified to naltrexone) to the active and inactive crystal structures (PDB ID: 5C1M and 4DKL, respectively) and found that the predicted low-energy conformations can bind to both receptors. To learn how water molecules impact the ligand conformation, we included the crystallized waters in the binding site. The predicted low-energy BU72 structure cannot bind to the receptor in the presence of the crystal water molecules. With opioids currently being the only effective chronic pain medication, the significance of this research is to eventually develop opioids that are safer and non-addictive. In knowing how these ligands bind, we can design more agonists that make the Gi protein-coupled μ-opioid receptor more favorable for pain relief, and they can be further developed into pain medication.

Oyan, Mohammad Najmush Sakib, Zahid Hossain, Arkansas State University

Evaluation of moisture resistance and chemical properties of warm mix asphalt

The future of Warm Mix Asphalt (WMA) technologies is promising in the U.S. as they have potentials to reduce the production temperatures of asphalt pavements to a great extent. However, the Arkansas Department of Transportation (ARDOT) does not have any specific guidelines to implement the additive-based WMAs in the field. This research aims to provide necessary baseline data for WMA as a proof of concept. In this study, three ARDOT approved Performance Grade (PG) binders namely PG 64-22, PG 70-22, and PG 76-22 were investigated. They were modified by varying doses of four selected additives: Sasobit®, Advera®, Evotherm®, and Rediset®. Penetration, Rotational Viscometer (RV), Dynamic Shear Rheometer (DSR), Surface Free Energy (SFE), Texas Boiling Test, Fourier Transform Infrared Spectroscopy (FTIR), and Acid Number (pH) tests were performed on these samples. Penetration test results showed a change in binder stiffness upon the addition of additives. RV test results showed reductions in mixing and compaction temperatures for Sasobit®, Evotherm®, and Rediset® modified binders. Binder samples modified by Sasobit® and, Advera® showed improved rut resistance among all the samples. Both, Evotherm®, and Rediset® modification resulted in higher surface free energy compared to their corresponding unmodified binders. FTIR test results showed that Advera® introduced sulfoxide (S=O) and hydroxyl (-OH) groups into base binders. Texas Boiling Test results showed that asphalt retention was high (>80%) for both Evotherm® and Rediset® modified samples. Acid number test results showed that both Advera® and Rediset® increased pH values of binder samples compared to their corresponding unmodified samples. These results will help the agencies and contractors to choose the right WMA technology for their projects.

Parnell, Amber M. , Harley L. Hines, Chiraz Soumia M. Amrine, Arkansas Tech University

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 the anthocyanins extracted from the native American Elderberry, Sambucus canadensis. It also aims to investigate the process of vinegar baking of the Elderberries with the goal to enhance the chemical space and to increase the biological properties. Frozen elderberries baked in vinegar and non-vinegar baked elderberries were utilized to test this theory. A Soxhlet extractor was used to extract anthocyanins. A rotary evaporator and a separatory funnel were required for many liquid extraction steps. The samples are subjected to normal phase chromatography, then to High performance liquid chromatography couples to a mass spectroscopy HPLC-MS in the hope of identifying new secondary metabolites. Our preliminary results shows an improvement of the antibacterial activity with the elderberries baked in vinegar extract compared to the raw organic extract.

Payne, Emily and Whit Lawrence, Ouachita Baptist University

Investigating Kombucha: The Effects of Honey and Green Tea on Microbes

Kombucha is a fermented sweet tea beverage containing yeast and bacteria existing in a symbiotic culture. The fermentation is initiated by yeast consuming the carbohydrate, typically sucrose, and producing alcohol and gas. Acetic acid bacteria then metabolize the alcohol and produce gas and acids, largely acetic acid. In this project, we investigated the effects of a different carbohydrate source (honey) and type of tea (green tea) on the yeast concentration and acid production of kombucha, compared to a control jar with sucrose and black tea. Yeast-peptone-dextrose agar plates were used to grow yeast from the kombucha in replicate experiments. A TTC assay was conducted to indirectly determine the number of bacteria by measuring whether the kombucha contained enough acid to kill Escherichia coli. Because of honey's antimicrobial qualities, we expected the honey jar to have a lower yeast concentration and decreased acid production compared to the white sugar control jar. As for our second independent variable, we expected that using green tea in the kombucha would also result in a lower concentration of yeast and reduced acid production compared to the black tea control jar because of the antimicrobial properties of green tea. After running the experiment for several weeks, we observed that the kombucha with honey had the highest yeast concentration, while the green tea kombucha had the lowest. Our TTC assay results were similar, indicating higher acid production in the honey jar than in the green tea jar, suggesting a greater concentration of bacteria in the honey jar than in the green tea jar. In the end, we concluded that honey actually created a very healthy environment for kombucha microbes and green tea is a great drink for fighting yeast and bacteria. Although our honey results did not match our initial hypothesis, the increased growth of yeast and bacteria observed could be due to the dilution of honey in the kombucha. Honey contains hydrogen peroxide, primarily responsible for its antimicrobial qualities, as well as vitamins and minerals. Perhaps the hydrogen peroxide is diluted or reacts with kombucha compounds and becomes less antimicrobial, while the vitamins and minerals from honey are still present and support microbial growth.

Prasad, Palyam Sathvik, Robin Ghosh, Arkansas Tech University

A web user interface image processing tool for classifying extent of dementia across Alzheimer's

Alzheimer's disease (AD) is the most common form of dementia. It is the sixth-largest leading cause of death in older adults. Despite the recent advancements in biomedical research, drug designing the medical treatment for Alzheimer's is purely symptomatic and ineffective. Deep learning offers a principled methodology for developing algorithms and discovering new patterns to analyze AD. This

project used four image specifications to classify the dementia stages in each patient applying the convolutional neural network (CNN) algorithm. Employing the CNN-based in silico model, the authors successfully classified and predicted the different AD stages and got around 97.19% accuracy. Later, a web interface tool was developed to educate doctors or researchers to check the patients' dementia level based on the MRI brain images and suggest symptoms that strengthen the predicted level of Artificial Intelligence (AI). A user uploads the brain scan to our front-end portal through a web interface sent to the backend server, where the image is processed and predicted the classification into four types, level0, which means the uploaded MRI scan has no illness. Level-1 is very mild dementia, Level-2 is mild dementia, and Level-3 is moderate dementia. After predicting the level, information is sent to the user with a web interface showing that level and some of the symptoms common in that specific level and recommend essential details on the stage. Different front-end technologies like HTML, SCSS, and react and back-end technologies like python are used to process the image data and send information back. We hosted our project on the google collab platform, giving us an instance of a highly configured server that can run machine learning models efficiently.

Pelley, Morgan K., Steven J. Beaupre, Allison R. Litmer, University of Arkansas

The influence of temperature and body size on food consumption in prairie lizards (Sceloporus consobrinus)

Understanding the effect of temperature on physiological and digestive processes, such as voluntary consumption rate, is critical for assessing the impact of climate change. Food consumption is required for lizard survival and reproduction and is dependent on temperature. As temperatures increase, the amount of food consumed to meet the energy requirements related to survival and reproduction must also increase. Information on the amount of food consumed at different temperatures is helpful in determining if lizards are able to meet the energy requirements necessary and could help predict the survival of lizard populations. Additionally, such information is beneficial in constructing predictive climate change models. In this study, I investigated the effect of body temperature on voluntary consumption for the prairie lizard, Sceloporus consobrinus. I also determined the effects of body mass (g), body size (snout-to-vent length, SVL in mm), and total length (TL in mm) on consumption rates. In the laboratory, I conducted feeding trials over a range of temperatures (23.0°C, 28.0°C, 30.0°C, 33.0°C, and 36.0°C) and body sizes measuring the amount of food consumed by each individual lizard. I found that consumption per lizard was highly dependent on temperature, and that between body temperatures 23.0°C - 36.0°C, consumption increased with subsequent increases in temperature. No relationship was found between body mass, body size (SVL), or total length (TL) on consumption rate. I conclude that body temperature significantly influences voluntary consumption rates Sceloporus consobrinus. As climate change proceeds and lizard body temperatures continue to rise, increased consumption at warmer temperatures suggests a greater demand for food availability for survival of Sceloporus consobrinus

Perez, Victoria and Ben Rowley, University of Central Arkansas

Antimicrobial Properties of Hops Alternative Worts

Hops (Humulus lupulus) are often used as a preservative in beer brewing. However, it has not always been the main flavor enhancing and preservative herb used. Recipes have included herbs that are less expensive and more available than hops. The ability of herbs other than hops to control bacterial growth in the brewing process has not been as thoroughly examined. The following study compares antimicrobial properties of worts (beer before fermentation with yeast) produced from non-hops beer recipes, individually and versus a hops-based recipe. Wort antibacterial capabilities were assessed via measurement of absorbance over time of a Gram-positive (S. epidermidis) and a Gram-negative (E. coli) microbe over a 6 hour period at 37°C. Results indicate that hops-based wort suppresses growth of both Gram-positive and Gram-negative bacteria. Of the seven non-hops recipes studied, most showed

differing inhibitory effects compared to the hops recipe. Only one recipe exhibited similar antimicrobial effects as the recipe containing hops. The variability observed is likely due to differences in the compounds extracted from the array of herbs used during the wort production process.

Phillips, Allyson, Ouachita Baptist Univeristy

A Multivariate Comparison of Stigmatization of Individuals with Schizophrenia, Binge Eating Disorder, and Intellectual Disabilities

Mental health diagnoses have been repeatedly linked to stigmatized behaviors and attitudes. While much research has been done on the stigma surrounding mental illness, no research has directly compared stigma for schizophrenia, binge-eating disorder, and intellectual disability. To effectively educate and address stigmatization, we must understand the specific attitudes and beliefs associated with each separate disorder, not disorders as a whole. The sample included 201 students from a faith-based liberal arts university. Participants read three vignettes in a randomized order. The vignettes were about a person with schizophrenia, a person with binge eating disorder, and a person with an intellectual disability. After reading each vignette, participants answered the Attribution Questionnaire-Short Form (AQ-27). The AQ-27 measures nine aspects of stigmatizing attitudes and beliefs about individuals with mental illness including blame, anger, pity, help, dangerousness, fear, avoidance, segregation, and coercion. A one-way repeated-measures multivariate analysis of variance was performed to investigate the effect of diagnosis on nine components of stigmatizing attitudes and beliefs. The overall MANOVA was significant, $F(18, 183) = 89.95$, $p < .001$, Wilks' Lambda = .10. When the results for the dependent variables were considered separately, all nine dependent variables reached significance ($p < .001$). Post hoc pairwise comparisons using Bonferroni corrections found that the schizophrenia condition had the highest stigmatization in all categories except for blame and pity. The binge eating condition showed the highest stigmatization in these two categories. Results showed differing patterns of stigmatization based on the diagnosis. Participants responded with increased fear towards the individual with schizophrenia. This diagnosis was associated with more danger, and participants were less likely to help and more likely to avoid this individual. Additionally, participants believed that an individual with schizophrenia should be forced into treatment and placed into a mental hospital because of perceived risk more so than the other diagnoses. In contrast, participants believed that individuals with binge eating were more responsible for their condition and at fault for the diagnosis, and, as such, participants felt less pity, sympathy, and concern for this individual.

Pickelman, Ryan and Adrian Salazar-Rivera, Ouachita Baptist University

Optimizing a Passive-Tracking Solar Panel System

For a solar panel to function efficiently, it must turn to face the sun throughout the day. Usually, an electronic device rotates a solar panel. In this experiment, hourly rotation of the panel was achieved through the contraction of a shape memory alloy (SMA) and a gear system. A Fresnel lens directed the sun's rays onto the SMA causing it to contract. A delayed reset system was built to turn the panel from west to east at the end of the day. In addition, this project investigated different materials to properly heat and cool the SMA within the plexiglass housing apparatus. The overall goal for the project was to automatically power an appliance on campus with solar energy.

Pinkins, Bridgett Williams, Jerri James, Sanjay Behura, University of Arkansas at Pine Bluff

Nanocomposites for Wearable UV Smart Sensors for Detecting Lupus Photosensitivity

Photosensitivity, sensitivity to ultraviolet (UV) light, is prevalent in systemic lupus erythematosus (SLE) or lupus. In lupus, photosensitivity is a common environmental trigger that increases the disease activity or flares from varying ultraviolet (UV) exposure amounts. Lupus flares trigger symptoms such as

fatigue, joint pain, rash, fever, and headaches, lasting up to several weeks. Therefore, in recent years, innovative technology such as wearables and UV biocompatible sensors are a target research market area in the healthcare industry. UV energy in the electromagnetic spectrum lies in the range of 0.01 – 0.4 μm (10 – 400 nm) and therefore, wide bandgap (WBG) materials with an energy band gap close to this range will be suitable for UV sensing. Nanoscale WBG material such as zinc oxide (ZnO), and its composites will be employed here to develop flexible, lightweight, and efficient skin-based sensors that will detect UVA and UVB rays as well as the time range needed to cause flares. Futuristically, data transmission can be integrated wirelessly from the sensor to the storage unit to transfer UV measurements to a smartphone application.

Pigott, Sidney, Emma Rouse, Marly Welbourn, and Joseph Bradshaw, Ouachita Baptist University

The Potential Advancement of Photodynamic Therapy using a Novel Water-soluble Zinc Porphyrin, ZnTPP-5AP

Photodynamic therapy (PDT) is a type of cancer treatment that uses light and a photosensitizing agent to kill malignant cells. This research focused on synthesizing and analyzing a new water-soluble zinc(II) porphyrin compound as the photosensitive agent. The specific porphyrin compound ZnTPP-5AP was synthesized by the addition of 5-amino-1-pentanol to the porphyrin, ZnTPPC. The new product was purified by column chromatography through Sephadex G-50 and LH-20 columns to ensure the purity of the product before characterization. The identification of ZnTPP-5AP was verified by infrared spectroscopy (IR), nuclear magnetic resonance spectroscopy (NMR), and ultraviolet-visible spectroscopy (UV-vis). Purity of the new material was determined by high performance liquid chromatography (HPLC). Finally, the utility of the ZnTPP-5AP as a photosensitizing agent was determined by examining the cytotoxicity of ZnTPP-5AP by MTT assay on the A549 lung cancer cell line, in the presence and absence of white light.

Plymale, Ruth, Ouachita Baptist University

Yes You Can: Design and Implementation of Freshman Course-Based Research Experiences

Course-based research experiences (CUREs) have the potential to engage students of all academic backgrounds in science, not just high-performing students. CUREs give all students the opportunity to see themselves as scientists, potentially increasing retention in STEM. At Ouachita Baptist University, we have identified four characteristics of successful CUREs and I have used these to design and implement multiple course-based research experiences for the freshman general biology lab at Ouachita. My primary goal in freshman biology CUREs is for students to develop foundational experimental techniques that they can use in future science courses and independent research. In this presentation I will describe the different course-based research experiences I have built at Ouachita and give tips for building a freshman CURE at your university.

Pruett, Christin and Nathan Reyna, Ouachita Baptist University

Not Just For Mean Tweets: Twitter Posters to Engage Students and Refine Communication Skills

Since the beginning of the pandemic, educators have been forced to think about the ways they communicate with their students and how their students engage in science and with the scientific community. Many instructors were able to adapt CUREs utilizing online data analysis, and virtual meeting software allowed for class discussions and synchronous learning. However, the ability for students to interact with the scientific community and network with other young scientists was still missing. Even before the pandemic, a subset of students would travel to regional or national meetings to present their work, but most students did not have these opportunities. With over 300 million active users, Twitter provided a unique platform for students to present their work to a large and varied

audience. The Cell Biology Education Consortium hosted an innovative scientific poster session held entirely on Twitter to engage undergraduate researchers with one another and the broader community. The format for posting in this popular social media platform challenged students to simplify their science and make their points with only a few words and slides. Nineteen institutions and over one hundred students directly participated in this event. We will present our experience from this project and provide guidance on how to do your own Twitter poster session. Twitter (animated) posters are simple and can be done with any class.

Rouse, Emma, Joseph E. Bradshaw, Ouachita Baptist University

The Development of a New Water-Soluble Zinc Porphyrin, ZnTPP-3AP, and its Potential as Photodynamic Therapy Agent

A new treatment method for cancer and other medical disorders know as photodynamic therapy (PDT) is being developed. PDT uses the radiant energy of light and a photosensitive agent for treatment. In this research a novel water-soluble zinc(II) porphyrin was developed as a potential PDT agent. When the porphyrin is activated by light, singlet oxygen is generated which effects the surrounding cells. The goal of this research was to synthesize and characterize a new water-soluble zinc(II) porphyrin incorporating the amine, 3-amino-1-propanol, to be used as a possible PDT agent. The novel porphyrin, ZnTPP-3AP, was purified using column chromatography, and characterized using IR, UV-vis, and NMR spectroscopies. The purity of the desired compound was determined using HPLC. Additionally, an MTT assay utilizing A549 lung cancer cells was completed to evaluate the cytotoxicity of the ZnTPP-3AP in both light and dark conditions. The exposure of ZnTPP-3AP to light was used to determine if the novel compound has the potential as a PDT agent.

Sadik, Nafis, Niamat Ullah Ibne Hossain, A M Mashrur Jauwad, Arkansas State University

Analysis of Electric Grid Resilience Using Bayesian network

This research utilizes Bayesian network to address a range of possible risks to the electrical power system and its interdependent networks (EIN) and offers possible options to mitigate the consequences of a disruption. The interdependent electrical infrastructure system in Arkansas State is used as a case study to quantify the resilience using the Bayesian network. Quantification of resilience is further analyzed based on different types of analysis such as forward propagation, backward propagation, sensitivity analysis, and information theory. The general insight drawn from these analyses indicate that reliability, backup power source, and resource restoration are the prime factors contributed towards enhancing the resilience of an interdependent electrical infrastructure system.

Say, Ty and Mark Hairston, University of Arkansas of Monticello

A Survey of Native Ticks and Their Pathogens in Arkansas

Tick surveillance is important to public health because it monitors the prevalence of tick populations while subsequently monitoring their pathogens. The purpose of this study is to supplement the lack of knowledge of native tick populations in Arkansas due to the progression of time. In fact, no other studies that meets the definition of active surveillance have been completed in Arkansas for over 9 years. Between the years of 2020 and 2022, we actively surveyed 27 various locations in Arkansas. The ticks we collected amounted up to 1.796 total ticks between four different species: Amblyomma americanum, Amblyomma maculatum, Dermacentor variabilis, and Ixodes scapularis. The lone star tick, A. americanum, is the most prevalent tick observed with a substantial 1,583 specimens collected. Other tick species did not approach the abundance of lone star ticks, but the numbers we observed is as follows: A. maculatum- 42 ticks, D. variabilis- 34 ticks, I. scapularis- 137 ticks. Tick infections varied depending on the species. Approximately 178 pools of Amblyomma spp. ticks were positively infected with Rickettsia

amblyommatis, a known tick symbiont. Several other pathogens were analyzed including Borrelia burgdorferi, Ehrlichia ewingii, E. chaffeensis, R. rickettsii, R. parkeri, and a novel pathogen named R. buchneri. More research is needed to further assess tick populations and their pathogens.

Schuster, Morgan, Samantha Jones, James Hyde, Southern Arkansas University

Characterizing adeno associated virus based GCaMP transfection in organotypically cultured pituitary glands

Organotypic tissue culture is the in vitro culturing of an organ, or tissue, that maintains the tissue's structure as well as its organization. Our lab's goal is to study widespread structure and organization of neuroendocrine networks in the anterior pituitary gland. We can directly monitor neuroendocrine activity via calcium imaging. The goal of this project is to study transfection properties and demonstrate effectiveness of adeno associated virus delivery of the GCaMP6f calcium probe in cultured pituitaries. Mouse pituitary glands were extracted and cultured using organotypic methods to maintain neuroendocrine network structure and organization. Adeno-associated virus (AAV9 serotype) with the GCaMP6f transgene was pressure injected into freshly extracted pituitaries using a picospritzer. The CAG promoter was selected to drive general expression across all pituitary cell types. The pituitaries are maintained in a serum-free culture to prevent exposure to hormones, which may affect pituitary activity and thus intensity of expression. Cultures were kept in a humidified 5% CO2 incubator to maintain cell viability. The glands are imaged under a fluorescent microscope with 50 and 950 ms exposures. Videos were recorded at 20 frames per second. Pituitaries were recorded every 2-3 days over the course of 30 days. Fluorescence of each pituitary was measured with ImageJ and background corrected intensity was analyzed. Videos were processed using the EZcalcium package with MATLAB. The pituitaries showed transgene expression within 48 hours of injection. Fluorescence rapidly increased during the first week post injection and continued to increase over the course of one month. MATLAB analysis demonstrated a variety of baseline cell activity patterns that agree with patterns demonstrated in the literature using synthetic calcium probes. Overall, this project showed AAV9.GCaMP6f is a viable AAV serotype that demonstrated robust calcium transients in pituitary cells. This study also showed that recordings can begin shortly after transfection and the viability of conducting future long term calcium studies in cultured pituitaries.

Seibert, Aubree, Joseph E Bradshaw, Ouachita Baptist University

The Photodynamic Therapy Potential of a Novel Water-Soluble Gallium Porphyrin

Photodynamic therapy (PDT) uses a photodynamic agent, which can be activated by light to produce cell death by a singlet oxygen. Porphyrins are known to be suitable photodynamic agents. In this project, a porphyrin with a gallium core was synthesized. This included synthesizing H2TTPC, the starting material from pyrrole and 4-formylbenzoic acid, then adding gallium to the center of the poryphyrin, then adding the amine, 3-amino-1,2-propandiol. After synthesis, the product was purified by a syringe filter, followed by two chromatography columns. The product was then characterized using nuclear magnetic resonance (NMR), UV-Vis, infrared (IR), and nuclear magnetic resonance spectroscopies. Finally, the cytotoxicity of the compound was measured using MTT Assay on A549 non-small cell lung cancer cells with and without exposure to light.

Seupaul, Savannah and Sarah E. Durant, University of Arkansas-Fort Smith

Antibacterial Properties of Horsehair Fungus (Marasmius) in Tropical Bird Nests

Fungal fibers are commonly used by birds as nest material. The black fibers of horse-hair fungi (Marasmius) are used in the nests of 98 bird species. Among the hypotheses proposed to explain this is that these dark fibers confer greater physical strength or better temperature modulation than other commonly available fibers. Another hypothesis is that these fibers have antimicrobial characteristics that may help birds in feather maintenance or disease avoidance. We tested the antimicrobial hypothesis

from 6 inactive nests of the Yellow-olive Flycatcher collected from Belize, Central America in June 2019. An inactive grassy nest from the sympatric Yellow-tailed Oriole (Icterus mesomelas) was used as a control. Petri dishes were prepared using Mueller Hinton nutrient agar. Each plate was spread with 200 µL of LB broth inoculated with E. coli bacteria (strain: K12) to produce a lawn of bacteria. Paper discs soaked with extracts from the dried and ground nest samples were plated using tweezers that were sterilized between each disc type. Discs soaked in distilled water and hydrogen peroxide served as additional controls. The petri dishes were incubated at 35°C and checked at 24 and 48 hours. The zone of bacterial growth inhibition around each paper disc was measured in centimeters on both days. Bacterial lawns were successfully grown on all discs by the 24-hour check. At 24 hours, only the discs soaked in hydrogen peroxide displayed zones of inhibition. The results were identical after 48 hours. The regions surrounding the paper discs soaked in Marasmius nest solution look identical to the regions surrounding paper discs soaked with distilled water and the control nest. Therefore, these results do not support the hypothesis that the black Marasmius fungal fibers exhibit antibacterial properties.

Shah, Manoj K., Chisom Okeke, Isaac Juma, Sylvester Amoah, Solomon Ojo, Sanjay Behura, Jifeng Liu, Shui-Qing Yu, and Mansour Mortazavi, University of Arkansas at Pine Bluff

Ordering-Disordering Analysis of GeSn Films using Raman spectroscopy

To explore the GeSn films material quality we studied the atomistic configuration through an investigation on the order-disorder analysis via Raman spectroscopy. The temperature dependent Raman measurement from Ge0.95Sn0.5 to Ge0.831Sn0.169 films grown on the silicon substrate was performed over the temperature range of 90 to 450 K using 785 nm and 532 nm lasers. The photon energy of the laser line was kept much larger than the bandgap energy of GeSn films to avoid the Raman resonance during the measurement. A conventional Raman system, LabRAM HR, equipped with a heating and cooling system from Linkam was used for the measurement. The Raman measurement was started at the lower temperature of 90 K then temperature was increased gradually at the rate of 3 K per minute and spectra was measured at the interval of 30 K. The sample temperature was maintained for 3 min to ensure the stable temperature during the measurement. A weak laser power was used to avoid the local heating caused by the laser and 50x long working distance lens was used for the measurement. 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 incorporation of Sn in the Ge lattice. For 785 nm laser Ge-Sn and Sn-Sn peaks are not clear due to high penetration depth. The 785 nm laser resonance better with Ge-Sn and Sn-Sn peaks, however, due to penetration depth it does not allow the better investigation of the samples. For 532 nm laser line Ge-Sn and Sn-Sn peaks are not suppressed and shows clear shift with Sn incorporation. The shift induced by temperature is larger than the Sn incorporation, which is mainly attributed by phonon-phonon coupling and thermal expansion. The intensity of the lower concentration Sn is comparatively lower than higher concentration Sn. The main Ge-Ge peak intensity decreases, and linewidth increases, and other peaks are not clear for the samples above and below the room temperature.

Shaver, Jeffrey, Roger Lightner, Ethan Moore, Brandon Romero, Hannah Warrington, University of Arkansas Fort Smith

Effect of Soil Microbiome Succession on the Prevalence of Antibiotic Resistance in Massard Prairie

Our project aims to determine how bacterial-fungal interactions impact the prevalence of antibiotic resistance genes (ARGs) in soil microbial communities undergoing tallgrass prairie restoration. We are currently investigating bacteriomes and mycobiomes in soils from virgin (Massard Prairie), remnant, developed, and restored tallgrass prairie in Ben Geren Park (Fort Smith, AR). Previously, twelve soil samples were collected from these sites in February 2019, March 2020, and September 2020. We had

characterized the microbiomes for samples collected in February 2019 and March 2020, but not for September 2020. As previously reported, for four of the samples collected in September 2020, one from each of the four sites, we studied the prevalence of antibiotic resistance using the Kirby-Bauer antibiotic disk diffusion method. From each of the four soil samples we cultured 10 pure bacterial isolates on Tryptic Soy Agar, and characterized the isolates by gram staining and testing with eight different antibiotics, including tetracyline (protein synthesis inhibitor), polymyxin B (cell wall disruptor), vancomycin (cell wall inhibitor), and sulfisoxazole (antimetabolite). Additionally, 16S rRNA Sanger sequencing of 32 of the 40 bacterial isolates was completed, and twenty-four isolates were identified as Bacillus bacteria. Thirty-three isolates were resistant to at least one class of antibiotic, and five of 10 isolates from restored prairie were resistant to three classes of antibiotics, including tetracycline. Though most of the isolates were Bacillus, based on our bacteriome analysis of samples from February 2019 and March 2020, less than 2.5% of prairie soil bacteria include Bacillus. ARG Microbial qPCR Arrays (cat. no. BAID-1901Z) were completed on 10 of the 12 samples collected in March 2020, and none of the 83 ARGs tested for were detected. New ARG results will be presented from samples collected in September 2020. This project is supported by a grant from NIGMS (P20 GM103429) at NIH.

Smith, Lauren, Mindy Farris, University of Central Arkansas

Steroid Signaling Mediates Longevity Responses to Dietary Restriction and Nutrient Availability in C. elegans

Dietary restriction (DR) extends lifespan and healthspan (time spent at or near peak health capacity) in a wide range of organisms, including mammals and Caenorhabditis elegans. C. elegans genetic models of DR use mutations in eat-2, resulting in restricted pharyngeal pumping and extension of lifespan by ~25%, without sacrificing function or activity. It has been demonstrated that steroid signaling mediates the DR longevity response. Notably, C. elegans cannot synthesize cholesterol as higher animals can; it must come from their diet. Cholesterol is then converted to various products, including steroid hormone precursors. By functioning as intracellular communication, steroid signaling is a probable mechanism for organism-wide cellular responses and lifespan control. Thus, enzymes active along the cholesterol-to-hormone biosynthetic pathways are likely candidates for longevity regulators. While HSD-2 and HSD-3, two members of the conserved 3β-hydroxysteroid dehydrogenase (3β-HSD) family, are required in C. elegans for lifespan extension and stress resistance conferred by DR, the hormone or hormones generated by these steroidogenic enzymes have not been identified. Another mechanism of inducing DR in C. elegans is bacterial deprivation (BD), where worms are placed on solid media in the absence of food. This technique may be accomplished using nematode growth media (NGM, containing agar, salts, peptone, and cholesterol) or minimal media (lacking peptone). In contrast to the eat-2 mutation, which is necessarily life-long, BD can be applied at specific times in the worm lifespan. We are examining effects of hsd-2 and hsd-3 on BD-mediated lifespan and stress resistance in order to determine whether the hormone effects are eat-2 specific, as well as consider the importance of coordinated timing of nutrient availability and hormone signaling. We have found that while hsd-3 is required for eat-2 early-life stress resistance, it does not appear to be required for BD early life stress resistance. Notably, HSD-3 is expressed in the hypodermis while HSD-2 is expressed in the intestine. These enzymes may thus work in concert to communicate the presence of food versus actual ingestion of food. We have also examined effects of added glucose (generally known to shorten C. elegans lifespan) on stress resistance in various mutant backgrounds. We have found that while glucose shortens overall lifespan, when in the presence of certain stressors glucose appears to have a protective effect, at least early in life. The effects of added glucose are neutral or negative in mid-life and late-life, respectively. Thus, the late life effects of nutrients may be the most relevant for overall lifespan.

Smith, Theophilus, Kelin Camp, Kaylan Crockett, Abul Kazi and Richard Walker, University of Arkansas at Pine Bluff

Development of Four New Computational Chemistry Laboratory Exercises for the Organic Chemistry Laboratory Course

As part of the NSF-funded Targeted Infusion grant, we have developed four laboratory exercises for the Organic Chemistry I and II laboratory courses. These exercises will be implemented during the Spring 2022 semester. These exercises involve chemical computations using the Spartan 8 program to investigate the relative stability of molecules and reactive intermediates. The PM3, Hartree-Fock and Density Functional methods are used. The following laboratory exercises were developed: 1) Relative Stability of Substituted Cyclohexanes; Axial or Equatorial? 2) SN1 or SN2; Which Way is the Best for You? 3) Carbocation Rearrangement and Alkene Stability 4) Electrophilic Aromatic Substitution; Ortho-Para versus Meta Directors. The exercises will be described in detail in this presentation. All of the exercises work well and are student-friendly. It is our expectation that these exercises will help students understand certain concepts taught in the Organic Chemistry lecture course with which students often have difficulty.

Spiva, Joshua, Sharon K. Hamilton, Ouachita Baptist University

Incorporating a Bioengineered Protein and a Collagen Analog into Modern Wound Dressings

Collagen is a vital part of wound healing and has been incorporated into a variety of modern wound dressings including electrospun fiber mats. The limitations of human collagen include high costs and limited availability. Chitosan, another biopolymer used in wound healing, possesses antimicrobial properties, and offers protection against biofilms which hinder healing of the wound bed. Previously, our lab has electrospun chitosan and PVA (poly(vinyl alcohol)) with collagen to produce fiber mats that have shown promise as modern wound dressings. Additionally, the Hamilton lab has developed a cost-effective collagen analog that has been incorporated into nanofiber scaffolds. The resulting nanofiber mats have been designed to mimic the morphology of the extracellular matrix in the body for use in biomedical applications including wound healing. These biomimetic electrospun scaffolds show promise for releasing molecules into the wound bed including proteins and other large molecules. Our lab has incorporated s-HFGF1 (super-human fibroblast growth factor), a bioengineered protein based on human fibroblast growth factor, into nanofiber mats. Studies have shown that the direct application of s-HFGF1 to cells results in increased proliferation in vitro. The protein paired with the biomimetic and antimicrobial properties of the novel nanofiber scaffolds should provide synergistic results including a faster wound healing as well as preventing bacterial infection. We have assessed the ability of our nanofiber mats to release the s-HFGF1 protein in physiological conditions. In the future, protein release studies will be performed in vitro and analyzed using cell migration assays. As a step towards cell studies, supernatants from these release studies will be used in NIH 3T3 viability assays to evaluate the ability of cells to survive exposure to these novel dressings. In the future, cell migration assays will be performed to determine the impact of the released protein and novel dressing on the rate of in vitro wound healing. It is anticipated that these experiments will further verify the release of biomolecules from novel nanofiber scaffolds and a synergistic healing effect will be observed.

Tarhuni, Fares, Zahid Hossain, Arkansas State University

Use of Rice Husk Ash (RHA) and Hydrated Lime as Stabilizing Agents for Poor Subgrade Soils and Embankments

Construction costs can be increased dramatically when soft and/or expansive clay is found on site. Replacing undesirable soil with more stable soil is widely practiced among many counties. The present study is focused on stabilizing poor quality soils in Arkansas. This study primarily focuses on two stabilizing agents, namely rice husk ash (RHA) and hydrated lime. The objective of this study is to

determine the optimum percentages of RHA, hydrated lime, or a combination of these two that stabilizes the subgrade and embankment. The laboratory tests include three stages. Firstly, the soil sample is tested by using 0% additive materials and was considered as a control sample. Secondly, the soil is mixed with RHA (3%, 6%, 9% by weight) or hydrated lime (1%, 3%, 5% by weight). Lastly, the soil is mixed with a combination RHA and Lim. The modified soils are then subjected to the Atterberg limit test, Modified proctor test, California Bearing Ratio (CBR), and Unconfined compression strength test. The preliminary result showed that one of the soil samples is classified as clayey soil (A-7-6) by AASHTO classification system with a specific gravity of 2.67. The Liquid Limit and Plasticity indices were measured for the control specimen, and were 46.41 and 28.78 respectively. Furthermore, the modified proctor test is carried out and the results show that the maximum dry density and optimum moisture content were 117.43 lb/ft3 and 11% respectively. The rest of the testing on the sample with additives is underway as the research is currently active. The findings of this research have the potential to significantly benefit the construction industry in the state of Arkansas by reducing costs associated with traditional methods of soil stabilization.

Tarlton, Andrew, McKenzie Smith, and Sharon Hamilton, Ouachita Baptist University

Alternative to Modern Wound Dressings: Developing a Biodegradable Collagen Analog

Recent studies in modern wound dressings have focused on producing materials that promote wound healing by mimicking biofunctions in the wound healing process. Breakthroughs in this field have been achieved by electrospinning nanofibers from collagen to best mimic the morphology and components of the extracellular matrix. However, these dressings are expensive, not always degradable, and do not always contain antibacterial properties. Polycaprolactone (PCL) is a biodegradable polyester that could be used with chitosan, an antibacterial biomacromolecule, to develop electrospun nanofibers that can be incorporated into wound dressings. The ideal wound dressing would be a hemostatic material that is biodegradable, inexpensive, inherently antibacterial, and promotes rapid wound healing. Therefore, the overall goal of this project is to develop a material that incorporates these properties and can be electrospun into a nanofiber scaffold. Towards this effort, this project has focused on the synthesis of a novel biomimetic polycaprolactone (bPCL) prepared by modifying PCL via amide coupling reactions to attach molecules that mimic the amino acids naturally occurring in collagen. It is anticipated that these moieties will promote healing and hemostatic properties essential for wound dressings. Thus far, electrospinning protocols for PCL/chitosan fiber mats have been established through electrospinning trials and it is anticipated that these protocols can be applied to bPCL/chitosan solutions to prepare degradable, biomimetic, antibacterial nanofiber scaffolds. These novel mats will be analyzed via degradation and in vitro assays. It is expected that these studies will help assess the utility of these mats in biomedical applications.

Tate, Brandie, J. Richard Abbott, Kurt Neubig, University of Arkansas at Monticello

Determining species delimitation of Sisyrinchium (Iridaceae) in Arkansas using genomic and phylogenetic approaches

The global genus Sisyrinchium, Iridaceae, is found throughout North America, where the most common and widespread species is S. angustifolium. Previous DNA based studies have supported this species as non-monophyletic, with many samples more closely related to other species, but with no apparent correlation to morphology or geography. In this study we are addressing this issue with a more limited scale, focusing on the nine species reported for Arkansas, to provide a phylogenic framework for understanding the patterns of morphological variation.

Taylor, Lauren, Lauren VanDee, Kendal Wells, Andrew Williams, University of Arkansas Monticello

Extraction and Analysis of Medicinal Biomolecules in Witch Hazel

Dating back millennia, plants have been used for their medicinal properties. Witch hazel (Hamamelis virginiana) is commonly known to calm skin irritants and is commercially used in dermatological topical agents. As a native plant it is readily available, and due to its biological activity, it presents itself as an interesting study. Extraction and analysis of the active compounds found in witch hazel as well as the determination of the quantities of each will provide the data for understanding its biological activity. Once this data has been analyzed, more studies will be done on the medicinal functions they have and the practicality of using them. Since these biologically active molecules can be extracted in aqueous solution and Witch Hazel is a readily available plant, it provides a more economical and environmentally friendly skin care product, providing and safe and green method to improve health.

Taylor, Lauren; Glover, Alaina; Gurnsey, Alexia; Totty, Jacey; Ashcraft, Payton; Martinez, Blake; Rodriguez, Jason; Jacks, Randa; Williams, Andrew, University of Arkansas at Monticello

Determination of Fatty Acid Concentrations in Algae

Algae are of scientific and commercial interest due to their ease of culture and high fatty acid content. It is reasonable to assume that different strains of algae contain different types and concentrations of fatty acids. Of interest is the fatty acid content contained within various algal strains in the class Eustigmatophyceae. The extracted fatty acids may be of potential use for phylogenetic classification of new algal species, in addition to human consumption and producing next-generation biofuels. Algal strains were collected and isolated from Lake Chicot in Arkansas, Tower Pond and Lake Itasca at Itasca State Park in Minnesota, and Thayer Lake in the upper peninsula of Michigan. The strains collected were subjected to a 5-step process for lipid preparation: lypholization, lipid extraction, filtration, esterification, and methyl ester extraction. The fatty acid extracts were analyzed using GC-MS. After qualitative determination of fatty acids by mass spectrometry, relative quantities of the fatty acids were determined by peak integration, and tricosanoic acid (C23:0) was used as a standard to determine absolute quantities. Preliminary results show differences between algal strains via relative fatty acid concentration.

Thomas, Theresa and Caitlin Scott, Hendrix College

Computational Drug Design to Target the Cannabinoid Type 2 Receptor to Develop Safe and Effective Pain Medication

The cannabinoid system, a biological network involved in regulating physiological and cognitive processes, consists of the Cannabinoid Type 1 Receptor (CB1) located in the central nervous system and the Cannabinoid Type 2 Receptor (CB2) located within the immune system. Activation of both these receptors mediates pain, however, CB1 is associated with physiological side effects, like addiction from opioids. The CB2 receptor plays a vital role in the regulation of immune responses, inflammation, pain, and other metabolic processes, and agonist targeting this receptor have been proposed as treatments for these conditions, however, there are currently no drugs on the market that targets the CB2 receptor. This research aims to develop a drug that relieves pain without the adverse side effects of opioids, more specifically, a drug that selectively targets the CB2 receptor. This research was conducted computationally through Schrodinger to stabilize the CB2 ligands. We first used LigPrep to prepare the crystallized structure of the ligand to edit for further simulations. To calculate the partial charges using quantum mechanics of each ligand, we performed Jaguar and then Superimposition to compare the crystal structure and experimental structure of each ligand. Finally, to obtain an empirical score that approximates the ligand binding free energy, we used GlideScore to dock the ligands into the CB2

receptor. My simulations indicate that the Ki values and binding scores from docking and the experimental ligands correlated with the crystallized structures. These findings indicate further development in a more selective drug design, bring new hope for the therapeutic potential of CB2 and a greater understanding of the endocannabinoid system.

Thomas, Kaleigh, Grace Tidwell, Kelsey Bester, and Christin Pruett, Ouachita Baptist University

Tree canopy cover influences habitat use of breeding birds at Jack Mountain Wildlife Management Area

Across the United States, bird populations have declined due to habitat loss. To better understand habitat use by species, researchers observed the bird populations at Jack Mountain Wildlife Management Area in Southwest Arkansas. Students at Ouachita Baptist University surveyed 94 point count locations to determine species diversity and species abundance. In addition, at each point, students recorded the percentage of tree canopy cover, ground cover, midstory cover, and shrub cover. These variables were used as explanatory variables in multiple regression analysis to determine which variables were influential in explaining variation in species diversity and species abundance. Locations with higher species diversity had higher midstory cover ($P=0.003$) and lower canopy cover ($P=0.020$). Higher species abundance was found at locations with lower canopy cover ($P<0.001$). Interactions between explanatory variables explained a significant proportion of the variation in species diversity and abundance among points. These findings suggest that the amount of canopy cover plays a substantial role in habitat use by breeding birds at Jack Mountain Wildlife Management Area.

Tidwell, Grace E., Kelsey M. Bester, and Christin L. Pruett, Ouachita Baptist University

Bird diversity & abundance in relation to habitat complexity at Jack Mountain Wildlife Management Area

Since 1973, North America has lost 2.9 billion birds due to habitat loss and fragmentation. To assess the effects of habitat complexity on bird diversity, 88 locations were surveyed at Jack Mountain Wildlife Management Area (WMA) using ten-minute point counts. All birds seen and heard at each point were documented and habitat complexity was assessed by examining the percentage of ground cover, shrub layer, mid-story tree layer, and canopy layer at each point. A habitat complexity index was generated from these plant surveys. Previous research at Jack Mountain has shown that habitats dominated by pine trees had the highest bird species diversity and abundance. Habitat complexity has been associated with an increase in bird species diversity and thus, we hypothesized that pine habitats would have greater habitat complexity and that habitat complexity would be positively correlated with bird diversity and abundance. Statistical tests were performed in R to assess these hypotheses. In comparisons between species diversity ($r=0.116$; $P=0.28$) or abundance ($r=0.115$; $P=0.28$) with habitat complexity index no significant correlation was observed. We then compared each of the four aspects of the habitat complexity with species diversity and abundance and found a significant negative correlation between species diversity ($r=-0.383$, $P<0.001$) and abundance ($r=-0.372$, $P< 0.001$) versus canopy coverage. Also, significant positive correlations were found between species diversity ($r=0.378$, $P<0.001$) and species abundance ($r=0.405$, $P<0.001$) versus ground cover and species abundance was also positively correlated with amount of shrub cover ($r=-0.097$, $P=0.366$). Each point location was also assigned to a habitat class based on the percentage of pine and deciduous tree cover. As found in previous summers by students at OBU, a comparison among habitat classes and species diversity showed higher numbers of species in pine habitats ($F=3.755$, $P=0.0274$) however, the habitat complexity index did not differ among habitat classes ($F=2.05$, $P=0.135$). To further evaluate, the drivers of larger numbers of birds in pine habitats, aspects of the habitat index were then compared to habitat classes. We found smaller amounts of canopy coverage ($F=0.4538$, $P=0.0134$) and larger amounts of ground cover ($F=4.538$; $P=0.0134$) and shrub cover ($F=6.879$, $P=0.0017$) in pine habitats than in deciduous or mixed habitats. These findings suggest that there are more bird species and individuals among pine habitats at Jack

Mountain because of less canopy coverage. A reduction in canopy coverage in pine habitats could lead to an increase in ground and shrub coverage, which are both correlated with an increase in the diversity and abundance of birds. In conclusion, we reject our initial hypothesis about bird diversity and pine habitats being associated with increasing habitat complexity. Our findings suggest that the population dynamics of birds at Jack Mountain are associated with a diverse set of habitat variables that cannot be simplified into a single habitat complexity index.

Trauth, Stan, Arkansas State University

Distal Urogenital Anatomy in the Male Wood Frog, Lithobates sylvaticus (Anura: Ranidae)

I investigated the microanatomy of the distal urogenital system of the male Wood Frog (Lithobates sylvaticus) from a small sample (n = 6) collected in northern Arkansas in February 2020. Specifically, my primary objectives were as follows: 1) to focus on the histology of the paired Wolffian (urogenital) ducts caudally from the kidneys to their merging with the urodeum of the cloaca, 2) to reveal the structure of the paired seminal vesicles (sperm storage structures), and 3) to compare epithelial morphologies between the distal urogenital tract and its neighboring distal alimentary tract. This information will promote a clearer understanding of this anatomical region for a North American ranid species and allow for comparisons to be made with other ranid frogs worldwide.

Trauth, Stan, Arkansas State University

Seasonal Gonadal Histology from a Small Sample of the Frecklebelly Madtom, Noturus munitus (Siluriformes: Ictaluridae), from Mississippi

I examined the seasonal changes in gonadal histology of the Frecklebelly Madtom, Noturus munitus, using light microscopy from 20 male and 18 female specimens collected periodically (1968–1981) from the Tombigbee River in Mississippi. This species possesses the lobate, unrestricted spermatogonial testis type (typical of ictalurid fishes) with numerous finger-like projections. Spermatogonial divisions occurred from October to May, and spermiogenesis occurred primarily in June and July; sperm were abundant in June and July. Recrudescence of the germinal epithelium of the testes began in August. Yolked ovarian follicles occurred from March through July. The first post-ovulatory follicles (corpora lutea) were observed in July. All corpora lutea were similar in size indicating that all eggs were spawned at one time. Atretic follicles were observed in spent ovaries in July and August. Ovaries remained regressed until March, and spawning appeared to be restricted to the summer months.

Trauth, Stan, Arkansas State University

Seasonal Testicular Histology and Acystic Lobular Spermatogenesis in the Western Lesser Siren, Siren intermedia nettingi (Caudata: Sirenidae)

I investigated the seasonal testicular histology and acystic lobular spermatogenesis in the Western Lesser Siren, Siren intermedia nettingi, from periodic sampling of this salamander over a span of 21 yr (1994-2015) in northeastern Arkansas. My results include the following general findings: 1) the largest testicular lobules occurred primarily in January-February during spermiogenesis and spermatozoa maturation; 2) lobular regression and spermatogenic cell recrudescence were underway by late March; 3) proliferation of secondary spermatogonia in lobules was prominent in May; 4) transformation of secondary spermatogonia into primary spermatocytes occurred by mid-July, and these cells became larger in diameter through increased nuclear size and by being heavy laden with lipid droplets, 5) lobular diameters gradually increased through the expansion of lobular luminal open space in July-August, and 6) lobular size continued to increase in October-December with lumina containing numerous secondary spermatocytes. Specifically, my primary objective in this part of a long-term study was to present histologically, for the first time, the annual testicular cycle in this species along with an explanation of the unique cellular complexities of acystic lobular spermatogenesis, a process which this sirenid species

shares with another genus (Pseudobranchus) within the salamander family Sirenidae. No other vertebrates of any kind possess this type of spermatogenesis.

Tumlison, Renn, Henderson State University

Distribution and Breeding of the Black-Bellied Whistling-Duck (Dendrocygna autumnalis) in Arkansas, with a brief chronology of distribution and breeding in southeastern United States.

The Black-Bellied Whistling-Duck (Dendrocygna autumnalis) was a rare bird first reported from Arkansas in 1982, when it was seen in Hempstead Co. in southwestern Arkansas. Observations surged in parts of the state about 2005, then again about 2016, and the bird is now fairly common seasonally in many parts of the state. By use of online sources for citizen science, I elucidate the history of occurrence and present analysis of seasonal distribution of this bird in Arkansas. Individuals occur in Arkansas throughout the year, but observations are most common and widely distributed from March-September, after which most individuals likely migrate southward. Most observations are of a few birds, but a maximum of 1,000 has been estimated at one location and time. The birds have been observed in 52 counties, but the longest and most consistent observations have been in counties near the Red River in southwestern Arkansas, and counties bordering the Mississippi and Arkansas Rivers. The first report of nesting was in Lafayette Co. of southwestern Arkansas, in 1996. Since then, nesting has been reported in 14 counties.

Vargas, Mariel, David Donley, Harding University

NMES-1 Modulates Microglial Activation in Response to Iron and Amyloid-Beta

Microglia are the primary immune cells of the central nervous system. They activate in response to external cues, but the activation is heterogeneous depending on the nature of the stimulus. Alzheimer disease (AD) is a neurodegenerative disease characterized by extracellular aggregation of amyloid-beta peptides (Aβ) coincident with accumulation of brain iron. These factors contribute to the pathology of AD but the response of microglia is still not well understood. Previous studies show that inflammatory responses resulting from Aβ and iron contribute to neurodegenerative processes in AD. Using proteomic analysis, we found that microglia stimulated with both Aβ and iron had differential expression of normal mucosa of esophagus-specific 1 (NMES1), an inflammation-associated gene. We found that NMES1 is significantly upregulated by Aβ simulation of microglia but significantly downregulated by iron exposure. The NMES1 transcript produces a protein and a microRNA (miR-147) but the role of each is not well understood. We found that blocking NMES1 using si-RNA in the presence and absence of Aβ increased microglia CD68, a measure of inflammatory activation. These data suggest that NMES1 acts as a molecular brake on activation. The goal of the present study is to understand the role of the miR-147 from NMES1 in the presence of iron and Aβ. We hypothesize that the miRNA influences microglial activation resulting from the responses to pathological stimuli. This study is contributing to our understanding of how NMES1 and miR-147 influence microglial activation. Dysregulation of the NMES1 transcript may represent one molecular

Vincent, Re'Nyah, University of Arkansas at Pine Bluff

Evaluating How Living In Highly Polluted Areas Result In Ineffective Asthma Control

The purpose of this study is to explore how living in highly polluted areas result in ineffective asthma control. In the United States, African Americans are almost three times more likely to die from an asthma episode than Caucasians. According to the U.S. Department of Health and Human Services Office of Minority Health, Non-Hispanic African Americans were 40 percent more likely to have asthma than non-Hispanic whites in 2018. In 2019, non-Hispanic blacks were almost three times more likely to die from asthma-related causes than the non-Hispanic white population. African Americans are five times more likely than white Americans to visit the emergency department due to asthma (In the United States of America). This study seeks to answer the research question, “How does the

environment affect asthma control?" The goal is to analyze the causes of asthma and determine whether air pollution plays a role. The study will be conducted through an educational webinar to educate others on how the environment affects people with asthma. The audience will be African American students on the campus of the University of Arkansas at Pine Bluff. The primary goal of the research is to improve awareness and understand the higher risk for asthma in areas with low socioeconomic status. Help others realize that geographical locations determine how likely they are to suffer from asthma.

Vue, Sarah, Henderson State University

Development of Difunctional Imidazole into Ionic Liquid Monomer

The development of new and efficient strategies for polymerization is crucial for use in sealed atmospheres, such as spacecraft, space-based habitation pods, or even submarines. Traditional polymer construction materials, i.e. plastics, often contain non-reacted monomer molecules that may cause some material off-gassing adding to the chemical contaminants in the small, sealed space. Recently, ionic liquids specifically designed to be monomers can be polymerized to make new ionic liquid polymers that are expected to exhibit thermal and chemical stability and have virtually no vapor pressure. In this research, the route to a suitable ionic liquid monomer will involve the preparation of and subsequent polymerization of various isocyanate esters. These isocyanate groups have been demonstrated to undergo ring cyclization reactions in the presence of silver acetate to form substituted imidazole rings. These substituted isocyanates can be linked to form elaborate polyester backbones that also contain the imidazole ring for subsequent conversion to ionic liquids. The research is currently ongoing and this route is expected to be a powerful tool in material science.

White, Kennedy J., Suzanne M. Neidhart, Robert M. Breece, Henderson State University

Development of cadmium detecting PADs for the use of human milk

Breast milk is an infant's first line of defense from infections and viruses. Still, breast milk cannot correctly contribute to the infant's microbiome if contaminated with heavy metals such as cadmium. Our group is developing a paper analytical device (PAD) for the detection of cadmium using a G-quadruplex. Cadmium forms a complex with DNA strands to form a G-quadruplex which is detectable via fluorescents. This work is the proof of principle that we can form these G-quadruplexes in the presence of cadmium in a biological sample.

Whittington, Kayla R., Joseph E. Bradshaw, Ouachita Baptist University

Developing Novel Water-Soluble Porphyrins for Potential Use as Photosensitizers in Photodynamic Therapy

This research focused on synthesizing novel water-soluble porphyrin compounds for use as photosensitive agents in PDT for the treatment of lung cancer. The outside of the porphyrin core can be modified with various substituents to assist with water-solubility and cytotoxicity. In this research, the core of 5, 10, 15, 20-tetrakis(4-carboxyphenyl)porphyrin, H2TPPC, was modified with the attachment of L-threoninol to create the novel H2TPP-LT. The core was also modified with tris(hydroxymethyl)aminomethane, TRIS, to synthesize H2TPP-TRIS. Additionally, ZnTPPC was modified using TRIS to form the novel ZnTPP-TRIS. Each compound was filtered prior to purification by column chromatography using both Sephadex LH-20 and Sephadex G-50. Additionally, nuclear magnetic resonance (NMR), infrared (IR), and UV-visible spectroscopies (UV-vis) were used to characterize each compound. Purity of the final products was determined using high performance liquid chromatography (HPLC). Finally, compounds were tested using MTT assays to determine cell viability in both light and dark conditions on an A549 non-small cell lung cancer cell line.

Wilcox, Alicen, David Donley, Harding University

Microglia polarize in response to transactive response DNA-binding protein-43 (TDP-43) and recover after removal of the stimulus

The proper response to protein signals is necessary for a healthy central nervous system (CNS), and protein dysregulation is a feature of neurodegenerative diseases. Transactive response DNA-binding protein-43 (TDP-43) is an intranuclear protein, but mislocalization is associated with amyotrophic lateral sclerosis (ALS). TDP-43 is released into the extracellular space where it is sensed by microglia, the CNS-resident immune cells. Our data and the literature suggest that microglia respond to TDP-43 dysregulation by increasing CNS inflammation. The goal of this study was to determine the impact of TDP-43 on microglial function and the extent to which microglia recovery. To study the inflammatory response, microglia were stimulated with TDP-43 in a 2x2 factorial design with other inflammatory stimuli. Using iNOS and arginase colorimetric assays, we found that TDP-43 caused microglia to lose the ability to appropriately respond to inflammation. To study recovery, cultured microglia were stimulated with TDP-43 or a vehicle; then the media was changed to remove the stimuli and allow a recovery period. Markers of activation were measured using flow cytometry and metabolic assays. After recovery, microglia had a slight decrease in phagocytic capability as compared to TDP-43 stimulation without recovery. Microglia also demonstrated a metabolic shift toward glycolysis, consistent with a proinflammatory phenotype but returned to baseline levels of metabolic activity after recovery. These data demonstrate that dysregulated TDP-43 shifts the balance of signaling pathways toward an inflammatory phenotype, but microglia begin to recover after removal of the inflammatory stimuli.

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