103rd Annual Meeting

Hosted by

HENDRIX
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1876

Chair's Remarks

Welcome to the 103rd annual meeting of the Arkansas Academy of Science on the campus of Hendrix College! We are delighted you are here, and we are privileged to be part of this longstanding tradition of gathering some of the most esteemed members of Arkansas' scientific community to learn about one another's work. Joining you are more than 250 scientists from all corners of the state who represent four government agencies and 21 different colleges and universities. The collection of work presented this weekend includes over 150 technical papers, from aeronautics to zoology, and we thank those of you who are sharing your research with us.

This year marks the fifth time Hendrix has hosted the AAS annual meeting but the first time since 2005. A meeting like this does not come together without the enthusiasm of AAS members like yourself and the volunteers who are at work behind the scenes to make sure this event runs smoothly. These volunteers include both our fellow AAS members who have agreed to serve as session chairs and presentation judges as well as Hendrix College students who have donated time to help move tables, stock snacks, and keep equipment running. If you see one of these volunteers, I hope you will join me in thanking them.

I also would like to thank my fellow members of the local organizing committee for their tireless efforts over the last year. The names of these great colleagues can be found below, but it is worth noting here their great service to the AAS.

From all of us on the local organizing committee, we hope you have an enjoyable and productive meeting.

Todd Tinsley
Chair, 103rd Arkansas Academy of Science Meeting
Hendrix College

Organizing Committee

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Schedule

Friday, March 29

10:00 a.m.	Executive Committee Meeting	SLTC – Campbell Dining North
11:00 a.m. – 5:00 p.m.	Registration and Payments	SLTC 106
12:00 – 12:30 p.m.	Judges and Session Chairs	SLTC 105
1:00 – 2:30 p.m.	Oral Sessions 1	DW Reynolds Lower Level
2:30 – 3:00 p.m.	Break – Refreshments	DW Reynolds Lobby
3:00 – 4:30 p.m.	Oral Sessions 2	DW Reynolds Lower Level
6:00 – 6:30 p.m.	Reception with Hors d'oeuvres	SLTC – Sun Porch
6:30 – 8:30 p.m.	Banquet and Keynote Address	SLTC – Worsham Ballroom

Saturday, March 30

8:00 – 9:00 a.m.	Continental Breakfast	SLTC - Burrow
8:00 – 10:00 a.m.	Registration and Payment	SLTC 106
8:30 – 10:00 a.m.	Oral Sessions 3	DW Reynolds Lower Level
8:30 – 10:30 a.m.	Poster Presentations	SLTC – Worsham Ballroom
10:30 – 11:30 a.m.	Meeting of Judges	SLTC 105
12:00 – 1:00 p.m.	Awarding of Prizes (AAS Business Meeting)	Mills Center – Room A

SLTC – Student Life & Technology Center

DW Reynolds – Donald W. Reynolds Center for Life Sciences

Keynote Speaker

We welcome Professor Luis M. Bettencourt, Pritzker Director of the Mansueto Institute for Urban Innovation, Professor of Ecology and Evolution, and Associate Faculty and Special Friend of Sociology at the University of Chicago. He is also External Professor of Complex Systems at the Santa Fe Institute.

Prof. Bettencourt received a doctorate in theoretical physics from Imperial College (University of London) and held postdoctoral positions at Los Alamos National Laboratory, the Massachusetts Institute of Technology, and the University of Heidelberg. His recent accolades include an invitation to the White House Frontiers Conference (2016), service on the President's Council of Advisors on Science and Technology working group on "Technology and the Future of Cities" (2015) and the World Cities Summit Young Leaders network (2015), and induction as Kavli Fellow of the National Academy of Sciences at the Frontiers of Science Japanese-American Symposium (2014).

Prof. Bettencourt will deliver our Keynote Address, "The Emerging Science of Complex Systems: From Physics to Cities and Back Again."

Abstract: Many of the most important and difficult challenges to science and policy today ask that we conceive of phenomena in nature and in human societies as complex systems.

This approach emphasizes processes and interconnections in the way phenomena in living systems take place, using quantitative methods from physics, population biology and economics to make sense of new big data.

I will discuss my own path as a physicist, faculty of ecology and evolution and scientific director of an institute for urban research to illustrate how connections between these disciplines can be a particularly fertile ground for education and research, and how a synthesis of ideas is emerging around processes in nature that create and sustain complexity and adaptation. I will make a case for a set of wonderful new opportunities ahead for those pursuing a broad and rigorous scientific culture that is able to transcend traditional silos and engage with big questions in research and in practice.

Oral Presentation Schedule

* Undergraduate student ** Graduate student

Friday Session 1

Geosciences - DW Reynolds 8

1:00 p.m.	**Michael Cruz***	Evaluation of a Micro Spectrometer for Satellite Missions
1:15 p.m.	**Courtney Hatch**	Water adsorption on atmospheric clay minerals: Experimental and theoretical studies of indirect effects on climate
1:30 p.m.	**Khalil Buckmire***	Geothermal Energy Use and Potential for the Caribbean Nation of Grenada
1:45 p.m.	**Russell Jeffery***	Pointing Isn't Rude: A Proof-of-Concept HAB Stabilizer

Ecology and Organismal Biology I - DW Reynolds 10

1:00 p.m.	**Grace Wills***	The Reproductive Season of the Highland Stoneroller, Campostoma spadiceum, Evidenced by Museum Specimens
1:15 p.m.	**Brianna Trejo****	Energy allocation patterns in a girdling and a non-girdling caterpillar
1:30 p.m.	**Sofie Varriano***	The synergistic relationship of bison grazing and arthropod herbivory in structuring a tallgrass prairie plant community
1:45 p.m.	**Caralee Shepard***	New state records for the Texas frosted elfin (Callophrys irus hadros) and its host plants (Baptisia spp.)
2:00 p.m.	**Allison Monroe***	Biodiversity of Hymenoptera Across Sky Islands of Arkansas
2:15 p.m.	**Jacob Idec***	Explaining the Diversity and Evolution of Color in Ants Using the AntWeb Image Database

Chemistry and Physics - DW Reynolds 11

1:00 p.m.	**Ashley Cotnam***	Laser Trapping of Polysterene Beads Using Optical Tweezers
1:15 p.m.	**Drake Jackson***	A Compact Raman Spectrometer Using Commercial Off the Shelf (COTS) Components
1:30 p.m.	**Eliza Hanson***	Implicit and Explicit Solvation Studies of Small Molecules and Ions in Water
1:45 p.m.	**Blake Ludwig***	Bond Valence / Bond Length Correlations for Phosphorus-Oxygen and Uranium-Oxygen Bonds
2:00 p.m.	**Natalie Lowry***	Investigation Anion Interactions with Tripodal Urea-Based Anion Transporters
2:15 p.m.	**Rajib Choudhury**	Exploring the potential of phenol derivatives: Charge transfer fluorophores and detection of protein in solution

Mathematics - DW Reynolds 13

1:00 p.m.	**Taylor Dague****	The Effects of Selection History on Perceptual and Semantic Interactions in Visual Search
1:15 p.m.	**Logan Sublett****	Initial Conditions for Numerical Simulations of Richtmyer-Meshkov Instability
1:30 p.m.	**Alaina Edwards***	Performance Optimization of the CFD code for flow simulations

Friday Session 2

Biological and Medicinal Chemistry - DW Reynolds 8

3:00 p.m.	**Frank Hahn**	Comparative Lipidomics of Phospholipids in Ground Beef Extracts by GC-MS and MALDI-TOF MS
3:15 p.m.	**Newton Hilliard**	Proteomics of carbon fixation in Halothiobacillus neapolitanus
3:30 p.m.	**T Yamashita**	Scorpion toxin proteomics: Sodium toxin gene identification, isolation, and protein overexpression
3:45 p.m.	**Courtney Holloway***	Role of the DJ-1 Protein in Mitochondrial Dysfunction and Parkinson's Disease
4:00 p.m.	**John Sisco***	Gene Expression Study of Sodium β Toxins on *Centruroides vittatus*
4:15 p.m.	**Britny Kirkpatrick***	Melanin Concentrating Hormone Receptor 1 (MCH1R) Antagonists for Treating Addiction
4:30 p.m.	**Henry North**	The Essentiality of the Vinyl Proton in Anticonvulsant Enaminones

Ecology and Organismal Biology II - DW Reynolds 10

3:00 p.m.	**Kevin Nordengren**	Observations of an Alligator (Alligator mississippiensis) nest and Hatchlings in Clark, County, with anecdotal observations of other Alligator Nests in Arkansas

Ecology and Organismal Biology II cont. - DW Reynolds 10

3:15 p.m.	**Stan Trauth**	Bilateral Diaphyseal Chondrodysplasia and Polymorphic Osteodysplasia of the Tibiofibulas in a Southern Leopard Frog, Lithobates sphenocephalus (Amphibia: Anura: Ranidae)
3:30 p.m.	**Ben Cash**	Response to rapid habitat perturbation in the slider turtle (Trachemys scripta): Behavioral and hormonal effects
3:45 p.m.	**Stan Trauth**	Age Estimation using Phalangeal Skeletochronology in Northern Crawfish Frogs, Lithobates areolatus circulosus (Amphibia: Anura: Ranidae), from Arkansas
4:00 p.m.	**Karen Fawley**	Phylogeny and Characterization of Paraeustigmatos columelliferum, an Arkansas alga that represents a new linage of the Eustigmatales (Eustigmatophyceae)
4:15 p.m.	**Anthony Holt**	Blackroll Creek Runs North: A family farm history and its changes from the 1800s to the present

Engineering - DW Reynolds 11

3:00 p.m.	**Sumit Verma****	Flow dependency upon the convection region height of a CFD Tornado simulator
3:15 p.m.	**Sumon Roy****	Examining Molecular Level of Properties of Asphalt Binders to Predict Their Moisture-Induced Damage
3:30 p.m.	**Kazi Islam****	Evaluation of Rice Husk Ash (RHA) as an Asphalt Modifier
3:45 p.m.	**Mohammad Nazmul Hassan****	Analysis of Asphalt Binders From Chemical Prospective
4:00 p.m.	**MM Tariq Morshed****	Exploration of Alternative(s) of the Empirical and Expensive Tests to Characterize Bitumen
4:15 p.m.	**MdAriful Hasan****	Corrosion Risks of Metal Culvert Pipes in Northeast Arkansas

Ecology and Organismal Biology III – DW Reynolds 13

3:00 p.m.	**Mosammat Briti Rabbani****	Deviation of antioxidant capability of colored sweetpotatoes and its uppers in relation to polyphenolic contents
3:15 p.m.	**Jamie Johnson***	Wild game consumption and greenhouse gas emission savings in the U.S.
3:30 p.m.	**Sarah Martin****	Determination of bat species' use of artificial bark enhanced habitat in northern Arkansas
3:45 p.m.	**Caleb O'Neal***	Spatial Ecology of Mud Snakes (Farancia abacura) in a Small Isolated Pond Within a Bottomland Hardwood Forest
4:00 p.m.	**Andrew Feltmann****	Effect of selection and genetic drift on phenotypic diversification in the eastern collared lizard.
4:15 p.m.	**Mason Rostollan****	Integration of Mixed Methods into Community-Based Participatory Research (CBPR): A Methodological Approach and Health-Centered Case Study
4:30 p.m.	**Margaret Young***	Estimating cultural ecosystem services provided by the Buffalo National River using a contingent valuation method

Saturday Session 3

Kim Smith Memorial Session - DW Reynolds 8

8:30 a.m.	**Maureen McClung**	Introduction to the session: Dr. Kimberly G. Smith's Legacy of Science and Conservation
8:45 a.m.	**Mitchell Pruitt****	Winter occurrence and habitat use of Northern Saw-whet Owls (Aegolius acadicus) in northwestern Arkansas
9:00 a.m.	**Ragupathy Kannan**	History and current status of the Inca Dove (Columbina inca) in Arkansas

Kim Smith Memorial Session cont. - DW Reynolds 8

9:15 a.m.	**Chris Kellner**	Thermal ecology of prairie lizards in the Arkansas River Valley
9:30 a.m.	**Christy Slay**	Drivers of global forest loss and what it means for Arkansas
9:45 a.m.	**Maureen McClung**	Recent studies on the behavioral responses of Arkansas wildlife to anthropogenic noise

Ecology and Organismal Biology IV - DW Reynolds 10

8:30 a.m.	**Blake Sasse**	Long-tailed weasel (Mustela frenata) status and distribution survey in Arkansas
8:45 a.m.	**Chris McAllister**	New Host and Distributional Records for Helminth Parasites (Trematoda, Cestoda, Nematoda) of Arkansas Reptiles (Testudines, Ophidia)
9:00 a.m.	**Chris McAllister**	Parasites (Apicomplexa, Trematoda, Nematoda, Phthiraptera) of Two Arkansas Raptors (Falconiformes, Strigiformes: Strigidae)
9:15 a.m.	**Renn Tumlison**	Occurrence of the Sinus Nematode Skrjabingylus sp. (Nematoda: Metastrongyloidea) Inferred from Nasal Lesions in Arkansas Mustelidae and Mephitidae
9:30 a.m.	**Renn Tumlison**	Vertebrate Natural History Notes from Arkansas, 2019
9:45 a.m.	**Jonathan Hardage**	New Angiosperm Records from Arkansas

Computer Science - DW Reynolds 11

8:30 a.m.	**Clayton Liddell***	Analyzing the adoption rate of Local Variable Type Inference in open source Java 10 projects
8:45 a.m.	**Donghoon Kim**	How can you become a software engineer in prestigious companies?
9:00 a.m.	**Zezhang Lin***	Automatic Customization of Web Pages to Enhance User Experience
9:15 a.m.	**Tanim Sardar** and Luay Wahsheh**	Cyber Security Awareness Training Program for University Students
9:30 a.m.	**Brett Baker***	Employing Ensemble Learning for the Categorization of Android Malware Types

Engineering - DW Reynolds 13

8:30 a.m.	**Rajesh Sharma**	Cadmium Sulfide-buffered PV Systems: Assessing the Environmental, Health, and Economic Impacts
8:45 a.m.	**Tamal Sarkar****	Electromagnetic tunability of charged particles in altered dielectric systems
9:00 a.m.	**Lionel Hewavitharana**	Experimental Investigation of Counter-Flow Heat Exchangers Exposed to Ambient Heat Leaks
9:15 a.m.	**Kaiman Zeng**	Design and Development of a Vision based Lane Keeping System
9:30 a.m.	**Michael Howell****	Moore's law and space exploration: new insights and next steps

Poster Presentation Schedule

SLTC - Worsham Ballroom

* Undergraduate student ** Graduate student

Biology – General Biology and Ecology

1	**Erin Guerra***	Like Moths to a Flame
2	**Matt Connior**	Notes on the Natural History of Selected Invertebrates
3	**David Bowles**	A dobsonfly (Megaloptera: Corydalidae, Corydalus cornutus) from Arkansas with aberrant mandibles

4	**JunHyeuk Shin***	The roles for specific chromatin environments in promoting dissociation of the FACT complex from 3' ends of genes following transcription.
5	**Brian Wagner**	History of Spring River Crayfish (Faxonius roberti) collections in the Strawberry River, Arkansas
6	**Edgar Sanchez***	De novo development of microsatellite markers for genetic characterization of house finches
7	**Drew Castleberry***	Effect of Sex on Osmoregulation of the Ohio Shrimp, Macrobrachium ohione
8	**Brianna Trejo****	A Tale of Two Sylamores: Understanding relationships among landuse, nutrients, and aquatic community assemblages across a subsidy-stress gradient
9	**Makayla Nguyen* and Katie Pike***	Effects of Recreational Activities on Mussels and the Asiatic Clam in the Lower Saline River
10	**Blake Sasse**	Plains Spotted Skunk Pelt Purchase Trends in the Ozarks and Ouachitas, 1943-1990
11	**John Hunt**	Photographic Record of a Greater Roadrunner (Geococcyx californianus) from Drew County, Arkansas.
12	**Tristian Wiles***	Behavioral response of Carolina Wrens (Thryothorus ludovicianus) to songs altered to escape masking effects of anthropogenic noise
13	**Shelby Sarna***	Songbirds alter their use of bird feeders in response to vocalization playback
14	**Hannah Adams* and Sarah Roddy***	Using Radio Frequency Identification to Test the Assumptions of Optimal Foraging Theory on Wintering Birds
15	**Colton Barrett***	Do phenotypic traits predict feeder use by wild birds?
16	**Kira Gibbs***	Comparison of sugar-based clearing techniques in avian embryos
17	**Chris McAllister**	Distribution, Habitat, and Life History Aspects of the Dwarf Crayfishes of the Genus Cambarellus (Decapoda: Cambaridae) in Arkansas
18	**Chris McAllister**	Dumortier's Liverwort, Dumortiera hirsuta (Sw.) Nees (Hepaticophyta: Marchantiales: Dumortieraceae) in Arkansas
19	**Chris McAllister**	Cotylogaster occidentalis (Aspidogastrea: Aspidogastridae) from Freshwater Drum, Aplodinotus grunniens (Perciformes: Sciaenidae), from Northeastern Oklahoma
20	**Chris McAllister**	Haemogregarina sp. (Apicomplexa: Eucoccidiorida: Adeleorina) from Eastern Spiny Softshell, Apalone spinfera spinifera (Testudines: Trionychidae), from Arkansas
21	**Chris McAllister**	More Distributional and Host Records for Two Acanthocephalan Parasites from Arkansas Fishes (Aphredoderidae, Catostomidae, Centrarchidae, Cyprinidae)
22	**Kameron Skinner***	Survey of Aedes albopictus oviposition in Southeast Arkansas
23	**Emily Neilson***	Energy Content of Seeds of Texas Doveween (Croton texensis) from the Diet of Mourning Doves (Zenaida macroura) from Southeastern New Mexico
24	**Kate Sanders***	Creating a New Molecular Phylogeny of Arceuthobium
25	**Sierra Hubbard***	Surveying variability in cyanide production of white clover (Trillium repens) across an urbanization gradient in Little Rock, AR and Memphis, TN
26	**Marvin Fawley**	Soil Algal Communities of Warren Prairie Natural Area
27	**Karen Fawley**	Soil Crust Algal Communities of Warren Prairie Natural Area
28	**Kara Burchfield* and Elizabeth Wess***	The antimicrobial activity of Callicarpa americana berry extracts

29	**Eleni Sallinger****	The bacterial microbiome of the social amoebae
30	**Ashley Stewart***	The effects of caffeine and chlorogenic acid on Daphnia magna
31	**Tel Johnson***	Effect of multi-course prenatal steroids on fiber-type profile and enzyme activity in the guinea pig rectus thoracis
32	**Dustin Booth* and Logan Pearson***	Biodiversity and Community Structure of Aquatic Insects in the Little Missouri River
33	**Ishrar Islam***	Supernumerary Sources of Human Diet and Bioenergy for the Twenty-first Century; Soybean (Glycine Max L.)
34	**Audrey Lawrence***	Chemical Analysis of Pond Development
35	**Mackenzie Hoogshagen* and Elizabeth Versluis***	Characterization of Smoke Particle Emissions from Rocket Stoves versus Three-Stone Fires
36	**Blake Mitchell***	Variation in Habitat Use and Body Condition of Etheostoma caeruleum and Etheostoma fragi in the Strawberry River, Arkansas

Biology - Medicine, Molecular and Cellular Biology

37	**Hannah Smith***	Analysis of de novo peptides for potential antimicrobial activity
38	**Jacie Cooper* and Kennedy Kuykendall***	Analyzing the Role of FszA-GFP in Mitochondrial Dynamics of Dictyostelium discoideum
39	**Grishma Patel***	Chronic ethanol administration to rodents induces mitochondrial biogenesis
40	**Jessica Harston***	Dissemination of Oxalate and Vitamin C Among Assorted Genotypes of Sweetpotato (Ipomoea batatas L.) Leaves
41	**Sarah Gilmour*, Jonathan Jenkins*, Moira Moore*, Cole Stanton*, and Keith Taylor***	Integrin Signaling is Required for Collagen-Mediated Tumorigenicity of Papillary Thyroid Cancer Cells
42	**Kevin Bombinski***	Using a yeast two-hybrid approach to investigate DNA repair in bdelloid rotifers
43	**Kaitlyn Kemp***	Characterization of the 1957-1958 influenza pandemic in Arkansas and Arizona
44	**Nathan Andress*, Michaela Edwards*, Amber Melcher*, and Brock Sullivan***	Chemokine Secretion Varies Significantly in Papillary and Follicular Thyroid Cancer Tumor Cells
45	**Vi Le***	Comparing the Effectiveness of Antibiotics and Essential Oils on Laboratory and Environmental Bacteria Strains
46	**Claudy Sarpong***	Effects of Simulated Microgravity and Radiation on SERCA Expression in Arteries
47	**Michael Ezeana***	Object discrimination abilities in blind individuals using echolocation
48	**Lauren Dwyer*, Brianna Kelly*, Hannah Moore* and Sesalie Satterwhite***	Papillary Thyroid Cancer Cells Display Differences in Drug Sensitivity that are Dependent on Extracellular Matrix Composition
49	**Landon Wolfe***	Analysis of De novo peptide 3337 from the venom of R. rabida

Chemistry

50	**Drake Jackson***	Analysis of BETX mixtures using Raman Spectrometry
51	**Sydnye Shuttleworth***	Analysis of Oxidative Stress of Membrane Lipids

52	**Jacob Belding***	Design and Optimization of a Low-Cost, Arduino-Controlled Fluorometer
53	**Kirstyn Baker***	Development of a modified Michaelis-Menten Langmuir kinetic model for supported lipid bilayer formation
54	**Jackson Bridges***	Investigating the role of a critical vesicle concentration in the formation of supported lipid bilayers
55	**Whitney Austin***	Iron Content in Dried Fruit Chips Versus Pureed Baby Food Using Two Different Methods
56	**Jada Fricks***	Determination of Caffeine Content in Popular Energy Drinks with High Performance Liquid Chromatography
57	**Tanner Parrott***	Analysis of Copper in Local Arkansas Wines
58	**Zach Hazeslip***	Lead concentrations in soil at the local shooting range
59	**Kallie Mendenhall***	Microenvironment-sensitive probes for selective recognition of serum albumin protein in solution
60	**Hayden Criswell*, Reece Mitchell*, and Shawqi Musallam***	Organocatalytic pericyclic reactions: catalyst reactivity and substrate scope
61	**Elizabeth Reed***	Photocatalysis as a Means of Disinfecting Water During Space Flight
62	**Rebecca Sain***	Photocatalytic activity of TiO2 in a closed circuit: eliminating organic contaminants in water using methyl orange as a model compound.
63	**Robbie Kiss***	Understanding the role of flow rate and lipid concentration in the kinetics of supported lipid bilayer formation
64	**Preston Eubanks***	Use of UV/Vis Spectroscopy to Measure ASA in Aspirin

Computer Science and Mathematics

65	**Thy Dao****	Skin cancer Spatial Survival models using R/SAS
66	**Xinming Li****	How Powerful Can Deep Learning Be Compared with Machine Learning? A Entity Resolution Case
67	**Mariofanna Milanova**	Computer Vision System for Identifying and Quantifying Waste
68	**Mariofanna Milanova**	Human Interaction with Multivariate Sentiment Distributions of Stocks Intraday
69	**John McGarigal***	Scalability Studies for Compressible Flow Simulations

Physics

70	**Kayce Conville***	A Real Time Automated Microclimate Ecosystem
71	**Dylan Mitchell***	Design and Implementation of 3D-Printable Optomechanical Components
72	**Nick Scoles***	Development of an Acoustic Field Scanner
73	**Yelaman Zhenis***	Investigating relationship between strain applied to Rat's Leg bone and bone's mechanical strength
74	**Alex Golden***	Preparation of polycrystalline Tin Selenide to Investigate Thermoelectric Properties
75	**Jordan Rhoades***	Protostellar Outflows in L1448
76	**Harrison Russell***	Quantitative Binding of Divalent Metal Ions To DNA Hairpin Loops

Engineering

77	**Isaac Raphael***	An Investigation of Thermoelectric Element Power Generation and Heat Pumping Ability

78	**Joel Howell*, Tristan Nivens* Jerry Ramsey* and Austen Wood***	Developing a Fluid Mechanics Experiment Using a 3D Printed Venturimeter
79	**Tristan Nivens***	Evaluation of the stress-strain state for the 3D printed airfoil using finite element method
80	**Kenneth Escudero***	Experimental Investigation of Stress Concentration in Plastic Materials Used for 3D Printing
81	**Kenneth Escudero* and Daniel McKague***	Developing Soft Actuators at SAU Engineering
82	**Elias Perez Reyes***	Effective Thermal Conductivity of Open Celled Copper Foam metals
83	**Becka Wilson* and Moriah York***	Experimentation and Modification of Various 3-D Printed Water Pump Designs
84	**Kailash Jajam and Sherif Selim***	Impact energy absorption behavior of lightweight interpenetrating phase composite foam
85	**Derrick Fuell***	Mixing of fluids in macro-channels
86	**Lucas Blake* and Matthew Gustafson***	Numerical Simulation of Oxy-Fuel Combustion
87	**Li Morrow***	Trout fishing tackle box
88	**Jacob Jackson***	Water recycling system for a hydraulic ram pump
89	**James Smith***	Wearable tackle/utility box

Geosciences

90	**Krishna Patel***	Biological and ecosystem level changes from the addition of reservoirs to headwater streams
91	**Karen Morris* and Rebecca Parham***	Cloud condensation nuclei (CCN) measurements: Design and calibration of a CCN analysis system
92	**Michael Davis Candy Roberts* and Hunter Vickers***	Locating legacy oil and gas wells in Arkansas: refining magnetic methods
93	**Varenya Nallur***	Restoration Potential of Abandoned Wells in the Fayetteville Shale
94	**Hailey Hayes***	Water adsorption on polyhydroxylate microspheres as a function of relative humidity using a quartz crystal microbalance
95	**Henry Dana***	Water adsorption on polyhydroxylate microspheres as a function of relative humidity using an FTIR spectrometer equipped with a flow cell

Oral Presentation Abstracts

Geoscience (Friday, Session 1)

Room: DW Reynolds 8

Evaluation of a Micro Spectrometer for Satellite Missions

Michael Cruz - Harding University, Undergraduate

(Co-Authors: E. W. Wilson, Jr. (Harding University); Y. X. Chan, PI (University of Arkansas Little Rock); Adam Po-Hao Huang (University of Arkansas Fayetteville))

A Hamamatsu C12666MA micro spectrometer was programmed to take spectra and store them on a flash memory card. The entire process was controlled by an Arduino UNO microcontroller. The C12666MA spectrometer occupies a volume of 20.1 mm x 12.5

mm x 13.4 mm and weighs 5 g making it attractive for use in the limited space available on a nanosatellite. The spectrometer consumes only 30 mW at 5 VDC. The optical sensor captures a spectrum on the 256 pixel linear array. The spectrometer used in this study has an operational wavelength range of 318nm to 808 nm with a resolution of approximately 15 nm. Spectra can be captured using variable integration times of 5 to 10,000 ms with an A/D converter with 16-bit resolution. The C12666MA can be connected to a microcontroller or computer using USB 2.0 protocol. To operate the micro spectrometer, only two TTL inputs are required: clock (CLK) and Start Pulse (ST); two outputs are generated: Video and End of Scan (EOS). The spectrometer wavelength accuracy was calibrated using gas discharge tubes and the wavelengths compared with the NIST spectral database. Spectra of the atmosphere using the Sun as the source were recorded and major spectral features identified. Water vapor measurements were extracted from the data. Methods will be described to program the C12666MA and extract atmospheric water vapor content.

Water adsorption on atmospheric clay minerals: Experimental and theoretical studies of indirect effects on climate

Courtney Hatch - Hendrix College

(Co-Authors: Paul R. Tumminello; Megan A. Cassingham; Annie L. Greenaway; Kenneth J. Harris; Matthew Christie; Rebecca Parham; and Karen Morris (Hendrix College))

The indirect aerosol effect on climate includes radiative effects from aerosol particles that take up water and form cloud droplets or alter the radiative properties and lifetimes of clouds. This effect is currently one of the largest uncertainties in understanding climate change. In the past, atmospheric climate models have neglected the potentially significant effect of mineral dust aerosol on the indirect climate effect. However, a number of recent studies have revealed the importance of adsorbed water on the cloud condensation nuclei (CCN) activity of insoluble dust particles. Additionally, the recently developed Frenkel, Halsey, Hill (FHH)-Adsorption Activation Theory has been used to explain CCN activity of insoluble particles and has been applied to atmospheric models to account for the contribution of insoluble particles to cloud droplet number concentration (CDNC). However, model results appear to be highly sensitive to the adsorption parameters used. In the current work, water adsorption on clay minerals was measured using an ATR-FTIR spectrometer equipped with a flow cell and adsorption parameters were determined by fitting results to the FHH adsorption isotherm model. The adsorption parameters were then used in FHH-Adsorption Activation Theory (FHH-AT) to predict CCN activation of mineral dust aerosol in the atmosphere. The predicted CCN activities for these clays are in excellent agreement with previously reported experimental CCN activity measurements.

Geothermal Energy Use and Potential for the Caribbean Nation of Grenada

Khalil Buckmire - University of Arkansas, Undergraduate student

(Co-Author: Christopher L. Liner)

Geothermal resources are of growing interest for residential heating and baseload commercial electrical generation. This renewable energy source utilizes natural waters trapped in geothermal reservoirs by moving fluids to the surface for conversion to steam which drives turbines generators sending electricity to the grid. Geothermal energy power plants are active in the western United States and several other countries with large economies.

The goal of this project is to analyse how geothermal renewable energy could be beneficial for small island developing states within the Caribbean for electricity production while minimizing greenhouse gas emissions that contribute to climate change. Geothermal evaluation is mature in developed nations, but there is little emphasis on this topic as it relates to the Caribbean Region. There is good evidence of geothermal potential within the Caribbean evidenced by the volcanic nature and tectonic setting of several islands, and existence of hydrothermal. We will focus on records and reports from countries that have undertaken geothermal exploration, particularly looking at heat flow above the super-heated depth of 6.5 km.

Results of this study will benefit public knowledge and decision makers as to whether geothermal power generation is viable as a large-scale renewable energy source for small island developing states.

Pointing Isn't Rude: A Proof-of-Concept HAB Stabilizer

Russell Jeffery - UCA, Undergraduate student

High-Altitude Balloons (HABs) are excellent platforms for research projects in physics, meteorology, engineering, and other related fields because of their low cost in comparison with other platforms that offer similar capabilities. One of the major drawbacks of HAB platforms, however, is their instability; lack of any fixed attachment point makes it practically impossible to use directional instruments in any controlled manner. While several HAB payload stabilization methods have already been developed, they all have limitations that leave something to be desired. For example, gyroscopes necessarily take up a large portion of the payload mass, leaving little room for instruments within the legal weight limits; servo motors promise low-cost, high-precision control, but it is difficult to design adequate control algorithms to compensate for the lack of stable attachment points; passive systems can be very cheap and relatively effective, but still lack precise attitude control capabilities. A method that does not appear to have been tried, however, is the use of cold-gas thrusters. This talk details the design and construction of a proof-of-concept, cold-gas thruster, stabilization device and thoughts about the potential value of further development.

Ecology and Organismal Biology I (Friday, Session 1)

Room: DW Reynolds 10

The Reproductive Season of the Highland Stoneroller, Campostoma spadiceum, Evidenced by Museum Specimens

Grace Wills - Henderson State University, Undergraduate student

(Co-Authors: Renn Tumlison (Department of Biological Sciences, Henderson State University, Arkadelphia, AR 71999); Henry Robison (9717 Wild Mountain Drive, Sherwood, AR 72120)

The Highland Stoneroller (Campostoma spadiceum) was described as a distinct species in 2010. Since then, the only study specific to this species is a survey of distribution, and nothing is known about reproduction. We examined 128 lots including 297 specimens of C. spadiceum housed in the Henderson State University collection of fishes to evaluate the timing of reproductive events. Individuals were dissected to reveal sex and reproductive status. Females as small as 49 mm total length were able to yolk eggs, and follicles were in development by October. Ripe eggs were present in specimens collected from January to May, but were most common in March and April. Females that had oviposited were found in early March, but most specimens that appeared to have spawned had done so likely in April. Nuptial tubercles appeared on males as early as January and February, but most adult males were fully tubercled from March through May.

Energy allocation patterns in a girdling and a non-girdling caterpillar

Brianna Trejo - University of Central Arkansas, Graduate student

(Co-Authors: David Dussourd (University of Central Arkansas); Matthew Gifford (University of Central Arkansas))

Some caterpillars use their mandibles to cut a ring around the petiole, rachis, or stem before feeding on the distal leaf blade. This girdling behavior has been observed in multiple notodontid species. In one study, final instar larvae of Oedemasia leptinoides spent up to 11% of their time girdling over a 12 hour observation period, whereas another notodontid, Lochmaeus manteo, did not girdle at all (Ganong et al., 2012). Girdling may improve leaf nutrition or reduce plant defensive responses. Using O. leptinoides and L. manteo as model notodontids, a combination of behavioral observations and respirometry data were used to produce overall energy allocation budgets for each species. Preliminary results indicate that the energetic cost of behaviors (feeding, walking, inactivity) was similar for the two caterpillar species, and that the cost of girdling in O. leptinoides was similar to the cost of feeding. L. manteo spent more time inactive. As a result, its overall energy expenditure was less, but it also grew more slowly than O. leptinoides, which spent more time feeding.

The synergistic relationship of bison grazing and arthropod herbivory in structuring a tallgrass prairie plant community

Sofie Varriano - Hendrix College, Undergraduate student

(Co-Authors: Luke H. Lefler (Hendrix College); Krishna Patel (Hendrix College); Carolina Kirksey (Hendrix College); Adam Turner (Hendrix College); Matthew D. Moran (Hendrix College))

Large mammal grazing is considered an important biological process that structures tallgrass prairie plant communities. While herbivorous arthropods are important consumers in terrestrial systems, their interaction with large mammal grazing is poorly studied. We performed a 2 X 2 factorial experiment manipulating bison grazing and herbivorous arthropod abundance in a tallgrass prairie following a prescribed burn and monitored the plant community for 15 months. Total plant biomass was unchanged by the end of the experiment, but individual biomass of forbs and grasses was altered by the treatment interactions. Forb biomass in the bison-grazed/arthropod-reduced plots was two to three times higher than other treatments, while grass biomass was higher where arthropods were unmanipulated. Our results suggest that bison grazing and arthropod herbivory work synergistically; bison reduce grass biomass, allowing forbs to increase, while arthropods reduce forb biomass, allowing grasses to increase. The increase in forbs and reduction in grasses under reduced arthropod herbivory is likely to reduce fuel load and delay the return of conditions conducive to future disturbance by fire. Therefore, we argue arthropod herbivory, interacting with large mammal grazing, is an additional important process affecting the plant community composition and disturbance patterns in tallgrass prairies.

New state records for the Texas frosted elfin (Callophrys irus hadros) and its host plants (Baptisia spp.)

Caralee Shepard - Hendrix College, Undergraduate student

(Co-Authors: Leah C. Crenshaw (Hendrix College); Natalie E. Phelan (Hendrix College); Melissa Lombardi (US Fish & Wildlife Service); William H. Baltosser (University of Arkansas at Little Rock); Maureen R. McClung (Hendrix College); Matthew D. Moran (Hendrix College))

The Texas frosted elfin (Callophrys irus hadros) is thought to be a rare species that is under consideration for listing under the Endangered Species Act. Part of this butterfly's range includes Arkansas, but its current distribution, population size, and habitat requirements are poorly understood. During the months when the adult butterflies were active in the spring of 2018, we searched much of southern and western Arkansas for suitable habitat, as defined by the presence of its host plants Baptisia spp. At each patch of Baptisia, we searched for adults and larvae, recorded GPS locations, and took notes on environmental conditions. Of 16 historical location records, we confirmed the presence of the butterfly in only two. We also found the species in 10 additional sites, which included three new county records. We have therefore expanded the known number of sites, although all new sites are in the same general geographic location as historical sites. In the course of our study, we also found four new county records for two Baptisia species. Current research is focusing on the habitat variables that best predict the presence of the butterfly. These data will help inform conservation status and habitat management for this species.

Biodiversity of Hymenoptera Across Sky Islands of Arkansas

Allison Monroe - Hendrix College, Undergraduate student

(Co-Authors: Oliver J. Kuhns (Hendrix College); Sierra C. Hubbard (Hendrix College); Reynol Rodriguez (Hendrix College); Maureen R. McClung (Hendrix College); Matthew D. Moran (Hendrix College); Michael W. Gates (Smithsonian National Museum of Natural History))

Sky islands are areas of higher elevation isolated from surrounding lowland habitats that often support unique biological communities. Arkansas houses several sky island habitats in the mountainous regions of the state (Ozark and Ouachita Mountains). While several unique insect species have been found in these areas, broad community comparisons are lacking. The objective of our study was to measure the community structure of Hymenoptera in sky islands of Arkansas and determine their similarity. We collected Hymenoptera using ground and canopy Townes-Malaise traps on Rich Mountain, Mount Magazine, and Petit Jean Mountain once a month from June through October 2017. Traps were positioned in areas of post oak (Quercus stellata) savanna habitat, the

predominant habitat in these sky islands. Specimens were identified to the superfamily level and then morphotyped. We then calculated diversity metrics and compared the number of common morphospecies across sites. Each site showed more than 100 species of hymenoptera, with high levels of evenness (J' > 0.85) at all sites. Each site exhibited many unique species (i.e., species found at only one sky island), in particular, Mount Magazine. Each site had few species in common, with no pair of sites having more than 16% morphospecies overlap. Low morphospecies overlap suggests that each sky island has a unique community assemblage of parasitic Hymenoptera. These sky islands are rich in hymenopteran diversity. The high degree of evenness is indicative of a community with many uncommon species and few dominant ones. Because these results suggest that sky island habitats in Arkansas each contain different communities, they may be worthy of enhanced conservation efforts.

Explaining the Diversity and Evolution of Color in Ants Using the AntWeb Image Database

Jacob Idec - Hendrix College, Undergraduate student
(Co-Author: Brian Fisher (California Academy of Sciences))

Living organisms use a wide range of color-producing pigments and structures for a variety of ecological functions. Despite many years of research in ant ecology and evolution, the diversity of color in ants as a group has not yet been closely examined or explained. Image databases like the ant database AntWeb are largely untapped sources of color information. Using specimen-level image data from AntWeb we present a new computational approach to examining large-scale color diversity. Images of ant heads were first segmented from their backgrounds using an active contour algorithm. The HSL colors of pixels in the segmented region were averaged and assigned to each ant specimen. We then tested for the effects of relatedness, caste, microhabitat, and environment on the HSL color parameters hue, saturation, and lightness. We found and visualized significant variation in saturation and lightness between different species and genera, but relatively little variation in hue. Significant differences in lightness and saturation were found between primary ant castes, with males being the darkest caste, workers the lightest, and queens in between. Significant differences were also found between ants found in different microhabitats, with genera and specimens coded as foraging in the trees being darker than those foraging on the ground and much darker than those foraging in the soil. At the level of all ants, average annual UV radiation and temperature at the collection location were not found to have significant effects on any color parameters. Given the decreased lightness (increased melanism) of reproductives and arboreal ants we tentatively suggest that this may be adaptively significant in UV protection. We are also in the process of conducting ancestral state reconstruction using the continuous color data and an existing phylogeny of ant genera to examine the evolution of color over time. A work-in-progress method for estimating pigment reflectance spectra from the HSL colors may also be presented.

Chemistry and Physics (Friday, Session 1)

Room: DW Reynolds 11

Laser Trapping of Polysterene Beads Using Optical Tweezers

Ashley Cotnam - University of Central Arkansas, Undergraduate student

The use of laser trapping in Biophysics has been an essential tool in understanding the dynamics of biological macromolecules such as in (i) the interactions of colloids in various concentrations of media (ii) electrophoretic mobility which is the movement of the macromolecules in response to an electric field. The applications of this technique have resulted in a better understanding of how the molecules affected by drag force and viscosity of different media. Presented here, is the experimental design and set up of an optical trap that will be used as part of a Junior/Senior level Physics lab course. This will allow students of have direct experience with the use of optics and single beam laser to trap micron sized beads and to control the beads using a combination of forces. The gradient force (Fg) as a result of the radiation pressure and the scattering force (Fs) which is a result of the change in velocity as light passes through optical media of different indices of refraction.

A Compact Raman Spectrometer Using Commercial Off the Shelf (COTS) Components

Drake Jackson - Harding University, Undergraduate student
(Co-Authors: Brandun Barnett (Harding University); Edmond W. Wilson, Jr. (Harding University))

A compact Raman Spectrograph was designed and built using commercial off the shelf (COTS) components. Raman excitation was provided by a 660 nm, single mode, diode laser with maximum optical output of 130 mW. A long pass edge filter with 675 nm cut-off was used to block the excitation source radiation from entering the spectrograph. Spherical mirrors greatly enhanced the intensity of the Raman peaks by focusing some of the scattered light back into the irradiation volume inside the 2 mm quartz liquid sample cell. Some of the scattered light from the excitation volume in the sample cell was collimated and focused onto the face of a 600 µm diameter multimode fiber to illuminate the entrance slits of a compact spectrograph with range 300 to 1050 nm. The Raman wavelength range of the constructed instrument was approximately 300 to 5000 wavenumbers. To test the instrument, samples of benzene, ethyl benzene, toluene and o-, m- and p-xylene (BETX) were analyzed and the spectrum of each was compared to spectra found in the NIST database. Samples of gasoline, kerosene and diesel fuel were analyzed for BETX. The results of the analysis and procedures taken to identify and quantitate these chemicals in the fuel samples will be presented.

Implicit and Explicit Solvation Studies of Small Molecules and Ions in Water

Eliza Hanson - John Brown University, Undergraduate student
(Co-Author: Dr. Jill Ellenbarger (John Brown University))

Water contamination by anions such as fluoride or nitrate can cause long-term health effects, experienced by many worldwide. The current research project is the first step in the development of inexpensive, urea-based detectors of water contamination. Urea has been selected as a starting point because it boasts several hydrogen-bonding interactions with anions. Aided by the use of both continuum and explicit solvation models, this project strives to understand urea's behavior when solvated with water. The solvation energies of several small, neutral molecules and a series of halides were calculated using a set of continuum solvation models. One of the models

has mathematically significant agreement with experimental results. In addition, the importance of the initial interaction distance of urea-chloride complexes in continuum solvent models was explored, and the resulting complexes showed that the anion was at a variable distance from urea depending on the initial interaction distance. These studies inspired further research into exactly how the continuum model energies differ from the reported energies, and motivated the modeling of urea through an explicit, multi-water molecule solvation model. The current focus is on measuring interactions between urea and ions in the water through interaction distances and solvation energies.

Bond Valence / Bond Length Correlations for Phosphorus-Oxygen and Uranium-Oxygen Bonds

Blake Ludwig - Arkansas Tech University, Undergraduate student
(Co-Authors: Kallie Mendenhall (Arkansas Tech University); Franklin D. Hardcastle (Arkansas Tech University))

In 1947, Linus Pauling suggested an empirical exponential dependence between bond valence, s, and bond length R: s=exp⁡((R-R_0)/b), where R_0 is the length of a chemical bond having unit valence and b is a fitting parameter. Recently, Pauling's empirical relationship was derived for the first time, and it was found that the b fitting parameter is simply the average of the single-zeta orbital exponents for the two bonding atoms. In the present study, we examine the relationship between phosphorus-oxygen and uranium-oxygen bond lengths and their respective bond valences. By performing a best fit between the literature bond lengths and bond valences (based on Pauling's electroneutrality principle), Ro, b, and the orbital exponents for uranium and phosphorus were found. The resulting P-O and U-O bond length – valence formulas can be applied to any phosphate or uranate bond regardless of oxidation state, physical state, or environment.

Investigation Anion Interactions with Tripodal Urea-Based Anion Transporters

Natalie Lowry - John Brown University, Undergraduate student

Cystic Fibrosis, an inherited and lethal disease, is caused by mutations in the cystic fibrosis transmembrane conductance regulator (CFTR) gene. The CFTR gene makes CFTR proteins which function as ion channels that transport chloride out of cells. Mutations in the CFTR gene result in either malfunctioning CFTR proteins or a lack of CFTR protein production. Over the last decade, chemists have begun working to develop synthetic anion transporters that would fulfill the role of the CFTR protein. This study uses Density Functional Theory methods to computationally investigate urea-based, tripodal anion transporters because tripodal transporters have been shown to have potential therapeutic applications. The strength of the interactions between chloride, the anion of interest, and tris-urea, tris-thiourea, and tris-selenourea receptors were calculated. The strength of the receptor-chloride interaction energies increase from tripodal tris-urea, to tris-thiourea, and then tris-selenourea. The interaction energies between these tripodal transporters and other biologically relevant anions were also studied. All three tripodal transporters have a stronger interaction with chloride compared to the other biological anions of interest. In the hope of finding increased interaction energies, the addition of amino acid-based fragments to urea was also computationally studied. The interaction energies between chloride and these amino acid-functionalized urea receptors are much stronger than the interaction energy between chloride and urea. The influence of the addition of amino acid-based fragments to the tripodal transporters is also being studied.

Exploring the potential of phenol derivatives: Charge transfer fluorophores and detection of protein in solution

Rajib Choudhury - Arkansas Tech University
(Co-Authors: Siddhi Patel (Arkansas Tech University); Kallie Mendenhall (Arkansas Tech University))

Charge transfer fluorophores are widely used in detection of ions, metabolites and biomolecules. Herein, we have developed and synthesized two long-wavelength emitting donor-acceptor fluorophores by coupling phenol donors and tricyanofuran acceptors. At lower pH the probes emit at higher energy region of the electromagnetic spectrum. At higher pH (physiological pH ≈ 7.4), the phenol donors undergo deprotonation and efficient intermolecular charge transfer to form new fluorochromes with longer wavelength emission in the far red and near infrared regions. The emission in solution is negligible due to energy loss from the excited states by non-radiative pathways. However, it can be recovered in viscous solution as well as by complexation with biomolecules or liposome. Both probes selectively responded to human serum albumin (HSA) in physiological buffer and in synthetic urine over other comparable proteins. The selective response and quantitative linear binding provided a scope to attain a very impressive detection limit as low as 1 μg/mL, and it met the requirement of traditional HSA determination assay in urine samples

Mathematics (Friday, Session 1)

Room: DW Reynolds 13

The Effects of Selection History on Perceptual and Semantic Interactions in Visual Search

Taylor Dague - University of Central Arkansas, Graduate student
(Co-Authors: Caroline Dacus (University of Central Arkansas, Department of Biology); Ken Sobel (University of Central Arkansas, Department of Psychology & Counseling); Amrita Puri (University of Central Arkansas, Department of Biology))

Visual search tasks are useful for investigating interactions between cognition and perception. Recent research has shown that semantic information can play a role in visual search for letters and digits (Sobel, Puri, & Hogan, 2015), and can interfere with processing of perceptual information as occurs in the size congruity effect (SCE). The SCE occurs in tasks in which participants view multiple numbers that have different physical and numerical sizes, and are asked to locate the physically (or numerically) larger (or smaller) number (Henik & Tzelgov, 1982; Sobel, Puri, & Faulkenberry, 2016). Response times (RTs) are faster when the target's physical and numerical sizes are congruent (e.g. a physically large 9 among physically small 2s and 3s) rather than incongruent (e.g. a physically large 2 among physically small 8s and 9s). Surprisingly, even when participants are instructed to search for targets based on physical size, the congruity effect persists; RTs are slower when the numerical size of the target is incongruent with the physical size. We examined the data reported by Sobel et al., 2016 to assess effects of "selection history"; that is, whether the irrelevant feature of the

previous target (e.g. the physical size of the target when searching based on numerical size) influenced congruity effects on the current trial. We found that when participants searched for numerical size, RTs were faster when the physical size of the current and previous target matched, and the effect of congruity was similar for both the match and non-match conditions. However, when participants searched for targets based on physical size, there was no overall effect of selection history, and the congruity effect was only present in the match condition. These results suggest the congruity effect observed when participants searched for physical size was driven by priming of numerical value in the match condition.

Initial Conditions for Numerical Simulations of Richtmyer-Meshkov Instability

Logan Sublett - University of Arkansas, Graduate student
(Co-Authors: Tulin Kaman; Alaina Edwards; John McGarigal)

Richtmyer-Meshkov (RM) instability is a specific type of Rayleigh-Taylor instability in fluid dynamics in which the interface between two fluids of different densities is impulsively accelerated such as with the passage of a shock wave. This instability begins with small amplitude perturbations which initially grow linearly, followed by a nonlinear regime, and finally chaotically when the two fluids mix. RM instability has been found to be present in various important physical phenomena such as fluid mixing in supernova, inertial confinement fusion reactions, and supersonic combustion. We use the front tracking method and high order WENO schemes in order to simulate RM instability. We analyze the mixing layer properties including width measures and kinetic energy spectra

Performance Optimization of the CFD code for flow simulations

Alaina Edwards - University of Arkansas – Fayetteville, Undergraduate student
(Co-Authors: John McGarigal, Tulin Kaman (University of Arkansas))

The numerical simulations play an important role to understand the dynamics of Rayleigh-Taylor instability that arises at the interface between two fluids due to the density gradient. This type of instability occurs in a wide range of science and engineering applications, such as astrophysics and all forms of fusion. A high-resolution computational grid is needed to predict the mixing growth rate accurately. The preliminary focus of this study is increasing the scalability of the compressible fluid dynamics (CFD) code to perform high-resolution numerical simulations efficiently on high performance computing systems. In this talk, we present computational performance data collected using the Cray Performance Measurement and Analysis Tools (CPMAT) on Blue Waters and the performance improvements achieved using OpenMP parallelization in the high-order WENO (weighted essential non-oscillatory) method.

Biological and Medicinal Chemistry (Friday, Session 2)

Room: DW Reynolds 8

Comparative Lipidomics of Phospholipids in Ground Beef Extracts by GC-MS and MALDI-TOF MS

Frank Hahn - Hampton University

Phospholipids are major components in cell membranes and play important roles in signal transduction for nutritional and neurogenetic disorder mechanisms. There have been many mass spectrometric methods developed for analyzing lipids due to the recent advances in mass spectrometry. However, there have been no reports for comparative profiling analyses of phospholipids by different mass spectrometers. In this study, rapid comparative analytical methods to profile specific phospholipids were successfully investigated by utilizing GC-MS and MALDI-TOF MS. For GC-MS analyses. FAMEs of sphingomyelin (SM) with an acid catalyst showed better signal-to-ratio GC-MS spectra, while FAMEs of phosphatidylcholine (PC) and phosphatidylinisitol (PI) with a base catalyst had better signal-to-ratio GC-MS spectra. It was also found that the FAME analyses with both acid and base catalysts needed to be performed to identify all targeted phospholipids in standards and tissue extracts. For MALDI-TOF MS analyses, 2,5-dihydroxybenzoic acid (DHB) in 90% EtOH/H2O showed minimal ion suppression/affinity effects and better signal-to-ratio among the other tested MALDI matrices (e.g., DHA, DHB and CHCA) of different solvents and their concentrations; Suppression effects by SM and PC were found, discriminating other lipid molecular ions including PI. MALDI-TOF MS is quicker and easier to get the brief snapshot before utilizing better tools. However, GC-MS is more detailed approach than MALDI-TOF MS. These developed methods would be applied to further analyses of the various tissue analytes with additional MALDI imaging and quantitation.

Proteomics of carbon fixation in Halothiobacillus neapolitanus

Newton Hilliard - Arkansas Tech University

Halothiobacillus neapolitanus is a carbon fixing, sulfur-oxidizing microbe unique in its ability to utilize oxidation of a wide variety of sulfur containing compounds to provide energy for carbon dioxide sequestration and fixation. Quantitative MS/MS proteomics of cultures grown utilizing 5mM bicarbonate vs 5% CO2(g) as carbon source clearly demonstrate changes in cellular levels of proteins associated with; the energy production/sulfur oxidation, carbon uptake/fixation and protein production/stabilization pathways. Of the two putative bicarbonate membrane transporters, only the two-subunit transporter located at gene loci Hneap_0210/0211 shows any significant change in cellular level with an approximate 4-fold increase when grown using carbon dioxide gas as dissolved inorganic carbon(DIC). This is accompanied by an apparent switch from RuBisCO form II to RuBisCo form I under these conditions. Other than sqrF, soxYZ and soxCD, proteins from sulfur oxidation pathways follow a general pattern of increased levels in the presence of bicarbonate. Cytoplasmic chaperone proteins groS, groL, dnaJ and dnaK show moderate decreases even though extracytoplasmic counterparts surA and ompH increase. The ability of the proteomics technique to accurately detect changes in cellular protein levels associated with growth conditions allows the technique to be used to determine optimum conditions for sulfide remediation and carbon dioxide fixation.

Scorpion toxin proteomics: Sodium toxin gene identification, isolation, and protein overexpression

T Yamashita - Arkansas Tech University

Scorpion venom contains a multitude of components with the protein fraction as the best characterized. Many toxin proteins have been identified and studied from the medically important species, but few have been characterized from scorpions with milder venom. These toxin proteins inhibit or modulate activities at neuron ion channels such as those that regulate the flow of Sodium, Potassium, and Calcium ions. Our work focuses on toxin proteins affecting sodium channels. We present data illustrating the isolation of a scorpion sodium beta toxin gene and subsequent protein overexpression and purification from bacterial cells.

Role of the DJ-1 Protein in Mitochondrial Dysfunction and Parkinson's Disease

Courtney Holloway - University of Central Arkansas, Undergraduate student
(Co-Author: Kari Naylor, Ph.D. (University of Central Arkansas))

DJ-1 is a protein produced by the PARK7 gene and is found in many organisms ranging from humans to bacteria. While the cellular role of DJ-1 is not entirely understood, it is thought to play a role in the regulation of mitochondrial homeostasis. One aspect of mitochondrial homeostasis is mitochondrial dynamics, or fission and fusion of the organelles. Mitochondria that cannot undergo these processes are less able to repair mitochondrial DNA damage that results from respiration, and the resulting buildup of damaged mitochondria can lead to disease. DJ-1 is implicated in Parkinson's disease (PD), and our lab has recently established a cellular model of Parkinson's disease in Dictyostelium discoideum and have shown that under PD cellular conditions, mitochondrial dynamics are decreased. To further this model and to explore the role of DJ-1, we will determine how different levels of DJ-1 expression affect mitochondrial dynamics. Here, we show that overexpression of DJ-1 increases fission and fusion rates almost fivefold. If mutations in DJ-1 affect the rates of fission and fusion, then damaged mitochondria can not be repaired or removed, and neurodegenerative diseases may develop. If this is the case, our new PD model will help us to further explore the cellular effects of PD and the development of PD treatment.

Gene Expression Study of Sodium β Toxins on *Centruroides vittatus*

John Sisco - Arkansas Tech University, Undergraduate student
(Co-Authors: Chloe Fitzgerald; Grace Rice (Arkansas Tech University))

Scorpions release venom when capturing prey or fighting off predators, and a large portion of this venom consists of neurotoxins. The area in the tail where the venom is produced and housed is called the telson gland. The neurotoxins produced are mostly composed of a combination of different sodium toxins which alter the kinetics of sodium channel gating in the nervous system cells where they have been injected. This exploratory study on the sodium β toxin gene activity for the striped bark scorpion, Centruroides vittatus, specifically focused on gathering relative quantification data for eight neurotoxin variants in particular: Na668, Na667, Na1210, Na654, Na689, CsBeta, CvAlpha, and Na3066. This was accomplished by quantitative real-time polymerase chain reaction, or qRT-PCR. Preliminary experiments have been conducted on both male and female organisms by which threshold values yielded from these have been statistically analyzed within biological replicates as well as computationally analyzed through the ΔΔCt method, which has gathered a tentative ratio of activity for these gene variants. The goal of this study was to determine the level of expression for the different sodium β toxin genes in the telson gland relative to body tissue in male and female scorpions of the eastern population. Bioinformatic research was also conducted to compare the amino acid sequences of the toxins used in our study to those used in a similar research. This concluded that our toxins used stood apart from those used in other researches. This information may one day be used to help develop antitoxins for medical use.

Melanin Concentrating Hormone Receptor 1 (MCH1R) Antagonists for Treating Addiction

Britny Kirkpatrick - Harding University, Undergraduate student
(Co-Authors: Jim Tarrant, Jacob Hatvany, Thomas Pencarinha)

Melanin Concentrating Hormone (MCH) is a 19-amino acid neuropeptide, predominantly expressed in the lateral hypothalamic area and zona incerta and MCH-producing neurons project throughout the brain. The MCH receptor is a G-coupled protein receptor and is involved in the regulation of feeding behavior and energy homeostasis, maintenance of REM sleep, depression, anxiety and is associated with emotional reactivity and reward behaviors connected to certain addictions. Of the two known MCH receptors, MCHR1 is widely distributed in the brain, including the hypothalamus, thalamus, olfactory cortex, amygdala, striatum, and hippocampus, in all vertebrates We intend to prepare a series of fluorinated octahydro-2H-pyrido[1,2-a]pyrazine analogs and test their anti-addiction properties in an ethanol self-administration model in rodents. Further, these fluorinated analogs may prove useful as 19F probes in NMR that will allow us to study these anti-addiction properties in the brains of animals and possibly in humans.

The Essentiality of the Vinyl Proton in Anticonvulsant Enaminones

Henry North - Harding University
(Co-Authors: Mariano S. Alexander (Howard University), Kenneth R. Scott (Howard University))

Background: Despite a variety of available antiepileptic drugs, many patients exhibit limited symptomatic treatment and drugs fail to cure more than 30% of the epileptic seizures. Enaminones, chemical compounds consisting of an amino group linked through a C=C bond to a keto group, have been synthesized extensively for use in anticonvulsant therapy. Here we report the design and synthesis of 2, 5- dimethyl enaminone derivatives, their anticonvulsant screening and in silico prediction studies of the pharmacokinetic properties.

Methods: The title compounds were synthesized according to the methylation of the respective beta-diketones, followed by condensation with the desired para-substituted anilines to form the enaminones. Anticonvulsant identification and quantification tests were performed in mice by the Epilepsy Therapy Screening Program (ETSP) of the National Institutes of Health (NIH) using

maximal electroshock (MES), subcutaneous pentylenetetrazole (scPTZ), 6 Hz psychomotor, and rotorod tests. Their physiochemical and pharmacokinetic properties were calculated using QikProp.

Results: Most of the compounds showed protection against MES, scPTZ and/or 6 Hz-induced seizures. MES studies show 5i, 5l, 5p were active at 100 and 300 mg/kg, 5a, 5o were slightly active in scPTZ studies in mice. The compounds were slightly active in rat MES studies and showed protection in both tests without neurotoxicity. According to the QikProp calculations, the title compounds were druglike and had some favorable properties such as high membrane permeability and oral absorptivity.

Conclusion: Anticonvulsant screening of a series of methyl substituted enaminones yielded some active derivatives in MES, scPTZ and 6Hz test. Promising compounds 5i, 5l, 5p emerged with activity at 100 and 300mg/kg and no toxicity. The compounds were predicted to be drug-like and have good pharmacokinetic properties.

Ecology and Organismal Biology II (Friday, Session 2)

Room: DW Reynolds 10

Observations of an Alligator (Alligator mississippiensis) nest and Hatchlings in Clark, County, with anecdotal observations of other Alligator Nests in Arkansas

Kevin Nordengren - Henderson State University

(Co-Authors: Allison Surf (Department of Biological Sciences, Henderson State University, Arkadelphia, AR 71999); Renn Tumlison (Department of Biological Sciences, Henderson State University, Arkadelphia, AR 71999); Kelly Irwin (Arkansas Game and Fish Commission, 213A Highway 89 South, Benton, AR))

Historically, the American alligator (Alligator mississippiensis) ranged through southern and much of eastern Arkansas. By the early 1900s, alligator populations had declined due to unregulated hunting, commercial exploitation, and habitat loss. In 1961, the Arkansas Game and Fish Commission (AGFC) established protection of this species, and in 1967 the U.S. Fish and Wildlife Service listed the alligator as an endangered species. The AGFC conducted a restocking program from 1972-1984, and the species made a full recovery in Arkansas. Still, little is known about reproductive biology in the state. We observed an alligator nest near Arkadelphia, Clark Co., the mound of which was 1.6 m long, 1.3 m across, and 43-56 cm in height. Because the nest had not hatched by a date late for the species, we opened the nest because some peeping by live hatchlings could be heard. The nest contained 33 eggs, of which 12 hatched, 8 had died recently (possibly due to a cold weather period) and the rest were unfertile or died early. We observed behaviors of baby alligators at the time of hatching from a wild nest, and the development of feeding behaviors while maintained in lab. Babies were aggressive and bit debris and each other while hatching, apparently to aid in their exit from the egg. Aggressive behaviors subsided, and young took crickets, earthworms, and shiners as food. After about 3 days, individuals who both grabbed parts of a shiner or earthworm began the spin behaviors to tear apart food items.

Bilateral Diaphyseal Chondrodysplasia and Polymorphic Osteodysplasia of the Tibiofibulas in a Southern Leopard Frog, Lithobates sphenocephalus (Amphibia: Anura: Ranidae)

Stan Trauth - Arkansas State University (Emeritus)

(Co-Author: M.L. McCallum (Langston University))

Much attention has been focused on limb malformations in anurans following the startling discovery of major limb deformities in Northern Leopard Frogs (Rana pipiens) in Minnesota in 1995. The numerous causes for these malformations can be attributed to a number of natural phenomena, or they can be considered as being manmade. In the present study, we report on a previously undescribed type of limb abnormality in a single individual of the Southern Leopard Frog (Lithobates sphenocephalus) from Arkansas. Histological examination of left tibiofibula revealed a complete disruption of the normal diaphyseal bone structure in this adult frog. The tibiofibula was separated into two poorly ossified and mostly fragmented bony shaft regions on opposite sides of the bone lesion. These peripheral segments of compact bone were surrounded by hypertrophic regions of hyaline cartilage intermingled with complexes of dysplastic bone. We observed three major polymorphic bone aggregates. The overall design of these osteogenic regions can best be described as an arachnoid-like patchwork of numerous pockets, channels, spaces, and nodules separated by trabeculae containing a matrix embedded with subperiosteal bone cells. At present, we are unaware of any environmental conditions that could account for the osteochondrous dysplasia in our specimen. Moreover, the remarkable bilateral placement of the 2 lesions in our specimen suggests the possibly of a genetic factor leading to a pairing of hindlimb developmental anomalies during embryonic bone growth in our specimen.

Response to rapid habitat perturbation in the slider turtle (Trachemys scripta): Behavioral and hormonal effects.

Ben Cash - University of Central Arkansas

The condition of resources in ecological systems is inherently stochastic and the physiology and activity patterns of organisms reflect this. Reptiles show an increased concentration of corticosterone in response to an array of stressors, both acute and chronic. The effects of corticosterone release have been linked to a number of important functions, both physiological and behavioral. A slider turtle population in north Mississippi experienced a rapid habitat perturbation when a dam failed on an artificial pond (Pond A). A significant number of turtles were previously marked in Pond A and surrounding ponds (n = 5; Ponds B–E) enabling potential recapture. From August through October 1997, turtles from Pond A were recaptured in all of the surrounding ponds. Thirty-three males and 11 female emigrants from Pond A were recaptured. Blood samples were obtained for all emigrants (E) and compared to known resident (R) populations for analysis of corticosterone, estradiol and testosterone concentrations. For all hormones measured, blood samples were obtained at time of capture (T0). Blood samples were also taken at 30 min and 60 min to complete a corticosterone stress profile. Pond A emigrants had significantly higher initial corticosterone when compared to resident turtles (Time0E=12.55 ng/mL ± 2.08SE vs. Time 0R=0.705 ng/mL ± 0.098SE; P = 0.003). Pond A male emigrants had significantly lower testosterone than residents (TE=1649.0 pg/mL ± 193.9SE vs. TR=7123.6 pg/mL ± 882.5SE; P = 0.001). Pond A female emigrants

had significantly lower estradiol than residents (E2E=106.5 pg/mL ± 28.1SE vs. E2R=288.7 pg/mL ± 49.6SE; P = 0.01). Importantly, the timing of the perturbation was at the height of hormonal activity and gonadal recrudescence in these populations. Observations such as these are important when considering behavioral and physiological mechanisms involved in a turtle's response to changing habitat quality and their implications to conservation.

Age Estimation using Phalangeal Skeletochronology in Northern Crawfish Frogs, Lithobates areolatus circulosus (Amphibia: Anura: Ranidae), from Arkansas

Stan Trauth - Arkansas State University (Emeritus)
(Co-Author: Christopher S. Thigpen (ASU))

As an obligate crayfish burrow dweller, crawfish frogs have historically occupied a relatively narrow ecological niche throughout their distribution in the tall grass prairies and grasslands of the central and south-central United States. In Arkansas, the Northern Crawfish Frog, Lithobates areolatus circulosus, occurs in only 19 of its 75 counties. Because of their secretive nature, late winter-early spring breeding season, and current protected status by the Arkansas Game and Fish Commission, this species remains a rarity in most museum collections in the state. Moreover, only anecdotal information exits regarding any aspect of their natural history in Arkansas. In the present study, we chose to conduct a phalangeal skeletochronological investigation using museum specimens (n = 9) deposited in the herpetological collection housed in the Arkansas Center for Biodiversity Collections located at Arkansas State University. Our results were mostly similar to the age-body length distributions from southern Illinois. Our oldest males exhibited 4 lines of arrested growth (LAGs), and this estimated age matched well with the body sizes of 4-year-old males found in Illinois. Two of our 3-year-old males had slightly larger body sizes compared to the Illinois sample. Our oldest female was 5 years old. Her body size was comparable to values found for 5-year-old females in Illinois. Also, 5 years was the maximum age recorded for this species in our study as well as for the frog in Illinois. Nine years has been reported as the maximum lifespan for this species.

Phylogeny and Characterization of Paraeustigmatos columelliferum, an Arkansas alga that represents a new linage of the Eustigmatales (Eustigmatophyceae)

Karen Fawley - University of the Ozarks
(Co-Authors: Yvonne Nemcova (Charles University, Department of Botany, Prague, Czech Republic); Marvin Fawley (University of the Ozarks, Division of Mathematics and Sciences, Clarksville, Arkansas))

The new taxon, Paraeustigmatos columelliferum (Eustigmatophyceae), was isolated from a mat of the filamentous alga Zygnema sp. on the shore of Lake Monticello, Drew County, Arkansas. Paraeustigmatos columelliferum is a simple coccoid alga ranging in size from 3.7 µm for autospores to 7.8 µm for large vegetative cells. No flagellate cells were observed. These cells are joined together as firm amorphous clumps. The results of phylogenetic analyses of 18S rDNA and rbcL sequence data indicate that this alga is likely allied with the Eustigmatales; alternately, it may represent a new third lineage of the class Eustigmatophyceae. Light and electron microscopy revealed several cellular features similar to other members of the Eustigmatophyceae. However, the cell walls bear unusual structures that resemble the columellae of the walls of pollen grains. These columellae may function to join the cells together in tight masses.

Blackroll Creek Runs North: A family farm history and its changes from the 1800s to the present

Anthony Holt - UACCM

An ARCGIS Story Map history of the Holt Farm near Black River in NW Jackson County, Arkansas. From arriving pioneers, to settlers, to farmers, to conservationists, the Holt Family has been a part of Northwest Jackson County, Arkansas since 1860. The original Farm has remained in the family for parts of three centuries and has grown to nearly 300 acres. Drawing on a Great Great Grandson's conservation/biology background, all but about 75 acres of the farm are now in some sort of conservation plan, restoring native timber and wetlands, with over 15 species of trees, including bur oak and native pecan.

Engineering (Friday, Session 2)

Room: DW Reynolds 11

Flow dependency upon the convection region height of a CFD Tornado simulator

Sumit Verma - University of Arkansas, Fayetteville, Graduate student
(Co-Author: R. Panneer Selvam (University of Arkansas))

In recent years, an increasing number of researches have used numerical simulation to study the flow structure of tornados using CFD and investigating the Fluid-Structure interaction that occurs when these numerically simulated vortices interact with structures in the numerical simulation environment. Because of mesh generation challenges in the CFD model arising as a concomitant due to inherent geometrical differences of various experimental tornado simulators and their vortex generation mechanism, a cylindrical domain with bottom inlet and a top open outlet has been used in the past and even till date on several instances to study the flow parameters. But those studies overlooked the element of flow dependence based on the convection region height, assuming that tornadic flows are independent of convection region height. In this study, the impact of variation of convection region height on flow characteristics is studied. It has been found that flow parameters are strongly influenced by Swirl ratio (S)-a parameter quantifying flow helicity and also convection region height (H) has some influence on flow parameters. When put concisely in a mathematical form, it can be represented in a functional notation as y = f (S, H), where y = flow parameters observed at the base of numerical simulator.

At a fixed convection region height, on increasing S, the touchdown condition was reached at S=0.45 which shows how tornadic flows change with increasing S. Similarly, when separately studied to obtain the phenomena of touchdown but with different convective heights, the parameter S was seen to be on a reverse trend to increasing H but at a slow rate.

Thus, it can be concluded that flow parameters obtained at the base of numerical simulator is also influenced by convection region height in addition to Swirl ratio, although not as strongly as Swirl ratio.

Examining Molecular Level of Properties of Asphalt Binders to Predict Their Moisture-Induced Damage

Sumon Roy - Arkansas State University, Graduate student
(Co-Author: Zahid Hossain (mhossain@astate.edu; Arkansas State University))

Stripping related moisture damage is a complex mechanism, which may result in surface distresses in asphalt pavement, and thereby reduce its performance and durability. Most of the current methods for measuring moisture susceptibility in the United States are based on either micro- and macro-level tests data. In this study, the Atomic Force Microscopy (AFM) technology was used to evaluate the molecular-level effects of moisture-induced damage on the properties of asphalt binders. Binders used in this study were collected from two different sources (Source 1 and Source 2) and were tested on dry and wet conditioned specimens. The Peak-Force Quantitative Nanomechanical Mapping (PFQNM) mode was used to capture the binder's topographical and mechanical properties. Afterward, the scanned maps were analyzed using the NanoScope Analyses software. The AFM test results showed that the binders modified using styrene-butadiene-styrene has a better resistance in preventing the moisture damage susceptibility among all the binders tested in this study. The outcomes of this study is expected to provide a better understanding of moisture damage mechanism that occurred at the atomic level of asphalt binders due to the moisture.

Evaluation of Rice Husk Ash (RHA) as an Asphalt Modifier

Kazi Islam - Arkansas State University, Graduate student
(Co-Author: Zahid Hossain (mhossain@astate.edu; Arkansas State University))

Highway agencies have been trying to reduce the amount and severity of pavement distresses by introducing the high-performance asphalt binders in pavements. Various types of elastomeric and plastomeric polymers such as SBS (Styrene–Butadiene–Styrene) have been used to increase the pavement performances, which includes rutting resistance, thermal cracking resistance, mixture durability, and increased service life. In this study, Rice Husk Ash (RHA) have been as an alternative potential asphalt modifier. The finest available RHA (nominal size 44 μm) was blended with a virgin performance grade (PG) binder (PG 64-22) at different percentages (1%, 2%, and 3%, by the weight of the binder). Test results showed that the viscosity of RHA-modified asphalt was found to be significantly higher compared to the virgin binder. Accordingly, the mixing and compaction temperatures measured for the RHA-modified asphalt were also found to be significantly higher than the virgin binder. Similarly, the increased values of complex shear modulus for RHA modified asphalt binder represents the increased rutting resistance factor of the asphalt binder. The findings of this study are expected to encourage the asphalt industry to consider RHA in producing high-performance asphalt binder. It will also reduce agricultural waste if RHA can be used as a modifier of asphalt and facilitate in reducing the cost of construction projects.

Analysis of Asphalt Binders From Chemical Prospective

Mohammad Nazmul Hassan - Arkansas State University, Graduate student
(Co-Author: Zahid Hossain (mhossain@astate.edu; Arkansas State University))

Mechanistic properties of asphalt binders change during its service-life. Most of these mechanistic properties are highly related with chemical fractional components: Saturates(S), Aromatics (A), Resins (R) and Asphaltenes (A), which are often called SARA fractions. Chemical compositions of asphalt binders from different sources differ significantly, therefore their mechanistic properties are expected to be different among crude sources. Moreover, binders are often modified with additives such as acid, polymer, or a combination of multiple additives to achieve improved performance to sustain heavy loads and adverse weather conditions. These modifications also cause significant variation in mechanistic properties of asphalt binder. During this study, variations in mechanical properties were observed for three types of modified binders: Polyphosphoric Acid (PPA) modified, Styrene-Beutadine-Styrene (SBS) modified and nanoclay modified asphalt binders. Among them, binders modified with PPA exhibited higher extent of acidic nature. It was also found that aging cause significant variation in chemical compositions, which subsequently also change mechanistic properties such as viscosity and rutting factors for all modified binders considered for this study.

Exploration of Alternative(s) of the Empirical and Expensive Tests to Characterize Bitumen

MM Tariq Morshed - Arkansas State University, Graduate student
(Co-Author: Zahid Hossain (mhossain@astate.edu; Arkansas State University))

The Arkansas Department of Transportation (ARDOT) evaluates modified asphalt binders by using a Dynamic Shear Rheometer (DSR) per AASHTO (American Association of State Highway and Transportation Officials) Standard T 315, which is unable to adequately capture the effects of elastomeric modification. Thus, ARDOT requires conducting, the Elastic Recovery (ER) method (AASHTO T 301), a Performance Grade (PG) Plus test that is empirical in nature, expensive and time consuming. On the other hand, the effects of the elastomeric or plastomeric polymer are not accurately identified through these conventional tests. The main objective of this study is to find suitable test method(s) to evaluate modified binders as a replacement of the ER test. The DSR-based Multiple Stress Creep Recovery (MSCR), ER-DSR, and Binder Yield Energy Test (BYET) have been investigated to find their effectiveness. Three ARDOT certified asphalt binders (PG 64-22, PG 70-22 and PG 76-22) have been selected for this study. These binders have been prepared by blending styrene-butadiene-styrene (SBS) polymer, PPA, or a combination of both. Test results indicate that the MSCR, BYET, or ER-DSR test would be a good replacement of the ER test to characterize polymer-modified binders. Further investigations are being done for characterizing PPA-modified binders, but the presence of PPA can be determined by conducting pH tests.

Corrosion Risks of Metal Culvert Pipes in Northeast Arkansas

MdAriful Hasan - Arkansas State University, Graduate student

(Co-Author: Zahid Hossain (mhossain@atate.edu; Arkansas State University))

Metal pipes used for culverts and cross-drains are susceptible to significant corrosion. However, there is knowledge gap in the corrosivity behavior of the soils of northeast Arkansas. The main objective of the project is to develop neural network (NN) models for predicting soil corrosivity by analyzing routinely available geotechnical and water quality data, and laboratory investigations of soils. For neural network modeling, literature has been reviewed, and physical and chemical properties of soil and water were collected. Laboratory test results of collected soil samples were incorporated with the dataset. Several backpropagation algorithms were applied to train the model to predict soil resistivity at different locations. The detail analysis shows that resilient backpropagation, gradient descent backpropagation and scaled conjugate gradient backpropagation have better accuracy than the other backpropagation algorithms. The R-values for the three NN models have been found as 0.789, 0.601 and 0.735, indicating fair accuracies, and they can be used for prediction of the resistivity of soils based on the routine geotechnical parameters. Finally, using soil resistivity and pH of soil, probable service life different types of metal pipes are estimated. The findings of this study will help transportation agencies in selecting appropriate metal pipes, which will assure better service life.

Ecology and Organismal Biology III (Friday, Session 2)

Room: DW Reynolds 13

Deviation of antioxidant capability of colored sweetpotatoes and its uppers in relation to polyphenolic contents

Mosammat Briti Rabbani - University of Arkansas at Pine Bluff, Graduate student

(Co-Author: Shahidul Islam)

Sweetpotato is a very promising staple that ranks as the world's seventh most important crop. It is adaptable and durable since it has low input requirements, is easy to produce and can be produced under adverse weather and soil conditions. Sweetpotato is one of the plants selected by the U.S National Aeronautics and Space Administration to be grown in a controlled ecological life support system as a primary food source. Antioxidant compounds in food play an important role as a health-promoting factor. Scientific evidence suggests that antioxidants reduce the risk for chronic diseases including cancer and heart disease. Studies have been done which compared the antioxidant content of different colored sweetpotatoes, and its leaves. The samples were tested for antioxidant capacity by 2,2'-azinobis (3-ethyl-benzothiazoline-6- sulfonic acid) (ABTS), 2,2-diphenyl-1-picrylhydrazyl (DPPH), and oxygen radical absorbance capacity (ORAC). The antioxidant activity in the hydrophilic fraction have a significant antioxidant effect when tested by each method. There was a relationship between total polyphenol content and antioxidant function in case of ABTS (r= 0.59) and ORAC (r= 0.35). The hydrophilic ABTS values correlate significantly with the hydrophilic DPPH values (r= 0.84), and the hydrophilic ORAC values correlate reasonably well with the hydrophilic ABTS values (r= 0.85). The hydrophilic DPPH values and hydrophilic ORAC values also showed a strong correlation (r= 0.87). The sweetpotato genotypes had significant antioxidant activity and polyphenolic contents. The phenolic content of all genotypes was ranged 3.5-4.8 mg TAE/g dwt. The ABTS method proved the best for antioxidant determination. The ABTS method proved the best for antioxidant determination in sweetpotatoes followed by ORAC method. The information provided by this research will also facilitate the genetic and chemical breeding study for improvement of the desired quality criteria of orange-fleshed sweetpotatoes, as well as other, produce.

Wild game consumption and greenhouse gas emission savings in the U.S.

Jamie Johnson - Hendrix College, Undergraduate student

(Co-Authors: Nathan Taylor; Benjamin Zamzow; Matthew Moran)

Modern industrial methods of food production produce a considerable proportion of global greenhouse gas emissions. The production of meat, in particularly, is noted for its relatively high CO2 and CH4 emissions. In the U.S., hunting and consumption of wild game is also a source of meat and, since there are no associated industrial emissions, presumably has much lower greenhouse gas impact. We calculated the total amount of meat that is legally harvested in the US and for which the federal government or individual states compile annual harvest numbers. We then determined the proportion of meat consumed which is harvested from the wild, the caloric value, the greenhouse gas impact of wild game harvest, and the potential greenhouse gas savings if wild game hunting increased above current levels. We found that wild game harvest accounts for about 424 billion kg, about 3% of meat consumed annually in the US. The benefits of wild game consumption is equal to about two billion kg of avoided CO2 emissions and one billion kg of avoided CH4 emissions (assuming hunting reduces game populations by 10%). The combined reductions of CO2 and CH4 are equivalent to about 600,000 cars being taken off of US highways. Therefore, wild game contributes a relatively small, but not irrelevant savings in greenhouse gas emissions. Increased hunting of wild game, which could be ecologically supported in the U.S., could further increase these greenhouse gas savings. State and federal wildlife conservation organizations could use the positive climate impacts of wild game harvesting as a potentially effective public relations tool to reverse the current decline of hunting participation.

Determination of bat species' use of artificial bark enhanced habitat in northern Arkansas

Sarah Martin - University of Central Arkansas, Graduate student

North American bat populations are increasingly threatened from white-nose syndrome (WNS,) climate change, and habitat loss. Knowledge of season-round bat demographics are uneven throughout the state, although significant research has been done on some species in select areas. My research seeks to augment our knowledge of roosting sites and habitat choices for tree-roosting species, such as the Indiana bat (Myotis sodalis). Specifically, I am investigating the feasibility of using artificial habitat to augment the roosting habitat for tree-inhabiting bats in northern Arkansas. To do this I am using BrandenBark™ artificial bark applied as 3 m X 1 m wrap-around sheets to telephone poles approximately 7 m tall. Four sites were chosen in collaboration with the U.S.F.W.S. Arkansas Field Office, and other invested land conservation entities. The sites are being visited year-round to collect visual and acoustic data. To date, five instances of pole use by bats at three of the four sites have been noted. Bat species using the poles will be ascertained by mDNA analysis using guano collected bi-weekly from the base of the poles. This analysis is being done at the Northern Arizona University Genetics lab. Thus far, 14 samples have been collected, but none yet analyzed. The research also seeks to corroborate the presence of all bat species in the area, and thus provide a quantitative indication of whether bats choose to use the artificial habitat. To do this I

am surveying the vicinity (approximately 5 – 7 ha surrounding and including the poles' arrays) using passive (Anabat Express) and active (EchoMeter 2 Pro) bat recordings. To date I have found approximately seven species. The bulk of the acoustic analyses will be done in the fall of 2019. We expect that our data on previously undocumented regional species and federally listed bats will be especially useful for managers.

Spatial Ecology of Mud Snakes (Farancia abacura) in a Small Isolated Pond Within a Bottomland Hardwood Forest

Caleb O'Neal - Harding University, Undergraduate student
(Co-Authors: Michael V. Plummer; Ryan Stork; Steven M. Cooper)

Understanding an animal's spatial ecology is crucial to understanding a species' ecological needs and preferences, which enables us to design management and conservation plans for a species potentially at risk. We radiotracked 8 Mud Snakes (Farancia abacura) from April-October 2018 in a small isolated wetland pond in central Arkansas. Mud Snakes were aquatic, fossorial, and exceedingly secretive. From 530 relocations, we found that Mud Snakes moved within small, well-defined home ranges that were confined to the pond basin. Home ranges of individual snakes overlapped extensively. Snakes did not venture away from the water source of the pond throughout the course of the study. The results from our study show the spatial ecology of Mud Snakes in a small isolated pond in central Arkansas was strikingly different than previously reported literature of Mud Snakes in a large continuous wetland in southeastern Missouri.

Effect of selection and genetic drift on phenotypic diversification in the eastern collared lizard.

Andrew Feltmann - University of Central Arkansas, Graduate student
(Co-Authors: Matthew Gifford (University of Central Arkansas); Emily Field (University of Central Arkansas))

Organisms display a wide diversity of traits that selection acts upon causing phenotypic change over time. When organisms disperse, however, the resulting small population can experience genetic drift due to decreased genetic diversity within the population. Reintroduction is one of the more common forms of population restoration in conservation management plans. The reintroduced populations face challenges that colonizing populations face (i.e. a reduced population number and possible inbreeding). These issues may lead to genetic drift which can majorly impact fitness in the population, potentially leading to population crash. We examined the effects of selection and drift on a metapopulation of Eastern Collared Lizards (Crotaphytus collaris) on Stegall and Thorny mountains in southern Missouri. We measured a suite of morphology and performance traits to assess levels of differentiation between mountains. Lizards on Thorny mountain were found to have longer fore limbs, higher bite forces, and had higher respiration rates. Stegall lizards had longer head lengths overall. This supports our prediction that the population on Thorny is experiencing novel selection pressures or genetic drift.

Integration of Mixed Methods into Community-Based Participatory Research (CBPR): A Methodological Approach and Health-Centered Case Study

Mason Rostollan - University of Central Arkansas, Graduate student
(Co-Authors Leah Horton (University of Central Arkansas))

The natural sciences have traditionally been dominated by postpositivist epistemology and quantitative research approaches; however, mixed methods research is gaining acceptance. This approach is particularly utilized in social sciences, medicine, education, linguistics, and similar fields. Mixed methods research blends both quantitative and qualitative methods to create a more thorough and contextualized study and we assert the natural sciences could benefit by blending qualitative components with otherwise quantitative studies.

Here we present a case study from Kanembwe, Rwanda, an impoverished village with limited access to healthcare. Our goal was to characterize environmental compartments that may lead to morbidity or mortality among the residents. To achieve this, we obtained quantitative data from health metrics and environmental conditions including lung function, smoke abundance, and water quality. We then employed semi-structured interviews to gain insight into participant attitudes toward interventions and perceptions of personal health. Without quantitative data, the findings are strictly based on participant interpretations of their surroundings; without qualitative data, the findings lack context and application.

Methods can be mixed at each level of research. In this case study, we mixed the methods in data collection, analysis, and reporting. This allows us to gain thick, rich data that can be directly translated into the context of our study site and provides opportunity for participants to directly see the effects of the study. Further, we were able to tailor our approach in a manner that accounts for social norms and cultural needs. This approach led to better intervention perception by the participants and more open communication, thus better feedback for future studies.

In conclusion, mixed methods research approaches have applications for the natural sciences through contextualizing studies and providing opportunities for blended approaches that yield more thorough and nuanced data and results, as exemplified by our study from Kanembwe, Rwanda.

Estimating cultural ecosystem services provided by the Buffalo National River using a contingent valuation method

Margaret Young - Hendrix College, Undergraduate student
(Co-Authors: Maureen R. McClung (Hendrix College); Matthew D. Moran (Hendrix College); William Haden Chomphosy (Hendrix College))

The Buffalo National River (BNR) is a 135 mile stretch of free-flowing stream under management of the National Park Service. Considered by many to be one of the most beautiful natural places in Arkansas, the River experiences high visitation rates, with over 1.2 million visitors in 2018 Understanding the cultural value of the River is important when discussing policy decisions that impact it. Cultural value can be measured using an ecosystem service framework, which estimates the monetary value of benefits that nature

provides freely to humans. This study is the first estimation of the BNR's cultural value (including spiritual, aesthetic, artistic, recreational, and cognitive development values) as it relates to Arkansans. We utilized a Contingent Valuation Method (CVM) survey distributed through Amazon Mechanical Turk to estimate aesthetic, spiritual, and artistic value of the River. The survey also contained components to assess which of three options (i.e. increasing the state sales tax, a one-time donation to a non-profit, or adding a vehicle entrance fee) would be the most successful at increasing the BNR's revenue to provide resources for protecting the River. The results show that taxation would generate the most revenue, with $152 million added annually to the River's budget. The donation and fee each increased revenue by about $2 million. The survey also showed that Arkansans care about aesthetics of the BNR most, followed by artistic creativity, then spiritual experience. We also collected demographic data from the 250 survey participants to determine which variables have the greatest impact on willingness-to-pay for protection of the River. This study shows that Arkansans care a great deal for the BNR and are willing to contribute monetarily to ensure the River's protection.

Kim Smith Memorial Session (Saturday, Session 3)

Room: DW Reynolds 8

Introduction to the session: Dr. Kimberly G. Smith's Legacy of Science and Conservation

Maureen McClung - Hendrix College

Winter occurrence and habitat use of Northern Saw-whet Owls (Aegolius acadicus) in northwestern Arkansas

Mitchell Pruitt - University of Arkansas, Graduate student
(Co-Author: Kimberly G. Smith (University of Arkansas))

The Northern Saw-whet Owl (Aegolius acadicus) is a well-documented autumn migrant in eastern and central North America. Recent studies have demonstrated saw-whet owls to be a fall migrant in the southern United States, leading us to explore the possibility of winter residency and habitat use in the southwestern Ozark Highlands ecoregion. During autumn of 2016 and 2017, we deployed 27 VHF radio transmitters on saw-whet owls captured at our banding site in Madison County, Arkansas. Telemetry surveys were conducted 12 November 2016 to 16 March 2017 and 18 October 2017 to 16 March 2018, resulting in the detection of 17 tagged individuals. Detections occurred from 1-112 d after release, suggesting some saw-whet owls winter in the southwestern Ozark Highlands. Locations of 19 roost sites were obtained for 7 owls in shortleaf pine (Pinus echinata, n =15) and eastern red cedar (Juniperus virginiana, n = 4); all in areas characterized by open understory. Landscape-scale habitat characteristics were obtained through GIS analysis of paired roost and random sites. We modeled roost site selection using conditional logistic regressions with matched-pairs case-control sampling, in relation to roost tree type (conifer/deciduous), mean elevation, and mean aspect. Results suggested saw-whet owls selected roost sites in coniferous trees in areas with southwesterly mean aspect values (201.4° ± 18.2°). The abundance of pine and cedar could provide optimal wintering habitat in the Ozark Highlands, a region not previously believed to be part of the saw-whet owl's winter range. We recommend further study of movement ecology and seasonal habitat use to determine the full extent of the species' winter range.

History and current status of the Inca Dove (Columbina inca) in Arkansas

Ragupathy Kannan - University of Arkansas--Fort Smith

The Inca Dove (INDO) is the smallest of the 4 species of doves in Arkansas. It was first recorded in Arkansas on October 26, 1968, in Saratoga (Howard Co.), by Mr. and Mrs. Ira McJenkins. Published range maps for this species indicate that it occurs as far south as Costa Rica and north as the southern United States bordering Mexico. However, there are many records of INDOs occurring outside this range, including Arkansas. This poster gives an account of the history of INDO's expansion outside its known range, within Arkansas. We used three citizen science publicly available databases, eBird, AR-Birds and Christmas Bird Counts to compile all known sightings of INDOs in Arkansas, and to get quantitative insights on the species' status in Arkansas. We documented over 300 reports. Now that the species seems well established and breeding here, we conclude that the range maps for INDOs need to be updated to include parts of Arkansas.

Thermal ecology of prairie lizards in the Arkansas River Valley

Chris Kellner - Arkansas Tech University

I was Kim Smith's first PhD student and I worked on the famous "Cicada Project". Although my dissertation and most of my career has focused on avian ecology, I will present a summary of recent work on prairie lizards (Sceloporus consobrinus). I compared activity periods, morphology, and survival of lizards in open rocky habitats to lizards in forested sites. Rocky sites heat up faster and reach a higher maximum temperatures than do forested sites. Based on many similar studies, I expected lizards in rocky sites to have shorter daily activity periods, be smaller, and survive better than lizards in forested sites. Activity patterns conformed to expectations; lizards in open habitats were inactive during the late afternoon in late-spring and summer. At mid-day, temperatures in rocky habitats are lethal for S. consobrinus during late spring and summer whereas lizards in forested habitats were active throughout the day. Consequently, lizards in rocky versus forested habitats should be smaller and live longer because they spend less time exposed to predators. Mean snout-vent length of lizards differed by only 0.95 mm (z=0.87, p=0.38). I also found that body temperatures of lizards in the two habitats were similar (~32o - 35o C). In 2017, my students and I recaptured 49 of 356 (0.137) lizards that were captured in 2016. The proportion of recaptures was similar in rocky (0.15) and forested (0.12) sites which was again puzzling. I speculated that lizards might move freely between the two thermal environments and are not exposed to a consistent temperature difference. A graduate student and I placed transmitters on lizards in the two habitats and we have found no evidence of movement from rocky sites to forested sites when sites are isolated by open water and paved roads.

Drivers of Global Forest Loss and What it Means for Arkansas

Christy Slay – The Sustainability Consortium
(Co-Author: F.E. Follett)

Forest loss is being driven by various factors, including commodity production, forestry, agriculture, wildfire, and urbanization. We used high-resolution Google Earth imagery to map and classify global forest loss since 2001. Just over a quarter of global forest loss is due to deforestation through permanent land use change for the production of commodities, including beef, soy, palm oil, and wood fiber. Despite regional differences and efforts by governments, conservationists, and corporations to stem the losses, the overall rate of commodity-driven deforestation has not declined since 2001. Leveraging our methodology, we further analyzed the connection of biofuel crops and deforestation and those results directly influenced the European Commission's recent decision to ban palm oil as biofuel. More locally, we analyzed the drivers of forest loss in Arkansas. We also analyzed global supply chains in both the agriculture and forestry sectors connecting to global imports of grain for animal feed, and exports of pulp and wood. Our results show forest loss in Arkansas is dominated by forestry and has expanding areas of deforestation due to urbanization. We also found that Arkansas is reliant on commodities that may have origins in countries where commodity-driven deforestation is high. Arkansas's reliance on and connection to commodity-driven deforestation in other geographies, as well as land use within the state is important for resiliency planning.

Recent studies on the behavioral responses of Arkansas wildlife to anthropogenic noise

Maureen McClung - Hendrix College

Research on the impacts of anthropogenic noise on wildlife has been on the rise since the late 1990s, however there has been a notable spike in the number of papers published on this topic since 2010. Obvious gaps still exist in our understanding of how anthropogenic noise influences wildlife in terms of variables such as habitat selection and use, reproductive behavior and success, and mortality. Recent studies from my lab attempt to shed light on some of these questions, and the results corroborate other research that suggests the response to noise, and the implications for ecosystem dynamics, are variable across taxa. We have found evidence that birds, but not fish or bees, appear disturbed by certain anthropogenic noise sources. While work still needs to be done on parsing out the impacts of noise on various aspects of animal life, perhaps the more immediate focus should shift to determining thresholds for disturbance so that recommendations can be made for limiting anthropogenic noise in habitats where sensitive taxa reside. The literature strongly indicates noise can be detrimental to certain wildlife. Now is the time to begin creating solutions to mitigate this type of disturbance.

Ecology and Organismal Biology IV (Saturday, Session 3)

Room: DW Reynolds 10

Long-tailed weasel (Mustela frenata) status and distribution survey in Arkansas

Blake Sasse - Arkansas Game and Fish Commission

(Co-Authors: SD Johnson (Tennessee Tech University), and RE Kissell Jr. (Tennessee Tech University)

Long-tailed weasels (Mustela frenata) have one of the widest geologic and ecologic ranges of mustelids in the western hemisphere and historically, were distributed across a majority of the American continents. However, knowledge of status and distribution at the regional scale and within Arkansas is lacking and conservation of M. frenata would benefit from an increased understanding of the species and its distribution at the regional scale. The study was conducted on public lands across Arkansas in multiple ecoregions. Twenty sampling points, five in each physiographic region, were randomly selected as survey sites for each year of sampling and at each sampling point 14 stations were established. Data collection occurred from 8 March to 11 June 2015, and from 24 February to 8 May 2016. A total of 14 mammalian species were detected in 2015 and 18 species were detected in 2016. Of the 35 sites sampled, none resulted in long-tailed weasel detections. In addition, intensive surveys were conducted on the Camp Robinson Special Use Area and Stone Prairie Wildlife Management Area in 2017 and a total of 1,606 trap days were surveyed for both sites with 49,945 images of 8,324 events were taken. Only one long-tailed weasel was captured by a camera; that image was captured 21 days after the site was established. The overall success rate, based on the number of events, was 0.002%. No evidence of long-tailed weasels was observed using track plates or hair traps. Previously used methods for surveying long-tailed weasels were insufficient for detection of the species in Arkansas over the time frame that stations were deployed and additional research on effective survey methods is needed.

New Host and Distributional Records for Helminth Parasites (Trematoda, Cestoda, Nematoda) of Arkansas Reptiles (Testudines, Ophidia)

Chris McAllister – Eastern OK St. College

(Co-Authors: C.R. Bursey (Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, PA 16146); T.J. Fayton (Lamar Fish Health Center, U.S. Fish and Wildlife Service, 400 Washington Avenue, Lamar, PA 16848); H.W. Robison (9717 Wild Mountain Drive, Sherwood, AR 72120); V. V. Tkach (Department of Biology, University of North Dakota, Grand Forks, ND 58202))

Between June 2013 and April 2017, 5 species/subspecies of turtles, including Chelydra serpentina serpentina, Kinosternon subrubrum hippocrepis, Pseudemys concinna, Sternotherus carinatus and S. odoratus, as well as 6 species/subspecies of snakes, including Agkistrodon piscivorus leucostoma, Diadophis punctatus arnyi, Heterodon platirhinos, Liodytes rigida sinicola, Nerodia sipedon pleuralis, and Thamnophis proximus proximus from various sites in 7 counties of Arkansas were examined for endoparasites. Found were a monogenean (Polystomoidella oblongum), 4 digeneans (Auridistomum chelydrae, Renifer aniarum, R. ellipticus and Telorchis corti), 3 tapeworms (Ophiotaenia marenzelleri, O. perspicua and Testudotaenia testudo), and 6 nematodes (Falcaustra affinis, F. wardi, Serpinema trispinosum, Spiroxys sp., S. contortus, and Serpentirhabdias eustreptos). We document several new host and distributional records for these parasites from some reptiles of the state.

Parasites (Apicomplexa, Trematoda, Nematoda, Phthiraptera) of Two Arkansas Raptors (Falconiformes, Strigiformes: Strigidae)

Chris McAllister – Eastern OK St. College

(Co-Authors: L.A. Durden (Department of Biology, Georgia Southern University, Statesboro, GA 30458); C.R. Bursey (Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, PA 16146); J.A. Hnida (Department of Microbiology and Immunology, Midwestern University, Glendale, AZ 85308); V.V. Tkach and T.J. Ackatz (Department of Biology, University of North Dakota, Grand Forks, ND 58202))

Nothing is known about the coccidian parasites of Arkansas raptors and very little is known about the helminth parasites of hawks and owls of the state. We had the opportunity to salvage 2 road-killed raptors, a red-shoulder hawk (Buteo lineatus) and a great horned owl (Bubo virginianus virginianus) from the state and examine them for ecto- and endoparasites. Found were chewing lice (Degeeriella fulva) and a nematode (Porrocaecum angusticolle) on/in B. lineatus, and a coccidian (Eimeria bubonis), 3 digenean trematodes (Echinoparyphium sp., Strigea elegans, and Neodiplostomum americanus), and a nematode egg (Capillaria sp.) from B. virginianus. We document 6 new distributional records as well as a new host record for these parasites.

Occurrence of the Sinus Nematode Skrjabingylus sp. (Nematoda: Metastrongyloidea) Inferred from Nasal Lesions in Arkansas Mustelidae and Mephitidae

Renn Tumlison – Henderson State University
(Co-Author: T. L. Tumlison (367 Mt. Zion Rd., Arkadelphia, AR 71923))

Nasal nematodes of the genus Skrjabingylus occur in the mammalian families Mustelidae and Mephitidae, and have been found from Canada to Costa Rica. Ingestion of infected snails, frogs, snakes, or mice can lead to infection of these mammalian hosts. Infection often causes pathology to bones in the sinus region, which may lead to discoloration, enlargement, and fenestrations of the bone. Examination of museum specimens for bone lesions or other evidence of infection has been used to evidence prior infection, but prevalence and intensity cannot be interpreted without actually recovering the parasite. We examined Mustelids and Mephitids in collections of mammals housed at Arkansas State University (ASU), Henderson State University (HSU), and the University of Arkansas at Little Rock (UALR) to evaluate the possible occurrence of nasal nematodes in Arkansas mammals. Evidence of infection was found in skulls of the striped skunk (Mephitis mephitis), spotted skunk (Spilogale putorius), mink (Neovison vison), weasel (Mustela frenata), and North American river otter (Lontra canadensis) from Arkansas. We report for the first time evidence of the presence and distribution of Skrjabingylus sp.infecting mammals in Arkansas.

Vertebrate Natural History Notes from Arkansas, 2019

Renn Tumlison - Henderson State University
(Co-Authors: C.T. McAllister (Division of Science and Mathematics, Eastern Oklahoma State College, Idabel, OK 74745); H.W. Robison (9717 Wild Mountain Drive, Sherwood, AR 72120); M.B. Connior (Life Sciences, Northwest Arkansas Community College, One College Drive, Bentonville, AR 72712); D.B. Sasse (Arkansas Game and Fish Commission, 213A Highway 89 South, Mayflower, AR 72106); P. R. Port (Arkansas Game and Fish Commission, 201 East 5th Street, Mountain Home, AR 72653))

Important observations of natural history often go unreported because they are not part of larger studies, but small details can provide insights that lead to interesting questions about ecological relationships or environmental change. We have compiled recent important observations of distribution, deformities, foods, parasites, and reproduction of various vertebrates. Included are a new record of Lake Sturgeon (Acipenser fulvescens), a new size record of mudpuppy (Necturus louisianensis), and a second observation of bilateral gynandromorphism in a Northern Cardinal (Cardinalis cardinalis). These unique observations continue to grow knowledge of vertebrate biology in Arkansas.

New Angiosperm Records from Arkansas

Jonathan Hardage - Henderson State University
(Co-Authors: Keenan Serviss (Arkadelphia, AR); Brook Olsen (Henderson State University); Brett Serviss (Henderson State University); and James Peck (Cedar Key, FL))

In 2017 and 2018, we documented 15 species of non-native angiosperms for a first or second occurrence in the Arkansas flora. Ten of these species are discussed here. Clerodendrum trichotomum Thunb., Euonymus japonicus Thunb., Jasminum nudiflorum Lindl., Lycoris squamigera Maxim., Pyracantha fortuneana (Maxim.) H.L. Li, and Ternstroemia gymnanthera (Wight and Arnolt) Beddome are reported as new to the flora of Arkansas. These records represent the first voucher specimen-based documentation of these species outside of cultivation in the state. Clerodendrum, Jasminum, and Ternstroemia are the first documented occurrences of these genera in the state's flora outside of cultivation. Colocasia esculenta (L.) Schott, Hydrangea macrophylla (Thunb.) Ser., Kerria japonica (L.) DC., and Malvaviscus arboreus Dill. ex Cav. var. drummondii (Torr. and Gray) Schery are documented for only their second occurrences in the state.

Computer Science (Saturday, Session 3)

Room: DW Reynolds 11

Analyzing the adoption rate of Local Variable Type Inference in open source Java 10 projects

Clayton Liddell - Arkansas State University, Undergraduate student
(Co-Author: Donghoon Kim (Arkansas State University) (Mentor))

In the world of computer science, "efficiency and ease of use" is the name of the game. This holds true such to the point that the aim is to not only design programs that are efficient and easy to use, but also to design efficient programming languages that facilitate ease of use. Certain features, such as Type Inference, are used in programming languages to improve ease of use; however, they often come at a cost. Type Inference is a feature in programming languages that allows for the type of a variable to be determined without it being specified. The development sector is rife with debate surrounding Type Inference in modern day programming languages and, more specifically, concerning whether the costs associated with Type Inference outweigh the benefits. In this study, the popularity of Type Inference was evaluated through analysis of popular open source Java projects. The study will show that Type Inference in open source Java 10 projects has not received widespread adoption. Additionally, potential reasons for this lack of usage will be discussed concerning the information gathered from the performed empirical study, which involved statically analyzing 6 popular open source Java 10 projects.

How can you become a software engineer in prestigious companies?

Donghoon Kim - Arkansas State University

This presentation will present an overview of how to become a software engineer. We introduce how students prepare their career path as a software engineer and interview process and how professors advise their students for their successful future career. We have observed that both undergraduate and graduate computer science students have only a vague knowledge about how to get a job in software companies (e.g., Google, Microsoft, and Facebook) or computer system companies (e.g., Intel, Apple, and Qualcomm). In addition, they may not know what kinds of subjects or classes should be taken and studied to prepare their career path as a software engineer. We have recognized that Arkansas students may not receive the same relative exposure to high-tech environments like Silicon Valley which is the home to many of the world largest high-tech corporations and Research Triangle Park (RTP) in North Carolina which is one of the largest research parks in the world. On the other hand, we have found that even top universities (e.g., MIT) open a workshop under the name of Hacking a Google Interview. They focus on computer science topics that frequently come up in programming interviews based on recent interview questions which covers time complexity, hash tables, binary search trees and some other things. However, there is no need to fear if we are well prepared for our future career as a software engineer. The lecturer for this tutorial was a software engineer at Samsung, SAS Institute and IBM for several years. Also, the lecturer has a wealth of experience in software engineer interviews. By his many mistakes and failure, the lecturer has learned that there are several subjects that students should focus on to become a software engineer. Thus, he wants to share his experience with practical recent interview questions for software engineer jobs.

Throughout this presentation, we expect that the audience is able to get a concrete idea on how to prepare and develop for their career as a software engineer after or during college.

Automatic Customization of Web Pages to Enhance User Experience

Zezhang Lin - UALR, Undergraduate student
(Co-Author: Dr. Chia-Chu Chiang(UALR))

Company employees spend a significant amount of their time at work searching for information, processes, and procedures on the tasks to which they are assigned. This search for document-driven information, processes, and procedures is sometimes repeated monthly, weekly, daily, and even hourly and has forced some companies to leverage staff to manage and maintain this workflow which is not only costly but introduces the potential for human error. Using modern technology, this workflow can not only be automated but also customized to maximize efficiency and reduce cost without degrading user experience.

In this research, document-driven workflow is defined as a repeatable pattern of business activities enabled by the systematic organization of documents into a process that provides services to a client. A repeatable pattern is defined as a recognizable and repeatable sequence of web pages with the associated documents. Once a workflow is recognized, it can be automated so that all relevant information, processes, and procedures will be automatically presented the next time a user begins that workflow. How the information, processes, and procedures can then be customized according to user preferences for subsequent use.

To accomplish this, machine learning using a neural network will be used to recognize document-driven workflows and present all relevant information, processes, and procedures to the user in a timely manner. The entire process will be implemented in Python.

Cyber Security Awareness Training Program for University Students

Tanim Sardar - Arkansas Tech University, Graduate student; Co-Presenter: **Luay A. Wahsheh** - Arkansas Tech University

Humans are often the weakest link in the cyber security chain. Cyber criminals are working faster than users can defend themselves. In this research work, we investigate effective counter-measures to help users stay secure and not be vulnerable to cyber threats. We have designed a training program that introduces university students to several types of cyber attacks. The anticipation is that the participants would have more knowledge of not only the types of attacks by which they could be targeted, but also how to defend themselves against these attacks. The program is not designed to target one specific major and classification, but rather a variety of majors and classifications. The program includes presentations and hands-on exercises that attract the participant's attention. In order to assess whether the participants retained the presented material, we use a game dubbed "Name that Attack" where the participants

are given a scenario and they have to name what type of common cyber attack it is. In addition, on the next day following the training, the participants would be sent a phishing attack via e-mail to see if they would fall victims to this type of attack. Our research work is in progress; our future directions include implementing the training program in a university setting. We believe that cyber attacks that threaten personal and organizational information can be prevented by creating a cyber security awareness culture. Our research work is a step towards achieving this goal.

Employing Ensemble Learning for the Categorization of Android Malware Types

Brett Baker - Southern Arkansas University, Undergraduate student
(Co-Author: Rami Alroobi (Southern Arkansas University))

With the high popularity of Android devices and the broad spectrum of functionalities that these devices provide, many users are becoming more dependent on them in performing significant portions of their everyday lives. This means that a lot of valuable information about those users is becoming more attractive for malicious attacks. This encourages malicious actors, e.g. hackers, to try to acquire this data by employing several types of malware attacks that target different aspects of the android device's data and functionalities.

Some of these attacks target user's financial information, health information, or job-related data. Other attacks aim at damaging or stopping some of the device's functions or gaining elevated access permissions on the device so that any process can be executed on that device. Therefore, it would be highly advantageous if these different types of malware activities can be categorized and labeled so that we have a better understanding about them to increase the effectiveness of the analysis and the countermeasures to these activities. In this work we try to employ Ensemble Learning, EL, to give more insights into the process of categorizing different android malware types and assess the EL performance against some other machine learning classification techniques.

Engineering (Saturday, Session 3)

Room: DW Reynolds 13

Cadmium Sulfide-buffered PV Systems: Assessing the Environmental, Health, and Economic Impacts

Rajesh Sharma - Arkansas State University
(Co-Author: Maqsood Ali Mughal, Electrical and Computer Engineering Department, Worcester Polytechnic Institute, Worcester, MA 01609, USA)

As the world's population continues to grow, it is expected that global energy demand will also continue to rise in the future. This growth in energy demand coupled with increases awareness on carbon emissions and global climate change associated with the use of fossil fuels has accelerated the demand for various renewable energy technologies, including photovoltaics (PV). PV technology is currently undergoing a transformation with development of several thin film technologies. These new thin film solar cells offer a number of advantages over Silicon based systems such as higher efficiency and reduction in materials use. Cadmium Sulfide (CdS) is a widely used buffer material in thin film photovoltaics, which has a significant advantage over other alternate buffer materials in terms of efficiency and low-cost of production for large-area processing of thin films, but the potential environmental risks associated with the use of cadmium are of concern. In this paper, we assess and monetize environmental, health, and socio-economic externalities associated with the use of this material. We quantified the environmental, human health, and socio-economic impacts of cadmium emissions from CdS-buffered PV system. In addition, this paper provides a comprehensive outlook of the past, current, and future global market growth rate of thin film photovoltaic technologies.

Electromagnetic tunability of charged particles in altered dielectric systems

Tamal Sarkar - Arkansas State University, Graduate student
(Co-Author: Brandon A. Kemp, PhD (Arkansas State University))

Interaction between electromagnetic field and binary charged particles in altered dielectric systems has received interest in recent research endeavors in the field of optical and electromagnetic manipulation. Micro-level interactive forces among charged particles create electrostatic stability in the particle assembly in altered dielectric system which leads to a lattice structure that constitutes spacing. With an applied field, the assembly is re-positioned to a stable condition which is simulated with the consideration of modification of the assembly of a non-touching lattice. The positional tunability of the charged particles of three and two particle assemblies provides a path to tunable photonic structures.

Experimental Investigation of Counter-Flow Heat Exchangers Exposed to Ambient Heat Leaks

Lionel Hewavitharana - Southern Arkansas University
(Co-Author: Kenneth Escudero (Southern Arkansas University))

Theoretical models have been developed to study the effect of ambient heat leaks to heat exchangers. These models have been influenced by the performance degradation of cryogenic heat exchangers subjected to external heat leaks. In cryogenic heat exchangers, there exists a substantial temperature difference between the heat exchanger fluids and the ambience, allowing heat leaks even under insulated conditions. Theoretical models reported in the literature predict substantial degradation of heat exchanger effectiveness. However, sufficient experimental studies that validate theoretical predictions are rare. The Present study examines the performance of small counter-flow heat exchangers completely exposed to ambience with moderate temperature difference between the heat exchanger fluids and the ambience. Experimental results show that substantial performance degradation is possible with heat exchanger effectiveness dropping to less than 10 percent.

Design and Development of a Vision based Lane Keeping System

Kaiman Zeng - Arkansas Tech University
(Co-Authors: Michael Langley; Nasser Alshahrani)

In modern vehicle systems, lane keeping assist or lane departure warning becomes an important feature, which aims to minimize accidents of collisions due to driver error, distractions and drowsiness. In general, there are vision based and GPS based lane keeping systems. The vision based approaches gain great attention due to its compatibility to current infrastructures and its adaptation to road constructions and changes. In this project, we design and develop a lane keeping system based on advanced image processing techniques. A microcomputer Raspberry Pi and the Pi camera are mounted on a previously developed RC car, in which the car movement and steering are implemented by adjusting the speed of two DC motors. The lane keeping assist is achieved by a real-time lane detection from the forward facing camera using Canny edge detection, Hough transfer and other image processing techniques. Our working processes of design, hardware configurations, algorithms, and testing results will be discussed in the presentation.

Moore's law and space exploration: new insights and next steps

Michael Howell - University of Arkansas at Little Rock, Graduate student
(Co-Authors: Venkat Kodali (CARTI); Richard Segall (Arkansas State University); Hyacinthe Aboudja (Oklahoma City University); Daniel Berleant (University of Arkansas at Little Rock))

Understanding how technology changes over time is important for Industry, scientists, and government officials. Empirical examination of the capability of technologies across various domains reveals that they often progress at an exponential rate. In addition, mathematical models of technological development have proven successful in deepening its understanding. One area that has not demonstrated any exponential trends, until recently, has been space travel.

The paper will also present plots illustrating visualization of data that we have created using available data for the mean lifespan of all satellites whose lifespan ended in a given year. Our study indicate that both the Wright's Law and Moore's Law regression show a general upward, accelerating trajectory. Wright's Law displays some bumpiness which is to be expected since volume produced is the dependent variable and not the passage of time.

For the Moore's Law regression we have a doubling time of approximately 15 years. For Wright's Law we can see an approximate doubling of lifespan with every doubling of accumulated production. When comparing the Root Mean Square (RMS) error of the Moore and Wright regressions we find that initially it appears that Wright's law has the better fit to our data.

In this paper we present more visualization of evidence that such a trend does exist with regards to satellite lifespan. Our findings indicate that when viewed in terms of Moore's law satellite lifespan doubles every 15 years. When modeled using experience curves, lifespan doubles with every doubling of accumulated launches. We conclude by presenting a conundrum generated by the use of Moore's law that is the subject of ongoing research.

Poster Presentation Abstracts

Biology - General Biology and Ecology

01 - Like Moths to a Flame

Erin Guerra - Arkansas Tech University, Undergraduate student
(Co-Author: Jorista Garrie (Arkansas Tech University))

Fire plays an important role in natural systems by limiting vegetative competition, consuming litter and debris, cycling nutrients into the soil, controlling insect pests, and enabling fire-dependent species. Fire results in a cycle of initial insect population decreases followed by recovery and growth, in which insect populations exceed pre-fire numbers. Our study sought to examine if this fire-induced cycle makes prescribed burned sites more suitable for moths. We collected moths from 20 burned and 20 unburned sites in the Ozarks of Arkansas to investigate differences in moth assemblages between burned or unburned sites. Moths were collected during early summer (April to July) and late summer (August to November) of 2017. We compared biomass and total counts of five representative moth species between burned and unburned sites, using t-tests. We also used regression analyses to look at the effect of basal area, number of snags, altitude, and canopy cover on total biomass and moth counts. Our results showed no significant difference in biomass ($p = 0.96$), or number of representative species between burned and non-burned sites. However, there was significantly higher biomass ($p = 0.002$) of moths in the early summer. We found no effect of burn status and any of the habitat-type variables on biomass of moths, but there was a significant greater number of moths at sites that had been burned ($p < 0.0001$), and at sites with higher basal area ($p < 0.0001$). The seemingly lack of effect of fire on moth biomass, could point to prescribed burns in the Ozarks being mild enough to not kill all moths, but harsh enough to kill off others. The greater abundance of moths in early summer is likely because of moth life cycles, warmer temperatures increasing flight activity, and the greater prevalence of food sources, during this time.

02 - Notes on the Natural History of Selected Invertebrates

Matt Connior - NWACC
(Co-Authors: R Tumlison (Henderson State University); HW Robison (Retired))

The invertebrate fauna are a large component of ecosystem. Yet, invertebrate biologists are few and scattered in Arkansas; thus, the invertebrate fauna of much of the state is poorly known. Herein we document new records of distribution and provide notes on the natural history of selected invertebrates from Arkansas. Of note, we provide records on planarians, crayfish, centipedes, and spiders.

03 - A dobsonfly (Megaloptera: Corydalidae, Corydalus cornutus) from Arkansas with aberrant mandibles

David Bowles - National Park Service

A male dobsonfly with effeminate mandibles is presented. This condition is thought to be due to gynandromorphism or intersex condition. The mechanism for this trait remains undetermined.

04 - The roles for specific chromatin environments in promoting dissociation of the FACT complex from 3' ends of genes following transcription.

JunHyeuk Shin - Hendrix College, Undergraduate student
(Co-Authors: Sydney Ozersky, Graham Harris, and Andrea A. Duina)

Transcription is first major process of gene expression where DNA segment is transcribed into a mRNA. In Eukaryotic cells, nucleosomes are present throughout the genome, including along the transcribed units of genes, which can disturb the transcription elongation. A histone chaperone, the Facilitates Chromatin Transaction (FACT) complex, composed of the Spt16 and Pob3 proteins in yeast, can promote transcription elongation by facilitating the disassembling and assembling nucleosomes while moving toward the 3' end of genes along with RNA Polymerase II. In previous studies from our laboratory using the Saccharomyces cerevisiae model system, we identified a region on the side of the nucleosome, which we refer to as the ISGI (Influences Spt16-Gene Interactions) region, that is required for proper dissociation of FACT from the 3' ends of transcribed genes. To further investigate the mechanisms that control FACT dissociation from genes, we are carrying out studies to determine possible roles for specific chromatin environments in this process. As a way to assess if specific chromatin environments are required for proper Spt16 dissociation from DNA, we are carrying out two mass spec-based experiments to define the chromatin environments (i.e., collection of all proteins and histone modifications) at 3' ends of genes in wild-type and ISGI-mutant cells –difference in chromatin environments between these cells may point to key proteins or histone modifications that regulate FACT dissociation from genes. This study will provide a more complete understanding of the factors that promote Spt16 dissociation from genes following transcription.

05 - History of Spring River Crayfish (Faxonius roberti) collections in the Strawberry River, Arkansas

Brian Wagner - AR Game & Fish Comm.

The Spring River Crayfish (Faxonius roberti) was recently distinguished from the Coldwater Crayfish (Faxonius eupunctus), encompassing its range in the Spring and Strawberry river basins. It was first detected in the Strawberry basin in a tributary in 1972 and the main river in 1974 - neither have yielded specimens in more recent sampling. In 2006 it was found at a low water crossing 17.6 km downstream. A 2010-11 study only collected 4 individuals from one site in the basin using quantitative kick-seining, suggesting lower abundance in the Strawberry. In 2011 snorkeling collections extended the range downstream 14.3 km from the 2006 collection. In 2016 efforts began to better understand of the species' range in this river by kayaking between access points and searching selected riffles. This documented 8 additional sites, including one 9 km upstream of the 2006 site. In 2017 efforts continued above and below the area surveyed in 2016. Upstream collections searched an additional 2 km above the 1974 collection, but did not locate any occupied sites. Downstream searches extended the occupied stream reach by 17.1 km. Combined, this documents that F. roberti currently occupies at minimum 15 sites over a 40.4 km section of the Strawberry River.

06 - De novo development of microsatellite markers for genetic characterization of house finches

Edgar Sanchez - Arkansas Tech University. Undergraduate student
(Co-Authors: J. Dylan Maddox (Field Museum of Natural History); Douglas G. Barron (Arkansas Tech University))

Microsatellites are short tandem repeats (e.g. TAGATAGA) of base pairs in a species' genome. High mutation rates in these regions produce variation in the number of repeats across individuals that can be utilized to study patterns of population- and landscape-level genetics and to determine parentage genetically. In this project our objective was to develop microsatellite markers for the House Finch, Haemorhous mexicanus. This species has become one of the most well-studied species of songbirds due to its unique geographical, evolutionary, and epidemiological history. Using mist-nets we captured birds on the Arkansas Tech University campus and collected blood samples to obtain genomic DNA. Samples were processed in The Field Museum's Pritzker Laboratory for Molecular Systematics and Evolution, where we fragmented genomic DNA and isolated fragments that contained potential microsatellites using specially designed biotin labelled probes. These DNA fragments were transformed into competent E. coli cells which were then PCR-amplified and Sanger sequenced. After sequencing approximately 500 E. coli colonies, we designed primers to amplify candidate microsatellite loci in 17 different House Finch individuals and identified 15 highly variable microsatellites suitable to determine parentage genetically. This finalized set of microsatellites will be used to genotype all captured individuals in our study so we may evaluate the relationship between adult characteristics and reproductive success.

07 - Effect of Sex on Osmoregulation of the Ohio Shrimp, Macrobrachium ohione

Drew Castleberry - University of Central Arkansas. Undergraduate student
(Co-Authors: Matthew E. Gifford (Department of Biology, University of Central Arkansas); S. Reid Adams (Deptartment of Biology, University of Central Arkansas))

The osmotic adaption capabilities of Ohio shrimp, Macrobrachium ohione, collected approximately 892 river km upstream from the Mississippi River estuary, were studied. Similar to the widely studied Macrobrachium rosenbergii and Macrobrachium acanthurus, M. ohione larvae require a brackish environment to continue development to adulthood. The question of whether female M. ohione migrate from inland locations within the Mississippi River to downstream estuarine environments to facilitate larval development was

explored via osmotic capabilities in this study. Females were compared to males to explore if adult female M. ohione migrate back downstream to brackish environments, then they should have a different osmoregulatory strategy relative to adult males that do not migrate. Shrimp were captured using wire mesh traps during the summer of 2018 and habituated to the laboratory environment for ~19 weeks. Shrimp were then acclimated over 12 days to three salinity treatments: 0 ppt, 10 ppt, and 20 ppt. Osmolality of shrimp hemolymph was measured with a water vapor osmometer. As a species, M. ohione exhibited hyperosmotic regulation at each of the three salinities. Males osmoregulated higher than females at 0 ppt and 20 ppt, while females osmoregulated higher at 10 ppt, similar in pattern to M. acanthurus. The osmoregulation strategy exhibited by female M. ohione reflects what might be expected, based on comparisons with other shrimp species, of individuals making a downstream migration to brackish environments.

08 – A Tale of Two Sylamores: Understanding relationships among landuse, nutrients, and aquatic community assemblages across a subsidy-stress gradient

Brianna Trejo - University of Central Arkansas, Graduate student

Co-Authors: D.M. Braund (University of Central Arkansas); A.J. Feltmann (University of Central Arkansas); G.B. Gavrielides (University of Central Arkansas); K.L. Lang (University of Central Arkansas); J.R. Main (University of Central Arkansas); A.K. Mogilevski (University of Central Arkansas); J.H. Mosbey (University of Central Arkansas); R.L. Relic (University of Central Arkansas); C.R. Rezac (University of Central Arkansas); G.L. Adams (University of Central Arkansas); S.R. Adams (University of Central Arkansas))

Agricultural land use is known to degrade aquatic systems with high inputs of nutrients, sediments, and pesticides. Increased nutrients can lead to increased algal growth and thus possible hypoxic conditions in slow moving water, while increased sediment loads have been shown to obstruct light and reduce substrate stability. These conditions negatively impact primary producers, macroinvertebrates, and fish. However, small-scale changes in land use can subsidize an aquatic ecosystem instead, where an increase in nutrients allows nutrient-limited biota to flourish, and minor increases in sedimentation may help support populations of collector-filterers. The stimulation in performance caused by small disturbances is part of the subsidy-stress gradient, where increasing perturbation subsidizes an ecosystem until a certain threshold is reached, at which a decline in performance and increased variability starts to occur. The North and South Sylamore watersheds in north Arkansas provide a useful template to investigate the subsidy-stress gradient in relation to land use. North Sylamore flows through the Ozark National Forest and has a heavily forested catchment, while South Sylamore flows through mostly private land, some of which is pasture (23%). Physicochemical, macroinvertebrate, and fish data were collected from multiple sites within each watershed to determine if South Sylamore is exhibiting a response to pasture/agriculture characteristic of a subsidy-stress gradient. Sites within South Sylamore had significantly higher nitrate levels and larger macroinvertebrate populations dominated by collector-filterers, suggesting South Sylamore may be subsidized by the surrounding pastoral lands. However, South Sylamore also had a significantly lower number of intolerant macroinvertebrate taxa, suggesting South Sylamore is experiencing stress as well. Habitat quality of South Sylamore could be improved by restoration of trees within the riparian zone. Monitoring aquatic systems for subsidy-stress responses can inform restoration/management decisions and guide intervention prior to watersheds and aquatic communities becoming overly stressed.

09 – Effects of Recreational Activities on Mussels and the Asiatic Clam in the Lower Saline River

Makayla Nguyen and Katie Pike – UAM, Undergraduate students

(Co-Author: Edmond J. Bacon (UAM))

Random quantitative samples were collected along six transects in the lower Saline River at Ozment Bluff to determine the impacts of recreational activities on mussels and the Asiatic clam. Nine taxa were identified at the collection sites, and the Asiatic clam Corbicula fluminea comprised 57 % of all animals collected. The mean density at the ATV crossing was 11.4 per square meter compared to 151.8 per square meter at the transects 6 to 10 m above. Densities above the ATV crossing were significantly higher based on ANOVA analyses ($P < 0.05$).

10 - Plains Spotted Skunk Pelt Purchase Trends in the Ozarks and Ouachitas, 1943-1990

Blake Sasse - Arkansas Game and Fish Commission

The plains spotted skunk was previously considered a common animal across much of the central United States. However, this subspecies has undergone a severe population decline and the current rarity of this subspecies has led to it being petitioned for protection under the Endangered Species Act. Pelt purchase records from Arkansas and Missouri were utilized to examine trends in the Ozark and Ouachita Mountains. Purchases were relatively high in the 1940s but began a steep decline in the Missouri Ozarks in the mid-1940s and in the Arkansas Ozarks and Ouachitas in the early 1950s. Purchases in the Missouri Ozarks continued to decline slowly, however the Arkansas Ozarks saw a modest recovery in the early 1960s and in the mid-1970s nearly returned to 1940s harvest levels. Lacking any other data upon which to assess spotted skunk population trends, this suggests that populations in the Ozark and Ouachita mountains did not decline from the 1940s through the 1970s as they did elsewhere and that this species may have always been rare in the region.

11 - Photographic Record of a Greater Roadrunner (Geococcyx californianus) from Drew County, Arkansas.

John Hunt - University of Arkansas at Monticello

(Co-Author: Christopher G. Sims (University of Arkansas at Monticello))

The geographic range of the greater roadrunner (Geococcyx californianus) extends from central Mexico to north-central California in the west and to western and central Arkansas in the east. Roadrunners were first reported from Arkansas in 1936, and have gradually extended their range to the eastern part of the state. Herein we provide the first published record and photograph of a greater roadrunner from Drew County, Arkansas.

12 - Behavioral response of Carolina Wrens (Thryothorus ludovicianus) to songs altered to escape masking effects of anthropogenic noise

Tristian Wiles - Hendrix College, Undergraduate student
(Co-Authors: Spencer M. Skaggs (Hendrix College); Maureen R. McClung (Hendrix College))

The recent boom in unconventional gas drilling in the U.S. has generated environmental concerns, including the impacts of noise pollution from compressor stations. Man-made noise affects various aspects of bird behavior, including their songs. Previous work by the authors found that Carolina Wrens (Thryothorus ludovicianus) sang at a higher minimum frequency near compressor stations compared to quieter well pads, but it is unknown whether these altered songs elicit different behaviors from the receivers. To determine if the wrens respond atypically to altered songs, we exposed four male birds to auditory playback of normal songs and altered songs under different noise conditions (simulated noise or no noise) and analyzed their behaviors in response to the playback. A song speaker and noise speaker were set up within each bird's territory and four trials were conducted with the following treatments: altered song/noise, altered song/no noise, unaltered song/noise, and unaltered song/no noise. Each trial was divided into three 10-minute phases: pre-, during, and post-playback. Using ad libitum sampling, three observers recorded the number of songs, number of flights, and closest approach to song speaker. The wrens tended to respond to playback by singing less, flying more, and approaching the speaker. Once the stimulus ended, birds often picked up singing again and remained closer to the speaker. However, statistical tests indicated that phase of the trial was more influential than treatment. The strongest responses were seen in the unaltered-noisy treatment and, to a lesser degree, by the altered-quiet treatment. These results are unexpected since higher frequency songs are considered an adaptive response to noise because they are more detectable against low-frequency noise. It appears Carolina Wrens still hear signals through the background noise of compressors regardless of differences in minimum frequency. Though the signals may change, they are still functional in communicating presence.

13 - Songbirds alter their use of bird feeders in response to vocalization playback

Shelby Sarna - Arkansas Tech University, Undergraduate student
(Co-Authors: Robin L. Middleton (Arkansas Tech University); Douglas G. Barron (Arkansas Tech University))

Bird vocalizations transmit information that may attract or repel other individuals. Basic research aimed to identify the function of vocalizations has given rise to applications utilizing playback to attract birds to colonize new areas or repel birds from undesired locations. Comparatively less is known about how birds respond to vocalizations in the context of supplemental food; that is, do vocalizations act to advertise the presence of (attraction) or to defend (repulsion) supplemental food sources? Here we focused on the most widespread form of supplemental wildlife food, bird feeders, to test the hypothesis that birds modify their use of bird feeders based on vocalizations from nearby birds. We tested this hypothesis by comparing bird visitation rates and durations at feeders in the presence or absence of vocalization playback from a nearby speaker. The vocalizations were obtained from actively foraging individuals of six species that commonly visit bird feeders. We found that birds were equally likely to visit feeders in the presence and absence of playback, though they spent half as much time at feeders when playback was present. Birds appeared to habituate to this stimulus, as this pattern of shorter visit duration disappeared with prolonged playback. This experiment demonstrates that birds do modify their use of bird feeders based on vocalizations from nearby birds and implies that foraging vocalizations may function to repel competitors. Although further research is needed, our findings also suggest playback could be applied to repel avian pests from unwelcomed food sources such as agricultural crops and feeds.

14 - Using Radio Frequency Identification to Test the Assumptions of Optimal Foraging Theory on Wintering Birds

Hannah Adams and Sarah Roddy - Harding University, Undergraduate students
(Co-Author: Patrick J. Ruhl (Harding University))

Optimal foraging theory predicts that organisms should exhibit foraging behaviors that maximize net energetic gain. Therefore, when presented with a choice between prey items that vary in energetic currency (E) and handling time (h), organisms should select prey items that maximize the E/h ratio. We used radio frequency identification (RFID) technology to determine whether the foraging preferences of Tufted Titmice (Baeolophus bicolor) and Northern Cardinals (Cardinalis cardinalis) reflected the predictions of optimal foraging models in situ. We equipped two bird feeders with RFID readers. Whenever a bird with an RFID leg band landed on a feeder, the RFID reader recorded the bird's unique ID#, the date, and the time of the feeder visit. We placed feeders ~ 1m apart from one another to represent a simultaneous foraging decision. For a 5-day period, we recorded baseline foraging preference data at both feeders using whole sunflower seeds (in the shell). We then replaced the whole sunflower seeds in one of the feeders with sunflower kernels (without the outer shell), and collected data for another 5 days. We used Chi-Square goodness of fit tests to determine if the foraging behavior of Tufted Titmice and Northern Cardinals reflected a priori predictions of optimal foraging cost-benefit models in a situation when energetic currency is kept constant and handling time is reduced.

15 - Do phenotypic traits predict feeder use by wild birds?

Colton Barrett - Arkansas Tech University, Undergraduate student
(Co-Author: Douglas G Barron (Arkansas Tech University))

Bird feeders are one of the most popular means by which citizens interact with local wildlife, with nearly half of US households feeding birds. This vast quantity of supplemental feeding is known to impact songbird populations in both positive (higher survival) and negative (increased disease) ways. Our current understanding of the effects of supplemental bird feeding largely ignores individual variation in feeding rates, even though we know that some birds visit feeders regularly whereas others visit rarely. Because the birds which visit feeders often will be disproportionately impacted by their presence, it is critical that we develop a framework for predicting which birds will visit feeders most frequently. In this study we are tracking the use of bird feeders by individual songbirds to search for characteristics that predict high feeder use. We are accomplishing this by using a network of bird feeders equipped with radio-frequency (RFID) identification dataloggers that automatically record every visit by tagged birds. Presently we have logged more than 130,000 feeder visits by over 100 individual birds from eight species. We will compare the logged frequency of feeder visits to individual characteristics (species, sex, mass, etc.) to ascertain whether certain characteristics are correlated with feeding behavior.

Ultimately this research will provide a better understanding of which phenotypic characteristics predispose birds to increased feeder use and its associated costs and benefits.

16 - Comparison of sugar-based clearing techniques in avian embryos

Kira Gibbs - Southern Arkansas University, Undergraduate student
(Co-Author: J. Hyde (Southern Arkansas University))

There is a large variety of biological studies on organism development. However, it is difficult to observe and measure the development of fluorescently labeled tissue in thick tissue specimens or whole embryo samples. A variety of new tissue clearing techniques have been developed over the last decade to clear brain tissue. These experiments were designed to test the effectiveness of a selection of these techniques in chicken embryos. Chicken embryos have been a favorite to study in the developmental field because they are easy to maintain, access and manipulate. These experiments tested Formamide and Urea based techniques to determine how effectively they could clear embryos, how long the clearing process would take, and if they would alter the tissue or fluorescent dyes used. We used the lipophilic dye, DiI, as a fluorescent label since it is frequently used for cell fate mapping. Most newer clearing techniques rely on removing lipids from fixed tissue. However, this would also eliminate the DiI. Gentler clearing techniques that do not rely on lipid removal were selected for these experiments. We used three different techniques used including Clear(t), a Formamide based solution; RTF, a Triethylamine/Formamide based solution; and UbasM, a Meglumine/Urea based solution. Our results showed significant clearing using each method. Ultimately, the Formamide-based clearing with Clear(t) demonstrated the greatest transparency. The clearing allowed us to visualize the DiI injection site in comparison to the other methods. However, while the DiI was still visible, we were unable to directly compare cell numbers due to microscope limitations.

17 – Distribution, Habitat, and Life History Aspects of the Dwarf Crayfishes of the Genus Cambarellus (Decapoda: Cambaridae) in Arkansas

Chris McAllister – Eastern OK St. College
(Co-Author: H.W. Robison (9717 Wild Mountain Drive, Sherwood, AR 72120))

The dwarf crayfishes of the genus Cambarellus are represented in Arkansas by only 2 species: Cambarellus (Pandicambarus) puer (Hobbs) and C. (P.) shufeldtii (Faxon). Both species are quite small and uncommonly encountered in the state. Between 1972 and 2017, we made 356 crayfish collections throughout the 75 counties in Arkansas. A total of 34 collections [our collections, plus museum specimens, and those previously collected by Reimer] yielded a total of 298 specimens of C. puer and 12 collections of C. shufeldtii yielded 52 specimens of C. shufeldtiii. Herein, we document these 2 dwarf crayfishes from primarily the West Gulf Coastal Plain and Mississippi Alluvial Plain physiographic provinces of Arkansas. Cambarellus puer is documented from 24 counties while C. shufeldtii was documented from only 12 counties. With regard to conservation status, both C. puer and C. shufeldtii should be considered as "Currently Stable" due to their widespread distribution and general abundance in Arkansas.

18 - Dumortier's Liverwort, Dumortiera hirsuta (Sw.) Nees (Hepaticophyta: Marchantiales: Dumortieraceae) in Arkansas

Chris McAllister - Eastern OK St. College
(Co-Authors: H. W. Robison (9717 Wild Mountain Drive, Sherwood, AR 72120); P.G. Davison (Department of Biology, University of North Alabama, Florence, AL 35632))

Dumortier's Liverwort, Dumortiera hirsuta (Sw.) Nees is a relatively common thalloid liverwort that is widely distributed in the tropics of both hemispheres and also in the more humid and warmer regions of the temperate zones of India, Nepal, Japan, Brazil, México, Jamaica, North and South America, Europe, British Isles, New Zealand, Hawaii and Africa. In the Western Hemisphere, it ranges southward to southcentral México and further south to Argentina; it is also found in some Caribbean islands. Apparently, Branner and Coville (1891) were the first to report D. hirsuta in Arkansas when they reported specimens from the vicinity of Salado Creek near Batesville (Independence County). Since then, several researchers have reported this liverwort in the state. Here we provide a summary of vouchered collections of D. hirsuta as well as an interesting new population we discovered in the Ouachitas of the state.

19 – Cotylogaster occidentalis (Aspidogastrea: Aspidogastridae) from Freshwater Drum, Aplodinotus grunniens (Perciformes: Sciaenidae), from Northeastern Oklahoma

Chris McAllister – Eastern OK St. College
(Co-Author: A. Choudhury (Department of Natural Sciences, St. Norbert College, De Pere, WI 54115))

Freshwater Drum, Aplodinotus grunniens Rafinesque are endemic to freshwater environs of the Americas, and their distributional range extends as far north as the Hudson Bay of Canada and reaches as far south as the Usumacinta River Basin of Guatemala. In Oklahoma, A. grunniens occurs throughout the state, mainly in the larger lakes and rivers and uncommon to absent in the northwest. Freshwater Drum have been reported to harbor over 66 taxa of parasites, including protozoans, aspidogastreans, monogenes, trematodes, cestodes, nematodes, acanthocephalans, leeches, mollusks, and crustaceans. One of these parasites, an aspidogastrean, Cotylogaster occidentalis Nickerson, 1902, was originally described from A. grunniens in the Minnesota River, Minnesota. It has also been reported from A. grunniens from Iowa, Louisiana, Mississippi, Tennessee, and Lake Erie, Canada, and from freshwater mussels from Connecticut, Delaware, Florida, Iowa, Michigan, North Dakota, Texas and Manitoba, Canada. However, nothing is known about C. occidentalis in Oklahoma. Here we present data on specimens of C. occidentalis obtained from an A. grunniens from the state, as well as providing scanning electron micrographs of the species.

20 - Haemogregarina sp. (Apicomplexa: Eucoccidiorida: Adeleorina) from Eastern Spiny Softshell, Apalone spinifera spinifera (Testudines: Trionychidae), from Arkansas

Chris McAllister - Eastern OK St. College

(Co-Author: H.W. Robison (9717 Wild Mountain Drive, Sherwood, AR 72120))

Haemogregarines are intraeythrocytic parasites that infect various vertebrates but are most commonly reported from aquatic turtles. Species of Haemogregarina are heteroxenous with gamonts found in the red or white blood cells of the vertebrate intermediate host. Sexual conjugation, via syzygy, is followed by sporogony, both of which occur in the invertebrate definitive host. In Haemogregarina, gametes mature, unite in a leech gut (the only complete life cycle known), and oocysts then develop in leech gut epithelial cells, but they contain no sporocysts, only "naked" sporozoites. These sporozoites migrate to the salivary glands of the leech, which then infects the next vertebrate host when it takes another blood meal. Numerous turtles from all the surrounding states of Arkansas (except Mississippi) have been reported to serve as hosts, including some from Louisiana, Missouri, Oklahoma, Tennessee, and Texas. A moderate amount of data is available on hematozoan parasites of Arkansas turtles, but nothing is known about those of any spiny softshell turtle (Apalone spp.) in the state. Here we report a new host record and the initial photomicrographs for a haemogregarine from a common softshell turtle in Arkansas.

21 - More Distributional and Host Records for Two Acanthocephalan Parasites from Arkansas Fishes (Aphredoderidae, Catostomidae, Centrarchidae, Cyprinidae)

Chris McAllister - Eastern OK St. College
(Co-Author: H.W. Robison (9717 Wild Mountain Drive, Sherwood, AR 72120))

Over the last few years, our research consortium has attempted to augment the previous void of information on the acanthocephalans of Arkansas fishes. We recently had the opportunity to examine additional fish collected from the Arkansas, Ouachita, and White river drainages of the state for these interesting parasites. Acanthocephalans are reported from Aphredoderus sayanus (Pirate Perch), Moxostoma erythrurum (Golden Redhorse), Minytrema melanops (Spotted Sucker), Bigeye Shiner (Notropis boops), Steelcolor Shiner (Cyprinella whipplei), and Ambloplites ariommus (Shadow Bass). Most importantly, we document the initial acanthocephalan from an Arkansas M. erythrurum, and a new host record for the genus Acanthocephalus from A. sayanus. In addition, we report the first acanthocephalan from N. boops that also represents only the second parasite ever recovered from this shiner, as well as the first acanthocephalan from C. whipplei from any locality. We suggest surveys on fishes of the Red and St. Francis river drainages of the state, where little work has been done on their parasites. This will undoubtedly increase our knowledge of the acanthocephalans and other parasites of fishes in Arkansas.

22 - Survey of Aedes albopictus oviposition in Southeast Arkansas

Kameron Skinner - University of Arkansas at Monticello, Undergraduate student

This study sought to determine the prevalence of Aedes albopictus and Aedes aegypti mosquitoes in Southeast Arkansas. Eggs were collected weekly using oviposition traps from five locations from July to September of 2018. A total of 326 Aedes albopictus eggs were collected weekly from each site over a 5-week period. The mean for all sites was 13.04 eggs with a standard deviation of 24.0. These data show that viable Aedes albopictus populations exist at multiple sites in Southeast Arkansas. This information is important to public health officials, as Aedes albopictus is a potential vector for emerging diseases like Zika virus, chikungunya, and yellow fever that could cause a public health emergency.

23 - Energy Content of Seeds of Texas Doveween (Croton texensis) from the Diet of Mourning Doves (Zenaida macroura) from Southeastern New Mexico

Emily Neilson - University of Arkansas at Monticello, Undergraduate student
(Co-Authors: John L. Hunt (University of Arkansas at Monticello); Matthew E. Grilliot (Auburn University-Montgomery); Collin S. Deen (University of Arkansas at Monticello); Dixie Lozano Lopez (University of Arkansas at Monticello); Taytumn R. Schlegel-Ridgway (University of Arkansas at Monticello))

Knowledge of the energy content of food is critical to understanding why an animal might choose one food item over another. We analyzed the energy content of seeds of Texas doveweed (Croton texensis) 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 Texas doveweed was greater than that previously reported from the diet of mourning doves.

24 - Creating a New Molecular Phylogeny of Arceuthobium

Kate Sanders - Hendrix College, Undergraduate student
(Co-Authors: Jacob Idec; Adam Schneider (Hendrix College))

Arceuthobium, also known as dwarf mistletoe, is a widespread genus of parasitic angiosperms. It primarily extracts water, minerals, and carbohydrates from host pine and cypress trees. Uncontrolled parasitism from Arceuthobium causes economic damage by deforming the branches and reducing the reproductive ability of its host. In the western United States alone, Arceuthobium causes the loss of over 11 million cubic meters of wood annually. However, the extreme morphological reduction of these parasites has made understanding evolutionary relationships and species-level taxonomy difficult. Hence, older taxonomies rely almost exclusively on geography for species identification. For more accurate classification and understanding of the evolution of Arceuthobium, the use of DNA sequence in constructing a phylogeny of Arceuthobium is needed. We constructed a phylogeny of Arceuthobium using Illumina sequencing data from chloroplasts and nuclear genomes. This phylogeny is an improvement on previous constructions due to an increased amount of data, both in terms of sequence data and individuals sampled. Additionally, the use of maximum likelihood methods for tree generation improved topological accuracy, including branch lengths. Our phylogeny yielded a number of interesting clades, such as distinct clades for new and old world species, that shed light on the evolution of range-distribution and host specificity. This research provides an increased understanding of the evolution of dwarf mistletoes and will lead to new and more accurate

taxonomy. This will aid foresters and land managers in understanding and controlling this economically and ecologically important parasite.

25 - Surveying variability in cyanide production of white clover (Trifolium repens) across an urbanization gradient in Little Rock, AR and Memphis, TN

Sierra Hubbard - Hendrix College, Undergraduate student

(Co-Authors: Savannah Draud; J. Tristian Wiles; Caralee Shepard; Joyce Hardin; Adam C. Schneider)

Cyanogenesis is a Mendelian-inherited trait in white clover (Trifolium repens) that serves as a defense against herbivory. Cyanogenic clines are associated with latitudinal and temperature gradients in Europe and North America, but may also be influenced by urbanization. In a study testing for cyanogenic clines in 4 major cities, the proportion of cyanogenic plants increased with distance from the city center in three of them. These results suggest that urbanization may be selecting against trait. To further test this hypothesis, we sampled 35 white clover populations along an urban-to-rural transect in Little Rock, and 50 populations along a similar transect in Memphis. We used the Feigl-Anger assay to screen each individual for cyanogenesis, and tested for a relationship between abundance of cyanogenic individuals and distance from the city center. We found evidence of clines in both cities, with frequency of cyanogenic individuals increasing with distance from the city center. This project is associated with the Global Urban Evolution project, which is an international collaboration to survey clover cyanogenesis gradients in 171 cities worldwide with the aim of better understanding how urbanization influences evolution. Locally, our results are important of recognizing patterns of defense in other plants in the mid-southern United States.

26 - Soil Algal Communities of Warren Prairie Natural Area

Marvin Fawley - University of the Ozarks

(Co-Authors: Karen Fawley (University of the Ozarks, Division of Mathematics and Sciences, Clarksville, Arkansas); Brent Baker (Arkansas Natural Heritage Commission, Little Rock, Arkansas).)

Warren Prairie Natural Area in Bradley and Drew Counties, Arkansas, is a strange mosaic of saline slicks that form flat, crusty depressions in a central area with a zone of lichens and a few rare angiosperms, and an outer zone of cyanobacterial mats. The edges of the saline slicks are home to the rare, diminutive vascular plant, Geocarpon minimum Mackenzie (Caryophyllaceae), which is a federally protected threatened species. The main objective of this project is to characterize the soil crust eukaryotic algal communities from two sites in Warren Prairie Natural Area using morphological and molecular techniques. We have characterized strains isolated from samples collected in February, 2016 and December, 2017. The eukaryotic algae of Warren Prairie slicks are highly diverse and include taxa from the Trebouxiophyceae and the Chlorophyceae (Chlorophyta), the Zygnematophyceae and the Klebsormidiophyceae (Streptophyta), and the Eustigmatophyceae and Xanthophyceae (Stramenopiles). Most of the genera are widely distributed in many types of soil, but a number of new species are present. Several strains represent new records for North America or the U.S. Our results show that the unusual chemistry of the barrens soil of Warren Prairie harbor unusual algae in addition to rare plants.

27 – Soil Crust Algal Communities of Warren Prairie Natural Area

Karen Fawley – University of the Ozarks

(Co-Authors: Brent Baker (Arkansas Natural Heritage Commission, Little Rock, Arkansas); Marvin W. Fawley (University of the Ozarks, Division of Mathematics and Sciences, Clarksville, Arkansas))

Warren Prairie Natural Area in Bradley and Drew Counties, Arkansas, is a strange mosaic of saline slicks that form flat, crusty depressions in a central area with a zone of lichens and a few rare angiosperms, and an outer zone of cyanobacterial mats. The edges of the saline slicks are home to the rare, diminutive vascular plant, Geocarpon minimum Mackenzie (Caryophyllaceae), which is a federally protected threatened species. The main objective of this project is to characterize the soil crust eukaryotic algal communities from two sites in Warren Prairie Natural Area using morphological and molecular techniques. We have characterized strains isolated from samples collected in February, 2016 and December, 2017. The eukaryotic algae of Warren Prairie slicks are highly diverse and include taxa from the Trebouxiophyceae and the Chlorophyceae (Chlorophyta), the Zygnematophyceae and the Klebsormidiophyceae (Streptophyta), and the Eustigmatophyceae and Xanthophyceae (Stramenopiles). Most of the genera are widely distributed in many types of soil, but a number of new species are present. Several strains represent new records for North America or the U.S. Our results show that the unusual chemistry of the barrens soil of Warren Prairie harbor unusual algae in addition to rare plants.

28 - The antimicrobial activity of Callicarpa americana berry extracts

Kara Burchfield and Elizabeth Wess - Southern Arkansas Univeristy, Undergraduate students

(Co-Author: Antoinette Y. Odendaal (Southern Arkansas University))

We are investigating the potential antimicrobial activity of various Callicarpa americana berry extracts. We are currently focusing on three extraction techniques, namely Soxhlet extraction, microwave-assisted extraction and ultrasonic extraction to prepare crude extracts using methanol, ethanol and ethyl acetate as solvents. The Kirby-Bauer disk-diffusion method is being used to probe the antimicrobial potential of the various extracts in several gram-positive (B. subtilis, S. epidermidis, and S. aureus) and gram-negative (E. coli and P. aeruginosa) bacterial species. To date, microwave-assisted extraction in ethyl acetate has shown the greatest inhibition against B. subtilis and S. epidermidis.

29 - The bacterial microbiome of the social amoebae

Eleni Sallinger - University of Central Arkansas, Graduate student

Multicellular life arose in a world that had been dominated by bacteria for over a billion years, and bacteria-host symbioses have likely been ubiquitous since multicellular life began. Despite their importance in both ecosystem functioning and for the survival of multicellular life, including humans, we still do not understand the factors involved in the evolution and maintenance of host-

associated microbiomes. Because they use phagocytosis, the mechanism also used by human macrophages, to engulf and digest their bacterial prey, the social amoeba species Dictyostelium discoideum is a common model organism for studying bacterial-eukaryotic interactions and intracellular pathogenesis. It was recently shown that some wild D. discoideum carry viable bacteria both intracellularly and within their multicellular fruiting bodies. Once fully characterized, the bacterial microbiomes of social amoebae have the potential to act as a simple model for studying microbiome dynamics. The objective of the present project is to characterize the natural bacterial microbiome of five co-occurring social amoeba species using next generation sequencing of bacterial 16S rRNA gene amplicons. Soil samples will be collected from various natural areas and brought back to the laboratory where they will be plated to allow for amoeba fruiting body formation. Fruiting bodies will be collected for DNA extraction. DNA will also be extracted directly from soil samples to assess how bacterial availability affects amoeba microbiome composition. From the DNA extractions, bacterial DNA will be amplified and sequenced. Sequences will be processed in QIIME2, where bacterial taxa will be identified and various diversity analyses will be performed. In addition to elucidating the potential utility of social amoebae as models for studying microbiome dynamics, this project could lead to the identification of novel symbiotic bacteria and further our understanding of the role social amoebae play as "training grounds" for the evolution of intracellular pathogens.

30 - The effects of caffeine and chlorogenic acid on Daphnia magna

Ashley Stewart - Southern Arkansas University, Undergraduate student
(Co-Author: Antoinette Y. Odendaal)

We are exploring the use of Daphnia magna, a freshwater microcrustacean, as a model organism for assessing the potential adverse effects of dietary supplements. D. magna is an established model organism used in environmental and ecological toxicology. We are expanding on the use of this test organism to include rapid in vivo screening of dietary supplements. Our current research investigates the effects of caffeine and chlorogenic acid on D. magna growth and reproduction.

31 - Effect of multi-course prenatal steroids on fiber-type profile and enzyme activity in the guinea pig rectus thoracis

Tel Johnson - Hendrix College, Undergraduate student
(Co-Authors: Judith Brown (Hendrix College); Julie Avery (Univ. of Alaska Fairbanks); Jennifer Dearolf (Hendrix College))

When a mother is set to give birth prematurely, she is often given glucocorticoids to accelerate the development of her fetus' lungs. Despite the steroids' known effect on lung development, little is known about the effects on ventilatory muscles. We hypothesize that exposure to prenatal steroids accelerates the development of these muscles. Thus, the breathing muscles of fetuses exposed to these steroids will have fiber-type profiles and enzyme activities more similar to those of 1-day-old neonatal muscles than the muscles of control fetuses. Pregnant guinea pigs were injected with either betamethasone (0.5 mg/kg body weight - treated) or sterile water (control) at 65%, 75%, and 85% gestation, and samples of the fetal rectus thoracis (RT) muscle were collected. Sections of the treated and control RTs were cut with a cryostat and stained for their reaction to myosin heavy chain antibodies. The antibody A4951 was used to stain for type I, slow-twitch fibers, and the antibody 2F7 was used to stain for type IIA, fast-twitch oxidative glycolytic fibers. Using ImageJ software, the diameter and density of staining for 2F7 was measured for the fast-twitch fibers. To determine the glycolytic and oxidative capacities of fetal, neonatal (1-day-old), and adult RT, lactate dehydrogenase (LDH) and citrate synthase (CS) activities were measured. The LDH and CS data will hopefully allow us to draw a conclusion about enzyme activity throughout development. If the treated fetal and neonatal data are similar, it would support the hypothesis that prenatal steroids accelerate fetal breathing muscle development. Thus, premature infants exposed to prenatal steroids will be able to ventilate their lungs just as well as full term infants.

32 - Biodiversity and Community Structure of Aquatic Insects in the Little Missouri River

Dustin Booth and Logan Pearson – UAM, Undergraduate students
(Co-Author: Edmond J. Bacon(UAM))

Biodiversity and community structure of aquatic insects were investigated in the Little Missouri River above the confluence with the Ouachita River at Tate's Bluff during 2017-2018. Total taxa exceeded 100 species with 62 species of EPT taxa that included 25 species of Trichoptera (caddisflies), 20 species of Ephemeroptera (mayflies), and 17 species of Plecoptera (stoneflies). Six species of burrowing mayflies were collected from the riffles, pools, and clay banks. Insect densities sampled in the riffles with a 363-micrometer net Hess sampler ranged from 770 to 2,830 individuals per square squared. Plecopterans and ephemeropterans accounted for 55 % of the total numbers of individuals.

33 - Supernumerary Sources of Human Diet and Bioenergy for the Twenty-first Century; Soybean (Glycine Max L.)

Ishrar Islam - Hendrix College, Undergraduate student
(Co-Authors: Z. Adam (University of Arkansas at Pine Bluff) and Shahidul Islam (University of Arkansas at Pine Bluff))

Discovery, the alimentary assessment in soybeans, is vital for possession merchandises at a low price while residual aware of people's health. This trial brings into the inquiry whether it would be valuable to consume soybeans more frequently an emphasis on the nutritional aspects of them, as well as the bioenergy benefits it provides. Therefore, the amounts of nutritional elements such as lipids, fatty acids, polyphenols, antioxidants, and soluble fibers tested within different varieties of soybeans. The highest phenolic content was in AS GROW 4754, followed by AS GROW 4632. The antioxidant capacity ranged from 2.35 3.44 µg/g of TEAC per 100g dry sample. The antioxidant activity follows as: AS GROW 4632> AS GROW 4754> AS GROW 4835. AS GROW 14632. AS GROWAG 4934. The Protein content ranges from 34.1 to 44.9 (%). The highest total protein was in AS GROW AG 4934, followed by AS GROW 4632, AS GROW 4754, AS GROW 4835 and AS GROW 14632. The lipid content ranges from 20.8 to 30.8 (%). The highest was in AG GROW 4835, and the lowest was in AS GROW 4632. Eight different fatty acids were found in the soybean. The Linoleic acid was found the predominant fatty acid 54%0 followed by Oleic acid (21%) and Palmitic acid (11%). The Behenic and Eicosenic acids found as trace amounts in soybean. Therefore, consumption of soybeans is beneficial but should also be incorporated within an overall healthy lifestyle. The difference in biomass and cell-wall components of five Arkansas grown soybean varieties examined to find out accessions that exhibited quality traits suitable for a potential bioenergy/biofuel crop. The Hemi-

cellulose (HCE), cellulose (CE) and ASH contents ranged 14–30 %, 8-18 % and 1-3 % of the DM, respectively. The results showed that the NDF% ranged from 28 to 47, and ADF% ranged from 22-32. The wide range of distinction in biomass and cell wall components point out that soybean has great potential for use as bioenergy/biofuel crops. The high amounts of cell-wall components between its species and in comparison to other bioenergy crops as well. The general range of distinction in biomass and cell wall components point out that soybean has great potential for use for multiple uses such as human food and nutrition, oil, energy, and biofuel potentials.

34- Chemical Analysis of Pond Development

Audrey Lawrence - Harding University, Undergraduate student

Little research has been done on the chemical development of ponds, though there is a lot of information on the conditions of water that are ideal for different types of life. Recently, two pits were dug to make way for a gravel road and they subsequently filled with water, making them ideal for testing to see how water quality changes over time. Baseline tests measuring oxygen content, nitrogen content, salinity, pH, temperature, carbonate hardness (KH), and turbidity were conducted at varying depths. The measurements will be continued, taken once a month to see how the water quality changed over time. It is hoped that the research conducted will be useful in providing guidelines for the chemical development of ponds.

35 - Characterization of Smoke Particle Emissions from Rocket Stoves versus Three-Stone Fires

Mackenzie Hoogshagen and Elizabeth Versluis - University of Central Arkansas, Undergraduate students
(Co-Authors: Dr. Leah Horton (University of Central AR); Mason Rostollan (University of Central AR))

Citizens of third world countries around the globe are negatively impacted by environmental factors such as smoke inhalation. Our research is centered in the small village of Kanembwe, Rwanda. This people group is limited by a lack of resources and recurrent sickness.

The residents traditionally cook over open three-stone fires. When smoke is inhaled into the lungs, some of the particles can become imbedded into the soft tissue and cause damage. This can result in lower elasticity which ultimately causes lower pulmonary functioning and chronic obstructive pulmonary disease (COPD). Rocket stoves, improved cook stoves, were introduced to the village, and tested to measure if rocket stoves' impact on human health via reduction in inhaled smoke. We conducted trials in which smoke particles from both rocket stoves and three-stone fires were collected onto filters using a Siotus cascade impactor. We then examined particles by using scanning electron microscopy (SEM) to characterize the abundance of the particles with respect to their size distribution.

We hypothesized that rocket stove intervention would have a positive impact on human health by releasing fewer inhalable particles by being exposed to fewer partides, residents should experience less respiratory illnesses. Further, peak expiratory flow rate was measured among residents who utilize either three-stone fires or rocket stoves as their primary cooking method to quantify direct impact on user health.

36 - Variation in Habitat Use and Body Condition of Etheostoma caeruleum and Etheostoma fragi in the Strawberry River, Arkansas

Blake Mitchell - University of Central Arkansas, Undergraduate student
(Co-Authors: Jennifer Main, Ginny Adams, and Reid Adams)

The Strawberry River is occupied by 19 fishes listed as Species of Greatest Conservation Need, including the endemic Etheostoma fragi. We explored potential differences in habitat use and body morphometrics between E. fragi and the more widespread E. caeruleum to better understand interactions between these two species. Totals of 453 E. fragi and 571 E. caeruleum were collected during 2017 and 2018 across 30 sites. Compared to historical data (1970-1980s), E. fragi was found at three additional sites and in higher abundance overall. Mean relative abundance E. fragi to E. caeruleum was significantly higher in pools (0.67 +0.08) compared to riffles (0.28 +0.06) and runs (0.20 +0.1) ($P < 0.001$). At 40% of sites where E. fragi was detected, they were found at 2X or greater abundance in pools compared to riffles, while E. caeruleum showed the opposite pattern. Both species showed similar condition (ANCOVA, $p>0.05$) within a species across habitat types (riffle, run, pool). Based on our data, future monitoring should include pool and run habitat to increase detection probability of E. fragi. Our data suggest E. fragi is stable or expanding within the system and interactions with E. caeruleum are probably influenced by habitat segregation.

Biology - Medicine, Molecular and Cellular Biology

37 - Analysis of De novo peptides for potential antimicrobial activity

Hannah Smith - Harding University, Undergraduate student
(Co-Authors: Brandon Hogland; Amber Hug; Ryan Stork (Harding University))

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 (Shrivastava,2017). 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 (Neu, 1992). Researchers have been challenged to find antibiotics in the least likely places. Arthropods such as scorpions and spiders have been highlighted as potential carriers of antimicrobial peptides. In our study, we chose the wolf spider, R. rabida as the model vector for identifying new antimicrobial agents. We hypothesized that the terrestrial R. rabida has peptides capable of antimicrobial activity. After RPLC/MS analysis, 739 known peptides were discovered in the venom in addition, we found 9500 peptides not matching sequences in the UniprotKB database. With the aid of the INBRE Bioinformatics Core, predictor analysis was used to identify 30 peptides that have

the potential for broad spectrum antimicrobial activity. De novo peptides 3282 and 4151 are of particular interest due to their peptide length, molecular weight, hydropathicity, hydrophobicity, favorable hemolytic profile and cationic charge. In vitro assays will be used to confirm antimicrobial ability.

38 - Analyzing the Role of FszA-GFP in Mitochondrial Dynamics of Dictyostelium discoideum

Jacie Cooper and Kennedy Kuykendall - University of Central Arkansas, Undergraduate students
(Co-Author: Dr. Kari Naylor (University of Central Arkansas)

The FtsZ prokaryotic protein functions to divide bacterial cells and is a homolog to the eukaryotic protein tubulin. Two FtsZs are found in our eukaryotic model organism Dictyostelium discoideum: FszA and FszB. Currently, results suggest that FszA and/or FszB may be involved in mitochondrial dynamics, which are fission, fusion, and motility. To study mitochondrial dynamics, our lab created a D. discoideum assay using confocal imaging of live cells and quantification of the dynamic events. To determine the role of the FtsZs in mitochondrial dynamics, we overexpressed FszB and found that it localizes to almost every fission and fusion event and decreases mitochondrial fission, fusion, and velocity. Here we present our plan to overexpress FszA and knockdown both FszA and FszB. We are currently transforming two different wild type strains (AX2 and AX4) with the appropriate plasmids; upon establishing we have the correct strains, we will image the cells and quantify the dynamics. The results from this study will not only further our understanding of D. discoideum mitochondrial dynamics but can be applied to other systems that also use FtsZs, such as bacteria, chloroplasts, and mitochondria in other lower eukaryotes.

39 - Chronic ethanol administration to rodents induces mitochondrial biogenesis

Grishma Patel - Hendrix College, Undergraduate student
(Co-Authors: Tristan Lovelace (Hendrix College); Macie Stultz (Hendrix College); Diego Valdivieso (Hendrix College))

Chronic ethanol consumption is a risk factor for chronic liver disease, a condition that is a major cause of morbidity and mortality in the United States. Despite the prevalence and severity of this health risk, the underlying mechanisms linking ethanol exposure to liver disease remain unresolved. Current experimental evidence has shown that chronic ethanol administration to rodents increases hepatic oxidative stress, a condition characterized by increased steady state concentration of reactive oxygen species (ROS). There is strong evidence that inhibition of mitochondrial protein synthesis linked to oxidative mitochondrial DNA (mtDNA) damage contributes to mitochondrial dysfunction. Therefore, we hypothesized that increasing lipid ROS by administration of polyunsaturated fat in the diet should exacerbate ethanol-induced chronic mitochondrial damage. Rats were fed intragastrically for four weeks isocaloric diets containing ethanol, excess fat, or its combination, and mitochondrial functionality was evaluated in isolated mitochondria. Our results show that the activity of mitochondrial complexes I, II, III and IV increased in rats fed intragastric ethanol, independently of the level of fat in the diet. We speculate that increased mitochondrial activity might be an adaptive response to increase the oxidation of NADH generated during ethanol oxidation by alcohol dehydrogenase.

40 - Dissemination of Oxalate and Vitamin C Among Assorted Genotypes of Sweetpotato (Ipomoea batatas L.) Leaves

Jessica Harston - University of Arkansas at Pine Bluff, Undergraduate student
(Co-Authors: Z. Adam and Shahidul Islam*)

The Oxalate compounds are present in many foods and beverages in the form of Oxalic acid. Oxalate, C2O4-2, is existing in many plant tissues. Its functions include pH regulation, and osmosis and calcium storage. Computing Oxalate levels is a preventative practice. Such as, animals absorb Oxalate through dietary intake, or the liver produces it due to glycolate metabolism. It is essential to monitor Oxalate levels because increased levels can cause kidney stone formation. Ascorbic acid/vitamin Cis also found in plants. In addition to its necessity to cure scurvy, it is also known for its fight against heart disease risk factors. Heart and related heart diseases are, nowadays, considered the number one death causes globally. The antioxidant property of the acid has raised awareness among the scientific community as a potential scavenger of the metabolic by-product, known as free radicals that are known for attacking cells. Thus these properties of the acids demand prior screening of food products before they are made available to human consumption. It is, therefore, with this objective in mind that the investigation of the thirty-one genotypes which were collected from worldwide of the sweet potatoes was conducted. Across all accessions studied, the oxalate contents ranged from 1049.5 mg per kg to 21619.35 mg/kg with an average of 6929 mg per kg. On the other hand, the ascorbic acid (vitamin C) contents ranged from 34.48 mg per kg to 2665 mg per kg. The extensive range of distinction in oxalate and vitamin C contents point out that sweetpotato has excellent potential for use as leafy vegetables.

41 – Integrin Signaling is Required for Collagen-Mediated Tumorigenicity of Papillary Thyroid Cancer Cells

Sarah Gilmour, Jonathan Jenkins, Moira Moore, Cole Stanton, and Keith Taylor - Hendrix College, Undergraduate students

Thyroid cancer is the most common endocrine malignancy, and projected increases in occurrence suggest it will exceed that of colon cancer by 2030. Of thyroid cancer subtypes, papillary thyroid cancer is most common and is associated with BRAFV600E mutations, which lead to constitutive activation of the MAPK signaling pathway. Previous studies in mouse models demonstrate that papillary thyroid tumors driven by BRAFV600E mutations and PTEN deletions are enriched in fibrillar collagen. Additionally, increased collagen expression in patient samples correlated with poor survival, suggesting its presence is important for papillary thyroid cancer progression. Recent unpublished data suggests that collagen increases proliferation, drug resistance, and motility in papillary thyroid cancer cells harboring BRAFV600E mutations and PTEN deletions, but a molecular mechanism has yet to be identified. Cells often signal to extracellular matrix components through integrins, and $\alpha2\beta1$ is required for collagen signaling. Here we test the hypothesis that $\alpha2\beta1$ integrin signaling is required for increased proliferation, drug resistance, and motility of papillary thyroid cancer cells grown in the presence of collagen. Our data suggests that inhibition of $\alpha2\beta1$ reduces proliferative capacity and motility of papillary thyroid cancer cells. Collectively, our results support the idea that papillary thyroid cancer cells develop increased tumorigenic characteristics in the presence of collagen.

42 - Using a yeast two-hybrid approach to investigate DNA repair in bdelloid rotifers

Kevin Bombinski - Hendrix College, Undergraduate student
(Co-Author: Andrew Schurko (Hendrix College))

The bdelloid rotifer Adineta vaga is a freshwater microscopic invertebrate that possesses the incredible ability to recover from excessive amounts of DNA damage caused by either desiccation or ionizing radiation. However, the mechanism behind this DNA repair, which involves the restoration of potentially hundreds of double stranded DNA breaks, is currently unknown. Previous transcriptome analysis (RNA-seq) revealed over 500 genes that were differentially expressed following exposure to ionizing radiation. These genes are strong candidates for encoding proteins involved in DNA repair. The objective of this project is to use yeast two-hybrid analysis to identify interactions between these candidate DNA repair proteins and other proteins in A.vaga. Five genes were selected and used to create "bait strains" of yeast that express the protein of interest fused to the GAL4 DNA-binding domain. A "prey library" of yeast strains (that express the A. vaga proteome) was then made by transforming yeast with plasmids that express proteins fused to the GAL4 activation domain. We carried out a yeast two-hybrid analysis by crossing the RAD51 bait strain with the prey library. Bait-prey interactions could then be observed using selectable markers in the prey strains (e.g. MEL1 reporter gene will form blue colonies in the presence of X-gal). Expression of reporter genes would indicate that the bait and prey proteins have interacted. Prey plasmids will then be purified and sequenced to determine the identity of the protein and homology to other known proteins, which will provide information about the roles of candidate proteins in DNA repair.

43 - Characterization of the 1957-1958 influenza pandemic in Arkansas and Arizona

Kaitlyn Kemp - University of Central Arkansas, Undergraduate student

Influenza pandemics can be studied retrospectively using death certificate analyses. The 1918 pandemic was the largest pandemic in the last 100 years in the United States (with 600,000 deaths), but the smaller pandemics of 1957 (70,000 deaths) and 1968 (34,000 deaths) have been overshadowed by it. As such, there are opportunities to learn more about pandemic influenza spread via analyses within these later time periods. The current study analyzes influenza deaths in 1957-1958 in Arkansas and Arizona. Deaths by demographic including sex, age, and county of death are analyzed, comparing against values extrapolated and estimated from US census data (1950-1980). These two states represent two distinctly different locations. Arkansas is a largely agricultural state with few urban centers, and a relatively low population size that is spread out across the state. Arizona, especially after World War II, is a state with a relatively low population that is clustered in several high-density population pockets, but otherwise very rural and low in population density. This study compares and contrasts the 1957-1958 influenza pandemic across these two different states' populations, testing the hypotheses that higher population density areas exhibited greater numbers of influenza deaths in the pandemic than areas with low population density, and that gender played no role (exhibiting no gender bias) in the influenza deaths that occurred.

44 - Chemokine Secretion Varies Significantly in Papillary and Follicular Thyroid Cancer Tumor Cells

Nathan Andress, Michaela Edwards, Amber Melcher, and Brock Sullivan - Hendrix College, Undergraduate students
(Co-Author: Sarah Glass (Hendrix College))

Thyroid cancer is the most common endocrine malignancy and incidence is likely to exceed that of colon cancer by 2030. The two most common types of thyroid cancer are well-differentiated papillary thyroid cancer and follicular thyroid cancer. Papillary thyroid cancer is associated with mutations in BRAF while follicular thyroid cancer is associated with mutations in HRAS, proteins which lie downstream of one another in the MAPK signaling pathways, but the two subtypes have differences in prognosis and metastases. Recently, significant differences were discovered between differences in the tumor microenvironments of papillary and follicular thyroid cancer. The tumor microenvironment of papillary thyroid cancer is enriched in fibrillar collagen and fibroblasts while the tumor microenvironment of follicular thyroid cancer is enriched in immune cells. How the two subtypes develop differences has yet been unstudied. We hypothesized that tumor cells from papillary and follicular thyroid cancer secrete different chemokines, which may lead to differences in the tumor microenvironment composition. In this study, we used chemokine arrays to assess differences in chemokine secretion in cellular models of papillary and follicular thyroid cancer. Notably, significant differences were observed between cell lines derived from papillary and follicular thyroid cancer. Additionally, we observed increased secretion of CXCL16 in papillary thyroid cancer cells grown in the presence of, which may play a role in papillary thyroid cancer progression.

45 - Comparing the Effectiveness of Antibiotics and Essential Oils on Laboratory and Environmental Bacteria Strains

Vi Le - University of Arkansas - Fort Smith, Undergraduate student
(Co-Authors: Evan Merritt; Roger Lightner; Jeff Shaver)

Antibiotic resistance is a naturally occurring phenomena that has seen an increase over time. This change, brought about through anthropogenic processes, has facilitated a need to find alternative ways to treat some pathogenic bacterial species. With certain treatments, like penicillin, becoming less effective due to an increase in antibiotic resistance, homeopathic alternatives have become a growing field of research. For this project, essential oils (EOs) and antibiotics were tested on laboratory and environmental bacterial strains. Zones of inhibition were measured and characterized based on their degree of resistance. Previous research has shown that EOs have inhibitory effects on bacteria growth, suggesting a possible alternative to current antibiotics. Therefore, we hypothesized that if a variety of EOs and antibiotics are screened for activity against laboratory and environmental bacterial strains, some bacteria that are resistant to multiple types of antibiotics will be susceptible to at least one EO. For this project, cultured bacteria were exposed to cinnamon, peppermint, eucalyptus, and peppermint. The same strains were also exposed to six common antibiotics. As a result, gram negative rods were found to be more prone to inhibition by the EOs than gram positive cocci or rods. This contradicts the notion that gram negative bacteria are generally more resistant to antibiotics than gram positive bacteria. Tetracycline had the greatest effect overall on gram positive bacteria, but cinnamon had the greatest overall antibiotic effect across all bacteria tested. Interestingly, one of the environmental strains was resistant to bacitracin, amoxicillin, penicillin and sulfisoxazole, but sensitive to all EOs. Our current study focuses on the metagenomic analysis of soil samples from different high- and low-traffic sites on the University of Arkansas Fort Smith campus, and further analyzing the prevalence of antibiotic resistance of these sites.

46 - Effects of Simulated Microgravity and Radiation on SERCA Expression in Arteries

Claudy Sarpong - University of Central Arkansas, Undergraduate student
(Co-Authors: Rahul Mehta (UCA, Dept of Physics & Astronomy); Parimal Chowdhury (UAMS, Dept. of Physiology); Brent J.F. Hill (UCA, Dept of Biology))

Microgravity is known to decrease the expression of the sarcoplasmic reticulum calcium ATPase (SERCA) in rats and mice; similar changes also happen in the skeletal muscle of humans. SERCA activity pumps cytosolic calcium into the SR, thus preventing a dramatic elevation in intracellular calcium in muscle cells. Our aim is to investigate the impact of radiation on SERCA expression in arteries from rats exposed to a microgravity environment (using hindlimb unloading). Adult male rats were housed and subjected to hindlimb unloading (to simulate microgravity) for a period of 30 days. At the beginning of 30 days, half the rats were irradiated with 1 gray of radiation. After 30 days, the aorta was dissection out and homogenized into a whole cell lysate. We used the Western Blot technique to compare SERCA to the loading control, beta-actin. Our preliminary/hypothesized results indicate that radiation exposure decreased SERCA expression. Our results may be extrapolated to understand how space radiation can impact the vascular system of astronauts. Support: Arkansas Space Grant Consortium.

47 - Object discrimination abilities in blind individuals using echolocation

Michael Ezeana - University of Central Arkansas, Undergraduate student
(Co-Authors: Santani Teng (Smith-Kettlewell Eye Research Institute); Amrita Puri (University of Central Arkansas))

Active echolocation involves emitting sounds and listening to the reflected auditory information to localize objects and navigate through surroundings. Although primarily associated with animals like bats and dolphins, some visually impaired humans use active echolocation to detect the location of objects and differentiate between objects of different sizes, shapes, and compositions. In a previous study, blind echolocators could detect differences in the horizontal displacement of two disks presented simultaneously with one above the other with spatial acuity comparable to that of visual location discrimination ability at about 35 degrees into the peripheral visual field. In preliminary work exploring object perception abilities in blind participants, echolocation practitioners performed an auditory-tactile task in which they examined a target object using echolocation. The object was then presented along with another object, and participants were instructed to use only touch to identify which of the objects they had previously examined echoically. Participants were able to identify the targets at significantly greater than chance levels, suggesting that shape information was preserved across sensory modalities; however, overall accuracy was relatively low (~60%). To determine whether this low accuracy reflects insufficient information in the echoes to aid in object recognition, or simply the small size of objects, we will use an analogous visual-tactile task in which sighted participants will view objects presented at 35 degrees in the periphery. They will then use touch to distinguish the target from a distractor object, as in the preliminary experiment. We hypothesize that if echoes lack information useful for object recognition, performance will be better on the visuo-tactile task compared to the auditory-tactile task. Alternatively, similar performance would support that spatial acuity of object recognition using echolocation is similar to that of object localization, but that performance in the preliminary experiment was limited by the small size of the objects.

48 - Papillary Thyroid Cancer Cells Display Differences in Drug Sensitivity that are Dependent on Extracellular Matrix Composition

Lauren Dwyer, Brianna Kelly, Hannah Moore, and Sesalie Satterwhite - Hendrix College, Undergraduate students

Thyroid cancer is the most common endocrine malignancy, and incidence is expected to exceed that of colon cancer by 2030. Papillary thyroid cancer is typically more aggressive and is associated with mutations in BRAF, while mutations in RAS are associated with follicular thyroid cancer. Jolly and others reported that papillary thyroid tumors derived from cells harboring activating BRAFV600E mutations and PTEN deletions are enriched with fibrillar collagen that corresponds with decreased survival. We investigated whether growth on collagen and other extracellular matrix components affected sensitivity to MEK inhibition. Cell lines derived from mouse models of papillary thyroid cancer tumors were grown in the presence and absence of thin plated collagen I, collagen IV, or fibronectin and assessed for rate of growth and sensitivity to inhibitor treatments using the GR50 metric. Notably, we observed differences in inhibition efficacy, suggesting that drug sensitivity is dependent on extracellular matrix composition.

49 - Analysis of De novo peptide 3337 from the venom of R. rabida

Landon Wolfe - Harding University, Undergraduate student
(Co-Authors: Amber Hug; Brandon Hogland; Ryan Stork (Harding University))

Antimicrobial research is once again becoming a central focus in pharmaceutical research due to the continued decrease in antibiotic susceptibility of antibiotics currently used to treat infection. With this new initiative in place, scientists are looking to soil, arthropods, other bacteria and fungi for answers to this new dilemma (Ageitos et al., 2017). Previous studies have indicated that spider venom contains proteins that are antimicrobial in nature. In our study, we chose R. rabida as the model vector in identifying new antimicrobial agents. R. rabida is native to most of central north America and in habitats with warm temperatures. This led us to hypothesize that the terrestrial wolf spider R. rabida has proteins capable of antimicrobial activity. After RPLC/MS analysis, 739 known peptides were discovered in the venom in addition, we found 9500 peptides not matching sequences in the UniprotKB database. Utilizing the INBRE Bioinformatics core, predictor programs were used to identify peptides with potential antimicrobial activity against fungi, viruses and bacteria. Of the 9500 peptides discovered 30 peptides were identified with strong predictor values. De novo peptide 3337 is predicted to have broad antimicrobial activity against both gram negative and gram positive bacteria in addition to its predicted ability to move through Biofilms. In vitro assays will be used to confirm predicted peptide activity against multiple bacterial species.

Chemistry

50 - Analysis of BETX mixtures using Raman Spectrometry

Drake Jackson - Harding University, Undergraduate student
(Co-Author: Dr. Ed Wilson)

My professor created from scratch a Raman Spectrometer. What we did was test and calibrated the spectrometer using benzene, toluene, ethylbenzene, and xylene. With the readings and results, we then compared them to commercial Raman Spectrometers to see if ours had the same accurate readings. We are working on making a spectrometer that can be utilized more efficiently for NASA and space travel.

51 - Analysis of Oxidative Stress of Membrane Lipids

Sydnye Shuttleworth - Harding University, Undergraduate student
(Co-Author: Dr. Dennis Province (Harding University))

Oxidative stress results in the breaking down of biomolecules as they interact with reactive oxygen species. These reactions cause cell damage which lead to disease and loss of cell function. Bacteria, like e-coli, are bound by a cell membrane that is made up in part by the fatty acids palmitic acid and steric acid. Irradiating TiO2 nanoparticles with light from UVLEDs with a maximum wavelength of 365 nm, reactive oxygen species are formed. This experiment exposed palmitic and steric acid to reactive oxygen species for 30 minutes to 3 hours to induce oxidative stress. Methyl esters were then formed from these fatty acids and analyzed by gas chromatography mass spectrometry. Using electron ionization, the fragmentation patterns of the eluted peaks will be used against a library data base to identify the oxidized fatty acid products and the area of the palmitic acid and steric acid peaks will be used to monitor the extent of the reaction. K12 e-coli will also be irradiated in the same way, the fatty acids derivatized to methyl esters and analyzed in a similar manner.

52 - Design and Optimization of a Low-Cost, Arduino-Controlled Fluorometer

Jacob Belding - Hendrix College, Undergraduate student
(Co-Authors: William Gunderson (Hendrix College); Julie Gunderson (Hendrix College))

A fluorometer is a device that is used to measure parameters of fluorescence (i.e. intensity, wavelength, and polarization). These observables are used to identify the presence of specific amounts of molecules in a medium, observe conformational changes within species, quantify ligand-receptor binding and dissociation activities, and determine relative distances between locations on biological macromolecules. Fluorescence analysis is ubiquitous in biomedical research, as it is used by biologists, chemists, biochemists, biophysicists, medical professionals, biomedical engineers, and environmental scientists to characterize samples. Fluorometers are common in biomedical research laboratories, but they are uncommon in educational research institutions because of their high cost. The goal of this work is to design a low-cost fluorometer that is suitable for teaching the principles of fluorescence spectroscopy. Here, we present a low-cost fluorometer constructed from a LED light source, two lenses, a photodetector, and an Arduino, and we demonstrate that this instrument can be built from 3D printed optomechanical components, which dramatically reduces the cost of assembly.

53 - Development of a modified Michaelis-Menten Langmuir kinetic model for supported lipid bilayer formation

Kirstyn Baker - Hendrix College, Undergraduate student
(Co-Authors: Robbie Kiss; Jackson Bridges; Peter Kett (all Hendrix College))

Supported lipid bilayers (SLBs) are model biological membranes which are used to study the interaction between lipids and proteins. SLBs are made up of a bilayer of phospholipid molecules which are sat on a non-metal oxide surface such as silicon dioxide. They form when a vesicle solution flows over the surface and the vesicles adsorb to the surface before rupturing. We have developed a model for understanding the mechanism of SLB formation based on a modified Michaelis-Menten Langmuir (MML) kinetics model. By fitting data acquired using a Quart Crystal Microbalance (QCM) to our model we are able to extract information such as the rate constant for vesicle adsorption and for vesicle rupture. We have made modifications to the MML model to account for what happens when we interrupt and then restart the flow of phospholipid vesicles over the silicon dioxide surface.

54 - Investigating the role of a critical vesicle concentration in the formation of supported lipid bilayers

Jackson Bridges - Hendrix College, Undergraduate student
(Co-Authors: Kirstyn Baker; Robbie Kiss; Peter Kett (all Hendrix College))

Supported lipid bilayers (SLBs) are composed of a bilayer of phospholipid molecules supported on a silicon dioxide surface. Although it is known that many experimental factors including pH, ionic strength, lipid headgroup, and surface affect whether an SLB will form the exact mechanism for the formation of these model biological membranes is unknown. Work carried out by other researchers using fluorescence microscopy and atomic force microscopy has previously shown that SLBs form in two steps with intact vesicles adsorbing onto the surface before rupturing to form a continuous bilayer. In the literature it is often stated that a critical coverage of adsorbed vesicles is required before rupture can begin, though there is little experimental evidence to back up this assertion. We have carried out a series of experiments in which we interrupted and then restarted the flow of phospholipid vesicles over the silicon dioxide surface and used a quartz crystal microbalance (QCM) to monitor the adsorption and rupture of phospholipid vesicles on the surface. Our experiments show that it is possible to understand the formation of an SLB without having to invoke the need for a critical concentration of adsorbed vesicles to be reached before the vesicles begin to rupture.

55 - Iron Content in Dried Fruit Chips Versus Pureed Baby Food Using Two Different Methods

Whitney Austin - Southern Arkansas University, Undergraduate student
(Co-Author: Gija Geme (Southern Arkansas University))

Iron deficiency, called anemia, is a serious condition for anyone, but even more so for pregnant women and infants. When either individual does not get a sufficient amount of iron, it can lead to developmental delays for the child and even death. This experiment was conducted in order to compare the amount of iron found in dried fruit chips to the amount found in pureed baby food in order to see the difference. Standard addition was done to accomplish this using a UV-Spectrophotometer for analysis. Also, an Inductively Coupled Plasma Spectrometry was used to analyze food for iron content. When observed by type of fruit, the apple and banana baby foods had the higher concentrations, and the mango chips had a higher concentration than the mango baby food.

56 - Determination of Caffeine Content in Popular Energy Drinks with High Performance Liquid Chromatography

Jada Fricks - Southern Arkansas University, Undergraduate student
(Co-Authors: Cole McKay (Southern Arkansas University); Brett Wacha (Southern Arkansas University); Gija Geme (Southern Arkansasa University))

Caffeine is a highly consumed neurological stimulant that has been labeled by the FDA by the designation “generally recognized as safe” (Kalumuck). Mechanically caffeine functions by acting as an inhibitor of the adenosine receptors which plays an important part in the feeling of tiredness and body fatigue. However, caffeine has also been linked to elevated blood pressures, psychological dependencies insomnia, promotion of urine formation and stimulation of the heart and lungs (kalumuck). It has even been purposed that caffeine could be responsible for life threatening diseases such as cancer and birth defects. Do to the possible health effects of caffeine high caffeine content drinks are of great concern. According to the 4.9 version of the Sigma Aldrich safety data sheet for caffeine the LD50 for oral ingestion of a male rat is reported to be 367.7 mg/kg (Sigma Aldrich) which comes out to 23.9 grams for a 65 Kilogram person. The purpose of the experiment was to determine the concentration of caffeine contained in various popular energy drinks. For this testing a Shimadzu HPLC with a UV detector was employed. Red bull, V8 Energy, 5 Hour Energy, 5 Hour Energy Extra Strength, Sonic, and NOS was tested. The study revealed a consistently higher than the reported values averaging 21.9% difference in caffeine concentration.

57 - Analysis of Copper in Local Arkansas Wines

Tanner Parrott - Southern Arkansas University, Undergraduate student
(Co-Author: Gija Geme (Southern Arkansas University))

The purpose of this experiment is to find the concentration of copper in wines from a vineyard in Arkansas and compare to the legal standards for copper in wine. In this study, a Graphite Furnace Atomic Absorption Spectrometer (GFAAS) method was used by direct injection of the wine on to the atomizer of the graphite furnace. For comparative analysis, a digestion was performed on the samples by adding 2.5 mL of two oxidizing agents (cc. HNO3 and cc.H2O2) to 5.0 mL of the wine. The digestion method yielded a copper concentration ranging from 11.29-49.27 ppb with an average concentration of 35.00 ppb. The addition of the Mg-Pd matrix modifier yielded a copper concentration ranging from 11.0-62.7 ppb with an average concentration of 42 ppb. The linear range was determined to be 99.921 ppb – 200 ppb. The MDL was determined to be 3.67 ppb. The RSD was calculated to be 7.84%. Furthermore, an analysis of the wine when added with Pd-Mg matrix modifier was conducted by adding 2.5 mL to 5.0 mL of the wine sample. The wines analyzed had a copper concentration ranging from 24.3-124.7 ppb for the direct injection method with an average concentration of 80.9 ppb—falling well within the limit mandated by the US.

58 - Lead concentrations in soil at the local shooting range

Zach Hazeslip - Southern Arkansas University, Undergraduate student
(Co-Authors: Robert Stanley (Southern Arkansas University); Gija Geme (Southern Arkansas University))

Lead is a naturally occurring element found in small amounts in the earth's crust. White it has some beneficial uses, it can be toxic to humans and animals causing health effects. Lead and lead compounds have been used in a wide variety of products found in and around our homes, including ammunition.

While natural levels of lead in soil range between 50 and 400 parts per million, different activities have resulted in substantial increases in lead levels in the environment. Lead may move from soil into ground water depending on the type of lead compound and the characteristics of the soil.

The purpose of this study was to analyze lead concentrations at the local shooting range. The soil was collected and digested using MARS5 digestion system and analyzed by Graphite Furnace Atomic Absorption Spectrometry (GFAAS). The preliminary results showed that highest lead concentrations were near the mound and the lowest were in the middle of the field. The bullets and shells were also collected at the site and scanned for different heavy metals using Energy Dispersive X-Ray Spectroscopy (EDX). The preliminary results showed that the majority of the bullets and casings contained copper and only small number of the bullets contained significant amount of lead.

59 - Microenvironment-sensitive probes for selective recognition of serum albumin protein in solution

Kallie Mendenhall - Arkansas Tech University, Undergraduate student
(Co-Authors: Siddhi Patel (Arkansas Tech University); Rajib Choudhury (Arkansas Tech University))

Two small molecule fluorophores were designed and developed in this project. They were utilized to quantitatively detect human serum albumin (HSA) in buffer solution. Quantitative estimation of HSA in body fluids, such as urine, saliva, and plasma is very important. Serum albumin is the most abundant protein in blood plasma. It plays vital roles in maintaining oncotic pressure of blood

and serves as a carrier for fatty acids, vitamins, hormones, drugs, etc. Different amount of HSA in urine indicates different health conditions, such as microalbuminuria or macroalbuminuria. Hence, search for efficient HSA detection methods in body fluids has gained extreme importance among researchers and medical scientists. This project aims to develop suitable fluorogenic compounds for simple, cost-effective, and selective detection of HSA in biological samples by spontaneous supramolecular association. Both probes selectively detected HSA in buffer solution. The association of the probes with the HSA was linear with the amount of protein in the solution which resulted high binding affinity and an impressive limit of detection in the synthetic urine solution.

60 - Organocatalytic pericyclic reactions: catalyst reactivity and substrate scope

Hayden Criswell, Reece Mitchell, and Shawqi Musallam - Hendrix College, Undergraduate students
(Co-Authors: Evan Glassford; Heidi A. Dahlmann (Hendrix College))

Many carbon-carbon bond-forming reactions, including pericyclic reactions, must either be carried out at high temperatures or must be mediated by a catalyst. Although metal-based catalysts can mediate certain pericyclic reactions very well, they can also be hard to remove from the reaction mixture, expensive, environmentally unfriendly, and toxic. Thus, we propose using milder, environmentally-friendlier organocatalysts to mediate pericyclic transformations. Herein we explore the reactivity of different organocatalysts for catalyzing carbonyl-ene reactions and other related carbon-carbon bond-forming reactions on a broad scope of substrates. We also attempt to correlate measurable catalyst reactivity with chemical properties such as pKa in order to better predict catalyst efficacy.

61 - Photocatalysis as a Means of Disinfecting Water During Space Flight

Elizabeth Reed - Harding University, Undergraduate student
(Co-Authors: Shelby Reid; Jade Toth (Harding University))

Human presence in space necessitates that all biospheres in which astronauts work and live be self-contained, including recycled air and water systems. To this end, a low power and green solution to water purification is desired. Photocatalysis is a promising solution to this issue. Titanium Dioxide nanoparticles can be photocatalytically activated using UV-LED light at a wavelength of 365 nm to create reactive oxygen species (ROS) that break down organic impurities and pathogenic organisms. In this project, concentrations of a variety of bacterial species before and after treatment with TiO2 and light were analyzed in order to begin determining the efficiency of disinfection parameters established in previous experiments. The preliminary data gathered in this experiment will be used to design more detailed studies in the future.

62 - Photocatalytic activity of TiO2 in a closed circuit: eliminating organic contaminants in water using methyl orange as a model compound.

Rebecca Sain - Harding University, Undergraduate student
(Co-Authors: Dr. Dennis Province (Harding University); McKenzie DiLeo (Harding University))

This research focused on the disinfecting ability of photocatalysis using UV rays and a TiO2 nanoparticle surface. The purpose was to build a closed system that would rely on photocatalysis to eliminate organic contaminants in water with the intent of recycling it for drinkable reuse. After preliminary work studying circuits, a simple circuit was constructed using UV LEDs at an output of 365 nm, and the degradation of methyl orange as a model compound was observed. Optimal parameters such as voltage, currents, TiO2 ratios, and temperature for maximum results were determined so that the most efficient system could be constructed. UV-Vis Spectroscopy was used to determine the rate of photocatalysis breakdown by measuring the maximum absorbance of methyl orange at 463.2 nm. Due to photocatalytic efficiency, low power and mass, a system such as this would potentially be beneficial in space craft water usage and recycling for extended missions. The results showed that the optimal current for operation is 200 mA, and the optimal ratio of methyl orange solution to 1.08% Degussa TiO2 slurry is about 20 mL to 3 mL. Cold temperatures of around 0 °C did not have a great impact on slowing the reaction. The mixture Degussa is a better photocatalyst than Anatase, and Potassium Titanate showed no useful photocatalytic behavior.

63 - Understanding the role of flow rate and lipid concentration in the kinetics of supported lipid bilayer formation

Robbie Kiss - Hendrix College, Undergraduate student
(Co-Authors: Kirstyn Baker; Peter Kett (both Hendrix College))

Supported lipid bilayers (SLBs) form when a vesicle solution is flowed over a surface such as silicon dioxide. Previous research has shown that SLB formation occurs in two steps. In the first step there is adsorption of vesicles from solution to the surface. In the second step the adsorbed vesicles deform until they are eventually under enough strain that they rupture to form a continuous phospholipid bilayer on the surface. The exact mechanism by which vesicles adsorb and then rupture is not known, though we have developed a model based on Michaelis-Menten Langmuir kinetics (MML) to help better understand this process, and have fitted quartz crystal microbalance (QCM) data to the model to acquire quantitative information on the formation process, including rate constants for the adsorption and rupture processes. In order to increase confidence in our model and to reduce the number of freely varying parameters we have looked at the role of flow rate and lipid concentration on SLB formation so that we can carry out constrained fits between our experimental QCM data and theoretical model.

64 - Use of UV/Vis Spectroscopy to Measure ASA in Aspirin

Preston Eubanks - Southern Arkansas University, Undergraduate student
(Co-Author: Gija Geme (Southern Arkansas University))

Acetyl salicylic acid is a pain-relieving compound that is in current over the counter pain relievers. It is commonly prepared with fillers in Aspirin tablets. In this experiment, four different brands of aspirin were tested using UV-Vis spectrometry. The aspirin was crushed one brand at a time by mortar and pestle, and then FeCl3 was added in order to be able to properly test the amount of ASA per tablet versus the amount of ASA stated on each box. The results showed that the Bayer, Equate, top-care, and Walgreens brands both had a

greater amount of ASA in the tablets then the amount that was stated on the boxes. The conclusion of this experiment showed that the amount of ASA in each tablet can likely be higher than what is stated on the box, and the brands had less fillers than what was expected.

Computer Science and Mathematics

65 - Skin cancer Spatial Survival models using R/SAS

Thy Dao - University of Arkansas Fayetteville, Graduate students

While survival analysis refers as censored time-to-event data, spatial terms refer as when such data is located in space. Spatial survival analysis combines both techniques from geo-statistics and survival analysis in response to the attention of the scientific interest in the role of geographical information in predicting survival. My method is the classic definition of the survival analysis, using the concept of censoring for the commonly-used models: proportional hazards and proportional odds. My presentation use both R and SAS softwares to examine geographically survival distributions of melanoma, a type of skin cancer, retrieved from Surveillance, Epidemiology, and End Results Program data.

66 - How Powerful Can Deep Learning Be Compared with Machine Learning? A Entity Resolution Case

Xinming Li - University of Arkansas at Little Rock, Graduate student
(Co-Authors: John R. Talburt(UALR), Ting Li(UALR), Xiangwen Liu(UALR))

The emerging volume of heterogeneously structured data, and even unstructured data, poses a challenge to traditional ER methods. These methods require extensive human time and effort. In recent years, advances in AI, especially in deep learning, provide cutting-edge methods and techniques to solve these challenges. This research explores the feasibility of applying machine learning and deep learning both to handle the new heterogeneous and unstructured data and to reduce the human work load in ER.

This research starts with pairwise matching (similarity), the core function of all ER tasks. First, to measure the similarity of heterogeneously structured records, we design a similarity measurement tool, scoring matrix; the inputs of scoring matrix are two raw records and the output is a score vector representing the extent to which these two records are similar. Thus, the process of standardizing all records into an identical attribute-based structure is avoided. Second, based on the similarity score vector derived from scoring matrix, machine learning can be applied. Both threshold method and various machine learning algorithms are explored for the pairwise matching, and results show that machine leaning enhances the performance significantly compared to the manually threshold method. Tests have shown an increase in F-measure from 0.55 to 0.80. Third, to further reduce human involvement and take advantage of advanced AI techniques, deep learning is explored. Pairwise matching is seen as a classification problem. The input is two raw records and the output is the match or non-match decision. Deep learning has the advantage of extracting features by itself avoiding subjective judgement. The preliminary results are promising. F-measures as high as 0.99, compared with 0.80 attained by the scoring matrix combined with machine learning, shows that deep learning has the potential to remove the pairwise matching task.

67 - Computer Vision System for Identifying and Quantifying Waste

Mariofanna Milanova – UALR
(Co-Author: Sumuel Wills, Department of Computer Science, UA Little Rock)

Human waste is often disposed of improperly, leading to a buildup of litter in and around the waterways, causing damage to the local ecosystem. Human effort must be expended to find and remove the waste materials. In this project, a system is developed using the Tensorflow software library to create an artificial neural network that is trained to identify several of the most common waste materials, which will then be implemented along Fourche Creek in Little Rock, Arkansas to detect, classify, and count the waste materials moving through the stream. The system aims to reduce the amount of physical labor involved in finding the waste by documenting the location and volume of waste in real time, providing valuable information to those who must eventually clean the trash. The system could be also be used to identify the primary sources of waste, allowing measures to be taken to prevent the entrance of the waste into the waterway.

68 – Human Interaction with Multivariate Sentiment Distributions of Stocks Intraday

Mariofanna Milanova – UALR
(Co-Author: Lamarcus Coleman, Computer Science Department, UA Little Rock)

In this work we show that the sentiment of the broader stock market, namely the S&P 500, is related to the activity of individual stocks intraday. We introduce a concept we term as embedded context which is an approach to improving unigram language models for restricted use cases. We use a Gaussian Mixture Model to create different sentiment regimes of the broader market over our training period and perform an analysis of the return and volatility characteristics of each stock per each regime. We create an intraday momentum trading strategy using a moving average and Relative Strength Index (RSI) over our testing period with no consideration to our prior sentiment regime analysis which serves as our baseline model. We then create an updated version of our intraday trading strategy which considers the sentiment regime of the broader market. Our results show an improvement in each stock's intraday strategy performance as a result of considering the broader market's sentiment regime.

69 - Scalability Studies for Compressible Flow Simulations

John McGarigal - University of Arkansas, Undergraduate student
(Co-Authors: Alaina Edwards; Tulin Kaman (University of Arkansas))

The focus of this study is to improve the scalability of the compressible front tracking code on Blue Waters, petascale supercomputer at the National Center for Supercomputing Applications. The performance measurements of the application code are conducted using TAU (Tuning and Analysis Utilities) to identify the most computationally expensive parts of the numerical simulations for turbulent flow problems. Automatic instrumentation of the code using the TAU's compilers and its profile visualization tool, paraprof, help us to analyze the performance data on thousands of cores. We identify the performance bottlenecks and work on the improvement of the high-order accurate numerical weighted essentially non-oscillatory (WENO) scheme implementation to reduce the time spent in computation. The use of hybrid MPI+OpenMP parallelization for further speed-up is discussed and the results are presented.

Physics

70 - A Real Time Automated Microclimate Ecosystem

Kayce Conville - University of Central Arkansas, Undergraduate student

The goal of the project is to create an automated microclimate which recreates any given ecosystem in real time. The ecosystem is controlled with a RasberryPi and the program is written in Python. The user is able to give the program a given weather station ID associated with Weather Underground, which the program then pulls the HTML code from the website providing the program with the real time weather information for that particular station. The program than process that data and pulls the information wanted, like current temperature, solar radiation, hourly precipitation, and daily precipitation. For proof of concept, the program will be taking in real time solar radiation data and mimicking the light within a controlled environment. The environment will be equipped with a semiconductor photodiode sensor which will give off a voltage proportional to the amount of energy given off by the light source. To create the scale of voltage versus light, data will be collected with the photodiode sensor in the vicinity of a weather station which reports solar radiation. The data from the weather station and the data from the sensor will then be analyzed to create this scale. With this information, the program will be able to take in the live data from the weather station and adjust the light source to give off the correct amount of energy, matching the real time conditions. By creating a real time automated microclimate ecosystem, it can allow the user to recreate an environment and observe the subject that is being studied in its natural habitat from anywhere in the world.

71 - Design and Implementation of 3D-Printable Optomechanical Components

Dylan Mitchell - Hendrix College, Undergraduate student
(Co-Authors: Ryan Bullis (Hendrix College), William Gunderson (Hendrix College), Julie Gunderson (Hendrix College))

Fused Filament Fabrication (FFF) 3D printing is a process by which three-dimensional objects are created by depositing layers of a material onto a hard, flat surface by a robot. It is often referred to as an 'additive manufacturing' technique because material is added in successive layers to create an object. Because many scientific applications require parts that are expensive to purchase or manufacture, 3D printing custom parts for scientific instrumentation can save (shipping and/or manufacturing) time and money, and it requires only one compact, computer-controlled robot. Thus, 3D printable scientific parts and equipment can drive down the costs of scientific research and can advance the pace of research progress. Here, we present a library of 3D printable optomechanical components that are compatible with commercial optomechanical parts. These components were tested for their optical stability and durability in home-built optical systems constructed entirely from 3D printed optomechanical components, and we demonstrate that optical systems built using 3D printable optomechanical components are comparable to their more expensive, commercially available counterparts. Thus, we expect our library of 3D printable optomechanical components to find utility in scientific research and teaching laboratories.

72 - Development of an Acoustic Field Scanner

Nick Scoles - University of Central Arkansas, Undergraduate student

A system has been designed to scan a microphone over a 30x30 cm plane to image an acoustic wavefield. The system uses two PI stepper motors to provide motion in both x and y directions. A quarter inch microphone is mounted on the stepper motor setup to scan an acoustic wavefield. The servomotors and data acquisition/analysis are controlled using python. This system makes is used to visualize acoustic wavefields projected from a defined acoustic source.

73 - Investigating relationship between strain applied to Rat's Leg bone and bone's mechanical strength

Yelaman Zhenis - University of Central Arkansas, Undergraduate student
(Co-Authors: Rahul Mehta (UCA/Dept of Physics & Astronomy); Parimal Chowdhury (UAMS/Dept of Physiology & Biophysics))

This project will investigate relationship between force bending rat femur leg bones with a stress (force per area) and strain (bent distance over length of the bone) that were applied. The procedure to bend the bones:
- Bone was exposed to strain by hanging masses (up to 300 grams) to one end of the bone
- Femur was fixed in vise with special jaws at the end closer to knee joint (lower extremity)
- The other end, closer to pelvic bone (upper extremity), was glued perpendicularly to non-reflective side of small mirror piece
- String was attached near the mirror piece
- The other end of the string was connected to system of pulleys, such that the horizontal force applied was weight of the masses
- Laser beam was incident on the mirror. Reflected beams would be recorded on the wall that mirror is facing.

This procedure was done twice. Special jaws would fix a bone at major axis at cross section, then it would be rotated 90 degrees and fixed at minor axis. This rotation must be done in order to consider elliptic shape of a bone. Collected data (mass applied, bent distance, strain and stress) will be used to analyze relationship of stress and strain and represent the elasticity of the bone.

74 - Preparation of polycrystalline Tin Selenide to Investigate Thermoelectric Properties

Alex Golden - Southern Arkansas University, Undergraduate student

(Co-Authors: Puskar Chapagain (Southern Arkansas University); Bothina Manasreh (University of Fayetteville))

Tin Selenide (SnSe) has become a material of choice for fundamental as well as industrial studies because of its potential application in thermoelectric devices. It has been found that the energy conversion efficiency of single crystal SnSe, which in turn depends upon electrical conductivity, Seebeck coefficient and thermal conductivity of the material, was found to be very low and highly directional-dependent. As the single crystal SnSe structure is very brittle, it is very hard to synthesize, which possibly limits the commercialization of SnSe. However, the anisotropic properties of this semiconducting material can be easily harvested by manifesting the sample in amorphous form. Preparing powder with well-defined grains is a very successful method in the area of material science and engineering. The polycrystalline material prepared by this technique is considered to be mechanically stronger than single crystal SnSe. On the other, this can yield large amount, with fairly low value of thermal conductivity. Several different techniques have been employed to synthesize this semiconducting material. Some of which include; physical/chemical vapor deposition, high-energy milling, ultrasonic spray pyrolysis and so on. In this project, we used wet chemical technique to synthesize polycrystalline SnSe. The nano/micro-meter sized grains thus obtained can be easily compressed under very high pressure to make pellets for further thermoelectric characterization. We chose this simple method because of its cost effectiveness, reproducibility, and fine grain structures. Furthermore, we also investigated the temperature dependent Seebeck coefficient, and thermal conductivity of SnSe which could directly impact the conversion of heat into electrical energy.

75 - Protostellar Outflows in L1448

Jordan Rhoades - University of Central Arkansas, Undergraduate student

Protostars are formed from molecular clouds and are at the forefront of star formation. Outflows within the L1448 region in the Perseus molecular cloud were observed using the Sub-Millimeter Telescope. We used the data from the protostars' spectra to determine the mass, momentum, and energy of the protostars systems. This allows us to see the effects on the molecular cloud and the protostar systems at a larger scale.

76 - Quantitative Binding of Divalent Metal Ions To DNA Hairpin Loops

Harrison Russell - Hendrix College, Undergraduate student

(Co-Authors: Julie Gunderson (Hendrix College); William Gunderson (Hendrix College))

Slipped-strand DNA structures can form when complementary repeating sequences on a single-strand pair up to form thermodynamically stable hairpins. The formation of these hairpin structures is believed to contribute to the expansion of nucleotide repeat tracts, which are mutations associated with the development of many hereditary and anticipative neurodegenerative diseases in humans. Mg(II) is a divalent cation that is known to play important structural roles within DNA molecules, but the number of Mg(II) binding sites and the affinity of Mg(II) to slipped strand DNA structures are not known. The objectives of this study are to determine the stoichiometry of interaction and the dissociation constant (KD) for Mg(II)/hairpin DNA binding. Mg(II) is spectroscopically silent and cannot be observed directly. To determine the binding characteristics of Mg(II) to DNA hairpins, competitive titrations with Mn(II) were performed. Concentrations of Mn(II) were determined using electron paramagnetic resonance (EPR) spectroscopy, and the number of Mg(II) binding sites and the KD for Mg(II) were calculated using a binding isotherm. The results suggest that Mn(II) binds to DNA hairpins with a significantly higher affinity than Mg(II).

Engineering

77 - An Investigation of Thermoelectric Element Power Generation and Heat Pumping Ability

Isaac Raphael – University of Central Arkansas, Undergraduate student

The purpose of this research project was two fold: to first quantify the cooling ability of two different CPU cooling units and then to characterize the power generation and heat pumping ability of a Peltier device in the context of a model CPU and CPU cooling unit. A Peltier device is a thermoelectric device that can work in two ways. Firstly, it can act as a power supply when the two sides of the device are at different temperatures. Secondly, the device can work as a heating/cooling device where one side of the device gets cold and the other side gets hot when an input voltage is applied to the leads. Along with that, the goal of the research project was to automate the data collection processes. This was accomplished with prototyped circuits on a breadboard that were controlled by a Raspberry Pi 3. Python was the language used for the automation programs. Python's Matplotlib plotting library as well as Matlab were used for data analysis. Studying the cooling ability of the CPU cooling units resulted in Temperature vs. Time plots that showed how the well the cooling units could stabilize temperature when an aluminum block (model CPU) was heated over a range of power levels. Then, using the ability to develop stable temperature differences between the metal block and cooling unit and placing a Peltier device in between the two allowed I-V curves of the Peltier device to be be produced. Applying varying input voltages to the device while having the device in between the cooling unit and metal block lead to a new set of Temperature vs. Time plots that were then compared to the heat pumping ability of the conventional cooling units.

78 - Developing a Fluid Mechanics Experiment Using a 3D Printed Venturimeter

Joel Howell, Tristan Nivens, Jerry Ramsey, and Austen Wood - Southern Arkansas University, Undergraduate students
(Co-Author: Mahbub Ahmed (Southern Arkansas University))

As part of this project an experimental setup in the area of fluid mechanics was developed. This project was a great learning experience for this student group and the end result will be used as a learning tool for the future engineering and technology students. Although theory is important, working on hands on projects are also very important. These hands-on projects prepare engineering and technology students to get ready for solving real world problems that they could encounter. This project involved developing a setup that would measure the volumetric flowrate using a venturimeter as the most crucial part of the setup. The venturimeter was designed as per the scientific guidelines and was 3D printed. The design parameters are elaborated in detail in the body of the poster. The piping systems of the setup was constructed using clear acrylic pipes that allow the learners to visualize the fluid flow process in a pipe system. The system allows students to measure the experimental flowrate using a traditional method by collecting water for a known period of time and dividing the volume with time. The theoretical flowrate would be estimated by measuring the pressure at the pressure taps - one at the upstream of the venturimeter and the other one at the throat. This pressure difference is then used to estimate the velocity as well as the flow rate in the pipe system. An experiment was already carried out using the setup and both theoretical and experimental flowrates were estimated and the relative percentage errors were calculated at different flowrates. It was found that the experimental flowrates were very close to the theoretical numbers. The small loss of accuracy could be due to different sources of errors that are elaborated in the poster.

79 - Evaluation of the stress-strain state for the 3D printed airfoil using finite element method

Tristan Nivens - Southern Arkansas University, Undergraduate student
(Co-Author: Jerry Ramsey)

Frictional drag and stress due to the load in an airfoil is an important issue for aircraft while it is in motion. Numerous experiments have already performed to analyze the elastic and plastic behavior of conventional structural material. With the advent of modern manufacturing technology such as 3D printed material, there are scope of exploring new technique to enhance structural property (shear, bending moment, and torque) by changing the percentage infill and printing pattern of the extruded filament. While the printed material is gripping the engineering community with large mass appeal, stress-strain analysis of structural material is very important to predict the service life and performance of an element while the element experience load. Additive manufacturing is convenient and effective in case of rapid rehabilitation and machine parts replacement where there is less opportunity for quick replacement. At the heart of 3D printing lies the design flexibility and there are no longer constraints of traditional manufacturing processes that limit the design best suited for form to function. Current study analyze the data acquisition and comparison of theoretical data with computational fluid dynamics method.

80 - Experimental Investigation of Stress Concentration in Plastic Materials Used for 3D Printing

Kenneth Escudero - Southern Arkansas University, Undergraduate student
(Co-Authors: Lionel Hewavitharana (Southern Arkansas University); Md Islam (Southern Arkansas University); Mahbub Ahmed (Southern Arkansas University))

Plastic materials are gaining wider use in component design due to the popularity of 3D printing. The growth of new medical devices made of 3D printed plastic components is on the rise, which exemplifies the wider application. However, there is a lack of sufficient engineering data related to stress concentration of plastic material. This present study was undertaken to study the stress concentration in 3D printed plastic materials and establish stress concentration factors for design purposes.

81 – Developing Soft Actuators at SAU Engineering

Kenneth Escudero and Daniel McKague - Southern Arkansas University, Undergraduate students
(Co-Author: Mahbub Ahmed (Southern Arkansas University))

The purpose of this project is to explore the emerging field of soft robotics. The main objective is to design and fabricate PneuNet (pneumatic network) actuators that can mimic biomotion. This kind of soft actuators was first developed by a team at Harvard University. The actuators are generally designed with a series of channels integrated inside of an elastomer (typically silicone rubber). When an actuator is subjected to pressure, these channels inflate which cause a specified motion. It is possible to control and manipulate this motion by creating different geometrical channels varying in shape, thickness, and material properties. When a PneuNets actuator is pressurized, expansion occurs in the stiff regions. In the current study, a combination of CAD and 3D printing technologies are used to design and fabricate the molds for such actuators. These molds are being used to cast using silicon rubber compounds to form the soft actuators. These actuators are then tethered to a fluidic control board to control the actuators electronically through programs. A detailed discussion about the types of actuators being developed and the relevant processes are provided in this presentation.

82 - Effective Thermal Conductivity of Open Celled Copper Foam metals

Elias Perez Reyes - University of Arkansas at Little Rock, Undergraduate student
(Co-Author: Srikanth Pidugu (University of Arkansas at Little Rock))

Understanding heat transfer characteristics of foam metals is vital in design of heat exchangers, energy storage devices, and convection enhancement devices. Heat transfer through foam metals is a complex process as it involves two phases, namely solid cellular structure and fluid that fills the structure. Therefore it not only involves conduction through solid structure but also convection in the fluid medium. For this reason, it is common practice to use term “effective thermal conductivity” instead of thermal conductivity. The goal of the research project is to experimentally determine effective thermal conductivity of open celled copper foam metals of various porosities.

83 - Experimentation and Modification of Various 3-D Printed Water Pump Designs

Becka Wilson and Moriah York - Southern Arkansas University, Undergraduate students
(Co-Authors: Daniel McKague (Southern Arkansas University); Mahbub Ahmed (Southern Arkansas University))

The purpose of the current project is to design, fabricate, and test small centrifugal pumps to gain a better understanding of fluid mechanics. As part of the process an industrial grade CAD tool, SolidWorks, was used to design all components of a centrifugal pump such as the impeller, the housing, the motor holder, etc. and to subsequently 3D print these parts. A 12 volt dc battery was used to run the pump. The pump assembly was attached to tubing and was tested for pumping water. The group dealt with several challenges that are being presented in the presentation. One of the challenges was minimizing the leak at the 3D printed pump attachment. Overall, this was a great learning experience in designing and 3D printing of engineering parts.

84 - Impact energy absorption behavior of lightweight interpenetrating phase composite foam

Kailash Jajam and Sherif Selim - University of Arkansas at Little Rock, Professor and Undergraduate student
(Co-Author: Ashokkumar Sharma (UA Little Rock))

With the increasing use of multiphase materials for weight sensitive applications in automotive, aerospace and defense sectors, it is important to design lightweight, fracture resistant composites with optimum stiffness, specific strength and improved impact energy absorption capacity. Keeping this as a central goal, this research is focused on manufacturing of interpenetrating phase composites (IPC) by infusing uncured particle-filled epoxy polymer into an open-cell aluminum foam. Of particular interest the effect of solid and hollow micron-size fillers on mechanical response of IPC composites is examined. By varying the volume fraction of solid and hollow fillers, particulate epoxy infiltrated into a continuous 3-D network of aluminum foam is subjected to Charpy impact loading conditions for energy absorption studies. Compression and flexural tests will be carried out at low strain rates followed by investigation of microscale toughening mechanisms using scanning electron microscopy.

85 - Mixing of fluids in macro-channels

Derrick Fuell - University of Arkansas at Little Rock, Undergraduate student
(Co-Author: Srikanth Pidugu (University of Arkansas at Little Rock))

Rapid fluid mixing in microchannels offers significant advantages in lab-on-chip testing applications. However, building a microchannel system and instrumentation required to study mixing characteristics is expensive. Studies can be conducted in fairly small sized macro-channel system by ensuring that the magnitudes of velocities are small which is a characteristic inherent to micromixers. By doing so, it is possible to study mixing behavior that can applied at microlevel. The goal of the project to design, fabricate and test a new macro-channel system using optically transparent materials. The novel feature in this design is to include a circular or hexagonal chamber(s) to create re-circulation zones.

86 - Numerical Simulation of Oxy-Fuel Combustion

Lucas Blake and Matthew Gustafson - Southern Arkansas University, Undergraduate students
(Co-Author: Mahbub Ahmed (Southern Arkansas University))

Coal has historically been one of the main focal points in the world's energy production. However, this large reliance on coal using traditional methods releases tremendous amounts of carbon dioxide into the atmosphere. Today's standards for clean green energy in developed countries are stricter than before and do not allow for the enormous amounts of pollution created when burning coal using traditional methods. One method of combating atmospheric pollution is to use a coal water mixture during the combustion phase. This method results in the carbon dioxide being captured within the water therefore it is no longer escaping into the atmosphere. This method of clean coal combustion is still relatively new therefore current designs have plenty of room to improve. In the current study, a multiphase simulation is being carried out using a computational fluid dynamic (CFD) tool to simulate the coal combustion. As part of this study, how different parameters such as flow rates, injector geometries, and the mixture composition affect the flow field are being studied.

87 - Trout fishing tackle box

Li Morrow - University of Arkansas at Little Rock, Undergraduate student
(Co-Authors: James W Smith, Ashokkumar M Sharma, Mamdouh Bakr (Department of Engineering Technology, University of Arkansas at Little Rock, Little Rock, AR 72204))

The available plastic tackle boxes in current market are too large and not easily portable as you move to different fishing locations. Moreover, the current market doesn't include a wearable plastic tackle box. The wearable vests make it difficult to organize the needed lures and gear. The newly designed Trout Fishing Tackle Box, which is 9.8" x 8.6" x 3.0", will be a solution for many trout fishermen. It will provide a small, inexpensive, easy to use, wearable, and floatable tackle box. With only one layer all fishing gear is easy to access. The SolidWorks® software has been used to build the layout and test functionality. A 3D printer was used for prototypes and alignment testing. The primary box material is a rigid homopolymer polypropylene (HPP), which offers a high strength-to-weight ratio, combined with good chemical resistance, weldability, and it is inexpensive. With a specific gravity of 0.90 - 0.91, this box can float. Based on the final design, important mechanical properties of the newly designed trout fishing tackle box are: Tensile strength 4500-6000 psi, elongation at break 100-600%, tensile modulus 16500-22500 psi, impact strength 0.4-1.4 ft-lb/in, and hardness 80-100. The final manufacturing process will be an injection molding. The latches and hinges will be snapped into place and the straps will be hot glued or welded. The trout fishing tackle box project provided an excellent exercise in engineering design and manufacturing, providing steps that can be used for similar projects using polypropylenes.

88 - Water recycling system for a hydraulic ram pump

Jacob Jackson - University of Arkansas at Little Rock, Undergraduate student
(Co-Authors: Ashokkumar M Sharma, Srikanth B Pidugu (Department of Engineering Technology, University of Arkansas at Little Rock, Little Rock, AR 72204))

The ram pump has been utilized for many years to move water from one source to another, it is most notable as being an electricity free system. It harnesses the pressure of the water due to gravity, yet there is one downside to the ram pump that it has a waste valve. The waste valve is an essential component that creates pressure inside the system to force the water up to the destination, usually a collection tank. In a utopian type setup for a ram pump it is best to utilize their abilities inside a river or stream, this way the gravity flow of the water naturally builds up the pressure needed to operate the pump, and the waste valve theoretically has no waste. Yet this is not always possible based on certain geographical locations in the world. The ram pump is also utilized in small countries around the world as a form of water transportation because of its lack of the electricity requirements. Although it does allow the people to move the water from one place to another, the waste valve is losing about 85% of the water it is trying to displace into the destination tank. The purpose of this research is to create a new system that can be attached to an existing ram pump's waste valve and create a water recycling system. The materials required for this research include, measuring instrumentation, a solar panel, a water pump, a collection tank, electrical wiring components, and pipes and fittings. Testing will be carried out to discover the most efficient setup for a water recycling system. Upon completion, we expect to find the optimal system arrangement and setup to create a water recycling system that can be attached and utilized with an existing ram pump.

89 - Wearable tackle/utility box

James Smith - University of Arkansas at Little Rock, Undergraduate student
(Co-Authors: Li Morrow, Mamdouh Bakr, Ashokkumar M Sharma (Department of Engineering Technology, University of Arkansas at Little Rock, Little Rock, AR 72204))

The idea behind this project is to provide a fisherman or various utility technicians with a small, compact, easily accessible box that is contoured to comfortably fit about the waist when attached to a belt. This wearable box organizes and provides easy access to fishing supplies, various types of fasteners, and other accessories, thereby eliminating the time-consuming problem of searching through a conventional tackle/tool box or vest. Proves useful in various situations such as a fisherman wading in water or a carpenter standing high up on a ladder. How this box works is it has two loops molded to the top lid that act as the destination for a belt which is wrapped around the waist. While strapped to the waist, the bottom box can be unlatched from said top lid, using two hands, and folded down to the open position. There are supports located at the hinges, which are molded to said top lid, that stop and hold said bottom box at a 90-degree angle. Once in the open position, 90-degree angle, a flat lid plate which is pivotally attached to the bottom box can be flipped open exposing all of the accessories inside. This flat lid plate secures the accessories inside and can also act as a table or shelf when in the closed position. The perimeter of this box is about 9.5" x 8.5" x 3" when in the closed position.

Geosciences

90 - Biological and ecosystem level changes from the addition of reservoirs to headwater streams

Krishna Patel - Hendrix College, Undergraduate student
(Co-Authors: Margaret A. Young (Hendrix College); Brian Staley (University of Central Arkansas); Danielle Braund (University of Central Arkansas); Maureen R. McClung (Hendrix College); Matthew D. Moran (Hendrix College); Sally A. Entrekin (University of Central Arkansas))

Dams on headwater streams in the Fayetteville Shale region of Arkansas are often built to enable water withdrawal for hydraulic fracturing. Dams have been shown to change the hydrology, chemistry, and habitat connectivity of streams, but these effects have not been well-researched in these first order streams. Alterations in physicochemical conditions can affect macroinvertebrate communities and their associated ecosystem functions. We measured physicochemical and biological variables in three dammed headwater streams and compared these metrics to three undammed reference streams. Since aquatic organisms are often adapted to flow regimes typical for their area, we hypothesized that dams would change the physicochemical qualities of these streams so that species diversity and evenness would decline. We found that dammed streams demonstrated trends for lower discharge and soluble reactive phosphorous. Conversely, damned streams had trends of higher mean temperature, specific conductivity, and percent dissolved oxygen. The mean Shannon diversity index for benthic macroinvertebrates was greater and rank abundance curves revealed greater taxa evenness in dammed compared to undammed streams. Overall macroinvertebrate total abundance did not differ between treatments; however, streams with dams tended to have greater collector-gatherer abundance than undammed streams (mean abundance of 20 versus 3) that may be from a combination of altered physicochemical conditions. Therefore, our study suggests that damming small headwater streams can affect the physicochemical and biological conditions that influence stream ecosystem function and structure. Considering the large number of dams constructed in the Fayetteville Shale region, it is likely that a large proportion of headwater streams have been altered.

91 - Cloud condensation nuclei (CCN) measurements: Design and calibration of a CCN analysis system

Karen Morris and Rebecca Parham - Hendrix College, Undergraduate students
(Co-Authors: Hailey Hayes, Olivia Eddings, Megan Cassingham, and Courtney D. Hatch (Hendrix College))

Cloud condensation nuclei (CCN) are atmospheric aerosol particles that provide a surface for water vapor to condense and grow into cloud droplets. These small particles play a major role in regulating the Earth's radiation balance and have an uncertain contribution to climate change. Current discrepancies in results from theory and experiments on the CCN activation of insoluble atmospheric aerosols demonstrate that further studies are warranted. The aim of this project is to determine closure between CCN activation measurements using combined water adsorption and Frenkel-Halsey-Hill (FHH) activation theory as well as direct CCN measurements of size-selected insoluble aerosol particles used to model hydrophilic mineral surfaces in the atmosphere. The CCN

activation measurements are performed using a Differential Mobility Analyzer (DMA) to size-select atomized and dried ammonium sulfate, followed by counting of total condensation nuclei (#CN) using a Condensation Particle Counter (CPC) and total cloud condensation nuclei (#CCN) using a CCN counter. Initial design and calibration results for the CCN activation measurements will be reported.

92 - Locating legacy oil and gas wells in Arkansas: refining magnetic methods

Michael Davis, Candy Roberts, and Hunter Vickers - Arkansas Tech University, Professor and Undergraduate students
(Co-Authors: Jason A. Patton (Arkansas Tech University); Jessica Buenrostro (Arkansas Tech University); Allie Roach (Arkansas Tech University))

Non-producing oil and gas wells, known as legacy oil and gas wells, are required by Arkansas law to be plugged and cut off 6 feet below the surface for land reclamation. These wells thus should have no surface expression. As these abandoned wells age, they have the potential to leak hazardous material into the environment. In this project we report on the second phase of our efforts to locate legacy oil and gas wells in Pope and Johnson counties, Arkansas, in which we refined our methodology in an attempt to accelerate the location process. An Overhauser Magnetometer was easily able to locate the metal cased wells utilizing the methods developed during the pilot phase of our project that took place during 2017-18. Our initial methodology was based on a rigid transect grid with 2-meter spacing across the abandoned well site. In this phase of our project we were able to confirm that the 2-meter spacing transects successfully identified the locations of the legacy wells; in addition, we determined that a well location could be recognized up to 20 meters away and could be rapidly found with a "random walk" approach, followed by a less rigid grid transect with approximately 2-meter spacing. Magnetic anomalies for seven additional wells located in this phase of our project generally range from ~2,000 – 7,000 nanoTeslas (nT), with one well exceeding 12,000 nT above the background measurements. In combination with our pilot phase of this project, maximum magnetic anomalies tend to be at least ~1,000 nT above the background magnetic field over the abandoned well, and have a horizontal extent of at least 20 m with a measurement of 50 nT above the background.

93 - Restoration Potential of Abandoned Wells in the Fayetteville Shale

Varenya Nallur - Hendrix College, Undergraduate student
(Co-Authors: Maureen R. McClung (Hendrix College); Matthew D. Moran (Hendrix College))

Unconventional oil and gas drilling has expanded across the U.S. in recent years, including the Fayetteville Shale gas field in north central Arkansas. The Fayetteville Shale region has seen substantial changes in land use, specifically the development of natural habitat and agricultural land for gas infrastructure. As the Fayetteville gas field has matured, numerous wells have ceased production and have been abandoned, which makes them eligible for land reclamation. However, most of these (80%) have not been reclaimed and are therefore continuing to cause losses in ecosystem services. If restoration was accomplished, we estimated that the reclamation eligible well sites could provide more than $2 million annually in agricultural and carbon sequestration value. These benefits far outweigh the costs of reclamation, especially since the benefits accrue over time and reclamation is either a one-time or short-term cost until natural regeneration is sustainable. As more gas wells stop production and are abandoned in coming years, the benefits of reclamation will further increase. We urge Arkansas government and citizens work to restore lands impacted by the Fayetteville Shale, so their value to landowners can be recovered, which will subsequently enhance long-term economic and environmental benefits.

94 - Water adsorption on polyhydroxylate microspheres as a function of relative humidity using a quartz crystal microbalance

Hailey Hayes - Hendrix College, Undergraduate student
(Co-Authors: Rebecca Parham, Karen Morris, Henry Dana, Cayman Botner, Megan Cassingham, and Courtney D. Hatch)

The indirect climate effect represents the largest unknown factor that contributes to climate change. Specifically, the ability of an aerosol particle to take up water and nucleate a cloud droplet is not well understood. However, water pre-adsorption on insoluble atmospheric aerosol particles is known to significantly affect the particle's ability to become an active cloud condensation nucleus (CCN), and potentially depends on particle morphology as well as size. In order to study the effect of particle morphology on water adsorption to insoluble surfaces, the water content on a model spherical atmospheric insoluble aerosol, 500 nm Polybead® polyhydroxylate microspheres (PHS) was measured as a function of relative humidity (RH). Water adsorption was measured using a quartz crystal microbalance (QCM) equipped with a flow cell. Results are compared to optical quantitative analysis of water adsorption on the same PHS sample using a Fourier transform infrared (FTIR) spectroscopy and modeled using a standard Brunauer, Emmett and Teller (BET) and Frenkel, Halsey, and Hill (FHH) adsorption model.

95 - Water adsorption on polyhydroxylate microspheres as a function of relative humidity using an FTIR spectrometer equipped with a flow cell

Henry Dana - Hendrix College, Undergraduate student
(Co-Authors: Cayman Botner, Rebecca Parham, Karen Morris, Hailey Hayes, Megan Cassingham, and Courtney D. Hatch)

The indirect climate effect represents the largest unknown factor that contributes to climate change. Specifically, the ability of an aerosol particle to take up water and nucleate a cloud droplet is not well understood. However, water pre-adsorption on insoluble atmospheric aerosol particles is known to significantly affect the particle's ability to become an active cloud condensation nucleus (CCN), and potentially depends on particle morphology as well as size. In order to study the effect of particle morphology on water adsorption to insoluble surfaces, the water content on a model atmospheric insoluble aerosol, 500 nm Polybead® polyhydroxylate microspheres (PHS) was measured as a function of relative humidity (RH). Water adsorption was measured using horizontal attenuated total reflectance Fourier transform infrared (HATR-FTIR) spectroscopy equipped with a flow cell and the results are compared to gravimetric analysis of water adsorption on the same PHS sample using a quartz crystal microbalance (QCM).

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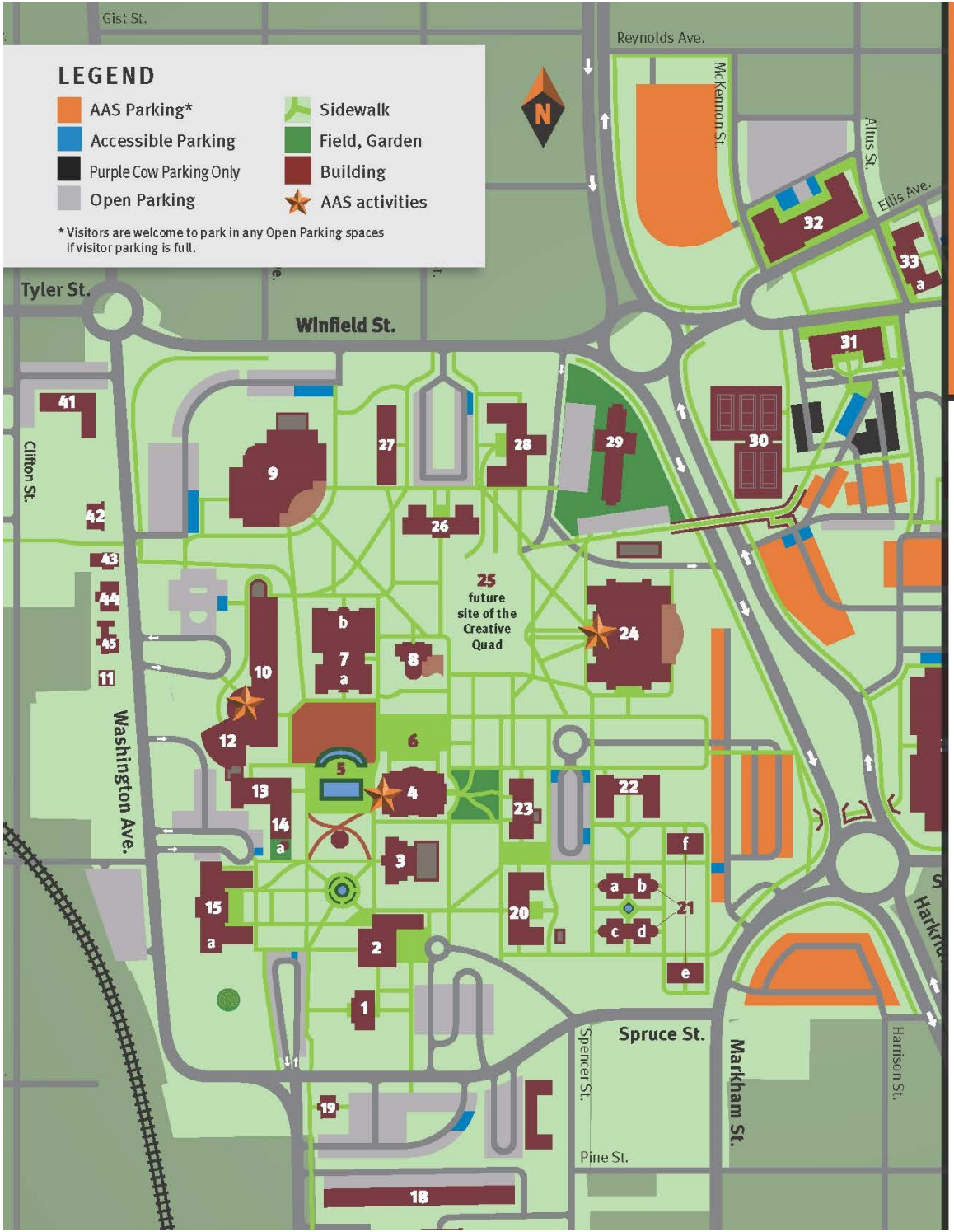

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5 Butler Plaza & Pecan Court
6 Brick Pit
7 Charles D. Morgan Center for Physical Sciences
- a John H. Reynolds Hall
- b Acxiom Hall

8 Bertie Wilson Murphy Building
9 Bailey Library
10 Mills Center for Social Sciences
11 Costume Shop
12 Cabe Theatre
13 Staples Auditorium
14 Greene Chapel
- a Hendrix Memorial Garden

15 Trieschmann Building
- a Reves Recital Hall

18 Front Street Apartments
19 Language House
20 Hardin Hall
21 Residence Houses
- a Dickinson
- b McCreight
- c Browne
- d Cook
- e Stella B. Smith
- f Brown

22 Couch Hall
23 Martin Hall
24 Student Life & Technology Center
25 Future site of Creative Quad
26 Veasey Hall
27 Raney Hall
28 Galloway Hall
29 Dawkins Welcome Center
30 Outdoor Tennis Courts
31 Market Square South
32 Market Square North
33 Market Square East
- a Village Books

37 Aquatics Center
38 Wellness & Athletics Center (houses Grove Gymnasium)
41 Marketing Communications
42 Public Safety
43 Technology Services
44 Human Resources
45 Health & Counseling