102nd Annual Meeting

Hosted by

Arkansas State University
It is a distinct pleasure to welcome you to the 102nd annual meeting of the Arkansas Academy of Science, and to our wonderful campus at Arkansas State University. This annual meeting is returning to Arkansas State University after 14 years.

There are more than 170 registrants and approximately 150 technical papers to be presented in 14 sessions during this meeting. There are 18 universities and four government agencies that are represented in this event.

The annual meeting is a gathering of members and guests who work and conduct research in any of the STEM (Science, Technology, Engineering and Mathematics) related areas. The AAS annual meeting emphasizes professional development, learning from experts, sharing of experiences and networking with peers.

We are grateful to the dedicated AAS members who have volunteered to serve as session chairs and/or judge the student papers. The success of this event is not possible without your contributions.

The organizing committee has worked hard to make your stay in Jonesboro pleasant and productive. If there is any way that we can assist you in making your visit more pleasurable, please be sure to let us know. I wish you all a very enjoyable and educational meeting.

Rajesh Sharma
Chairman, 102nd Arkansas Academy of Science Meeting
Arkansas State University

Chairman’s Remarks
Organizing Committee

Rajesh Sharma, Chairman ..................................................... rsharma@AState.edu
Andrew Sustich, Associate Vice Chancellor for Research ................................ sustich@AState.edu
Emily Devereux, Executive Director of Research Development .................... edevereux@AState.edu
Ross Carroll (Physics) .............................................................. bcarroll@AState.edu
Kwangkook (David) Jeong (Mechanical Engineering) .................................. kjeong@AState.edu
Zahid Hossain, (Civil Engineering) ........................................ mhhossain@AState.edu
John Hershberger (Chemistry) ............................................. jhershberger@AState.edu
Brook Fluker (Biological Sciences) ........................................... bfluker@AState.edu
Tanja McKay (Biology) .......................................................... tmckay@AState.edu

Schedule

Friday, April 6

10:00 a.m. Executive Committee Meeting 1909 RSU
11:00 a.m. – 5:00 p.m. Registration and Payments AL-RSU
Noon – 12:30 p.m. Judges and Session Chairs RSU
1:00 – 2:30 p.m. Oral Sessions 1 RSU
2:30 – 3:00 p.m. Break - Refreshments
3:00 – 4:30 p.m. Oral Sessions 2 RSU
5:00 – 6:00 p.m. Mixer CBSS
6:00 – 8:00 p.m. Banquet and Keynote Address CBSS

Saturday April 7

8:00 – 9:00 a.m. Continental Breakfast RSU
8:00 – 10:00 a.m. Registration and Payment AL-RSU
8:30 – 10:30 a.m. Oral Sessions 3 RSU
8:30 – 10:30 a.m. Posters CH-RSU
10:30 a.m. – Noon Tour ACBC Lab Science East
10:30 – 11:30 a.m. Meeting of Judges RSU
Noon – 1:00 p.m. Awarding of Prizes (AAS Business Meeting) Auditorium, RSU

Schedule of Scientific Sessions

Friday Session 1

Aquatic Biology, White River Room

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:00 p.m.</td>
<td>Claire Turkal*</td>
<td>Effects of recreational boat noise on avoidance and feeding behaviors in an important freshwater stream fish</td>
</tr>
<tr>
<td>1:15 p.m.</td>
<td>Taylor Stone*</td>
<td>Culture-independent analysis of Hot Springs National Park thermophiles</td>
</tr>
<tr>
<td>1:30 p.m.</td>
<td>Dustin Thomas**</td>
<td>Stocking Assessment and Long-Term Impacts of Non-Native Walleye on the Native Population in the Eleven Point River, Arkansas</td>
</tr>
<tr>
<td>1:45 p.m.</td>
<td>Jeremiah Salinger**</td>
<td>Distribution Records of the Chestnut Lamprey in Arkansas</td>
</tr>
<tr>
<td>2:00 p.m.</td>
<td>David Bowles</td>
<td>Aquatic invertebrate community assessments at Ozark National Scenic Riverways, Missouri, 2005-2014</td>
</tr>
</tbody>
</table>

General Biology & Ecology, Mockingbird Room

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:00 p.m.</td>
<td>Adam Turner*</td>
<td>Impact of Lespedeza cuneata invasion on arthropod abundance in a tallgrass prairie</td>
</tr>
<tr>
<td>1:15 p.m.</td>
<td>Carolina Kirksey*</td>
<td>Patterns of Lespedeza cuneata invasion in tallgrass prairies and arthropod community structure</td>
</tr>
<tr>
<td>1:30 p.m.</td>
<td>Varenya Nallur</td>
<td>Unconventional gas development effects on ecosystem services in the Fayetteville Shale of Arkansas</td>
</tr>
<tr>
<td>1:45 p.m.</td>
<td>Caleb O’Neal*</td>
<td>Aerobic Pushups: Cutaneous Ventilation in Overwintering Smooth Softshell Turtles, Apalone mutica</td>
</tr>
<tr>
<td>2:00 p.m.</td>
<td>Stan Trauth</td>
<td>Germinal Epithelium Cytology during Spermatogenesis in the Alligator Snapping Turtle, Macrochelys temminckii (Reptilia: Chelydridae)</td>
</tr>
<tr>
<td>2:15 p.m.</td>
<td>Karen Fawley</td>
<td>Soil Crust Algal Communities of Warren Prairie Natural Area</td>
</tr>
</tbody>
</table>

AL-Alumni Lounge         CH-Centennial Hall     RSU-Reng Student Union   CBSS-Centennial Bank Stadium Suite
**Friday Session 2**

**General Biology & Ecology, Black River Room**

3:00 p.m. Helena Abad*  
Current and future threats to the Chihuahuan Desert bioregion: a landscape-level analysis

3:15 p.m. Margaret Young*  
Valuation of ecosystem services of the Arctic National Wildlife Refuge

3:30 p.m. Allison Monroe*  
A Proposal for Practical and Effective Biological Corridors in Northwest Costa Rica

3:45 p.m. Benjamin Zamzow*  
Terrestrial mammal and bird communities in protected and unprotected lands in Costa Rica

4:00 p.m. Sarah Nieman*  
Terrestrial mammal and bird survey results in the Arenal – Tilarán Conservation Area of Costa

4:15 p.m. Sofia Varriano*  
Migratory birds and nutrient transfer across continents

**Chemistry & Geosciences, Arkansas River Room**

3:00 p.m. Blake Ludwig*  
A Bond Valence / Bond Length Correlation for Tantalum-Oxygen Bonds

3:15 p.m. Katie Farmer*  
Quantification of Brominated Vegetable Oil in Beverages by LCMS

3:30 p.m. Amberly Vaughan*  
Development of a Novel Method for Purification of Recombinant Proteins

3:45 p.m. Kaylee McAdoo*  
Tree Ring Dating of the Ficklin-Imboden Log Structures, Powhatan State Park, Arkansas

4:00 p.m. Lucia Acosta-Gamboa**  
Phenomics Approaches to Elucidate the Contribution of the Four Ascorbate Pathways to Abiotic Stress Tolerance in Arabidopsis

4:15 p.m. Mohammad Nazmul Hassan**  
Effects of Zeolite on Chemical Elementals and Glass Transition Temperature of Asphalts

**Engineering, Pine Tree Room**

3:00 p.m. Andrew Lea*  
Design and Development of a Self-Driving RC Car

3:15 p.m. Hamdi Albinasheer**  
A Step by Step Design Procedure for Current Control of a 5 MW Three-Phase Grid-Connected Inverter

3:30 p.m. MM Tariq Morshed**  
Prospects of Nanoclay as a Pavement Construction Material

3:45 p.m. Mohammad Nazmul Hassan**  
Effects of Zeolite on Chemical Elementals and Glass Transition Temperature of Asphalts

4:00 p.m. Renn Tumlison  
New Records of the American Badger (Taxidea taxus) in Arkansas, with an updated distribution map

4:15 p.m. David Sasse  
Incidental Captures of Plains Spotted Skunks (Spilogale putorius interrupta) By Arkansas Trappers, 2012-2017

**Molecular & Cellular Biology, Mockingbird Room**

3:00 p.m. Chloe Fitzgerald*  
Relative Gene Expression Study on Centruroides vittatus: Investigating Sodium Toxin Gene Activity

3:15 p.m. Brandon Hogland*  
Comparison between environmental bacteria found in the soil and the wolf spider, Rabidosa rabida microbiome using 16srRNA sequencing analysis

3:30 p.m. Mohammad Fazle Azim**  
Production of a Prenylated Stilbenoid in Muscadine Grape Hairy Roots Expressing a Prenyltransferase Gene from Peanut

3:45 p.m. Neha Verma**  
Genetic modification of Switchgrass cell wall for improved biomass processability

4:00 p.m. Newton Hilliard  
Using Proteomics to Investigate Microbial Acid Tolerance Response

4:15 p.m. David McClellan  
Molecular Adaptation of Myoglobin Proteins in Deep-diving Cetaceans

**Terrestrial & Wildlife Biology, White River Room**

3:00 p.m. John Veon*  
Disturbance of wintering waterfowl by traffic noise

3:15 p.m. Heather May  
New records of distribution of Dracunculus sp. infecting River Otters (Lontra canadensis) in Arkansas

3:30 p.m. Nathan Taylor*  
Wild game harvest and effects on diet-related CO2 emissions in the U.S.

3:45 p.m. James Gore**  
Indiana Bat Occupancy Estimates of Buffalo National River Using a Multi-state Occupancy Model

4:00 p.m. Renn Tumlison  
New Records of the American Badger (Taxidea taxus) in Arkansas, with an updated distribution map

4:15 p.m. David Sasse  
Incidental Captures of Plains Spotted Skunks (Spilogale putorius interrupta) By Arkansas Trappers, 2012-2017
### Math, Physics & Computer Science, Arkansas River Room

<table>
<thead>
<tr>
<th>Time</th>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>3:00 p.m.</td>
<td>Zach Rail*</td>
<td>Mathematical Modeling of a rod-beam system</td>
</tr>
<tr>
<td>3:15 p.m.</td>
<td>Baylee Landers*</td>
<td>Wave Profile for Current Bearing Lightning Return Strokes</td>
</tr>
<tr>
<td>3:30 p.m.</td>
<td>Yosuke Kitakaze*</td>
<td>An Interacting Model between Dark Energy and Dark Matter</td>
</tr>
<tr>
<td>3:45 p.m.</td>
<td>Tulin Kaman</td>
<td>Verification and Validation for Turbulent Mixing Simulations</td>
</tr>
<tr>
<td>4:00 p.m.</td>
<td>David Peterson</td>
<td>Nutrient Concentrations in Big Creek Correlate to CAFO Presence</td>
</tr>
<tr>
<td>4:15 p.m.</td>
<td>Puskar Chapagain</td>
<td>Efficacy of Supplemental Instruction on Algebra and Calculus-Based Physics Teaching-Learning Processes</td>
</tr>
</tbody>
</table>

### Chemistry & Geosciences, White River Room

<table>
<thead>
<tr>
<th>Time</th>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30 a.m.</td>
<td>Franklin Hardcastle</td>
<td>Bond Valence - Length Relationships and Orbital Exponents for Hydrogen through Fluorine</td>
</tr>
<tr>
<td>8:45 a.m.</td>
<td>Mariusz Gajewski</td>
<td>Inhibition of Cystine Transport Leads to Human Glioma Growth Retardation.</td>
</tr>
<tr>
<td>9:00 a.m.</td>
<td>Rajib Choudhury</td>
<td>Understanding the Complexation of Small Molecules with a Macromolecule</td>
</tr>
<tr>
<td>9:15 a.m.</td>
<td>Michael Davis</td>
<td>Optimum Magnetometer Transect Spacing to Locate Legacy Oil and Gas Wells</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>Kristin Dooley</td>
<td>Comparison of effective optical properties of two-component internally mixed aerosols using various mixing rules</td>
</tr>
</tbody>
</table>

### Saturday Session

**General Biology, Mockingbird Room**

<table>
<thead>
<tr>
<th>Time</th>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30 a.m.</td>
<td>Brian Wagner</td>
<td>Gene flow and genetic structure of two of Arkansas's rarest darter species (Teleostei: Percidae), the arkansas darter, Ethoestoma cragini, and the least darter, E. microperca</td>
</tr>
<tr>
<td>8:45 a.m.</td>
<td>Renn Tumlison</td>
<td>Distribution of Campostoma spadiceum in southern Arkansas</td>
</tr>
<tr>
<td>9:00 a.m.</td>
<td>David Jamieson</td>
<td>Notes on Tarantula (Aphonopelma Hentzi) Reproduction in Missouri</td>
</tr>
<tr>
<td>9:15 a.m.</td>
<td>Stan Tranth</td>
<td>Distal Urogenital Anatomy in Male Southern Coal Skinks, Plestiodon anthracinus phuilias (Reptilia: Scincidae)</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>David Sasse</td>
<td>Early Seasons Primeness in Arkansas Raccoon Pelts</td>
</tr>
<tr>
<td>9:45 a.m.</td>
<td>Jack Jackson</td>
<td>Avian Frugivory in a Fruiting Mulberry Tree (Morus spp.) in Arkansas</td>
</tr>
<tr>
<td>10:00 a.m.</td>
<td>Renn Tumlison</td>
<td>Vertebrate Natural History Notes from Arkansas, 2018</td>
</tr>
<tr>
<td>10:15 a.m.</td>
<td>Heather May</td>
<td>New records of distribution of Dracunculus sp. Infecting River Otters (Lontra Canadensis) in Arkansas</td>
</tr>
</tbody>
</table>

**Chemistry & Geosciences, White River Room**

<table>
<thead>
<tr>
<th>Time</th>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30 a.m.</td>
<td>Richard Segall</td>
<td>Steps Toward Measuring World Space Exploration Activity</td>
</tr>
<tr>
<td>8:45 a.m.</td>
<td>Xin Yang</td>
<td>Deep Learning-based framework for DMRI Autism Image classification</td>
</tr>
<tr>
<td>9:00 a.m.</td>
<td>Ashokkumar Sharma</td>
<td>RAM pump, an energy independent solution to improve water accessibility to underdeveloped inhabitants in the world – A performance improvement study</td>
</tr>
<tr>
<td>9:15 a.m.</td>
<td>Brandon Kemp</td>
<td>Applications of theoretical advances in the optical energymomentum debate: invisibility cloaks, tractor beams, and reversed radiation pressure</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>Cheyenne Sheppard</td>
<td>The Electrodynamics of Kinetic, Canonical, and Hidden Systems Under Relativistic Motion</td>
</tr>
<tr>
<td>9:45 a.m.</td>
<td>Muhammad Safeer Khan</td>
<td>Investigation of Acoustic-Based Crack Detection in PVC Pipes</td>
</tr>
<tr>
<td>10:00 a.m.</td>
<td>Ismaeel Al-Baidhany</td>
<td>A study of M and Mdyn masses at the different of the dynamical parameters of the spiral host galaxies</td>
</tr>
<tr>
<td>10:15 a.m.</td>
<td>Sami Chiad</td>
<td>Optical Properties and Dispersion Parameters of PMMA-MnCl2</td>
</tr>
</tbody>
</table>

**Parasitology, Black River Room**

<table>
<thead>
<tr>
<th>Time</th>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:30 a.m.</td>
<td>Chris McAllister</td>
<td>Parasites of the Spotted Sucker, Mnintrema melanops (Cypriniiformes: Catostomidae) from Arkansas and Oklahoma</td>
</tr>
<tr>
<td>9:45 a.m.</td>
<td>James Daly Sr.</td>
<td>Prevalence as a Predictor of other Helminth Population Descriptors (Mean, Standard Deviation, Maximum Number) is Relatively Inaccurate at High Parasite Densities in the Hosts.</td>
</tr>
<tr>
<td>10:00 a.m.</td>
<td>Chris McAllister</td>
<td>Additional Records of Acanthocephalan Parasites from Arkansas Fishes, with New Records from Missouri Fishes</td>
</tr>
<tr>
<td>10:15 a.m.</td>
<td>James Daly Sr.</td>
<td>Proportionality of Statistical Parameters for Helminth Parasite Populations in Smallmouth Bass (Micropterus dolometae) from the Buffalo National River in Arkansas</td>
</tr>
</tbody>
</table>

**Engineering & Computer Science, Arkansas River Room**

<table>
<thead>
<tr>
<th>Time</th>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:30 a.m.</td>
<td>Chris McAllister</td>
<td>Parasites of the Spotted Sucker, Mnintrema melanops (Cypriniiformes: Catostomidae) from Arkansas and Oklahoma</td>
</tr>
<tr>
<td>9:45 a.m.</td>
<td>James Daly Sr.</td>
<td>Prevalence as a Predictor of other Helminth Population Descriptors (Mean, Standard Deviation, Maximum Number) is Relatively Inaccurate at High Parasite Densities in the Hosts.</td>
</tr>
<tr>
<td>10:00 a.m.</td>
<td>Chris McAllister</td>
<td>Additional Records of Acanthocephalan Parasites from Arkansas Fishes, with New Records from Missouri Fishes</td>
</tr>
<tr>
<td>10:15 a.m.</td>
<td>James Daly Sr.</td>
<td>Proportionality of Statistical Parameters for Helminth Parasite Populations in Smallmouth Bass (Micropterus dolometae) from the Buffalo National River in Arkansas</td>
</tr>
</tbody>
</table>
### Schedule of Scientific Sessions

**Poster Session, Centennial Hall**

#### Biology - General Biology & Ecology

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Kimberly Smith</td>
<td>House Finch (Haemorhous mexicanus) nesting in December in Arkansas</td>
</tr>
<tr>
<td>15</td>
<td>Kimberly Smith</td>
<td>Observations of Townsend's Solitaires (Myadestes townsendi) on Mount Magazine in Logan County, Arkansas</td>
</tr>
<tr>
<td>16</td>
<td>Kimberly Smith</td>
<td>Second record of the Gray-headed Junco (Junco hyemalis caniceps) in Arkansas</td>
</tr>
<tr>
<td>17</td>
<td>Amanda Trusty*</td>
<td>Does frequently visiting a Bluebird nest increase predation risk?</td>
</tr>
<tr>
<td>18</td>
<td>Michael Trusty*</td>
<td>Does axle grease effectively protect bluebird nests from predators?</td>
</tr>
<tr>
<td>19</td>
<td>Edgar Sanchez*</td>
<td>Developing Microsatellite Markers for Genetic Identification of Songbirds</td>
</tr>
<tr>
<td>20</td>
<td>Gary Graves</td>
<td>Winter surveys of Cotinus obovatus (American smoke tree) in the Ozark Mountains</td>
</tr>
<tr>
<td>21</td>
<td>Zac Campbell</td>
<td>High-throughput Plant Phenotyping at the A-State Phenomics Facility</td>
</tr>
<tr>
<td>22</td>
<td>Leila Henning</td>
<td>Novel nuclear and plastid loci and their utility for inferring relationships among species of the genus Streptanthus (Brassicaceae) found in Arkansas and adjoining states,</td>
</tr>
<tr>
<td>23</td>
<td>Jennifer Bryant*</td>
<td>The Hunt for Bigleaf</td>
</tr>
<tr>
<td>24</td>
<td>Emma Martin**</td>
<td>Assessing Mitigative Properties of Vegetation in Northeast Arkansas Agricultural Ditches using Biotic and Abiotic Measures</td>
</tr>
<tr>
<td>25</td>
<td>Chris McAllister</td>
<td>A Preliminary Checklist of the Stoneflies (Arthropoda: Insecta: Plecoptera) of Arkansas</td>
</tr>
<tr>
<td>26</td>
<td>Chris McAllister</td>
<td>Additional County Records of Invertebrates from Arkansas</td>
</tr>
<tr>
<td>27</td>
<td>Brian Staley</td>
<td>Biological and ecosystem-level changes from the addition of reservoirs to headwater streams</td>
</tr>
<tr>
<td>28</td>
<td>Sierra Hubbard*</td>
<td>Biodiversity of Hymenoptera across sky islands of Arkansas</td>
</tr>
<tr>
<td>29</td>
<td>Brianna Trejo**</td>
<td>Energetic cost of gridding in the notodontid caterpillar, Oedemasia leptinoides</td>
</tr>
<tr>
<td>30</td>
<td>John Hunt</td>
<td>Organochloride Pesticides Present in Animal Fur, Soil, and Streambed in an Agricultural Region of Southeastern Arkansas</td>
</tr>
<tr>
<td>31</td>
<td>Stacy Scherman**</td>
<td>Southeastern Myotis and Rafinesque's Bigeared Bats Switch their Roosting Habits Seasonally in Arkansas Bottomlands</td>
</tr>
<tr>
<td>32</td>
<td>Andrew Feltmann</td>
<td>Serial founder effects in Crotaphytus collaris: the influence of genetic drift on phenotypic diversification</td>
</tr>
<tr>
<td>33</td>
<td>Hilary Canada*</td>
<td>Phylogeographic analyses suggest cryptic diversity within the Bluntnose Darter, Etheostoma chlorosoma</td>
</tr>
</tbody>
</table>

#### Biology - Medicine, Molecular & Cellular Biology

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jasleen Saini**</td>
<td>Generation and Analysis of chromosomal gene deletion mutants of two putative thiosulfate sulfurtransferases in Mycobacterium smegmatis</td>
</tr>
<tr>
<td>2</td>
<td>Saroj Mahato**</td>
<td>Investigation of the function of a putative cysteine synthase homolog in Mycobacterium smegmatis using unmarked gene deletion mutation</td>
</tr>
<tr>
<td>3</td>
<td>Kelsey Martin**</td>
<td>The Effect of SLCO Transporter Polymorphisms on Prostaglandin Levels in Healthy Postmenopausal Volunteers</td>
</tr>
<tr>
<td>4</td>
<td>Mason Rostollan**</td>
<td>Characterization of Biomass Smoke Particles via Scanning Electron Microscopy and Energy-Dispersive X-Ray Spectroscopy</td>
</tr>
<tr>
<td>5</td>
<td>Nirman Nepal**</td>
<td>Molecular Mechanisms Underlying the Higher Biomass and Abiotic Stress Tolerance Phenotype of Arabidopsis MBOX Overexpressers</td>
</tr>
<tr>
<td>6</td>
<td>Brenna Walters*</td>
<td>Exposure to carbon black nanoparticles during larval development affects adult physiological stress tolerance in wild type isolates of Caenorhabditis elegans</td>
</tr>
<tr>
<td>7</td>
<td>Spencer Long*</td>
<td>A Retrospective Multistate Analysis of Influenza Pandemic Deaths</td>
</tr>
<tr>
<td>8</td>
<td>Ryan Williams</td>
<td>Transient Receptor Potential Channel 3 And its Effects On Systemic Blood Pressure Regulation in Diseased Versus Healthy Mesenteric Arteries</td>
</tr>
<tr>
<td>9</td>
<td>Spencer Sanson**</td>
<td>Detection of Ten Antineoplastic Drugs in a clinical setting by Wipe Test and LC-MS/MS analysis</td>
</tr>
<tr>
<td>10</td>
<td>Malaynn McKay</td>
<td>A comparison of Japanese and American children's diets, and a literature review of diet and disease</td>
</tr>
<tr>
<td>11</td>
<td>Antionette Davis*</td>
<td>The effect of green tea extract on Daphnia magna</td>
</tr>
<tr>
<td>12</td>
<td>Jeremy Brown*</td>
<td>Genetic engineering of the Mad locus using CRISPR/Cas-9 and Phi-C31 recombination</td>
</tr>
<tr>
<td>13</td>
<td>Jeremy Brown*</td>
<td>Identify Microbes in Drinking Water using PCR</td>
</tr>
<tr>
<td><strong>Chemistry</strong></td>
<td><strong>Engineering</strong></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td>34 Ben Quattlebaum*</td>
<td>52 Kaushik Luthra**</td>
<td></td>
</tr>
<tr>
<td>35 Gray Orman*</td>
<td>53 Kazi Tamjidul Islam**</td>
<td></td>
</tr>
<tr>
<td>36 Ryan Coleman*</td>
<td>54 Md Saber Nazim**</td>
<td></td>
</tr>
<tr>
<td>37 Harper Grimsley</td>
<td>55 Summon Roy**</td>
<td></td>
</tr>
<tr>
<td>38 Sydne Shuttleworth</td>
<td>56 Tamal Sarkar**</td>
<td></td>
</tr>
<tr>
<td>39 Conner Breen*</td>
<td>57 Obane Ikwyumu*</td>
<td></td>
</tr>
<tr>
<td>40 Eliza Hanson*</td>
<td>58 Haylee Campbell*</td>
<td></td>
</tr>
<tr>
<td>41 Emily Joy Seminara*</td>
<td>59 Megan Cassingham*</td>
<td></td>
</tr>
<tr>
<td>42 Kylie Cleavenger*</td>
<td>60 Ryan Tumminello*</td>
<td></td>
</tr>
<tr>
<td>43 Peyton Munch*</td>
<td>61 Sonja Wagner*</td>
<td></td>
</tr>
<tr>
<td>44 Pooja Lukhi*</td>
<td>62 Timothy Brown* &amp; Jealin Greer*</td>
<td></td>
</tr>
<tr>
<td>45 Trevor Loew*</td>
<td>63 Trae Staggers*</td>
<td></td>
</tr>
<tr>
<td>46 Kaleb Reid*</td>
<td>64 Jackson Mixon*</td>
<td></td>
</tr>
<tr>
<td>47 Ayesha Siddiqua**</td>
<td>65 Jake Bass*</td>
<td></td>
</tr>
<tr>
<td>48 Alexander Rothenberger**</td>
<td>66 Nicholas Scales*</td>
<td></td>
</tr>
<tr>
<td>49 Sarah Phillips</td>
<td>67 Samantha Dix*</td>
<td></td>
</tr>
<tr>
<td>50 Divya Kandanool**</td>
<td>68 Yassamine Ghazzali*</td>
<td></td>
</tr>
<tr>
<td>51 Kan Takahashi**</td>
<td>69 Patrick Tribbett*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>70 Paul Niyonkuru*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>71 Paul Niyonkuru*</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Geosciences</strong></th>
<th><strong>Physics</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>52 Laushak Luthra**</td>
<td>61 Sonja Wagner*</td>
</tr>
<tr>
<td>53 Kazi Tamjidul Islam**</td>
<td>62 Timothy Brown* &amp; Jealin Greer*</td>
</tr>
<tr>
<td>54 Md Saber Nazim**</td>
<td>63 Trae Staggers*</td>
</tr>
<tr>
<td>55 Summon Roy**</td>
<td>64 Jackson Mixon*</td>
</tr>
<tr>
<td>56 Tamal Sarkar**</td>
<td>65 Jake Bass*</td>
</tr>
<tr>
<td>57 Obane Ikwyumu*</td>
<td>66 Nicholas Scales*</td>
</tr>
<tr>
<td>58 Haylee Campbell*</td>
<td>67 Samantha Dix*</td>
</tr>
<tr>
<td>59 Megan Cassingham*</td>
<td>68 Yassamine Ghazzali*</td>
</tr>
<tr>
<td>60 Ryan Tumminello*</td>
<td>69 Patrick Tribbett*</td>
</tr>
<tr>
<td></td>
<td>70 Paul Niyonkuru*</td>
</tr>
<tr>
<td></td>
<td>71 Paul Niyonkuru*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Chemistry</strong></th>
<th><strong>Engineering</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>34 Ben Quattlebaum*</td>
<td>52 Kaushik Luthra**</td>
</tr>
<tr>
<td>35 Gray Orman*</td>
<td>53 Kazi Tamjidul Islam**</td>
</tr>
<tr>
<td>36 Ryan Coleman*</td>
<td>54 Md Saber Nazim**</td>
</tr>
<tr>
<td>37 Harper Grimsley</td>
<td>55 Summon Roy**</td>
</tr>
<tr>
<td>38 Sydne Shuttleworth</td>
<td>56 Tamal Sarkar**</td>
</tr>
<tr>
<td>39 Conner Breen*</td>
<td>57 Obane Ikwyumu*</td>
</tr>
<tr>
<td>40 Eliza Hanson*</td>
<td>58 Haylee Campbell*</td>
</tr>
<tr>
<td>41 Emily Joy Seminara*</td>
<td>59 Megan Cassingham*</td>
</tr>
<tr>
<td>42 Kylie Cleavenger*</td>
<td>60 Ryan Tumminello*</td>
</tr>
<tr>
<td>43 Peyton Munch*</td>
<td>61 Sonja Wagner*</td>
</tr>
<tr>
<td>44 Pooja Lukhi*</td>
<td>62 Timothy Brown* &amp; Jealin Greer*</td>
</tr>
<tr>
<td>45 Trevor Loew*</td>
<td>63 Trae Staggers*</td>
</tr>
<tr>
<td>46 Kaleb Reid*</td>
<td>64 Jackson Mixon*</td>
</tr>
<tr>
<td>47 Ayesha Siddiqua**</td>
<td>65 Jake Bass*</td>
</tr>
<tr>
<td>48 Alexander Rothenberger**</td>
<td>66 Nicholas Scales*</td>
</tr>
<tr>
<td>49 Sarah Phillips</td>
<td>67 Samantha Dix*</td>
</tr>
<tr>
<td>50 Divya Kandanool**</td>
<td>68 Yassamine Ghazzali*</td>
</tr>
<tr>
<td>51 Kan Takahashi**</td>
<td>69 Patrick Tribbett*</td>
</tr>
<tr>
<td></td>
<td>70 Paul Niyonkuru*</td>
</tr>
<tr>
<td></td>
<td>71 Paul Niyonkuru*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Geosciences</strong></th>
<th><strong>Physics</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>52 Laushak Luthra**</td>
<td>61 Sonja Wagner*</td>
</tr>
<tr>
<td>53 Kazi Tamjidul Islam**</td>
<td>62 Timothy Brown* &amp; Jealin Greer*</td>
</tr>
<tr>
<td>54 Md Saber Nazim**</td>
<td>63 Trae Staggers*</td>
</tr>
<tr>
<td>55 Summon Roy**</td>
<td>64 Jackson Mixon*</td>
</tr>
<tr>
<td>56 Tamal Sarkar**</td>
<td>65 Jake Bass*</td>
</tr>
<tr>
<td>57 Obane Ikwyumu*</td>
<td>66 Nicholas Scales*</td>
</tr>
<tr>
<td>58 Haylee Campbell*</td>
<td>67 Samantha Dix*</td>
</tr>
<tr>
<td>59 Megan Cassingham*</td>
<td>68 Yassamine Ghazzali*</td>
</tr>
<tr>
<td>60 Ryan Tumminello*</td>
<td>69 Patrick Tribbett*</td>
</tr>
<tr>
<td></td>
<td>70 Paul Niyonkuru*</td>
</tr>
<tr>
<td></td>
<td>71 Paul Niyonkuru*</td>
</tr>
</tbody>
</table>
Our keynote speaker is Dr. Travis Marsico, an associate professor of botany in the Department of Biological Sciences at Arkansas State University. Marsico’s research focuses on biogeography, biodiversity conservation, natural history and species invasions. He currently researches risk associated with hitchhiking plant propagules at U.S. shipping ports, invasion of herbivorous insect pests, plant diversity patterns in fragmented landscapes of the Upper Mississippi River Alluvial Plain, and plant diversity patterns along elevation gradients in the Neotropics. His work emphasizes making and utilizing natural history collections in research. He also studies biology education and improvements to university-level education, utilizing specimen-based projects in coursework. Marsico has been a faculty member at Arkansas State University for eight years, where he teaches Curation of Collections, Dendrology, Global Change Biology, Mechanisms of Speciation, Natural History Collections Research Design, and Plant Systematics. At A-State, Marsico curates the herbarium and manages the Laboratory Sciences Greenhouse.

“Natural History Collections and their Role in Arkansas Science and Education” For the plenary session on Friday evening, Marsico will discuss the important role that natural history collections have played in shaping scientific knowledge in Arkansas. In his talk, he will also address current biodiversity research being conducted by students and faculty members associated with the newly formed Arkansas Center for Biodiversity Collections (ACBC) at Arkansas State University. He will highlight expanded opportunities for educating students in basic and applied biodiversity science through the ACBC. Finally, Marsico will share his vision for how research utilizing natural history collections is as relevant as it has ever been on a planet with natural ecosystems threatened by anthropogenic pressures.

### Oral Presentation Abstracts

#### Aquatic Biology Session (Friday, Session 1)

#### Room: White River Room

**AQUA BIO – 01 – Claire Turkal**

Hendrix College, Undergraduate Student

Judge: Yes

**Effects of recreational boat noise on avoidance and feeding behaviors in an important freshwater stream fish**

(Co-Authors: Trystin F. Anderson, Maureen R. McClung)

As anthropogenic noise continues to increase across the globe alongside human development, conservation scientists seek to understand how noise impacts ecological communities. Both terrestrial and aquatic species have been shown to exhibit physiological stress, greater mortality rates, and avoidance behaviors in the presence of noise. However, research has yet to extensively investigate how noise impacts not only the behavior of individual species, but the nature of food webs and ecological systems. Our research investigates whether stonerollers (Campostoma spp.), common freshwater fish in Arkansas that act as keystone species in stream ecosystems, avoid recreational boat noise and thus modify stream algal communities through avoidance behavior. We captured highland stonerollers (Campostoma spadiceum) from streams in central Arkansas and placed them within experimental tanks both with and without intermittent playback of a small, recreational boat motor. By monitoring algal feeding behaviors and tank location occupation in each trial, we compared control and experimental trials to detect the impacts of boat noise on stoneroller feeding and avoidance behavior. Preliminary results will be presented that highlight the importance of considering human impact on entire ecological communities in wildlife management decisions to ensure minimal negative consequences in light of increasing anthropogenic noise in the future.

**AQUA BIO – 02 – Taylor Stone**

Hendrix College, Undergraduate Student

Judge: Yes

**Culture-independent analysis of Hot Springs National Park thermophiles**

(Co-Authors: Matthew Moran)

The thermal water systems of Hot Springs National Park (HSNP) in Hot Springs, Arkansas exist in relative isolation from other North American hot water systems. The HSNP waters could therefore serve as undisturbed reservoirs of biodiversity. However, these springs remain largely unexplored for species of thermophilic bacteria with culture-independent next generation sequencing. Additionally, HSNP has been the focus of anthropogenic development, capping-and diverting the springs for use in recreational bathhouse facilities. Human modification of these springs may have impacted the structure of these bacterial communities compared to springs left open to the air. The goal of this study was to compare the community structure in two capped springs and two uncapped springs in HSNP. To this end, we used Illumina 16S rRNA sequencing of water samples from each spring, used the QIIME workflow for sequence analysis, and generated measures of genera and phyla richness, diversity, and evenness. In total, over 700 genera were detected and most individual samples had more than 100 genera. There were also several novel genetic sequences that could not be placed in known taxa, indicating that HSNP contains undescribed bacteria. There was great variation both between sites and within samples, so no significant differences were detected in community structure between sites. Our results suggest that these springs, regardless of their human modification, contain a considerable amount of biodiversity, some of it potentially unique to the study site.
AQUA BIO – 03 – Dustin Thomas
Arkansas State University, Graduate Student
Judge: Yes

Stocking Assessment and Long-Term Impacts of Non-Native Walleye on the Native Population in the Eleven Point River, Arkansas

(Co-Authors: Brook Flaker, Brett Timmons)

The spring fed Eleven Point River contains a natural population of Walleye, Sander vitreus. Supplemental stocking of Walleye in Arkansas has occurred in the Eleven Point River since 1986. The river is managed for multiple sport fish species, but it was not until 2002 that researchers began to investigate the complexities of Walleye stocking programs in the Eleven Point River. Researchers discovered a unique mitochondrial DNA haplotype for the native population in the Black River drainage. The native haplotype is identified as haplotype C or Black River Strain Walleye. From 1986 to 2011, a non-native northern strain known as White River Strain Walleye or haplotype A were stocked into the Eleven Point River. This project will assess the impact and success of the Walleye stocking program. It will also assess the impact of the non-native strain on the native strain and other sport fish species such as Smallmouth Bass, Micropterus dolomieu. Preliminary data will be presented from Tenmile Point River, which follows a 6-year gap in Walleye stocking from 2011 to 2017, and will be compared to data collecting during 2011.

AQUA BIO – 04 – Jeremiah Salinger
University of Arkansas at Pine Bluff, Graduate Student
Judge: Yes

Distribution Records of the Chestnut Lamprey in Arkansas

(Co-Author: Ron Johnson)

Lampreys other than sea lampreys have been poorly studied in North America. The Chestnut Lamprey, Lethenteron canadense, has a distribution within the Mississippi River drainage system ranging from Canada to Texas. Since the Fishes of Arkansas was published in 1988, few papers have been published reporting on updating the statewide distribution of this lamprey. We incorporated gray and published literature in taking a watershed approach for the distribution of lampreys within the state. Reported are 274 records of Chestnut Lampreys over a 60-year period encompassing 40 streams and/or reservoirs.

AQUA BIO – 05 – David Bowles
U.S. National Park Service, Faculty Researcher
Judge: No

Aquatic invertebrate community assessments at Ozark National Scenic Riverways, Missouri, 2005-2014

(Co-Authors: Lloyd W. Morrison, Janice A. Hinsey, J. Tyler Orbits)

Aquatic invertebrate community structure was used to assess long-term water quality integrity in mainstream rivers located at Ozark National Scenic Riverways, Missouri from 2005 to 2014. Benthic invertebrate samples and associated habitat and water quality data were collected at 107 sites using a Slack-Suber sampler of mine samples. The samples were collected from a 30 meter transect. Data were collected to assess integrity of the invertebrate communities. This index is calculated using taxa richness, EPT (Ephemeroptera, Plecoptera, Trichoptera) richness, Shannon’s diversity index, and Hanssen Biotic Index (HBI). The benthic invertebrate fauna was diverse with 153 distinct taxa identified from among all sites with similarities ranging from 72% to 86%. Mean taxa richness was high among sites ranging from 22 to 30, and EPT richness values ranged from 11 to 16. Shannon’s diversity index values generally ranged from 1.9 to 2.5 among sites and years indicating moderate递给. The invertebrate taxa of the Current River and Jacks Fork are largely intolerant across all taxa represented (mean tolerance value = 4.25). Mean HBI did not exceed 19 in the Current River or 4.4 for the Jacks Fork. SCI scores were relatively high among sampling sites and generally were well above 16 indicating they are not impaired. Habitat and water quality data were summarized, but found to be poorly correlated with individual invertebrate metrics (<30% significance) indicating community similarity among sites, and similarity scores were then analyzed using ascendant hierarchical cluster analysis. Similarity among sites was 72% or greater. Cluster analysis showed that Current River and Jacks Fork sites clustered separately and in a downstream progression, with those sites closest to one another in linear distance generally being the most closely related. The uppermost collection site on the Current River was most unlike the other sites, which probably relates to the distinct physical features of that site compared to the others. NMDS was used to evaluate the relationship of invertebrate metrics to habitat and water quality. The NMDS model was found to be a good fit (stress=0.04) and specific conductance, temperature and discharge were among the most important factors in defining the relationship among upper and lower Current River sites and Jacks Fork sites. The three lower Current River and Jacks Fork sites each were closely ordered, but the three lower Current River sites were poorly ordered. The punctuated influence of several large volume springs near those sites is suspected of producing such disparity. Although the condition of invertebrate communities and water quality in the Current River and Jacks Fork are largely sound and have high integrity, ongoing and projected threats to these resources remain, and those threats largely originate outside of the parks jurisdictional boundaries. Inherent variability of invertebrate community diversity and density across sites and years highlights the importance of using multi-metric assessments and multiyear monitoring to support management decisions.

AQUA BIO – 06 – Charles Gagen
Arkansas Tech University, Faculty Researcher
Judge: No

New Applications of Radio Frequency Identification Stations for Monitoring Fish Movement through Headwater Road Crossings and Natural Reaches

Headwater streams in the Ouachita National Forest intersect with roads resulting in thousands of low-water crossings that potentially alter hydrology and reduce longitudinal fish movement. During 2012 and 2013, we monitored movements of three native fish species individually tagged with radio frequency identification chips (RFID; n = 2,171) to investigate the potential impacts of road crossings on fish passage. We established solar powered RFID stations in two streams with road crossings and two reference streams without road crossings. Each of the four continuous monitoring stations included a pair of antennas bracketing a crossing or similarly-sized natural reach. When fish passed both antennas, upstream passage could be distinguished from downstream passage based on timing of detections. We explored new applications of RFID technology by direct in-stream installation of half-duplex, full-duplex, crossover antenna designs to avoid the need for rigid in-stream structures required to apply the more common full-duplex technology (half-duplex appeared particularly suited to natural reference streams). This technique appears promising, but technical difficulties limited the consistency of fish passage detection and consequently limited the strength of ecological conclusions. Even so, we will report evidence that fish passed at significantly higher rates across reference reaches than across road crossings.

Funkhouser and colleagues released radiotagged fish at reference and road crossings in two streams to assess integrity of the invertebrate communities. This index is calculated using taxa richness, EPT (Ephemeroptera, Plecoptera, Trichoptera) richness, Shannon’s diversity index, and Hanssen Biotic Index (HBI). The benthic invertebrate fauna was diverse with 153 distinct taxa identified from among all sites with similarities ranging from 72% to 86%. Mean taxa richness was high among sites ranging from 22 to 30, and EPT richness values ranged from 11 to 16. Shannon’s diversity index values generally ranged from 1.9 to 2.5 among sites and years indicating moderate递给. The invertebrate taxa of the Current River and Jacks Fork are largely intolerant across all taxa represented (mean tolerance value = 4.25). Mean HBI did not exceed 19 in the Current River or 4.4 for the Jacks Fork. SCI scores were relatively high among sampling sites and generally were well above 16 indicating they are not impaired. Habitat and water quality data were summarized, but found to be poorly correlated with individual invertebrate metrics (<30% significance) indicating community similarity among sites, and similarity scores were then analyzed using ascendant hierarchical cluster analysis. Similarity among sites was 72% or greater. Cluster analysis showed that Current River and Jacks Fork sites clustered separately and in a downstream progression, with those sites closest to one another in linear distance generally being the most closely related. The uppermost collection site on the Current River was most unlike the other sites, which probably relates to the distinct physical features of that site compared to the others. NMDS was used to evaluate the relationship of invertebrate metrics to habitat and water quality. The NMDS model was found to be a good fit (stress=0.04) and specific conductance, temperature and discharge were among the most important factors in defining the relationship among upper and lower Current River sites and Jacks Fork sites. The three lower Current River and Jacks Fork sites each were closely ordered, but the three lower Current River sites were poorly ordered. The punctuated influence of several large volume springs near those sites is suspected of producing such disparity. Although the condition of invertebrate communities and water quality in the Current River and Jacks Fork are largely sound and have high integrity, ongoing and projected threats to these resources remain, and those threats largely originate outside of the parks jurisdictional boundaries. Inherent variability of invertebrate community diversity and density across sites and years highlights the importance of using multi-metric assessments and multiyear monitoring to support management decisions.
Unconventional gas development effects on ecosystem services in the Fayetteville Shale of Arkansas

Unconventional oil and gas development, defined as the combination of horizontal drilling and hydraulic fracturing (fracking), has expanded dramatically across the United States in recent years. This change in the fossil fuel industry is causing a rapid transformation of landscapes across many regions and modifying much natural habitat. The natural world provides many free goods and services to humans, which are characterized as ecosystem services. Presumably, the extensive landscape alteration effects of unconventional oil and gas are having negative effects on these ecosystem services. We studied land-use patterns and subsequent loss of ecosystem services in the Fayetteville Shale, an important unconventional gas field located in north-central Arkansas. We found that habitat development and modification is causing ecosystem services losses in the tens of millions of dollar annually, costs that are concentrated in agricultural and climate regulation services. Estimates for agriculture alone account for more than $25 million USD are lost each year in the Fayetteville Shale due to gas development. Since these gas wells are predicted to produce for decades, these ecosystem services costs are likely to continue. The costs associated with ecosystem services losses due to fossil fuel development are not typically included in cost-benefit analyses, but are likely to be an important economic externality reducing the overall benefits from unconventional gas development and causing detrimental, but underappreciated, effects on human well-being.

Aerobic Pushups: Cutaneous Ventilation in Overwintering Smooth Softshell Turtles, Apalone mutica

We observed the behavior of overwintering Smooth Softshell Turtles Apalone mutica in an outdoor simulated pool with remote cameras. Submerged overwintering turtles buried themselves shallowly in a sand/mud substrate where they periodically raised and lowered the posterior portion of their shells into the water column in a “pushup” fashion. Pushups were separated by regularly spaced intervals and were similar in appearance and amplitude within and among individual turtles. Pushup frequency was positively correlated with water temperature and was passed more often at lower water temperatures. We also observed pushup behavior of A. mutica under simulated winter conditions in laboratory aquaria. Turtles maintained in water with high dissolved oxygen content executed pushups less frequently than turtles in water with lower oxygen content. Our observations of pushup behavior in A. mutica in a semi-natural enclosure and laboratory are consistent with other reports that show cutaneous ventilation function. Softshell turtles, known to be highly intolerant of anoxia, ostensibly sustain aerobic metabolism by creating currents that replenish the oxygen-depleted boundary layer between the turtles’ skin and the oxygenated water.

Germinal Epithelium Cytology during Spermatogenesis in the Alligator Snapping Turtle, Macrochelys temminckii (Reptilia:Chelydridae)

We investigated the cytology of the seminiferous epithelia of the Alligator Snapping Turtles (Macrochelys temmincki). Spermatogenic and regressed testes were assessed from 2 large individuals collected in Arkansas in May and September of 1993. Specifically, we focused on the cellular phases of germ cell development and maturation. The germ cell morphology with respect to cell type and cell lineage were evaluated. We observed spermatogonia, spermatocytes, spermatids, and spermatozoa. However, the spermatozoa were rare and difficult to distinguish. The spermatogonia exhibited a range of sizes and shapes, with some appearing round, oval, or elongated. The spermatocytes were larger than the spermatogonia and exhibited a more prominent nucleus. The spermatids were smaller than the spermatocytes and had a more developed nucleus. The spermatozoa were the smallest and had a well-developed head, midpiece, and flagellum.

The mechanism of thymoquinone-induced apoptosis in oral cancer cells

One of the significant challenges in cancer research is the development of effective and minimally toxic treatment options for oral cancer. Thymoquinone, a naturally occurring phytochemical found in black cumin seeds, has shown promising anti-cancer properties in preclinical studies, including inducing apoptosis in various cancer cell lines. Apoptosis is a programmed cell death process that plays a critical role in maintaining tissue homeostasis and preventing the development of tumors. The induction of apoptosis in cancer cells is a promising therapeutic strategy, as it can selectively eliminate cancer cells while sparing normal cells.

In this study, we investigated the mechanism of thymoquinone-induced apoptosis in oral cancer cells. We used a well-established oral cancer cell line, HSC-3, which is widely used in preclinical studies due to its high sensitivity to apoptosis-inducing agents. The cells were treated with different concentrations of thymoquinone, and the effects on cell viability, apoptosis, and cell cycle distribution were assessed.

Our results demonstrated that thymoquinone exhibited a concentration-dependent induction of apoptosis in HSC-3 cells. The treatment led to a significant increase in the number of cells undergoing apoptosis, as evidenced by the increased percentage of cells in the sub-G1 phase of the cell cycle, which corresponds to the apoptotic population. Moreover, we observed morphological changes characteristic of apoptosis, including cellular shrinkage and the formation of apoptotic bodies.

The mechanism of thymoquinone-induced apoptosis in oral cancer cells was further investigated through the analysis of key apoptotic regulators. We found that thymoquinone significantly altered the expression levels of key pro-apoptotic and anti-apoptotic proteins, such as caspase-3 and Bcl-2, respectively. These changes were likely responsible for the induction of apoptosis, as caspase-3 activation is a central event in the execution phase of apoptosis, while Bcl-2 is a member of the Bcl-2 family that can inhibit apoptosis.

Overall, our findings suggest that thymoquinone is a promising anti-cancer agent with potential for the development of new therapeutic strategies against oral cancer. Further research is needed to fully understand the molecular mechanisms underlying thymoquinone-induced apoptosis and to translate these findings into clinical applications.

Unconventional gas development effects on ecosystem services in the Fayetteville Shale of Arkansas

Unconventional gas development, defined as the combination of horizontal drilling and hydraulic fracturing (fracking), has expanded dramatically across the United States in recent years. This change in the fossil fuel industry is causing a rapid transformation of landscapes across many regions and modifying much natural habitat. The natural world provides many free goods and services to humans, which are characterized as ecosystem services. Presumably, the extensive landscape alteration effects of unconventional oil and gas are having negative effects on these ecosystem services. We studied land-use patterns and subsequent loss of ecosystem services in the Fayetteville Shale, an important unconventional gas field located in north-central Arkansas. We found that habitat development and modification is causing ecosystem services losses in the tens of millions of dollar annually, costs that are concentrated in agricultural and climate regulation services. Estimates for agriculture alone account for more than $25 million USD are lost each year in the Fayetteville Shale due to gas development. Since these gas wells are predicted to produce for decades, these ecosystem services costs are likely to continue. The costs associated with ecosystem services losses due to fossil fuel development are not typically included in cost-benefit analyses, but are likely to be an important economic externality reducing the overall benefits from unconventional gas development and causing detrimental, but underappreciated, effects on human well-being.

Aerobic Pushups: Cutaneous Ventilation in Overwintering Smooth Softshell Turtles, Apalone mutica

We observed the behavior of overwintering Smooth Softshell Turtles Apalone mutica in an outdoor simulated pool with remote cameras. Submerged overwintering turtles buried themselves shallowly in a sand/mud substrate where they periodically raised and lowered the posterior portion of their shells into the water column in a “pushup” fashion. Pushups were separated by regularly spaced intervals and were similar in appearance and amplitude within and among individual turtles. Pushup frequency was positively correlated with water temperature and was passed more often at lower water temperatures. We also observed pushup behavior of A. mutica under simulated winter conditions in laboratory aquaria. Turtles maintained in water with high dissolved oxygen content executed pushups less frequently than turtles in water with lower oxygen content. Our observations of pushup behavior in A. mutica in a semi-natural enclosure and laboratory are consistent with other reports that show cutaneous ventilation function. Softshell turtles, known to be highly intolerant of anoxia, ostensibly sustain aerobic metabolism by creating currents that replenish the oxygen-depleted boundary layer between the turtles’ skin and the oxygenated water.

Germinal Epithelium Cytology during Spermatogenesis in the Alligator Snapping Turtle, Macrochelys temminckii (Reptilia:Chelydridae)

We investigated the cytology of the seminiferous epithelia of the Alligator Snapping Turtles (Macrochelys temmincki). Spermatogenic and regressed testes were assessed from 2 large individuals collected in Arkansas in May and September of 1993. Specifically, we focused on the cellular phases of germ cell development and maturation. The germ cell morphology with respect to cell type and cell lineage were evaluated. We observed spermatogonia, spermatocytes, spermatids, and spermatozoa. However, the spermatozoa were rare and difficult to distinguish. The spermatogonia exhibited a range of sizes and shapes, with some appearing round, oval, or elongated. The spermatocytes were larger than the spermatogonia and exhibited a more prominent nucleus. The spermatids were smaller than the spermatocytes and had a more developed nucleus. The spermatozoa were the smallest and had a well-developed head, midpiece, and flagellum.

The mechanism of thymoquinone-induced apoptosis in oral cancer cells

One of the significant challenges in cancer research is the development of effective and minimally toxic treatment options for oral cancer. Thymoquinone, a naturally occurring phytochemical found in black cumin seeds, has shown promising anti-cancer properties in preclinical studies, including inducing apoptosis in various cancer cell lines. Apoptosis is a programmed cell death process that plays a critical role in maintaining tissue homeostasis and preventing the development of tumors. The induction of apoptosis in cancer cells is a promising therapeutic strategy, as it can selectively eliminate cancer cells while sparing normal cells.

In this study, we investigated the mechanism of thymoquinone-induced apoptosis in oral cancer cells. We used a well-established oral cancer cell line, HSC-3, which is widely used in preclinical studies due to its high sensitivity to apoptosis-inducing agents. The cells were treated with different concentrations of thymoquinone, and the effects on cell viability, apoptosis, and cell cycle distribution were assessed.

Our results demonstrated that thymoquinone exhibited a concentration-dependent induction of apoptosis in HSC-3 cells. The treatment led to a significant increase in the number of cells undergoing apoptosis, as evidenced by the increased percentage of cells in the sub-G1 phase of the cell cycle, which corresponds to the apoptotic population. Moreover, we observed morphological changes characteristic of apoptosis, including cellular shrinkage and the formation of apoptotic bodies.

The mechanism of thymoquinone-induced apoptosis in oral cancer cells was further investigated through the analysis of key apoptotic regulators. We found that thymoquinone significantly altered the expression levels of key pro-apoptotic and anti-apoptotic proteins, such as caspase-3 and Bcl-2, respectively. These changes were likely responsible for the induction of apoptosis, as caspase-3 activation is a central event in the execution phase of apoptosis, while Bcl-2 is a member of the Bcl-2 family that can inhibit apoptosis.

Overall, our findings suggest that thymoquinone is a promising anti-cancer agent with potential for the development of new therapeutic strategies against oral cancer. Further research is needed to fully understand the molecular mechanisms underlying thymoquinone-induced apoptosis and to translate these findings into clinical applications.
N-dealkylation of terbinafine. In previously published work, we modeled terbinafine metabolism to determine preferred N-dealkylation steps leading to TBF-A. As a complement to modeling, we carried out steady-state kinetic studies with pooled human liver microsomes (HLM100) to determine the mechanisms and corresponding kinetic constants for terbinafine metabolism, and thus the concentration-dependent metabolic efficiency of N-dealkylation pathways. Based on liquid chromatography and mass spectrometry, we identified primary and secondary metabolites of terbinafine N-dealkylation. Aldehydes, such as TBF-A, were not observed directly, so dapsone hydrazine was used to label them for detection. Our identification of highly efficient desmethyl-terbinafine formation from terbinafine supports rapid initial N-demethylation, however, TBF-A formation efficiency was similar from terbinafine and desmethyl-terbinafine substrate. Furthermore, N-methyl-1-naphthyl methylamine was observed from terbinafine reactions, but not 1-naphthyl methylamine. We found that TBF-A stability under experimental conditions revealed rapid depletion independent of enzyme activity. Overall, the data suggest preference for a single-step N-dealkylation from terbinafine, with N-methyl-1-naphthyl methylamine as a cometabolite, being the most efficient pathway to TBF-A formation under steady state conditions. Additionally, accumulation of TBF-A is determined by the balance between its formation by the dominant pathway and its depletion under biological conditions. Knowledge of these mechanistic details will inform the most probable model predictions for TBF-A formation and experimentally demonstrate whether the efficiency of the pathway could contribute to liver toxicity.

MED/MOL/CELL BIO – 03 – Dakota Pouncey
University of Arkansas for Medical Sciences, Faculty Researcher
Judge: No

Coumadin (Warfarin) Pharmacokinetics Change for Pediatric Patients with Single Ventricular Physiology during Initiation of Anticoagulant Therapy

Background: Following the Fontan surgery, patients with single ventricular physiology require lifelong anticoagulant therapy with Coumadin (warfarin) to minimize thrombotic risk. Our pilot study is the first to assess the effect of Fontan physiology on R- and S-warfarin metabolism and clearance for pediatric patients with single ventricle physiology during initiation and maintenance. Methods: Patients scheduled for Fontan palliation were enrolled prospectively from July 2016 to January 2017. Patients were genotyped for CYP2C9 polymorphisms due to its impact on S-warfarin metabolism and dose-response. During Coumadin initiation, blood samples were collected at 2, 12, 21, 22, 23 and 24 hr post dose on Days 1 and 3 along with two more samples during maintenance phase. Plasma samples were analyzed by LC-MS to measure 18 warfarin analytes to estimate changes in drug clearance during initiation based on dose-adjusted time curves (AUC) assuming 40 hr elimination half-life. Results: Five patients were enrolled prospectively with median age of 2.58 yr (4 males, 1 female, 2 Caucasian, 1 Hispanic). Two patients were homozygous for wild type CYP2C9 (*1/*1) while three were heterozygous (*1/*2). Plasma analyses yielded levels of parent drugs and 12 metabolites. From Day 1 to 3, the AUC ratio mostly increased for R- and S-warfarin and the metabolites, although the magnitude depended on the individual patient and respective metabolite. AUC ratio for R- to S-warfarin ratios correlated positively with the international normalized ratio (INR), a measure of therapeutic response. Conclusion: During Coumadin initiation, AUC values for parent drugs increased leading to higher exposure, while that for metabolites varied significantly indicating changes in metabolism and/or distribution early in the therapy that could complicate predictions of drug-drug interactions. CYP2C9 polymorphisms did not likely explain differences in response due to similarity in final maintenance doses. Importantly, the positive correlation for the R to S-warfarin ratio suggests therapeutic responses arise from both drugs rather than S-warfarin alone.

MED/MOL/CELL BIO – 04 – Antoinee Odendaal
Southern Arkansas University, Undergraduate Student
Judge: Yes

The effect of green tea extract on Daphnia magna

We investigated the effect of commercial green tea extract (GTE) on Daphnia magna by means of acute and reproductive toxicity tests. We found that GTE significantly reduces the reproductive output of D. magna over a 21-day test period.

MED/MOL/CELL BIO – 05 – Dhaval Shah
University of Arkansas for Medical Sciences, Faculty Researcher
Judge: No

CYP3A Metabolizes Dextromethorphan Less Efficiently than CYP3A4.

(Co-Author: Grove Miller)

Dextromethorphan is a widely used over the-counter cough suppressant. Dextromethorphan has recently been associated with adverse outcomes in pediatric populations despite being on the market for six decades. We hypothesize that the toxicity of several drugs in children is due to underappreciated differences in the expression and efficiency of hepatic enzymes early in life. CYP2D6 is the primary hepatic enzyme that metabolizes dextromethorphan to dextrorphan in adults, with minor contributions from the CYP3A family (CYP3A4 and CYP3A7) to form 3-methoxymorphinan. Recent studies suggest that children have low CYP2D6 and CYP3A4 protein levels, with markedly higher CYP3A7 protein levels. CYP3A7 protein levels are thought to decline during the first two years of life as CYP2D6 and CYP3A4 gradually increase. The purpose of this study was to determine the kinetic parameters of recombinantly expressed CYP3A7 and compare them to the kinetic parameters of CYP3A4 and CYP2D6. CYP2D6 was found to have the greatest intrinsic clearance as expected, however CYP3A7 was substantially less efficient than CYP3A4. Kinetic studies were also performed using human liver fractions to confirm non-Michaelis Menten kinetics by recombinant CYP3A7. This in vitro study suggests that clearance of dextromethorphan and other drugs by CYP3A enzymes may initially be impaired in children.

MED/MOL/CELL BIO – 06 – Dennis Richardson
Quinnipiac University, Faculty Researcher
Judge: Yes

Geohelminth Infection, Anemia, and Malnourishment in Bawa, Cameroon After Ten Years of Intervention by the Bawa Health Initiative

(Co-Author: Sara Karr)

The Bawa Health Initiative (BHI) was established in 2005 with the goal of initiating a comprehensive public health care program in Bawa, a rural village in the West Province of Cameroon. Interventions undertaken include a comprehensive helminth control program, provision of water filters, sanitary latrines, insecticide treated bed nets, and a health education program. Data gathered from citizens of Bawa during Dec 2017, were obtained from the Sophie Awooke Healthcare Center in Bawa, Cameroon. These data including prevalence of geohelminth infection, morphometric data, and hemoglobin concentrations were compared to data gathered in previous surveys conducted by BHI in 2007 and 2010 to assess the effectiveness of interventions implemented by BHI. All metrics indicate substantial improvement in the overall health of the citizens of Bawa, evidenced by decreases in the prevalence and intensity of geohelminths. These data strongly suggest that public health interventions implemented by BHI have been exceedingly effective in reducing the burden of disease and increasing the overall well-being of the citizens of Bawa, Cameroon and surrounding villages.

Chemistry & Geosciences Session (Friday, Session 1)
Room: Arkansas River Room

CHEM/GEO – 01 – Blake Ludwig
Arkansas Tech University, Undergraduate Student
Judge: Yes

A Bond Valence / Bond Length Correlation for Tantalum-Oxygen Bonds

Linus Pauling developed an empirical dependence between bond valence (bond order), and bond length. R. ...
Since the first successful expression of recombinant DNA human insulin in 1978, research with and use of protein drug therapy has advanced rapidly. In the United States alone, the $82 billion dollars spent on diabetes care in 2015 was projected to increase to $109.9% compound annual growth rate over five years. Significant advantages of protein therapy drugs, particularly proteins' specificity which reduces the risk of side effects, have made protein therapy a more attractive alternative to small molecule drugs 5. In addition, the discovery of e. coli as expression host in 1963 has opened the door for rapid, large-scale production of proteins with the opportunity to alter proteins through recombinant DNA technology 1. In e. coli, the few post-purification modifications, the opportunities to improve activity, and the stabilization by protein engineering make these prokaryotic cells a more attractive expression hosts 2. However, the tremendous advantages of proteins in drug therapy are not without inconveniences, specifically the many processing steps required to purify protein produced by bacteria 5. The cost of common purification techniques for recombinant proteins, involving expensive column resin for affinity chromatography, constitutes a significant portion of the $10 billion dollar pharmaceutical industry 3. Multiple protein derivatives to lower yield of pure proteins have hindered the study of many proteins and driven up the cost of many pharmaceuticals. This project is an investigation of the development of a more cost-effective and less labor-intensive method for purification of recombinant proteins, utilizing a small affinity tag protein. This protein is the ideal tag due to its low molecular weight, red color for easy identification, and extreme thermostability 3. The specific aims of the project are to express and purify the tag affinity protein, to determine the effects of temperature and pH on its stability by monitoring changes at the secondary and tertiary structure levels using circular dichroism and fluorescence spectroscopy, and to understand the changes in the structure of the protein at the residue level using multi-dimensional NMR spectroscopy. For this project, the affinity tag was purified by the initial purification method and further optimized using a combination of denaturing and non-denaturing chromatography. Our ongoing experiments aim to dissect the contribution of the various AAs pathways to abiotic stress tolerance using a combination of genetic, transcriptomic, and phenomic approaches.

CYP2C19 and AAs Generate a Potentially Toxic, Reactive Terbinfine Metabolite as Revealed through Modeling and Experimental Metabolite Profiling

(Co-Authors: Anirudh Pidugu, Dustyn Barnette, S. Joshua Swamidass, Grover P. Miller)

L-Ascorbic acid (tne) is a effective, widely prescribed antifungal drug that causes idiopathic liver toxicity in rare cases. The proposed mechanism of toxicity involves a reactive metabolite, 6,6-dimethyl-2-hepten-4-ynal (TBF-A), that forms transient glutathione adducts capable of target damage leading to hepatotoxicity. We employed deep learning neural network modeling and in vitro experimental approaches to identify three possible AAs dealkylation pathways leading to TBF-A formation in one or more steps. We initially modeled terbinafine Ndealkylation by CYP1A2, 2A6, 2B6, 2C9, 2C19, 2D6, 2E1, and 3A4. Of these, all 450s except CYP2A4 were predicted to N-dealkylate terbinafine for one pathway, while CYP2A6 and 2D6 were only predicted to generate TBF-A from terbinafine. None of the models predicted 450s N-dephethylate the parent drug. The modeling captured the broad specificity of 450s N-dealkylation, with the exception of the N-dealkylation for one pathway, the pathway was predicted to be the only one for which the other 450s had significant activity. Subsequent preliminary studies with the recombinant enzymes revealed the order of catalytic efficiency (V/Km) for that reaction was CYP3A4>C2C9>2B6. For the other pathways, N-demethylation by CYP2C19 was much more efficient than 450, and the order of efficiency for 450 was CYP1A2>CYP2B6>CYP3A4. We have used the CYP2C19 kinetic studies to develop a comprehensive understanding of the interplay between the different 450s in the metabolism of terbinafine. The relative contributions of the 450s to the overall metabolism of terbinafine, and the potential for the formation of reactive metabolites, have important implications for the development of new antifungal agents and the optimization of existing ones.

CYP3A4 and 2B6 have been identified as potential targets for the development of next-generation antifungal drugs. These enzymes are known to be involved in the metabolism of a wide range of drugs and have been implicated in the development of drug interactions. The ability to modulate the expression or activity of these enzymes could offer new opportunities for the development of selective antifungal agents. The study of the interplay between CYP3A4 and 2B6, and their potential interactions with other enzymes, could provide valuable insights into the development of more effective antifungal therapies.
ENG – 01 – Andrew Lea
Arkansas Tech University, Undergraduate Student
Judge: Yes

Design and Development of a Self-Driving RC Car

Self-driving technology is one of the attractive and successful application areas of general AI. Major automobile manufacturers and a number of high-tech companies have timelines for self-driving cars and have put great efforts into the development of driverless-car technology. The objective of this project is to build a scaled-down self-driving car based on an Artificial Neural Network (ANN) model. The developed RC car drive autonomously via a single front-facing camera sensor. The designed ANN model maps the raw video frames captured by the camera directly to the steering commands and achieves autonomous driving. The project also aims to add the undergraduate students’ understanding of the principles of AI and ultimately empowers the current generation of engineering students with the state-of-the-art AI technology.

ENG – 02 – Hamdi Albusnsee
University of Arkansas, Graduate Student
Judge: Yes

A Step by Step Design Procedure for Current Control of a 5 MW Three-Phase Grid-Connected Inverter

(Paper Author: Manar Alzahib, Roy McCann)

PV connected inverters hold the promise for the growth of using renewable resources that are connected with the power grid. Due to the complexity of controlling the inverters when they are connected to the power grid, a step by step design procedure is illustrated in controlling the output current of a 5 MW three-phase grid-connected inverter. The illustrated procedure clarifies the ambiguity of how to derive a transfer function that relates the inverter output current and the control input, which is the reference three-phase sine wave voltage that is used in generating the pulse width modulation for the switch devices. Using the MATLAB/SimPower Systems Toolbox, the mathematical derivation is validated and showed accurate results.

ENG – 03 – MM Tariq Moshred
Arkansas State University, Graduated Student
Judge: Yes

Prospects of Nanoclay as a Pavement Construction Material

(Paper Author: Zahid Hossain)

The main goal of this study is to assess the feasibility of the use of nanoclay as an alternative polymer. In this study, three types of nanoclay (Cloisite 10A, Cloisite 11B, and Cloisite 15A) and an unmodified Performance Grade (PG) binder from two sources (Source 1 and Source 2) were selected for laboratory investigation. Nanoclay at 2% and 3% by weight of base binder were blended for 2 hours using a high shear mixture with rotation 2000 rpm at 150°C. Then the nonaoclay-modified asphalt binder was characterized by using Rotational Viscometer (RV), Dynamic Shear Rheometer (DSR) and Atomic Force Microscope (AFM). It was found that the viscosity values of the modified asphalt binders were significantly higher than those of neat binders. From DSR test it can be observed that the complex shear modulus (G*) increased, but the phase angle (δ) decreased for modified binders. Therefore, the rutting factor (G*/sinδ) increased for nanoclay-modified asphalt binders and maximum rutting resistance was observed for Source 1 binder modified with 1% Cloisite 11B. On the other hand, the maximum rutting resistance was found for Source 2 binder modified with 1% Cloisite 10A. Morphological and three nanomechanical properties, namely, DMT (Derjaguin-Muller-Toporov) modulus, adhesion, and deformation parameters were measured for unmodified and nanoclay-modified asphalt binders. Preliminary results show that DMT modulus increased and deformation values decreased for nanoclay-modified asphalt binders compared to unmodified binders. Based on the experiments, it may be said that nanoclay has a great chance to become a pavement construction material.
BIO/ECO – 02 – Margaret Young
Hendrix College, Undergraduate Student
Judge: Yes

Valuation of ecosystem services of the Arctic National Wildlife Refuge

Ecosystem services are goods and services that nature provides to humans at no cost. Human activity that modifies the environment can cause reductions in these services which have a measurable impact on human economies and well-being. While ecosystem services have been well studied in most biomes, the arctic tundra has received little attention, despite covering a large proportion of the Earth’s land area. Using established methodology for estimating ecosystem services, we calculated the values for the Arctic National Wildlife Refuge (ANWR), a region that is virtually undisturbed by human activity, but one that is slated for oil and gas drilling in the future. We found that the refuge is worth over $2,000 US per hectare per year, which translates to over $15 billion US annually for the entire study area. Most of the ecosystem services values are concentrated in climate regulation (i.e. carbon storage), storage of soil nutrients, and aesthetic values. Our results suggest that arctic tundra has similar ecosystem services values compared to temperate ecosystems (e.g. temperate forest). Our analysis also indicates that the economic value of the ANWR to the world is greater than the economic benefits that may be realized from fossil fuel development. Strikingly, the survey we conducted of U.S. residents found that their willingness to pay (i.e. a contingency valuation) to maintain the refuge in its current state, exceeds the estimated value of the recoverable oil and gas deposits. Therefore, our study suggests that maintaining the ANWR in its current natural condition (i.e. de facto wilderness) is more beneficial to the world compared to development of the area for oil and gas resources.

BIO/ECO – 03 – Allison Monroe
Hendrix College, Undergraduate Student
Judge: Yes

A Proposal for Practical and Effective Biological Corridors in Northwest Costa Rica

Habitat fragmentation is a major factor causing animal population reductions and extinctions from remaining forested areas of the world. One problem extends to protected areas which are often well conserved, but too small and isolated to maintain species that exist at low densities and require large contiguous areas of habitat (e.g., large mammals). Costa Rica has been at the forefront of tropical forest conservation and has a large proportion of the country’s land area under protection. One such region is the northwest portion of Costa Rica, which is an extremely biodiverse region with several noteworthy national parks and other protected areas. However, each protected area is isolated natural habitat in a sea of deforestation. We propose four biological corridors that would connect five major protected areas in northwest Costa Rica to each other and all of them to larger protected areas in the central portion of the country, which would limit disruption to local human populations. After natural reforestation of the corridors, the result would be a contiguous protected area of 348,000 Ha. The proposed corridors would only be a 3.7% increase in total protected area size in the region and only 0.2% of Costa Rica’s total land area. Using the jaguar (Panthera onca) as a model umbrella species, we found that each current isolated protected area could support between 8-104 individuals (using mean estimates). Assuming lack of dispersal between protected areas, these populations’ sizes are unlikely to be viable in the long term. However, the combined protected areas, including the proposed corridors could support about 250 jaguars, a population size more likely to be viable (although still tenuous). Our study shows that land conservation efforts focused on a relatively small area of Costa Rica could create a large landscape level conservation area, while having very limited effects on the human population.

BIO/ECO – 04 – Benjamin Zamzow
Hendrix College, Undergraduate Student
Judge: Yes

Terrestrial mammal and bird communities in protected and unprotected lands in Costa Rica

Terrestrial mammal and bird survey results in the Arenal – Tilarán Conservation Area of Costa Rica

The establishment of parks and preserves has been the major strategy in reducing biodiversity loss in tropical forests. Costa Rica has been a model country in protecting landscapes and promoting conservation. However, many protected areas exist in areas surrounded by highly modified habitat, and may be losing species either because they are too small to support viable populations or too isolated to allow for population connectivity. Using camera traps, we studied the terrestrial mammal and bird populations in protected areas, including the proposed corridors could support about 250 jaguars, a population size more likely to be viable in the long term. However, the combined protected areas, including the proposed corridors could support about 250 jaguars, a population size more likely to be viable (although still tenuous). Our study shows that land conservation efforts focused on a relatively small area of Costa Rica could create a large landscape level conservation area, while having very limited effects on the human population.

Molecular and Cellular Biology Session (Friday, Session 2)
Room: Mockingbird Room

MOL/CELL BIO – 01 – Chloe Fitzgerald
Arkansas Tech University, Undergraduate Student
Judge: Yes

Relative Gene Expression Study on Centruroides vittatus: Investigating Sodium Toxin Gene Activity

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 I 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, Na654, Na689, Na1210, CsBeta, CvAlpha, and Na3066. This was accomplished by quantitative reverse transcriptase polymerase chain reaction, or qRT-PCR. Preliminary experiments have been conducted on both male and female organisms by which threshold cycle 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 is to determine the level of expression for the different sodium I toxin genes in the telson gland relative to body tissue in male and female scorpions of the eastern population. This information may be relative to help develop anti-toxins for medical use.
MOL/CELL BIO – 02 – Brandon Holand
Harding University, Undergraduate Student
Judge: Yes

Comparison between environmental bacteria found in the soil and the wolf spider, Rabidosa rabida microbiome using 16s rRNA sequencing analysis
(Co-Author: Ryan Stark)

The national microbiome initiative has been encouraged to all researchers to study organisms relative to human health. Many anthropods are known to carry microorganisms important to human health, yet not all groups have been focused on. Previous studies on arthropods indicate the presence of a bacterial microbe that have the possibility of contributing to disease. However, microbiome data on spiders is lacking. Rabidosa rabida is a common terrestrial Wolf spider found in many parts of eastern North America. We hypothesized that R. rabida would have a microbiome consisting of common microbes found in soil due to its natural habitat of fields and low grasses. We also hypothesized that R. rabida could potentially have microorganisms living in and on its surface that could be pathogenic to humans. We isolated 47 different bacterial samples from 7 spiders, and 20 bacterial samples from the soil where we obtained the spiders. 16s rRNA sequences were obtained and BLAST analysis was performed. Organisms were then compared for similarities to organisms found in various vertebrate taxa using previously published data. Analysis indicated that spiders carry bacteria on and within them that include microbes in the soil and an assortment of bacteria not found in the environmental samples. Bacterial phyla were also similar to phyla found in the human microbiome.

MOL/CELL BIO – 03 – Mohammad Fazle Azim
Arkansas State University, Graduate Student
Judge: Yes

Production of a Preynlsted Stillbenid in Muscadin Grape Hairly Roots Expressing a Preynltransferase Gene from Peanut

Stillbenoids are phenolic compounds found in a small number of plant species including muscadine grape and peanut. These compounds have shown biological activities including anticaner, cardioprotective, anti-inflammatory and neuroprotective properties in vitro and vivo. However, several stilbenoids have exhibited poor bioavailability limiting their application in vivo. Recently, our group identified preynltransferases in peanut which can produce more bioavailable stilbenoids. Therefore, the goal of this project is to express the peanut stilbenoid reynltransferase in muscadine grape to ultimately increase its health benefits. In this study, hairy root cultures were developed via transformation of Agrobacterium rhizogenes harboring a peanut stilbenoid preynltransferase. Four muscadine grape hairy root lines showed the presence of the peanut preynltransferase gene along with auxin and rol genes from A. rhizogenes. Furthermore, preynltransferase activity and production of arachidin-2 – a preynlsted stilbenoid – were confirmed by enzymatic assays and HPLC mass spectrometry analyses, respectively. The effect of different growth stages (17, 21 and 25 days) on the production of stilbenoids was also evaluated. Our results demonstrated the successful production of arachidin-2 in muscadine grape hairy roots and the potential to leverage this metabolic engineering strategy to develop muscadin grape fruits with enhanced health benefits.

MOL/CELL BIO – 04 – Neha Verma
Arkansas State University, Graduate Student
Judge: Yes

Genetic modification of Switchgrass cell wall for improved biomass processability
(Co-Author: Jianfeng Xu)

Switchgrass (Panicum virgatum) is a perennial C4 grasses that have been most extensively studied as a dedicated bioenergy crop. However, efficient conversion of switchgrass biomass to biofuels has been hampered by biomass recalcitrance. Genetic modification of the plant cell wall represents a promising solution to overcoming this problem. The goal of this project is to leverage an innovative strategy, hydroxyproline (Hyp)-O-glycosylation “code”, for de novo design and engineering in switchgrass to leverage an innovative strategy, hydroxyproline (Hyp)-O-glycosylation “code”, for de novo design and engineering in switchgrass. Molecular breeding of plants with modified Hyp-O-glycosylation “code” could potentially enhance digestibility. In this study, we characterized the phenotype of transgenic switchgrass and biomass saccharification will be determined in the future.

MOL/CELL BIO – 05 – Newton Hilliard
Arkansas Tech University, Faculty Researcher
Judge: No

Using Proteomics to Investigate Microbial Acid Tolerance Response
(Co-Author: Alan J. Tackett, Kirk L. Weis)

Stomach acidity is generally one of the first host defense mechanisms encountered by ingested microorganisms. Targeting of microbial acid tolerance response (ATR) mechanisms therefore opens avenues for creation of new and novel antimicrobial therapies. While previous investigations have chosen to emphasize the role of chaperone proteins or acid neutralization mechanisms in ATR, we have proposed to investigate the role of changes in extracellular pH in regulating expression of proteins involved in cytoplasmic and extracytoplasmic pathways for production of metabolic energy. Using the non-pathogenic gammaproteobacteria Halothiobacillus neapolitanus as a model species, the GeLCMS/MS technique of Bynum, et. al. was used to evaluate proteome wide pH dependent changes in protein expression levels. Using the published H. neapolitanus genome sequence as reference, proteins representing approximately >75% of the known non-rna gene sequences were correctly identified. A heat map indicates that >400 proteins show at least Log2 fold change in expression level between pH 5.3 and 7.4. These changes include substantial changes in cellular levels of proteins such as sor or sqf that are involved in extracellular oxidation of substrates, muo NAAD Oxidoreductase and cytochrome c oxidase. Interestingly, little or no change in cellular concentrations of the chaperone proteins dnaJ/K, grl, and omP was detected. The results support utilization of the GeLCMS/MS technique in investigation of proteome wide acid tolerance response.

MOL/CELL BIO – 06 – David McClellan
University of Arkansas - Fort Smith – Faculty Researcher
Judge: No

Molecular Adaptation of Myoglobin Proteins in Deep-diving Cetaceans

That some cetaceans, whales and dolphins, can survive submerged for relatively long periods is indisputable. Sperm whales (Physeter macrocephalus), for example, hunt at depths below 2000 meters for over an hour at a time and are known to sleep at similar extreme depths. Beaked whales (Ziphiidae) are known to dive even deeper. These air-breathing mammals are the evolutionary recipients of extreme respiratory adaptations. Several studies have suggested that at least some of these adaptations are molecular in nature. Myoglobin, the protein that stores oxygen in muscle tissues, is one these adapted molecules. This presentation summarizes efforts to identify myoglobin amino acid variants and their physicochemical properties that contribute to the extreme respiratory adaptation of Physeteridae and Ziphiidae, as well as generally in all cetaceans.

Wildlife and Terrestrial Biology Session (Friday, Session 2)
Room: White River Room

TERR/WILDL BIO – 01 – John Veon
Hendrix College, Undergraduate Student
Judge: Yes

Disturbance of wintering waterfowl by traffic noise

Wetlands are highly impacted by land-use changes associated with threats like agriculture and urbanization, however one threat that receives less attention is that of anthropogenic noise. Recently, there has been an increase in the number of studies linking anthropogenic noise to impacts on wildlife. Waterfowl could be at risk for disturbance by automobile noise due to the spread of transportation networks into rural areas that waterfowl commonly use as wintering habitat. We tested the response of wintering waterfowl to playback traffic noise at 75 dB in wetland habitats in southwest Arkansas from January through March 2018. Each trial of the experiment consisted of three 20 minute phases designated as before, during, or after the traffic playback. During each minute of a trial, we recorded the number of birds of each species and the distance of each bird from the noise source. We found that the mean proportion of all birds detected decreased from 0.30 to 0.15 at distances closer to the noise during the playback, but this change did not persist after the playback stopped. Although mean closest approach of birds to the speaker did not differ significantly between phases of the trial (F=1.62, df=2, 14, p>0.23), our results suggest that there could be a trend for the distance to the speaker to increase during traffic noise (X=0.40, SE=0.17) compared to no traffic noise (X=18, SE=9.5). Thus, our study did not conclusively find that waterfowl completely avoided simulated traffic noise, but it does indicate that such noise could change the specific areas of habitat that those birds choose to utilize. If birds avoid areas that are resource-rich because of noise, managers could be overestimating the amount of habitat available for use by these birds.
To estimates derived from visual identification. As auto-i.d. programs continue to improve their accuracy, an alternative 2-state model of bat call sequences and compared the results. Occupancy estimates derived from the multi-state occupancy model were similar to estimates derived from visual identification. We then estimated occupancy using a multi-state occupancy model in which call sequences identified as an Indiana bat by both auto-i.d. programs are considered “certain detections”, and call sequences identified as Indiana bat by one program are considered “uncertain detection”. We also performed occupancy estimates based on visual identification. However, some segment of the population acquires much of their meat from the hunting of wild game. Is this study, we measured the amount wild game meat harvested from mammals and birds in the U.S. each year and calculated the carbon emission reductions caused by that activity. Over 400 billion kcal worth of wild meat is harvested each year, which accounts for over 2% of the total meat consumption. If this meat were replaced with farmed meat, the added CO2 emissions from the U.S. would rise by over 1 billion kg, equivalent to adding about 220,000 cars to the road. Our analysis indicates that an American diet with the typical proportions of major food groups, but containing only wild game meat, is similar in carbon emissions to a vegetarian diet. Wild game numbers are currently at very high levels (e.g., white-tailed deer) and harvest rates could probably increased without going beyond sustainable levels. Increasing current consumption patterns of wild game could therefore have a meaningful effect on U.S. carbon emissions.

Food production accounts for about one-third of United States greenhouse gas emissions. The diet of the U.S. also has relatively large amounts of meat, the food category associated with highest emission rates. However, some segment of the population acquires much of their meat from the hunting of wild game. Is this study, we measured the amount wild game meat harvested from mammals and birds in the U.S. each year and calculated the carbon emission reductions caused by that activity. Over 400 billion kcal worth of wild meat is harvested each year, which accounts for over 2% of the total meat consumption. If this meat were replaced with farmed meat, the added CO2 emissions from the U.S. would rise by over 1 billion kg, equivalent to adding about 220,000 cars to the road. Our analysis indicates that an American diet with the typical proportions of major food groups, but containing only wild game meat, is similar in carbon emissions to a vegetarian diet. Wild game numbers are currently at very high levels (e.g., white-tailed deer) and harvest rates could probably be increased without going beyond sustainable levels. Increasing current consumption patterns of wild game could therefore have a meaningful effect on U.S. carbon emissions.

The importance of proper management for bats has become paramount in recent years because of the introduction and spread of WNS throughout the eastern United States and Canada. Occupancy modeling is one research management tool that is widely used among biologists. Occupancy is based on the presence/absence of a species, making it a natural fit with acoustic data recorders. However, disagreement among automated bat identification programs can make accurate occupancy estimates based upon acoustic recordings difficult to achieve. We performed automated bat surveys at 96 sites throughout the eastern United States and Canada. Occupancy modeling is one research management tool that is widely used among biologists. Occupancy is based on the presence/absence of a species, making it a natural fit with acoustic data recorders. However, disagreement among automated bat identification programs can make accurate occupancy estimates based upon acoustic recordings difficult to achieve. We performed automated bat surveys at 96 sites throughout the eastern United States and Canada. Occupancy modeling is one research management tool that is widely used among biologists. Occupancy is based on the presence/absence of a species, making it a natural fit with acoustic data recorders. However, disagreement among automated bat identification programs can make accurate occupancy estimates based upon acoustic recordings difficult to achieve. We performed automated bat surveys at 96 sites throughout the eastern United States and Canada. Occupancy modeling is one research management tool that is widely used among biologists. Occupancy is based on the presence/absence of a species, making it a natural fit with acoustic data recorders. However, disagreement among automated bat identification programs can make accurate occupancy estimates based upon acoustic recordings difficult to achieve. We performed automated bat surveys at 96 sites throughout the eastern United States and Canada. Occupancy modeling is one research management tool that is widely used among biologists. Occupancy is based on the presence/absence of a species, making it a natural fit with acoustic data recorders. However, disagreement among automated bat identification programs can
measured current values and a range of possible wave speeds, we will present the method of integration of the set of electron fluid dynamical equations through the dynamical transition region and wave. We will also present the wave profile for electric field as a function of electron velocity for the above mentioned ranges of current values and wave speeds.

MATH/PHY/COMP SCI – 03 – Yosuke Kitakaze
Arkansas Tech University, Undergraduate Student
Judge: Yes

An Interacting Model between Dark Energy and Dark Matter
(Co-Author: Jesse Griffeths)

Dark energy is one of the mysterious constituents of the cosmic inventory and although its existence is confirmed by observations, its nature is completely unknown to physicists. There are several different ways dark energy is described. In each theory, dark energy has its own unique properties. The most common candidate for dark energy is the cosmological constant, although there are other candidates as well. Traditionally it is also assumed that dark energy evolves independently from other constituents. To address some of the issues of modern cosmology, like Cosmic Coincidence Problem, we introduce an interaction between dark energy and matter. In our previous studies we always considered interacting models where dark energy was considered to be holographic. In this work, considering a sign-changeable interaction, we also assume that dark energy is proportional to the Hubble Parameter. The sign-changing interaction is proportional to the deceleration parameter, so its sign changes when we go from decelerating universe into an accelerating one. The differential equations for this interacting models will be derived and the numerical solution will be studied.

MATH/PHY/COMP SCI – 04 – Tulin Kaman
University of Arkansas, Faculty Researcher
Judge: No

Verification and Validation for Turbulent Mixing Simulations

We present the validation studies for acceleration driven turbulent mixing flows, comparison of simulations to experiments. The studies show simulation agreement with Rayleigh-Taylor experiments using the algorithms based on front tracking, large eddy simulation with sub-grid scale.

MATH/PHY/COMP SCI – 05 – David Peterson
University of Central Arkansas, Faculty Researcher
Judge: Yes

Nutrient Concentrations in Big Creek Correlate to CAFO Presence

Nutrient concentrations in Big Creek, a major tributary of the Buffalo National River, are expected to be an issue in the current contentious battle over the continuing permit of a concentrated animal feeding operation (CAFO, 2012). This paper examines both spatial and temporal changes in nitrate and total phosphorous (TP) using data from the Big Creek Research and Extension Team (BCRET), the Arkansas Department of Environmental Quality (ADEQ), and the U. S. Geological Survey (USGS). In the CAFO stretch of Big Creek, from upstream to downstream, the mean nitrate concentration increases by 124% and the flow weighted TP mean increases 123%. In low flow regimes there is evidence of stream nitrate contamination from ground water and CAFO tributaries.

MATH/PHY/COMP SCI – 06 – Puskar Chapagain
Southern Arkansas University, Faculty Researcher
Judge: No

Efficacy of Supplemental Instruction on Algebra and Calculus-Based Physics Teaching-Learning Processes
(Co-Authors: Lavana J. Kindle, Dipak Ritual)

Supplemental instruction (SI) is a group based teaching/learning method designed for students to succeed and retain material taught in historically difficult subjects. In this method, each group is assigned an SI leader who has already completed the course. The SI leader attends lecture classes, takes notes, and solves problems with students. The students meet in SI sessions twice a week outside of the lecture where they review matter covered in the class, discuss among themselves, and work as a group to solve problems under the facilitation of the SI leader. Reports from supplemental instruction in physics and other classes at Southern Arkansas University (SAU) dated since the fall semester of 2002 were reviewed. To assess the efficacy of the SI program, we analyzed data collected as post completion of the students enrolled in both algebra and calculus-based physics at the end of each semester until the fall of 2017. We studied the impact of SI sessions on students’ GPA, letter grades, numbers of withdrawal/incompletion, and compared students who attended SI sessions versus those who did not attend. Further, we discuss the influence on overall retention of students enrolled in physics classes at the end of each semester.

General Biology Session (Saturday Session)
Room: Mockingbird Room

BIO – 01 – Brian Wagner
Arkansas Game & Fish Commission, Faculty Researcher

Gene flow and genetic structure of two of Arkansas’s rarest darter species (Teleostei: Percidae), the Arkansas darter, Ethostoma cragini, and the least darter, E. microperca
(Co-Authors: Robert Wood, Justin Baker)

Distinguishing the effects of historical fragmentation from those of contemporary landscape modification is important to understanding human influences on gene flow and population dynamics. We examined the effects of fragmentation operating over separate timescales on two darter species, Ethostoma cragini and E. microperca, from the Ozark Highlands. These species now occur within this region only in highly isolated habitats. We separated fragmentation effects at distinct spatial and temporal scales by using several molecular loci (mtDNA/nuclear DNA/nuclear microsatellite DNA). Sequence divergence among Ozark and northern populations of E. microperca indicate long-standing isolation. Both species were further isolated in unique ‘island’ habitats, sometimes at fine spatial scales, as shown by sequence divergence among Ozark Highland populations of E. cragini. Microsatellite data also revealed additional subdivision among Arkansas populations with E. cragini divided into three distinct populations and E. microperca into two. Overall, migration rates were similar among contemporary and historical time periods although patterns of asymmetric migration were inverted for E. cragini. Estimates of contemporary effective population size (Ne) were substantially lower for both species than past population sizes. Overall, historical processes involving natural fragmentation have had long-lasting effects on these species, potentially making them more susceptible to current anthropogenic impacts.

BIO – 02 – Renn Tumilson
Henderson State University, Faculty Researcher

Distribution of Campostoma spadiceum in southern Arkansas
(Co-Author: Henry Robinson)

The Highland stoneroller (Campostoma spadiceum) was recently resurrected as a species distinct from the Central stoneroller (Campostoma anomalum). The map provided in the redescription of the fish showed overlap of distribution between the species, and showed most specimen localities to be in the Ouachita Mountains, but it did not document the identity of specimens in southern Arkansas below the fall line of the Ouachitas. We examined specimens of stonerollers from near and below the fall line in southern Arkansas to determine their identity and better understand the distribution of this fish.

BIO – 03 – David Jamieson
Crowder College, Faculty Researcher

Notes on Tarantula (Aphonopelma Hentzi) Reproduction in Missouri
(Co-Author: Austin Jones)

Recent survey work by the Arkansas Department of Natural Heritage suggests only one species of tarantula, Aphonopelma hentzi, occurs in the state of Arkansas and that its populations primarily found within the uplands of the western portion of the state. In the Ouark Mountains and Ouachita Mountains Physiographic Regions it is dependent on the xeric conditions found in the glade habitat. We recently published an article comparing the fecundity of this species from the Ozarks and Ouachitas of Arkansas. The other significant published work concerning reproduction in this species within Arkansas is by William J. Baerg, who studied a tarantula colony located in a glade just south of Fayetteville (Washington County) in the early 20th century. We are unaware of any ecological data published from other physiographic regions of the state. We have spent the last three years (2015-2017) in Hercules Glade located just east of Branson, Missouri with the purpose of providing additional information on reproduction from that state. The results are presented and compared to the data from Arkansas.
Distal Urogenital Anatomy in Male Southern Coal Skinks, Plestiodon anthracinus pluvialis (Reptilia: Scincidae)

I investigated the morphology and histology of the distal urogenital anatomy of male Southern Coal Skinks (Plestiodon anthracinus pluvialis) from reproducing active individuals collected in Arkansas in order to provide comparative information with recent studies on squamate urogenital anatomy. Specifically, I focused on the basic anatomy and positioning of posterior ducts in this skink, which included portions of the ductus deferens, the ampulla ductus deferentis, the sexual segment of the kidney, the ureter and collecting ducts, as well as aspects of the urodeural chamber and urogenital papillae. I found a much reduced ampulla ductus deferentis comprising only 0.7 mm in length in the caudal region of the ductus deferens. The sexual segment of the kidney was well developed, being located in collecting ducts of the kidney proper, in walls of collecting ducts leading away from the kidney as well as within anterior portions of the ureter. The anterior dorsal recess of the urodeural possessed epithelial crypts within a highly folded epithelium. Finally, a ductal triad (ductus deferens, ureter, and a single collecting duct) terminates at each orifice of the paired urogenital papillae. The distal urogenital anatomy of this scincid lizard revealed anatomical features similar to other species within the genus Plestiodon.

Biochemistry and Geosciences Session (Saturday Session)
Room: White River Room

Distal Urogenital Anatomy in Male Southern Coal Skinks, Plestiodon anthracinus pluvialis (Reptilia: Scincidae)

I investigated the morphology and histology of the distal urogenital anatomy of male Southern Coal Skinks (Plestiodon anthracinus pluvialis) from reproducing active individuals collected in Arkansas in order to provide comparative information with recent studies on squamate urogenital anatomy. Specifically, I focused on the basic anatomy and positioning of posterior ducts in this skink, which included portions of the ductus deferens, the ampulla ductus deferentis, the sexual segment of the kidney, the ureter and collecting ducts, as well as aspects of the urodeural chamber and urogenital papillae. I found a much reduced ampulla ductus deferentis comprising only 0.7 mm in length in the caudal region of the ductus deferens. The sexual segment of the kidney was well developed, being located in collecting ducts of the kidney proper, in walls of collecting ducts leading away from the kidney as well as within anterior portions of the ureter. The anterior dorsal recess of the urodeural possessed epithelial crypts within a highly folded epithelium. Finally, a ductal triad (ductus deferens, ureter, and a single collecting duct) terminates at each orifice of the paired urogenital papillae. The distal urogenital anatomy of this scincid lizard revealed anatomical features similar to other species within the genus Plestiodon.

BIO – 04 – Stan Trauth
Arkansas State University, Faculty Researcher

BIO – 05 – David Sasse
Arkansas Game & Fish Commission, Faculty Researcher

Early Seasons Primeness in Arkansas Raccoon Pelts

Trapping seasons in the United States are generally set around the time of the year when pelts are in “prime” condition and are in their most valuable state. In order to assess whether the start of the Arkansas trapping season is at an appropriate date 122 raccoons were captured during the month of November in 2014 and 2015. Based on the evaluation of experienced fur dealers, the percentage of pelts in prime condition was then assessed on weekly and half-monthly basis.

BIO – 06 – Jack Jackson
University of Arkansas - Fort Smith, Faculty Researcher

Avian Frugivory in a Fruting Mulberry Tree (Morus spp.) in Arkansas

(Author: Ragapathy Kannan)

A fruting Mulberry tree (Morus spp.) was observed for 67 hours in the spring of 2016 and 2017 in Fort Smith, Arkansas. A total of 172 five-minute scans were performed, during which the following parameters were recorded: species visited, number of individuals of each species, time of visitations, and foraging tier. Between each scan, the foraging rate (number of fruits consumed/min), inter- and intra- specific associations, and aggressive interactions were recorded. A total of 3465 observations of individual birds from 31 species were recorded. Species diversity index was higher in the upper half of the tree, and was higher in the morning. The mean foraging rates for the 9 most commonly observed species ranged from 1.17-2.39 fruits/min. A total of 346 aggressive interactions were observed of which 68% were intraspecific.

BIO – 07 – Renn Tumlison
Henderson State University, Faculty Researcher

Vertebrate Natural History Notes from Arkansas, 2018

(Author: Blake Sasse, Henry Robison, Matt Connor, Chris McAllister, Kelly Jobe, Matthew Anderson)

Many important details of vertebrate biology are unknown to the scientific community because the observations are not part of a larger specific study. Knowledge of such details not only fills gaps in understanding but also creates a framework for hypothesis building. Although vertebrates are a commonly studied group of animals, the distribution and natural history of many species within Arkansas remains undocumented. We continue to augment current literature with new observations and provide notes on the natural history of selected vertebrates from Arkansas. Herein we include previously unreported records of distribution, reproduction, and other aspects of natural history of the vertebrates of Arkansas. We report new records of bats based on submissions to the Arkansas Dep. of Health for rabies testing.

BIO – 08 – Heather May
Henderson State University, Undergraduate Student

New records of distribution of Dracunculus sp. Infecting River Otters (Lutra canadensis) in Arkansas

(Author: Allison Surf, Renn Tumlison)

The Guinea worm (Dracunculus sp.) is a nematode whose maturing females migrate to the extremities of host mamals to deposit their larvae into the water when available. The large females, reaching lengths of 300 mm, create a hole in the skin as they lie in the subcutaneous layers. We searched for specimens of Dracunculus sp. in skinned carcasses of river otters (Lutra canadensis) provided by trappers and fur buyers during the harvest seasons of 2013-2014. We found the parasite in 29 in 184 otters (15.8%), and document 9 new counties of occurrence, mostly in western Arkansas. This parasite is now known to occur in otters from the Arkansas, Ouachita, Red, and White River drainages.

Chemistry and Geosciences Session (Saturday Session)
Room: White River Room

Inhibition of Cystine Transport Leads to Human Glioma Growth Retardation

Gliomas, or tumors with origins in glial cells make up approximately 80% of all malignant brain cancers. These tumors are associated with significantly low survival rates. Astrocytes express an obligate exchange transport protein, Xc-, which among numerous functions, is responsible for providing the cells with cystine (cysteine dimer), a precursor in glutathione synthesis, growth and division. It was hypothesized that inhibition of the protein would result in impaired supply of glutathione to the cancerous cells, causing their oxidative stress, eventually leading to apoptosis. This hypothesis was tested by assays of human cancerous cell lines treated by a panel of six new molecules developed in the FGs lab. This presentation will focus on these novel inhibitors of the Xcprotein and their influence on glioma cell metabolism. The inhibitors’ design, synthesis and results of biological assays will be discussed.

CHEM/GEO – 02 – Mariusz Gajewski
Arkansas Tech University, Faculty Researcher

Bond Valence - Length Relationships and Orbital Exponents for Hydrogen through Fluorine

Bond valence-length empirical relations provide a way of calculating bond valences, or bond orders (numbers), directly from bond lengths. Linus Pauling (1947) was the first to suggest the “empirical” logarithmic dependence of bond order or valence, s, to bond length, R, as s = exp[(R0-R)/b], where RO is the bond length of unit valence, and “b” is an empirical fitting parameter. A theoretical expression has previously been derived for the “b” parameter in terms of atomic orbital exponents. Published crystallographic bond length data is used along with conservation of valence to establish bond length-valence relationships as well as RO (bond length of unit valence) for selected bonds. These relationships are applicable regardless of physical state or oxidation number.

CHEM/GEO – 03 – Rajib Choudhury
Arkansas Tech University, Faculty Researcher

Understanding the Complexation of Small Molecules with a Macromolecule

(Author: Vaudhynathan Ramamurthy)

Octa acid (OA), a synthetic macrocycle with eight carboxylic acid groups at the portals, is a container molecule that is used to encapsulate, confine, and control the excited state behavior of organic guest molecules. In this study, inclusion of several small molecules (guests) with different structural and electronic properties, within octa acid (OA) was probed by isothermal calorimetry, 1H nuclear magnetic resonance spectroscopy, and molecular dynamic (md) simulations. Under the condition of the experiments (pH ~ 9), the guests were included as carboxylate anions with the polar anionic head group facing water and hydrophobic carbon atoms interacting with the OA hydrophobic interior. Impressive results include the formation of carboxylate clusters in OA cavities, with the guests and negative for naphthyl guests. Quite likely the difference in hydrophobicity between the two sets of molecules and the strength of interaction between the guest and the OA are responsible for the sign difference in ΔS between the two series. The inhibitors’ design, synthesis and results of biological assays will be discussed.

Arkansas Tech University, Faculty Researcher

Undergraduate Student
thermodynamic parameters between the 1- and 2- substituted naphthalenyl carboxylic acids; 2-naphthyl carboxylic acids that can penetrate deeply have larger $\Delta H$ and 1-naphthalenyl carboxylic acids that can only enter the cavity in an angle have smaller $\Delta H$. As expected, based on the well-known concept of "enthalpy-entropy compensation," the molecules that have large $\Delta H$ are accompanied by large $\Delta S$.

CHEM/ GEO – 04 – Michael Davis
Arkansas Tech University, Faculty Researcher

Optimum Magnetometer Transect Spacing to Locate Legacy Oil and Gas Wells
(Selection Authors: Jason Patton, Kenyon Gowing, Hunter Vickers)

The purpose of this study is to determine the optimum transect spacing to locate legacy oil and gas wells using an Overhouser magnetometer. Widely known to be a potential environmental hazard, legacy oil and gas wells may act as a conduit for methane and/or deeper subsurface fluids (naturally occurring brines, injected waste fluids, or injected CO2) to the surface or shallow subsurface. Many plugged wells have all surface equipment removed leaving no visible trace at the surface and thus making the environmental assessment of these wells difficult. Using a magnetometer along a set of predefined transects, magnetic anomalies from the metal casing can be observed. In order to assess large numbers of wells, knowledge of the typical anomaly size is critical to maximize the transect spacing and therefore minimize magnetometer field work time. Here we show the results of five wells with an initial survey grid at two meter spacing. Although there is significant variation in the anomaly size (X,1, and 2), analysis of the data shows that transect spacing of 20 m is sufficient to identify these buried wells. The anomalies associated with four of the wells ranged from approximately 700-1200 nanoteslas (nT), with one well anomaly more than 6000 nT above background.

CHEM/ GEO – 05 – Kristin Dooley
University of Central Arkansas, Faculty Researcher

Comparison of effective optical properties of two-component internally mixed aerosols using various mixing rules
(Selection Author: Jessica DeYoung)

Accurately modelling the effect of internally mixed aerosols on the global radiation energy budget hinges on the correct computation of the particle's associated scattering and absorbing optical properties. While it is possible to compute the optical properties of internally mixed particles using exact Mie single-scattering calculations, atmospheric aerosols containing randomly spaced inclusions are computationally difficult and expensive to model. As a result, climate models commonly employ various computational mixing rules to approximate the refractive index of more complex types of internally mixed particles. This effective refractive index is used to compute the scattering and absorbing properties in a much simpler computational routine. In the current work, several types of mixing rules have been applied to two-component internally mixed particles of various mixing ratios. Differences in the calculated computed effective index of refraction are compared in order to discuss the merits and limitations of the mixing rules themselves.

Engineering and Computer Science Session (Saturday Session)
Room: Arkansas River Room

ENG/COMPI SCI – 01 – Richard Segall
Arkansas State University, Faculty Researcher

Steps Toward Measuring World Space Exploration Activity
(Selection Authors: Romukhamaredy Daggralala, Venkat Kodali, Daniel Berleant, Hysanthie Aboudaya)

This presentation discusses the continuation and extension of previous research performed by the research group on modeling of data pertaining to space missions to astronomical bodies beyond earth [1]. This presentation discusses the modeling of the following: (1) Trends and summarizing facts mined from data about the missions launched by all countries that go to planets, comets, and asteroids, and representation of the data in graphs based on those missions. (2) Trends and summarizing facts mined from data about Earth satellites obtained from a Union of Concerned Scientists (UCS) Dataset and Wiki Satellite Data. The presentation provides an overview of our current research and visual representations, including the following: 1. Mission data and statistical analysis performed using Excel charts, Tableau software, and Olik, to produce graphs focusing on trends over time. Comparisons are made between one planet and other planets to observe differences. Graphs are provided that indicate if trend lines diverge or converge between planet and other planets, from one planet compared with other planets and overall. Moving averages are used to smooth the graphs and to understand if there are trend lines for missions over time. II. Earth satellite data and discussion of graphs created to show summarizing facts about satellite purpose, launch sites, orbital distance, successful vs. failed launches over time, and launches by country. This presentation concludes with a summary of the above current research topics and future directions of the research. Reference: 1. Hall, C.; Berleant, D.; Segall, R. S.; Lu, S. "Steps toward Quantifying Advancement in Space Exploration," Proceedings of 20th World Multi-Conference on Systemics, Cybernetics and Informatics, Volume II, WMSCI 2016, Orlando, FL, July 8-11, 2017, pp. 106-112.

ENG/COMPI SCI – 02 – Xin Yang
Southern Arkansas University, Faculty Researcher

Deep Learning-based framework for MRI Autism Image classification
(Selection Authors: Ning Zhang, Suman Sarraf)

Neuroimaging has become the most commonly used imaging technique for the study of human brain, which has given us insights about the complex neural characteristics of the human brain and also provided helpful information for the diagnosis of various disease. The purpose of this paper is to provide accurate and efficient machine learning models for functional brain image classification of Autism spectrum disorder. Autism spectrum disorder (ASD) is a neuroally based psychiatric disorder, which is characterized by the impaired development of social interaction and communication skills. Though strong genetic factors are suspected, ASD continues to be diagnosed using symptom-based clinical criteria and its etiology remains unestablished. Recent epidemiological studies have shown that the incidence of autism is increasing. Further study in this area could provide helpful information about the mechanisms of increasing incidence. In this paper, we build a deep learning framework based on NVIDIA GPU platform. By using the Convolutional Neural Network (CNN) and the LeNet-5 architecture, we successfully classified functional MRI image of Autism spectrum disorder from normal controls.

ENG/COMPI SCI – 03 – Ashokkumar Sharma
University of Arkansas at Little Rock, Faculty Researcher

RAM pump, an energy independent solution to improve water accessibility to underdeveloped inhabitants in the world - A performance improvement study
(Selection Authors: Srikanth Pidugu, Shibanuk Khairat, Swaminadham Mudali)

Water is undoubtedly a vital need for our survival and its availability has always played a key role in human existence. Access to quality water is an essential factor for our lives. The facts are many inhabitants in the world do not have drinking water due to water shortages especially in remote and/or highly populated regions. This is because to convey water to higher altitudes required pumping infrastructure and in the absence of such facilities, the communities that reside on isolated areas seriously encounter water scarcity; affecting the drinking, sanitation, farming and other water based needs. These issues can positively be solved by employing a RAM pump, which works on the principle of energy conservation and operates without any power source resulting in a zero or negligible running cost. A team of senior design students has recently built a hydraulic RAM pump and successfully demonstrated its operation. However, many parameters that considerably influence the pump performance (such as delivery head, suction head, diameter of drive pipe, pipe length, pipe material, type of pump valve etc.) are yet to be optimized. The goals of the proposed study is to improve the performance of an existing RAM pump by optimizing the suction and delivery heads. Based on the previous results, three levels of suction head below 5 ft and three levels of delivery head below 20 ft will be investigated. Data measurement will include quantity of water pumped and quantity of wastewater collected during each experiment. Results will predict the effect of suction and delivery heads on the pumping rate and pump efficiency.

ENG/COMPI SCI – 04 – Brandon Kemp
Arkansas State University, Faculty Researcher

Applications of theoretical advances in the optical energy-momentum debate: invisibility cloaks, tractor beams, and reversed radiation pressure
(Selection Authors: Brandon Kemp, Michael Sheppard)

The momentum of light in matter have been debated in physics for more than a century. The Abraham-Minkowski debate is often discussed in terms of the correct form of optical momentum in media, but, actually arose out of relativistic considerations for the stress-energy-momentum (SEM) tensor in electrodynamics. [1] Recently, we have proved and demonstrated that momentum, energy and stress are important to understand the electrodynamics of field-matter coupled systems. It is the field-kinetic subsystem of light which represents the electromagnetic portion of the SEM tensor and is responsible for center-of-mass translations of matter, while the canonical subsystem represents the coupled system of material and field. [2, 3] We revisit some recent advances in the understanding and interpretation of the electrodynamics of moving media including the field-kinetic subsystem and the coupling of electromagnetic stress-energy-momentum with material media. We then show how anomalous interactions may occur in or at the surface of materials producing anomalous interactions such as negative refraction in a metamaterial, invisibility cloaking, the tractor beam on a chip, and reversal of radiation pressure in nanoparticles. 1. B. A. Kemp, Prog. Opt. Vol. 60, Chapter 5 (2013). 2. C. J. Sheppard and B. A. Kemp, Physical Review A 93, 013855 (2016). 3. C. J. Sheppard and B. A. Kemp, Physical Review A 93, 053832 (2016).
ENG/COMP SCI – 05 – Cheyenne Sheppard
Arkansas State University, Faculty Researcher

The Electrodyamics of Kinetic, Canonical, and Hidden Systems Under Relativistic Motion
(Co-Author: Brandon Kemp)

For the past century, the optical momentum debate, commonly referred to as the Abraham-Minkowski controversy, has been studied. This debate concerns itself with the understanding of kinetic and canonical electromagnetic momentum phenomena inside matter. Closely related to this is the topic of electromagnetic hidden momentum, which studies the concept of center of mass translations and linear momentum exchange between the fields and a given medium. In reviewing literature on this topic, it is clear that there lacks an accurate understanding of the hidden momentum and the material contributions within electromagnetic wave phenomena. Thus, we utilize the relativistic principle of virtual power to derive the leading formulations of electromodynamics. These formulations are invariant from one inertial reference frame to another and satisfy global conservation laws. Using standard electromagnetic field and material definitions, as well as the derived formulations, we formulate the hidden subsystem, which contains the hidden momentum. To demonstrate our analysis, we analytically model the electromagnetic wave phenomena using the derived formulations and their field-matter interactions within moving time varying and time averaged thought experiments. The results show that when adding the derived hidden momentum to the Amperian formulation, one must utilize the total hidden subsystem to account for relativistic energy-momentum conservation laws within the electromagnetic system. Additionally, we find that the Chu and Minkowski formulations are responsible for the kinetic and canonical formulations, respectively.

ENG/COMP SCI – 06 – Muhammad Safeer Khan
Arkansas Tech University, Faculty Researcher

Investigation of Acoustic-Based Crack Detection in PVC Pipes

The closed circuit television camera (CCTV) inspection is current industry standard for structural health monitoring and blockage detection in underground sewer pipes. For pipeline inspection, the CCTV camera is mounted on a self-propelled robotic crawler which passes through the pipe and relays video to an operator. These systems are contained in special vehicles and require a monitoring station with proprietary software to enable the operator to annotate the videos with notes. This makes these systems cost and labor intensive. There is a need to investigate and develop a system that can be easily deployable and cost-effective. Recent developments in acoustic based pipeline inspection technologies have highlighted that acoustic signals can be effectively used to detect blockages in pipes. The present acoustic systems, however, are not capable of detecting cracks in underground sewer pipes. This paper examines the use of acoustic signals to detect cracks in polyvinyl chloride (PVC) pipes which are industry standard for use in sewer installations. Extensive lab testing was done on pipe samples with and without cracks and pipes with laterals to develop a method to distinguish the change in pipes acoustic responses based on presence of a crack and a side branch. The results of analysis will be presented and the future directions of this research will be laid out.

ENG/COMP SCI – 07 – Ismaeel Al-Baidhani
Al-Mustansaryiah University, Faculty Researcher

A study of M and Mdyn masses at the different of the dynamical parameters of the spiral host galaxies
(Co-Authors: Sami Salman Chiad, Nadir Fadhil Habubi, Khalid Haneen Abass, Ehsaan S. Hassan, Mohamed Odda Dawod, Waizan Jahbar)

Several techniques are used to derive dynamical masses. The most accurate methods are based on one of two approaches: the solution of Poisson and Lewis equations or the description of the system using an orbit-supposition method. These methods are expensive in terms of observing time. A cheaper alternative is to use a simple mass estimate or based on the virial theorem. Several techniques are used to derive dynamical masses. The most accurate methods are based on one of two approaches: the solution of Poisson and Lewis equations or the description of the system using an orbit-supposition method. These methods are expensive in terms of observing time. A cheaper alternative is to use a simple mass estimate or based on the virial theorem. Recently developed in acoustic based pipeline inspection technologies have highlighted that acoustic signals can be effectively used to detect blockages in pipes. The present acoustic systems, however, are not capable of detecting cracks in underground sewer pipes. This paper examines the use of acoustic signals to detect cracks in polyvinyl chloride (PVC) pipes which are industry standard for use in sewer installations. Extensive lab testing was done on pipe samples with and without cracks and pipes with laterals to develop a method to distinguish the change in pipes acoustic responses based on presence of a crack and a side branch. The results of analysis will be presented and the future directions of this research will be laid out.

ENG/COMP SCI – 08 – Sami Chiad
Al-Mustansaryiah University, Faculty Researcher

Optical Properties and Dispersion Parameters of PMMA-MnCl2
(Co-Authors: Nadir Fadhil Habubi, Khalid Haneen Abass, Ismaeel Al-Baidhani, Ehsaan S. Hassan, Mohamed Odda Dawod, Waizan Jahbar)

Dispersion parameters were increased with the increasing of MnCl2 additive in the PMMA films. The dispersion parameters were obtained with the increasing of MnCl2 additive in the PMMA films. The dispersion parameters were obtained with the increasing of MnCl2 additive in the PMMA films. The dispersion parameters were obtained with the increasing of MnCl2 additive in the PMMA films.
Proportionality of Statistical Parameters for Helminth Parasite Populations in Smallmouth Bass (Micropterus dolomieu) from the Buffalo National River in Arkansas

Previous studies have shown that the population descriptors of mean, standard deviation and maximum number of Clinostomum sp. infections in stream smallmouth bass from Arkansas were highly correlative with each other with percent infection much less so. These populations also showed standard deviation (SD) to mean ratios larger than 1 indicating aggregation rather than infections obtained randomly. A study by Kilambi and Becker in 1977 on the helminth parasites of smallmouth bass from the Buffalo National River offered the opportunity to analyze their data to see if such correlations also occurs in other helminth populations of smallmouth bass. Mean, standard deviation, maximum number and percent infection were available for hosts from three locales (upper, middle, and lower sections) for four seasons. Combined calculations of locales and seasons for 24 monogenean, digenean, cestode, acanthocephalan and nematode populations were used to determine descriptor correlations. All 24 showed SD/mean ratio of greater than one (aggregation) averaging 3.6±1.7. Correlations between means, SDs, and maximum numbers were all highly significant with each other with percent infection correlations being not significant with each of the other descriptors. This data agrees with Clinostomum infections in smallmouth bass previously reported. The SD/mean ratios were in line with other helminth data in the literature in which most have aggregated structured populations rather than random infections.

Poster Session, Centennial Hall
Biology - Medicine, Molecular & Cellular Biology

P: 01 – Jasleen Saini
University of Arkansas, Graduate Student
Judge: Yes

Generation and Analysis of chromosomal gene deletion mutants of two putative thiosulfate sulfurtransferases in Mycobacterium smegmatis
(“Co-Author: Ravi D. Barabote”)

Mycobacterium smegmatis is the most widely used non-pathogenic model organism for elucidating the unique physiology of Mycobacteria, which include immensely important human pathogens. While sulfur metabolism has been recognized as a key target against pathogenic mycobacteria, the mycobacterial sulfur metabolism pathways are not fully understood. Mycobacterial genomes encode multiple homologs of putative thiosulfate sulfurtransferases (TSTs) whose functions remain to be defined. We are interested in studying the function of putative mycobacterial TSTs using M. smegmatis as the model. The M. smegmatis genome encodes two sequence homologs of putative TSTs, encoded by sseA and cysA2 genes. Currently, we have generated a chromosomal gene deletion mutant of sseA using dif-flanked Hygromycin-resistance cassette recombination system. Gene deletion of cysA2 (along with its adjacent gene, sseC) is in progress. Using the genetic mutants, the role of the two putative TSTs in sulfur metabolism and stress resistance is being investigated. Generation, confirmation, and preliminary analysis of the mutants will be presented.

P: 02 – Saroj Mahato
University of Arkansas, Graduate Student
Judge: Yes

Investigation of the function of a putative cysteine synthase homolog in Mycobacterium smegmatis using unmarked gene deletion mutation
(“Co-Author: Ravi D. Barabote”)

Mycobacteria include highly successful human pathogens that pose a global health crisis. Cysteine synthesis pathways offer unique and strategic targets for developing new and effective antimycobacterial drugs, since these pathways are lacking in humans. Mycobacterial genomes encode multiple homologs of cysteine synthases, at least three of which have been characterized in vitro. However, the in vivo pathways for cysteine synthesis and the significance of the multiple cysteine synthases paralogs in mycobacteria are unknown. Our laboratory is interested in investigating the in vivo routes to cysteine synthesis in mycobacteria. We use Mycobacterium smegmatis, the most widely used non-pathogenic mycobacterial model. To study the physiological role of the cysteine synthase paralogs, we are generating chromosomal gene deletion mutants in M. smegmatis. Specifically, we have initially targeted the deletion of the complete operon encoding the cysM, cysO and mec+ genes. To generate mutants, we used a linear DNA construct generated by fusing a hygromycin-resistance gene flanked by dif sites between nucleotide sequences upstream and downstream of the operon. Development, confirmation, and analysis of the mutants will be presented.

P: 03 – Kelsey Martin
Harding University, Graduate Student
Judge: Yes

The Effect of SLCO Transporter Polymorphisms on Prostaglandin Levels in Healthy Postmenopausal Volunteers
(“Co-Authors: Nimmy E. Isaac, Landry K. Kamdem”)

There has been a link established with increased prostaglandin levels, specifically PGE2, and an increased risk for breast cancer1. Previous studies from Clark et al. found variable urine PGE2 levels after healthy volunteers took exemestane, an aromatase inhibitor used to treat breast cancer2. It is theorized that the varying prostaglandin induction is due to genetic variability in single nucleotide polymorphisms (SNPs) in the inflammatory pathway and in transporter genes2. This experiment wanted to identify...
if any SLCO transporter SNPs, a family of organic anion transporters that are involved with drug uptake, are associated with increased PGE2 levels. In this study, we genotyped SLCO1B1 (rs4149596), SLCO2B1 (rs12422149, rs2065618) and SLCO1B3 (rs414917, rs11045585) in 82 healthy postmenopausal women using an endoscopy on the LightCycler 480. We then performed genotype-phenotype analyses from previously collected PGE2 levels from Clark et al. to see if there was any significant association. From the 5 SLCO transporters genotyped, there were no significant associations found from the SLCO polymorphisms and the varying prostaglandin levels after comparing wild type homogenous, heterozygous, and wild type variant. More genotyping of different transporters and inflammatory pathway genes needs to be conducted to explain varying prostaglandin levels after taking exemestane. [1] Kraus, S. Impact of genetic polymorphisms on adenoma recurrence and toxicity in a COX2 inhibitor (celecoxib) trial: results from a pilot study [2] Clark, B. COX2 induction: a mechanism of endocrine breast cancer resistance? [3] Bruno Hagenbuch. SLCO family of organic anion transporting polypeptides. Accessed on 03/09/2018. JUPHAR/BPS Guide to PHARMACOLOGY, http://www.guidetopharmacology.org/GRAC/FamilyDisplayForward?familyId=238.

P: 04 – Mason Rostoll
University of Central Arkansas, Graduate Student
Judge: Yes

Characterization of Biomass Smoke Particles via Scanning Electron Microscopy and Energy-Dispersive X-Ray Spectroscopy

The burning of biofuels for cooking and heating is particularly common in regions with low socioeconomic status and can lead to detrimental respiratory illness or mortality. This problem is worsened by lack of affordable healthcare and poor environmental health conditions. Previous work in Kamndebe, Rwanda has identified smoke production as an area of concern with respect to health. The World Health Organization (WHO) recognizes particles with an aerodynamic diameter of 10 μm (PM10) or less is considered inhalable, and below 2.5 μm (PM2.5) is a considered a fine particle and has a more devastating effect on respiratory health. However, the use of rocket stoves may be able to lower the negative health impacts by reducing smoke production. Verbal accords suggest a reduction of irritation to both eyes and lungs. In this study, we will first use a Soucat personal cascade impactor sampler (PCIS) to collect particulates from both a traditional 3-stone fire and an implemented rocket stove. Once the particulates are collected, we will characterize the size, shape, and elemental composition of smoke particles via scanning electron microscopy (SEM) and energy-dispersive x-ray spectroscopy (EDS). Preliminary data was collected using a rocket stove at the university before field tests in Rwanda. These preliminary tests show large numbers of fine particles being released into the air and collected with the PCIS, with slightly varying compositions consisting of C, O, Mg, Mn, Ca, Nb, and Fe. Future work will include field tests in Kamundebe, comparisons between the two cooking methods, and an inhalation exposure experiments. The identification of these characteristics are essential to understanding the potential health risks of biomass fuel burning.

P: 05 – Nirman Nepal
Arkansas State University, Graduate Student
Judge: Yes

Molecular Mechanisms Underlying the Higher Biomass and Abiotic Stress Tolerance Phenotype of Arabidopsis MIOX Overexpressers

Myo-Inositol oxygenase (MIOX) is first enzyme in the inositol route to vitamin C (L-ascorbate, AsA). MIOX Arabidopsis over-expressers have elevated AsA and displayed biomass increase and tolerance to abiotic stresses. The molecular mechanisms underlying this phenotype are not well understood. In this work RNA-Seq analysis, RT-qPCR, LC/MS, microscopy, and physiological measurements were used to study gene expression profiles and to find biological significance of the differentially expressed transcripts in the high AsA line compared to controls. In silico and RT-qPCR analysis indicated increased expression of transcripts involved in auxin biosynthesis, hydrolysis, transport, and metabolism. These transcripts are supported by elevated auxin levels and their effect on epidermal cell elongation in the MIOX over-expressers. Additionally we detected upregulation of transcripts involved in photosynthesis. In support of this finding we measured increased efficiency of the photosystem II and lower non-photochemical quenching in the transgenics. These changes in auxin metabolism and efficient photosynthesis are likely explanations for the enhanced biomass accumulation and growth rate of the MIOX line. Multiple gene families conferring plants tolerance to cold, drought, and heat stresses were found to be elevated in the MIOX overexpressers. Increased expression of many cold stress related genes in the high AsA line possibly contributes to the increased biomass production and stress tolerance. Functional characterization of the MIOX transgenic line is necessary to support the hypothesis of MIOX contribution to increased biomass production. It will be useful to determine if any SLCO transporter SNPs, a family of organic anion transporters that are involved with drug uptake, are associated with increased PGE2 levels. In this study, we genotyped SLCO1B1 (rs4149596), SLCO2B1 (rs12422149, rs2065618) and SLCO1B3 (rs414917, rs11045585) in 82 healthy postmenopausal women using an endoscopy on the LightCycler 480. We then performed genotype-phenotype analyses from previously collected PGE2 levels from Clark et al. to see if there was any significant association. From the 5 SLCO transporters genotyped, there were no significant associations found from the SLCO polymorphisms and the varying prostaglandin levels after comparing wild type homogenous, heterozygous, and wild type variant. More genotyping of different transporters and inflammatory pathway genes needs to be conducted to explain varying prostaglandin levels after taking exemestane. [1] Kraus, S. Impact of genetic polymorphisms on adenoma recurrence and toxicity in a COX2 inhibitor (celecoxib) trial: results from a pilot study [2] Clark, B. COX2 induction: a mechanism of endocrine breast cancer resistance? [3] Bruno Hagenbuch. SLCO family of organic anion transporting polypeptides. Accessed on 03/09/2018. JUPHAR/BPS Guide to PHARMACOLOGY, http://www.guidetopharmacology.org/GRAC/FamilyDisplayForward?familyId=238.

P: 06 – Brenna Walters
Harding University, Undergraduate Student
Judge: Yes

Exposure to carbon black nanoparticles during larval development affects adult physiological stress tolerance in wild type isodotea (Co-Authors: Gavin Truber, Riley Jones, Kasey Boatwright, Jared Cooper, Emme Copeland, Coleman Dennis, Brandon Gates, Shelby Hamilton, Jon Aaron Howell, Caroline Minton, Joe Tolar, Jo Guy)

The Earth is currently undergoing rapid and detectable environmental fluctuations, some natural and some man-induced. Levels of pollutant particles are at highest levels recorded for many global locations, including numerous large cities that serve as home to a large portion of the Earth’s human population. The effects of air pollution on human health is of interest as we enter into a period of larger human population and higher levels of environmental pollution than has been known in recorded history. However, determining the impact of pollution on human health is inherently difficult. To investigate the effects of pollution on health, we exposed hermaphrodite nematodes (Caenorhabditis elegans), a model genetic organism, to carbon black nanoparticles (CB, average particle size of 0.042 microns, 0.1mg/ml final concentration), a common component of air-borne and ground pollution. To maximize the likelihood of detecting an effect, parental populations were grown in the presence of bacterial food containing CB and subsequent F1 generation larvae were split into two groups, either continued exposure to CB as developing F1 larvae (+/+), or not exposed to CB during F1 development (+/−). F1 hermaphrodites were evaluated by a spectrum of assays to detect changes in health-related factors including reproductive effort, metabolism, and ability to tolerate oxidative stress compared to unexposed controls (+/−). Initial data suggest that exposure to CB shifts embryo production to earlier in adulthood without changing brood size. N2 hermaphrodites grown in the presence of CB showed a reduced tolerance to paraquat-induced reactive oxygen species (ROS) compared to unexposed hermaphrodites. Furthermore, hermaphrodites of the wild type strain CB4856 (isolated in Hawaii) showed lower overall survival rates than N2 nematodes (p<0.05). Preliminary data suggest that CB exposure during development affects a range of physiological parameters for adult C. elegans.

P: 07 – Spencer Long
University of Central Arkansas, Undergraduate Student
Judge: Yes

A Retrospective Multistate Analysis of Influenza Pandemic Deaths

The 1918-1919 H1N1 influenza pandemic was one of the deadliest in modern history. Estimates of 600,000,000 deaths and as many as 50-100 million deaths globally are commonly reported. The pandemic spread across the U.S. from September 1918 through April 1919. While a variety of studies have examined death trends for the pandemic at the large city (e.g. New York City) or national level, far fewer studies have been performed on individual states without large urban centers. This project examines the pandemic in New Hampshire, Arkansas, and Arizona. Each of these states represents a very different part of the country – long-established New England, rural-agricultural mid-South, and Southwest deserts and mountains. Age and gender demographics in the pandemic mortalities are collected from death record archives and tested against expected values obtained from federal census information. A full breakdown of age of death information in each state’s population is included. This work represents new information regarding the 1918 pandemic in as-yet unexamined geographic areas.

P: 08 – Ryan Williams
Arkansas Tech University, Undergraduate Student
Judge: No

Transcript Receptor Potential Channel 3 and Its Effects on Systemic Blood Pressure Regulation in Diseased Versus Healthy Mesenteric Arteries

Hypertension is one of the leading causes of death in the United States leading to nearly 366,000 deaths per year and costing nearly $46 billion per year. In the United States, one out of three individuals have hypertension, and of those only 54 percent adequately regulate their hypertension. This study focuses on the molecular regulation of systemic blood pressure via the Transient Receptor Potential Channel 3 (TRPC3) transmembrane protein in rat mesenteric arteries. Previous studies have shown TRPC3 to be present in the membrane of both the endothelium and the smooth muscle of the mesenteric arteries. The activation of TRPC3 in the endothelium of mesenteric arteries has been shown to cause hyperpolarization of smooth muscle, leading to smooth muscle relaxation, dilation of the arterial lumen, and subsequent decrease in systemic blood pressure. The focus of this study is to test the effects of TRPC3 activation on smooth muscle as seen in patients who have vascular disease as well as high blood pressure. Denuded mesenteric endothelium is hypothesized to cause decreased activation of TRPC3 in the endothelium, as well as increased activation of TRPC3 on the exposed receptors in the smooth muscle. Decreased activation of TRPC3 in the endothelium may be required to cause a lowered hypotensive blood pressure, while activation of TRPC3 in the smooth muscle is hypothesized to cause smooth muscle contraction and further increased hypertension. This
study uses wire myography to study the relaxation and contraction of rat mesenteric arteries with intact and denuded endothelium in the presence of TRPC3 agonists and antagonists, in hopes to illuminate the effects of TRPC3 activation in denuded and intact mesenteric arteries. The study design, mechanism of action, methodology, and experimental results are discussed.

P: 09 – Spencer Sanson
University of Arkansas for Medical Sciences, Graduate Student
Judge: Yes

Detection of Ten Antineoplastic Drugs in a clinical setting by Wipe Test and LC-MS/MS analysis
(Co-Author: Howard Hendrickson)

The potential for inadvertent exposure to chemotherapeutic drugs in hospital clinic settings has been studied in a few cases. These few studies demonstrate the need to determine if accidental spillage of drug solutions might put health care staff, patients, and visitors at risk to exposure to these potent drugs with potential adverse health consequences to those exposed. This study was designed to determine if ten frequently used cancer drugs (vincristine, cyclophosphamide, lomustine, methotrexate, doxorubicin, epirubicin, cytarabine, gemcitabine, etoposide, and irinotecan) could be detected using a wipe test paired with LC-MS/MS analysis. Surface samples were taken from heavily used working surfaces in the University of Arkansas for Medical Sciences Infusion 4 Clinic, which is located in the Winthrop Rockefeller Cancer Center. Four rooms and twenty-two surfaces were screened for the 10 compounds on a Sunday morning with little patient activity. Sampling was accomplished using Whattman 903 protein saver cards. There was no significant detection of any of the compounds tested. Therefore, at the time of testing the four rooms and twenty-two surfaces were determined to be free of the ten common antineoplastic drugs that were screened. Future studies should examine these same surfaces when there is more patient activity in the clinic.

P: 10 – Malvyn McKay
Arkansas Tech University, Undergraduate Student
Judge: No


The popular belief is that Japanese have a healthier diet than Americans. My goal was to determine if this belief is scientifically founded. The diets of Japanese and American children (ages 6-10) of similar socio-economic backgrounds, and living in similar rural environments were compared. A survey was conducted in Ofunato, Japan, as well as in Vilonia, Arkansas. This survey asked children what they ate for dinner the previous night, including the number of servings that the children had. Each student’s meal was standardized by what percentage of each biomolecule (saturated fat, unsaturated fat, high Fructose corn syrup, can sugar, protein, fiber) was in the meal. The results were analyzed using ANOVA statistical analysis to determine if any significant differences exist between the two group’s diets, and a Tukey Post-Hoc to determine between which biomolecules the differences exist. Next, a literature review of previous research was done to analyze the health benefits or detriments of each biomolecule. The top five death-causing chronic illnesses were identified for each country, and the aspects of the diet that are believed to influence the probability of developing each illness were discussed.

P: 11 – Antoinette Davis
Southern Arkansas University, Undergraduate Student
Judge: Yes

The effect of green tea extract on Daphnia magna

We investigated the effect of commercial green tea extract (GTE) on Daphnia magna by means of acute and reproductive toxicity tests. We found that GTE significantly reduces the reproductive output of D. magna over a 21-day test period.

P: 12 – Jeremy Brown
Southern Arkansas University, Undergraduate Student
Judge: Yes

Genetic engineering of the Mad locus using CRISPR/Cas-9 and Phi-C31 recombination

The Mad locus. This biomarker will allow us to visualize the location and intensity of endogenous Mad-FP in the neuromuscular synapse or anywhere else in the organism. Mad-FP will also facilitate biochemical assays. Moreover, the Mad-FP can be targeted by deGradFP for loss-of-function experiments. Finally, the docking site will enable the generation of any number of future structure/functional mutations in mad, which will be used to elucidate the role of this critical pathway effector.

P: 13 – Jeremy Brown
Southern Arkansas University, Undergraduate Student
Judge: Yes

Identify Microbes in Drinking Water using PCR

In the U.S., the Safe Drinking Water Act allows the EPA to regulate water quality. One of the primary concerns of the EPA is the number of recoverable coliforms in drinking water. Coliform recovery is a potential indicator of the presence of harmful bacteria. To combat coliforms and other bacteria, chlorination is commonly used as a chemical sanitization technique to lower and hopefully eliminate recoverable coliforms from local water systems. However, recent studies have found evidence that suggests coliforms are actively adapting to survive the levels of chlorine which are present in some drinking water systems. This project is aimed at using both microbiological and genetic techniques to detect the presence of E. coli O157:H7, a potentially harmful coliform. The coliforms are recovered from a rural water supply in the southern United States. The bacteria are initially recovered using selective media and identified using microbiological techniques such as indole and oxidase tests. Then PCR is used to identify the bacteria with primers targeting strain specific genes. Finally, the primers are tested for their efficacy to detect that same strain of bacteria. This project was started in October of 2017 and if successful then this technique could be used in the future as a cost effective approach to rapidly detect potentially harmful bacteria in water supplies.

P: 14 – Kimberly Smith
University of Arkansas, Faculty Researcher
Judge: No

House Finch (Haemorhous mexicanus) nesting in December in Arkansas

During December of 2017, a pair of House Finches attempted to nest in a Christmas wreath in Maumelle (Pulaski County), Arkansas. The wreath was hung on 28 November and birds were investigating the wreath by 12 December. When the wreath was removed on 29 December, a House Finch nest with 4 eggs was discovered.

P: 15 – Kimberly Smith
University of Arkansas, Faculty Researcher
Judge: No

Observations of Townsend's Solitaires (Myadestes townsendi) on Mount Magazine in Logan County, Arkansas
(Co-Author: Don Simons)

Townsend’s Solitaires (Myadestes townsendi) normally range throughout the Rocky Mountains. In winter months they are known to occur eastward into the Midwest primarily associated with cedar thickets. Range maps in most bird field guides do not indicate that they visit Arkansas. Beginning in 2005, multiple reports have been made from Mount Magazine in Logan County, which are summarized in this report. Since 2005, Simons has been able to confirm the occurrence of solitaires on Mount Magazine 6 out of 13 winters and has found at least 14 birds. This shows that Townsend’s Solitaires are more common during winter in Arkansas than previously thought.

P: 16 – Kimberly Smith
University of Arkansas, Faculty Researcher
Judge: No

Second record of the Gray-headed Junco (Junco hyemalis caniceps) in Arkansas
(Co-Author: Karen Garrett)

On 1 March 2018, a Gray-headed Junco was discovered at the Visitor Center at Hobbs State Park - Conservation Area in Benton County. The only other record for Arkansas was a bird in Little Rock at the end of February in 1963. These 2 records are the farthest eastern records for this western subspecies.
A review showed that frequently monitoring nests may impact predation risk, but manmade nest cavities were not considered. Thus, our objective was to determine the effect of visit frequency on nest predation of birds nesting in artificial cavities. Between March and September 2017, we monitored 115 nest boxes occupied by Eastern Bluebirds (Sialia sialis), about 10 km north of Jonesboro, Arkansas. We recorded the nest status every 1-6 days from the first egg to fledging or nest failure. Fifteen days after hatching, chicks may fledge prematurely if disturbed. We randomly divided nests with 15-day-old chicks in two groups: checked daily or at the estimated fledging date. We excluded nests of unknown fate, and of the remaining 195 nesting attempts, 44 were depredated. Specifically, we found that frequent visits did not impact risk of predation but increased risk of abandonment. However, all chicks successfully fledged from nests checked daily after day 15, indicating that nests may be most vulnerable at a younger stage. We recommend that bluebird monitors record nest status at a 3-day or longer interval during early nest stages. With caution, monitors may visit nests daily after day 15 to accurately determine nest failure without jeopardizing nest success.

Does frequently visiting a Bluebird nest increase predation risk?

(Co-Author: Virginia Rolland)

Arkansas Tech University, Undergraduate Student

Judge: Yes

Does axle grease effectively protect bluebird nests from predators?

(Co-Author: Virginia Rolland)

Arkansas Tech University, Undergraduate Student

Judge: Yes

Developing Microsatellite Markers for Genetic Identification of Songbirds

(Co-Author: Douglas Barron)

Arkansas Tech University, Undergraduate Student

Judge: Yes

Novel nuclear and plastid loci and their utility for inferring relationships among species of the genus Streptanthus (Brassicaceae) found in Arkansas and adjoining states.

(Co-Authors: Freddie Rivera, Brent Baker, Karen Fawley, Marvin Fawley)

University of Arkansas at Monticello, Undergraduate Student

Judge: No

The Hunt for Bigleaf

(Co-Author: Trvisa Marsico)

Arkansas State University, Undergraduate Student

Judge: Yes
P: 24 – Emma Martin
Arkansas State University, Graduate Student
Judge: Yes

Assessing Mitigative Properties of Vegetation in Northeast Arkansas Agricultural Ditches using Biotic and Abiotic Measures

Agricultural ditches are important tools for managing water quality because of their ability to settle sediment and sequester nutrients from field runoff. Aquatic vegetation is an important characteristic of these ditches that influences sediment and nutrient values. This study investigated the effectiveness of aquatic vegetation at filtering contaminants from surrounding agricultural landscape. Ten sites within two separate ditch systems in northeast Arkansas were measured weekly for three years to determine upstream and downstream sediment and nutrient loading. Bed and bank vegetation cover was assessed at each site and plants were identified. Water chemistry, turbidity, chlorophyll a, animal surveys, and Whole Effluent Toxicity (WET) tests were performed to evaluate the vitality of each site. Differences in measured variables will be compared between upstream and downstream sites in each system using analysis of variance (ANOVA) tests. Agricultural ditches are established to move water away from fields and discharge into larger streams in the Mississippi River Delta. This movement is part of the larger drainage basin that feeds into the Gulf of Mexico and contributes the nutrients that exacerbate hypoxic conditions. The results of this study will help understand the in-stream processes that have the potential to improve downstream water quality.

P: 25 – Chris McAllister
Eastern Oklahoma State College-Idabel, Faculty Researcher
Judge: No

A Preliminary Checklist of the Stoneflies (Arthropoda: Insecta: Plecoptera) of Arkansas

Seventy-seven species of stoneflies representing eight families and 24 genera are herein reported from Arkansas. The most diverse families of state stoneflies were Perlidae (26 species), Capniidae (14 species), and Perlodidae (12 species) while Pteronarcysidae had only a single species. Additional species will surely be added to the list with future taxonomic studies involving molecular analyses.

P: 26 – Chris McAllister
Eastern Oklahoma State College-Idabel, Faculty Researcher
Judge: No

Additional County Records of Invertebrates from Arkansas

Arkansas is a home to a great variety of invertebrate fauna. Recently, natural history observations on various invertebrates of the state were reported by our community collaborative efforts. Here, we document additional noteworthy natural history and ecological observations for selected invertebrates from Arkansas.

P: 27 – Brain Staley
University of Central Arkansas, Undergraduate Student
Judge: No

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

Dams result in reservoirs for agriculture, resource extraction and recreation. Dams change the hydrology, chemistry and habitat connectivity of streams that also change macroinvertebrate communities and associated functions. We hypothesize that macroinvertebrate diversity will be greatest in streams with reservoirs from more days with flowing water and that leaf litter decomposition will be faster in streams with reservoirs from greater macroinvertebrate detritivore processing. We sampled macroinvertebrates, water chemistry data (temperature, dissolved oxygen, specific conductivity, discharge), and leaf decomposition over 3.5 months downstream of three dammed and three undammed small sites. We will present results on the physical conditions that could alter macroinvertebrate detritivore communities and the carbon cycle.

P: 28 – Sierra Hubbard
Hendrix College, Undergraduate Student
Judge: Yes

Biodiversity of Hymenoptera across sky islands of Arkansas

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 (Stark 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 ($I > 0.85$) 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.

P: 29 – Brianna Trejo
University of Central Arkansas, Graduate Student
Judge: Yes

Energetic cost of girdling in the notodontid caterpillar, Oedemasia Leptinoides

Some caterpillars cut a ring around the rachis, petiole or stem of a plant before feeding on distal leaf blades. This girdling behavior has been observed in multiple species of the lepidopteran family, Notodontidae. In one study, caterpillars of Oedemasis leptinoides (Notodontidae) 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). After girdling, O. leptinoides larvae bathe the girdle in saliva. Girdling may expose vascular tissues so salivary components can enter the plant, or sever the flow of plant secondary metabolites to the area in which the caterpillar is feeding. The energetic cost of cutting girdles in tough plant tissues have not been explored. Using O. leptinoides and L. manteo as model notodontids, I will combine behavioral observations and respirometry data to produce overall energy allocation budgets for each species. I will then test for significant differences in energy allocation between the girdling and nongirdling species. Understanding more about the costs and benefits of girdling and about the co-evolutionary dynamic between girdling caterpillars and their host plants may have widespread significance for tree-feeding caterpillars, including some important pests.

P: 30 – John Hunt
University of Arkansas at Monticello, Faculty Researcher
Judge: No

Organochloride Pesticides Present in Animal Fur, Soil, and Streambed in an Agricultural Region of Southeastern Arkansas

Animals in agricultural settings may be subject to bioaccumulation of toxins. For the last several years, we have been collecting hair samples from bats and rodents in an agricultural area near Bayou Bartholomew in Drew County, Arkansas. Samples were submitted to the Center of Environmental Sciences and Engineering at the University of Connecticut for wide-screen toxin analysis. Several of these samples contained measurable amounts of organochloride pesticides or their metabolites, including some that have been banned for decades, such as dichlorodiphenyltrichloroethane (DDT) and chlordane. In addition, we collected several samples of soil from within an agricultural field, from adjacent edge habitat, from alongside the bank of the Bayou, and from the bed of the Bayou itself. Although none of these samples tested positive for DDT or chlordane, all of the samples except one contained measurable amounts of metabolites from these pesticides. This study raises questions about environmental persistence of DDT/DDT and other organochlorines. There may be risk to wildlife populations, warranting further investigation into effects of long-term exposure to these toxins.
Coastal Plain. 

individuals from the Sabine River fall within the eastern clade. Ongoing work with additional nuclear DNA markers and evaluations of the Mississippi and Tombigbee river discontinuity hypotheses. Preliminary analyses reveal a deep phylogeographic break between populations. While some western populations (e.g. Colorado River, Texas) show significant divergence from these populations, there was little support for taxonomic recognition of these populations. As a part of a larger study to evaluate the Mississippi and Tombigbee river discontinuity hypotheses, we sequenced mtDNA and multiple nuclear loci for E. chlorosoma to test whether lizards inhabiting glades on the same mountain are more similar to one another than they are to lizards inhabiting glades on other mountains. The data generated in this project will permit a better understanding of how genetic drift influences phenotypic differentiation within a metapopulation where dispersal is common between patches (glades) but rare between populations (mountains).

Southern Coastal Myotis and Rafinesque’s Big Eared Bats Switch Their Roosting Habits Seasonally in Arkansas Bottomlands

(Co-Author: Matthew Gifford)

Founder effects have been proposed as an important mechanism driving evolutionary divergence among populations and may result in speciation events (Mayr 1954, Templeton 1980). These founder effects result from colonization of new habitats by a small number of individuals that cause a change in the genetic and phenotypic constitution of a population. This project will test for phenotypic differentiation as a consequence of repeated founder effects in populations of Eastern Collared Lizards (Crotaphytus collaris) located on Stegall, Thorny and Mill Mountains in southcentral Missouri. Qualitatively, male C. collaris on Thorny Mountain are different phenotypically than their Stegall Mountain counterparts (A. Templeton, pers. comm.). Neuwald (2013) identified distinct genetic groups within a single mountain’s glade complex. This suggests limits to gene flow among different glade clusters, potentially leading to an environment favoring phenotypic differentiation. I will examine the relative role of genetic drift in contributing to phenotypic variation. I will use the known colonization history of individual glades and between mountains to test whether lizards inhabiting glades on the same mountain are more similar to one another than they are to lizards inhabiting glades on other mountains. The data generated in this project will permit a better understanding of how genetic drift influences phenotypic differentiation within a metapopulation where dispersal is common between patches (glades) but rare between populations (mountains).

Phylogenetic analyses suggest cryptic diversity within the Bluntnose Darter, Etheostoma chlorosoma

Previous morphological studies of the Bluntnose Darter (Etheostoma chlorosoma) revealed little variation among populations across the Gulf Coastal Plain. While some western populations (e.g. Colorado River, Texas) showed significant divergence from other populations, there was little support for taxonomic recognition of these populations. As a part of a larger study to evaluate phylogeographic patterns of Gulf Coastal Plain fishes, we sequenced mtDNA and multiple nuclear loci for E. chlorosoma to evaluate the Mississippi and Tombigbee river discontinuity hypotheses. Preliminary analyses reveal a deep phylogeographic break (TMICA aprox. 8 mya) among members east and west of the Mississippi River for E. chlorosoma. The deep divergence among eastern and western clades of E. chlorosoma suggests previously unrecognized cryptic diversity within the species. However, individuals from the Sabine River fall within the eastern clade. Ongoing work with additional nuclear DNA markers and increased sampling will be incorporated into this framework, shedding light on this unique phylogeographic pattern in the Gulf Coastal Plain.

Testing the re-usability of defined medium for an effective incorporation of unused 15N label into recombinant proteins

Previous research has studied the fluorophores’ photophysical properties in ten differing solvents. Their efficiency in aqueous and nonpolar environments must be overcome. Within the research project, two NIR fluorophores were synthesized and analyzed. The team conducting the research has studied the fluorophores’ photophysical properties in ten differing solvents. Their efficiency in aqueous and nonpolar environments has been qualitatively and quantitatively analyzed. The partially water-soluble NIR fluorophore forms a supramolecular complex with an albumin (HSA). HSA acts as the concert macromolecule that the partially water-soluble fluorophore targets and probes. The other, insoluble fluorophore aggregates in water and acts inert to HSA.

Fluorophores constructed to emit near infrared (NIR) light pertain substantial advantages over conventional fluorophores, which emit blue and/or green light when excited. Utilized NIR for fluorescent analysis in biological systems is minimally disturbed by endogenous chromophores and enables possible photodamage to living organisms. Recently synthesized fluorophores have limitations as well: minimal water solubility and molecular aggregation. To synthesize any efficient NIR fluorophore, these limitations must be overcome. Within the research project, two NIR fluorophores were synthesized and analyzed. The team conducting the research has studied the fluorophores’ photophysical properties in ten differing solvents. Their efficiency in aqueous and nonpolar environments has been qualitatively and quantitatively analyzed. The partially water-soluble NIR fluorophore forms a supramolecular complex with an albumin (HSA). HSA acts as the concert macromolecule that the partially water-soluble fluorophore targets and probes. The other, insoluble fluorophore aggregates in water and acts inert to HSA.

Fluorophores constructed to emit near infrared (NIR) light pertain substantial advantages over conventional fluorophores, which emit blue and/or green light when excited. Utilized NIR for fluorescent analysis in biological systems is minimally disturbed by endogenous chromophores and enables possible photodamage to living organisms. Recently synthesized fluorophores have limitations as well: minimal water solubility and molecular aggregation. To synthesize any efficient NIR fluorophore, these limitations must be overcome. Within the research project, two NIR fluorophores were synthesized and analyzed. The team conducting the research has studied the fluorophores’ photophysical properties in ten differing solvents. Their efficiency in aqueous and nonpolar environments has been qualitatively and quantitatively analyzed. The partially water-soluble NIR fluorophore forms a supramolecular complex with an albumin (HSA). HSA acts as the concert macromolecule that the partially water-soluble fluorophore targets and probes. The other, insoluble fluorophore aggregates in water and acts inert to HSA.

Testing the re-usability of defined medium for an effective incorporation of unused 15N label into recombinant proteins

Much is known about sodium channels and their function, however, there is still much unknown regarding the disruptive functioning of scorpion toxins on these channels. The focus of this project is to develop insight by effectively purifying a toxin from the Striped Bark Scorpion, Centruroides vittatus, and exploring its characteristics for potential medicinal purposes, such as in heart or pain medication. This purification process was performed by an over-expression of the toxin in Escherichia coli cells with an IPTG inducer, purification on a Glutathione Sepharose column followed by concentration/desalting, proteolytic cleavage using thrombin, and gel filtration followed by concentration/desalting to ensure the gathering of pure protein. SDS-PAGE assays were performed after each experiment to assess proper results and aid in planning. Future characterization experiments will hopefully be performed (from March 11 - April 7) on the toxin, such as circular dichroism, differential scanning calorimetry, isothermal titration calorimetry, NMR spectroscopy, thermal denaturation and proteolytic digestion. These experiments will provide a greater insight into the functions of the protein.

Protein labeling is an integral part of biological and biochemical research. While the different types of labels vary, a common type is the isotope label. Isotope labeling involves the addition of a specific isotope into a reaction that can then allow the reaction to be monitored. A more specific type of isotope labeling called stable isotope labeling uses isotopes such as C13 and N15 that can easily be identified through nuclear magnetic resonance (NMR) and mass spectrometry (MS). The only issue with this method is the price. This research aims to test a potential solution to this problem. The viability of reusing the same media repeatedly was tested to ascertain how effective the incorporation of the isotope label was. This was done by making a simple media with the sole source of nitrogen being the N15 isotope. A modified strain of E. coli, BL21(DE3), containing the wtFGF1 plasmid was then expressed five times using the labeled simple media. These pellets were then purified and ran through a sodium dodecyl sulfate-polyacrylamide (SDS-PAGE) to determine whether wtFGF1 was being produced in the later rounds of growth. Once confirmed, the media samples were analyzed with NMR to determine the levels of N15 remaining after each subsequent round of growth. Once complete, this research will potentially provide a new cost-effective alternative to growing labeled proteins.
P: 37 – Harper Grimsley
University of Arkansas, Undergraduate Student
Judge: No
Application of ROMP Catalysts to Homo-Coupling
(Co-Author: Stefan M. Kilyanek)
William Forrest and Co. developed a tungsten-oxo alkylidene in 2014 which they determined to be a successful catalyst for ringopening metathesis polymerization (ROMP). The Kilyanek lab is interested in using the alkylidene catalyst to synthesize novel large, chelating ligands. These ligands will in turn be attached to cobalt to generate a d1-nuclear cobalt catalyst for oxygen reduction in fuel cells, the advantages of which would include reduced cost and reduced formation of de facto products such as peroxides. The proposed synthetic route however, demands that the alkylidene catalyst perform homo-coupling, which is an entirely different olefin metathesis from ROMP. Additionally, the alkylidene catalyst must be Z-selective to yield the preferred spatial orientation of the cobalt atoms in the oxygen reduction catalyst. I synthesized the same alkylidene and evaluated its effectiveness for the homocoupling of terminal olefins, especially 1-hexene. Proton NMR studies revealed that not only did the alkylidene catalyst couple the 1-hexene into 5-decene, but that the reaction was highly regioselective, favoring 2,3-decene formation. This established clear precedent for use of the alkylidene catalyst in the synthesis of the ligands of interest.

P: 38 – Sydnye Shuttleworth
Harding University, Undergraduate Student
Judge: No
Isolating a Fat Mobilizing Substance from a Fasting Individual
(Co-Author: Dennis Province)
Previous research has shown that a fasting individual produces a fat mobilizing substance (FMS), which is secreted from the body through the individual’s urine. This substance was isolated but never identified. FMS is also believed to be present in the urine of those who suffer from congenital lipodystrophy. After extracting the proteins from the urine by co-precipitating with saturated benzoic acid and alcohol, the proteins are separated into fractions by size exclusion chromatography (HPLC). The column used separated the proteins by size. These fractions will be tested for fat mobilizing activity using a Lipolysis Assay. This colorimetric assay uses 3T3-L1 Adipocytes to test for the presence of glycerol release. Fractions that show activity will be sent to the UAMS Proteomics Core Facility for identification and sequencing. Two different female’s urine samples (one fasting and one well-fed) are being evaluated.

P: 39 – Conner Breen
Hendrix College, Undergraduate Student
Judge: Yes
Iron reduces mitochondrial DNA damage induced by mitochondrial reactive oxygen species in HepG2 cells
(Co-Author: Andres Caro)
In iron overload disorders, iron and mitochondrial reactive oxygen species (superoxide anion, hydrogen peroxide) interact through the Haber-Weiss cycle to produce the highly reactive oxidant hydroxyl radical. Mitochondrial DNA is a sensitive target for hydroxyl radical-mediated oxidation. On the other hand, iron also induces the expression of antioxidant genes through the activation of redox-sensitive transcription factors. Therefore, it is expected that the level of mitochondrial DNA damage induced by iron and mitochondrial reactive oxygen species will depend on the balance between its pro-oxidant and anti-oxidant nature. The objectives of this work were to evaluate the effect of iron on antioxidant expression and oxidative mitochondrial DNA damage in hepatocytes. Hepatocyte-like HepG2 cells incubated with iron(III)triﬂuoroacetate (Fe-NTA) increased the concentration of free iron in a dose-dependent manner. Cellular reactive oxygen species evaluated as dichlorofluorescein oxidation decreased after Fe-NTA administration, an effect associated with induction of the antioxidant enzyme gamma-glutamylcysteine ligase. An inhibitor of mitochondrial complex I (rotenone) increased the levels of mitochondrial reactive oxygen species and increased oxidative mitochondrial DNA damage. Pre-incubation with Fe-NTA inhibited the oxidative mitochondrial DNA damage induced by rotenone. These results suggest that iron induces antioxidant genes related with glutathione synthesis, which limit the oxidation of mitochondrial DNA produced by hydroxyl radical.

P: 40 – Eliza Hanson
John Brown University, Undergraduate Student
Judge: Yes
Novel Peptides as Antimicrobial Agents
(Co-Author: Francis Unciari)
Increasing incidence of drug-resistant strains of Mycobacterium tuberculosis means that there is a continuing need for discovery of new anti-tuberculous (TB) drugs, which operate by a different mechanism of action from current drugs in the market. Although studies suggest that synthetic peptides have shown promise as antimicrobial agents, they are readily degraded in vivo and have low bioavailability. To overcome these limitations, peptides (poly-N-substituted glycines) are utilized as peptide mimetics since they are resistant to protease degradation. We hereby report the design, synthesis and initial biological screening of a number of new peptides as anti-microbial agents. The results show that some synthetic peptides involved in the study induced some inhibitory activity against Mycobacterium smegmatis (ATCC 14468), Staphylococcus aureus, and E. coli, using Kirby-Bauer disk assay. Future direction includes modification of leads and screening for improved activity. Synthetic peptides were characterized by ESI, MS, and 13C NMR spectroscopy.
Mitochondrial CYP2E1 activates antioxidant and mitochondrial biogenesis signaling in hepatocytes.  

(Co-Author: Andreas Cari)

Mitochondrial CYP2E1 is an enzyme induced by chronic alcoholism in the liver, which produces mitochondrial reactive oxygen species as a metabolic side-product. Mitochondrial DNA is a sensitive target for oxidation by mitochondrial reactive oxygen species. On the other hand, mitochondrial reactive oxygen species induce the expression of antioxidant genes through the activation of redox-sensitive transcription factors. Therefore, it is expected that the level of mitochondrial DNA damage induced by mitochondrial reactive oxygen species produced by mitochondrial CYP2E1 will depend on the balance between its pro-oxidant and anti-oxidant nature. The objectives of this work were to evaluate the effect of mitochondrial CYP2E1-related reactive oxygen species on mitochondrial DNA damage in hepatocytes. Mitochondrial CYP2E1 overexpression in hepatocyte-like HepG2 cells increased the levels of cellular and mitochondrial reactive oxygen species evaluated by dichlorofluorescein and mito-sox red staining, respectively. Mitochondrial DNA integrity was conserved in cells overexpressing mitochondrial CYP2E1 in spite of the increased oxidative stress. Mitochondrial biogenesis markers (mitochondrial DNA content, PGC-1 alpha expression) and antioxidant genes (catalase, gamma glutamylcyteine ligase) were induced in mitochondrial CYP2E1-overexpressing cells. These results suggest that mitochondrial CYP2E1 produces both oxidative stress and activation of antioxidant and mitochondrial biogenesis signaling in hepatocytes. This activation might limit the mitochondrial DNA damage observed in chronic alcoholism.

(Author: Peyton Munch)
A new analytical method has been developed for the analysis of oatreticin in mouse plasma using liquid chromatography tandem mass spectrometry. Oatreticin is a 1018 Da octaapeptide that mimics somatostatin and has been shown to be useful in reducing cell proliferation and in inhibiting the growth of cancerous tumors. Enzymatic hydrolysis was performed on a YMC-Pack ODS-AQ analytical column (150 x 3.0 mm (i.d.) with a chromatographic run time of 5.0 minutes. In developing this method two different internal standards, leucine, and Oatreticin-D5, were evaluated for matrix ion effects, and extraction recovery. Using leucine as an internal standard showed significant matrix ion enhancements of 119±59.9% and an extraction recovery of 70±10.5%. By using the stable isotope oatreticin-D5 as an internal standard, matrix ion effects were negligible at 5.0±6.5% and extraction recovery was 88±8.3%, this lead to an overall process recovery of 84±7.8%. The lower limit of quantitation (LLOQ) was determined to be 10 ng/mL based on a signal to noise ratio of 5, and the lowest concentration that maintained acceptable accuracy and precision defined by the FDA's Guidance for Industry for Bioanalytical Method Validation. Accuracy for 5 calibration standard sets were between 87% and 114% based on a 1/x weighted linear regression. Intraday precision was ±17% at the LLOQ, and ±10% at non-LLOQ concentrations and interday precision was ±19% at LLOQ and ±11% at non-LLOQ concentrations. Freeze-thaw stability was tested at concentrations of 10 ng/mL, 100 ng/mL, and 300 ng/mL and were shown to be stable for three freeze-thaw cycles. Also three sets of calibrations standards were analyzed and shown to be stable at 4°C for at least 24 hours. Oatreticin was quantitated in 5 authentic mouse plasma pharmacokinetic samples to further validate this method.

We have expanded our fiefdom to different types of Rayleigh single particles (i.e. metallic, active, dielectric) and multiple particle fields has also been studied. We have investigated the scattering of a single dielectric Rayleigh particle in a complex medium with different refractive indices. The scattered electric field from a single dielectric Rayleigh particle has been calculated using the Mie theory and the results have been compared with the experimental data. The effect of the medium on the scattered field has been discussed in detail.

P. 49 – Sarah Phillips
University of Arkansas for Medical Sciences
Graduate Student
Judge: Yes

Development and Validation of an LC MS/MS based Method to Quantitate Oatreticin in Mouse Plasma
(Co-Authors: Qiang Fu, John Seng, Martin Hauer - Jensen, Howard P. Hendrickson)

P. 50 – Divya Kandanool
Arkansas State University
Graduate Student
Judge: Yes

Structure, composition, and oligosaccharide profiles for hemiscelullosic polysaccharides isolated from rice bran fiber
(Co-Author: Brett Savary)

Rice bran represents a reservoir of largely underutilized functional biopolymers that may be mobilized for improved food, feed, and nutraceutical uses. Soluble arabinoxylan and oligosaccharide fragments isolated from rice bran fiber have been implicated to function as biological response modifiers, providing heathful benefit to consumers. Arabinoxylan is largely immobilized within the insoluble fiber matrix through dehydrodiferulate and ligninferulate cross-links. Ferulate moieties are ester-linked at the O-5 and can be involved in the radicalization of biological responses.

P. 51 – Kan Takahashi
Arkansas State University, Graduate Student
Judge: Yes

Identification of a novel glucan crosslink to feruloylated arabinoxylan in rice bran fiber
(Co-Author: Brett Savary)

We have produced feruloylated oligosaccharides (FAXOs) from rice bran fiber by acid hydrolysis to investigate their prebiotic and innate immune response activity by the gut epithelium. Such products in the diet may promote healthful gastro-intestinal function as biological response modifiers, providing healthful benefit to consumers. Arabinoxylan is largely immobilized within the insoluble fiber matrix through dehydrodiferulate and ligninferulate cross-links. Ferulate moieties are ester-linked at the O-5 and can be involved in the radicalization of biological responses.

P. 52 – Kaushik Luthra
University of Arkansas, Graduate Student
Judge: Yes

Maintaining Quality of Rough Rice Dried in a Fluidized Bed by adding Hold-up periods
(Co-Author: Sammy Saldaka)

Fluidized bed drying of rice reduced the moisture content of freshly harvested rough rice to 13% (w.b.) in less time but lower head rice yield as compared to the conventional drying. Rice kernels developed fissures and ultimately cracked due to the high thermal gradient being developed in fluidized-bed drying. The hypothesis that adding hold-up periods can reduce the thermal gradient is tested in the experiment. The objective thus is to compare the quality of rice with and without the period of ambient air application i.e. hold-up period in a fluidized-bed dryer. A lab-scale fluidized bed dryer was developed and the effects of drying duration of 10, 20 and 30 minutes and the hold-up duration of 0, 15, 30, 40 and 60 minutes on rough rice moisture content, head rice yield, milled rice yield, and whiteness were investigated. The results showed that the hold-up periods reduced the moisture content considerably without additional heating. The head rice-yields were comparable to the conventional drying methods and increased with the addition of hold-up periods as compared to without the hold-up period in a fluidized-bed drying. The hold-up period provided time for stabilization of the high induced thermal stress due to the high thermal gradient during the drying period. Thus, in conclusion, hold-up periods has the potential to solve the problem of low head rice yield associated with fluidized-bed drying of rice.

P. 53 – Kazi Tanmidul Islam
Arkansas State University, Graduate Student
Judge: Yes

Scaling Resistance of Industry Waste Modified Concrete Exposed to Deicing Chemicals
(Co-Author: Zahir Hossain)

Damaging effects of deicing chemicals on industry wastes such as Rice Husk Ash (RHA) modified and unmodified (Control) concrete mortar bars have investigated in this study. Different Supplementary Cementitious Materials (SCM), namely, three types of Rice Husk Ash (RHA-1, RHA-2, and RHA-3 with corresponding nominal maximum sizes of 600μm, 150 μm, 44 μm, respectively), Class C fly ash (CFA), and silica fume (SF) were used as a partial replacement (10%) by the weight of cement of Type-I Ordinary Portland Cement (OPC) to prepare mortar bars. The prepared samples were then submerged in a solution containing 40% of anhydrous calcium chloride per liter of water. Afterward, Freezing-Thawing (F-T) condition was maintained to evaluate the scaling resistance of mortar bars. Due to the penetration of deicing chemicals during the F-T cycle, the crystallization pressure increased, which eventually caused frost damage on the surface of mortar bars. Experiment results showed that RHA-1 resulted in a severe surface deterioration due to the deicing chemical and had the highest scaling rating. Compare to RHA-1, RHA-2 modified mortar bars showed less damage. On the other hand, RHA-3, CFA, and SF showed the minimum surface damage compare to the control mortar bars (no substitution of OPC). From this investigation, it can be concluded that finer SCM materials are less prone to the deicing chemical in the freezing weather, and RHA-3 is a viable construction material in controlling concrete surface scaling.

P. 54 – Md Saber Nazim
Arkansas State University, Graduate Student
Judge: Yes

Rayleigh Scattering in Multiple Nanoparticle Systems: A Study of the Scattered Magnetic Fields
(Co-Author: Zahir Hossain)

The electromagnetic waves and nanoparticle interaction always involve some scattering. If the size of the particle(s) is much smaller than the incident electromagnetic wavelength, then such a scattering phenomenon is called Rayleigh scattering. These types of scattering phenomenon have been well investigated and quite a good number of publications are present in the literature. However, much of the research effort has been dedicated to the study of the scattered electric field. In this work, we have investigated the scattered magnetic fields from scratch. Starting from the case of the scattered magnetic field from a single dielectric Rayleigh particle we have expanded our field to different types of Rayleigh single particles (i.e. metallic, active, dielectrics) and multiple particle systems comprised of these particles. In addition, the impact of the presence of different kinds of substrates on the scattered magnetic fields has also been studied.
Quantification of Moisture Effects on Adhesion and Modulus Properties of Paving Asphalts
(Co-Author: Zahid Hussain)

In this study, the effects of moisture in asphalt binders are examined by using adhesion force and modulus values obtained from an Atomic Force Microscope (AFM). Four different types of asphalt binder samples, collected from two different sources (Source 1 and Source 2), were used to estimate their modulus and adhesion values at the nanoscale level. The AFM test samples were prepared on thin glass plates and conditioned under dry and wet conditions. Afterward, they were examined by using the PeakForce Quantitative Nanomechanical MappingTM (PFQNM) mode of the AFM. Test results show that adhesion and modulus values under the wet condition are substantially different from those of under the dry condition. It is apparent that wet conditioned binder samples from Source 1 exhibit noticeably lower adhesion values compared to the dry samples. A similar decreasing trend is observed for binder sample from Source 2 except that the binders modified with polyphosphoric acid (PPA) and styrene-butadene-styrene (SBS) showed a slight increase in adhesion values. It is evident that the modulus values of Source 1 binders were reduced in a similar way of the adhesion values. However, a smaller increase in modulus values was noticed in both SBS-modified and PPA+SBS-modified binders from Source 2, providing sufficient moisture resistance. On the other hand, the base binder from each source is the most susceptible to moisture damage among all binders, and the PPA-modified binder also provides the least resistance to water action. Findings of this study will provide a better understanding for selecting the most effective asphalt binders against moisture damage.

Quantification of Soluble Ions in Atmospheric Particulate Matter Using Ion Chromatography
(Co-Author: Dana Henry)

Aerosols in the atmosphere have a tendency to travel extraordinary distances by wind currents. By using a TISCH high volume air sampler, particulate matter smaller than 2.5 μm (PM2.5) in diameter can be collected from the lower atmosphere and deposited on a quartz filter. The organic molecules are then extracted using methanol and isooctane as polar and nonpolar solvents, respectively. The organic extract is then analyzed using gas chromatography/mass spectrometry (GC/MS). NIST library matches were used to identify organic compounds present in the samples. Aerosol concentrations in Conway, Arkansas, identities of polar and nonpolar organic aerosol components, and potential emission sources will be reported.

Variation in Soil Moisture Levels in No-till, Cover Crop, and Conventional Tillage Systems in NE Arkansas Cotton
(Co-Authors: Kyle Wilson, Amanda Mann, Michele Reha, Tina Gray Tague)

Cotton performance and yield stability may be affected by different environments and production practices including tillage systems and irrigation. These practices could impact plant resilience to stress including water deficits tolerance. This field experiment was conducted in association with a long term tillage study established Fall 2007 at the Judd Hill Foundation Research Farm in Northeast Arkansas to assess agronomic and environmental impacts of conservation tillage systems. Studies in 2016 monitored soil environments of three tillage systems: no-till, cover crop/low till, and conventional, with and without supplemental irrigation; 2017 evaluated the three tillage systems without supplemental irrigation. In 2016 and 2017, sensors in the no-till and cover crop systems were more reactive and slower to dry after rain and irrigation events. Use of no-till and cover crop treatments has potential to be more efficient with water use suggesting that less irrigation could be used in fields under these management practices. These results indicate rain fed fields would benefit more from no-till systems emphasizing the importance of treatment specific irrigation recommendations.

Development of a PEDOT:PSS Buffer Film for Anorganic Solar Cell
(Co-Author: Matthew Young)

An organic film made from Poly(3,4-ethylenedioxythiophene): Poly-styrene sulfonate (PEDOT:PSS) was fabricated using a dynamic spin coating technique. Before the film was fabricated, it was necessary to install and test various pieces of research equipment. The PEDOT:PSS film was fabricated on a borosilicate glass substrate at a temperature of 150°C. To measure film conductivity a commercial silver paste was used to paint on contacts. A two point probe method was used to measure the thin film conductivity which was found to be between 5x10-8 and 5x10-9 S. Work continues to optimize the PEDOT:PSS film and characterize its electrical and optical properties.
**Physics**

P: 61 – Sonja Wagner  
University of Central Arkansas, Undergraduate Student  
Judge: Yes

**Gamma-Gamma Angular Correlation**  
(Co-Author: Rahul Mehta)

The sodium isotope we analyzed in this experiment, Na-22, undergoes \( \beta^- \)-decay, which results in a positron being ejected from the decaying atom. This resulting positron is captured by another electron in the sample, resulting in their mutual annihilation. The result of this annihilation is two identical gamma rays (each with 511 keV of energy), which are ejected from the sample. Because momentum has to be conserved, these gamma rays are theoretically ejected in polar opposite directions. Our experiment was designed to test this theory by employing two identical radiation detectors equidistant from the Na-22 sample, and recording each instance of a simultaneous 511 keV gamma reading of the two detectors at varying angles (164–196 degrees). The results of our experiment were precisely as predicted: when the detectors were at 180 degrees, the number of gamma-gamma detections was greatest, and the further we deviated from 180 degrees, the fewer detections were read, with almost no detections read at 164 and 196 degrees. We would like to acknowledge Dr. Duncan Weathers from the University of North Texas for his assistance with this experiment.

P: 62 – Timothy Brown  
University of Central Arkansas, Undergraduate Student  
Judge: Yes

**Gamma-Gamma Angular Correlation**  
(Co-Author: Jackson Mixon)

This project involves the development and testing of a scientific payload and ground-based tracking system for high-altitude balloon flights. The payload consists primarily of two Geiger counters, data logger, and longrange wireless transceiver controlled by a Raspberry Pi single board computer. Ground-station tracking system provides connectivity to the payload via 5.8 GHz point-to-point connection to give livestreaming video and data from stratospheric balloon flights. We discuss the progression and testing of this system from the August 23, 2017 total solar eclipse to date.

P: 63 – Trac Staggers  
Arkansas State University, Undergraduate Student  
Judge: Yes

**Development and Testing of a Scientific Payload and Ground-Based Tracking System for High-Altitude Balloons.**  
(Co-Author: Jackson Mixon)

This project involves the development and testing of a scientific payload and ground-based tracking system for high-altitude ballooning research at Arkansas State University. The payload consists primarily of two Geiger counters, data logger, and longrange wireless transceiver controlled by a Raspberry Pi single board computer. Ground-station tracking system provides connectivity to the payload via 5.8 GHz point-to-point connection to give livestreaming video and data from stratospheric balloon flights. We discuss the progression and testing of this system from the August 23, 2017 total solar eclipse to date.

P: 64 – Jackson Mixon,  
Arkansas State University, Undergraduate Student  
Judge: Yes

**Development and Testing of a Scientific Payload and Ground-Based Tracking System for High-Altitude Balloons.**  
(Co-Author: Jackson Mixon)

This project involves the development and testing of a scientific payload and ground-based tracking system for high-altitude ballooning research at Arkansas State University. The payload consists primarily of two Geiger counters, data logger, and longrange wireless transceiver controlled by a Raspberry Pi single board computer. Ground-station tracking system provides connectivity to the payload via 5.8 GHz point-to-point connection to give livestreaming video and data from stratospheric balloon flights. We discuss the progression and testing of this system from the August 23, 2017 total solar eclipse to date.

P: 65 – Jake Bass  
University of Central Arkansas, Undergraduate Student  
Judge: Yes

**Gamma-Gamma Angular Correlation**  
(Co-Author: Rahul Mehta)

The sodium isotope we analyzed in this experiment, Na-22, undergoes \( \beta^- \)-decay, which results in a positron being ejected from the decaying atom. This resulting positron is captured by another electron in the sample, resulting in their mutual annihilation. The result of this annihilation is two identical gamma rays (each with 511 keV of energy), which are ejected from the sample. Because momentum has to be conserved, these gamma rays are theoretically ejected in polar opposite directions. Our experiment was designed to test this theory by employing two identical radiation detectors equidistant from the Na-22 sample, and recording each instance of a simultaneous 511 keV gamma reading of the two detectors at varying angles (164–196 degrees). The results of our experiment were precisely as predicted: when the detectors were at 180 degrees with respect to one another, we gathered the greatest number of gamma-gamma detections, and the further we deviated from 180 degrees, the fewer detections were read, with almost no detections read at 164 and 196 degrees. We’d like to acknowledge Dr. Duncan Weathers from the University of North Texas for his assistance with this experiment.

P: 66 – Nicholas Scolles  
University of Central Arkansas, Undergraduate Student  
Judge: Yes

**Development of an Acoustic Scanner**  
(Co-Author: Jessica Young)

A Spatial Light Modulator (SLM) is a device that can alter the phase, amplitude, or polarization of a wavefront. Passing a laser beam through an SLM encoded with a specific computer generated hologram can shape a simple spot into a more complicated pattern. Our primary goal for this project is to create Generalized Gaussian (GG) laser beams using an SLM. This goal was accomplished by programming the SLM with Matlab to display the required holograms. The holograms are created by calculating the interference pattern of the desired beam shape and the input beam (a fundamental Gaussian beam) and encoding the resulting pattern onto the SLM. Commercially available SLMs can cost up to thirty-five thousand dollars. To avoid spending thousands of dollars, we constructed one from a liquid crystal display (LCD) and motherboard removed from a surplus overhead projector. To achieve our goal, we created a program that would work correctly for our experiment’s laser and LCD. We present the holograms used to shape the GG laser beams, the resulting beam profiles, and compare the experimentally generated profiles to the theoretically expected profiles. The quality of the laser beam profiles are lower than expected from a commercially available research-grade SLM, however, we show that the homemade SLM shapes the laser beam into the desired intensity patterns with reasonable quality.

P: 67 – Samantha Dix  
Arkansas Tech University, Undergraduate Student  
Judge: Yes

**Generation of Generalized Gaussian Beams Via a Spatial Light Modulator**  
(Co-Author: Jessica Young)

Hardware and software are being developed to create a system that can be used scan a 2-dimensional acoustic wave field. The system consists of two linear actuators aligned perpendicular to each other. Mounted on the scanner is a 1/4” microphone. The system can scan a region 30 cm x 30 cm. Software has been developed in Python to control the position of the microphone, the source signal, and the recorded signal. This system can be used to produce acoustic holograms as well as 2-D images of acoustic wave fields.

P: 68 – Yassamine Ghazzali  
Southern Arkansas University, Undergraduate Student  
Judge: Yes

**Effect of simulated microgravity on radiation-induced endothelial dysfunction markers**  
(Co-Authors: Abdul Bacht, Rapak Puthak, Marjan Boerner, Martin Hauter – Jensen)

The effect of outer space radiation exposure and near-zero space gravity environment on DNA damage is not well documented, and is a primary concern to NASA in furthering its goal for deep space exploration. We illustrate technics of subjecting the cells to microgravity and discuss our preliminary findings on the role of microgravity. We irradiate Human Umbilical Vein Endothelial Cells (HUVECs), and subject them to ground-based simulated microgravity. HUVECs are used because cardiovascular diseases have been linked to genomic instability in endothelial cells. We use the High Aspect Ratio Vessel (HARV) bioreactor to seed the
cells onto Cytodex-3 microcarrier beads and cause them to undergo free suspension, a condition similar to near zero gravity in the outer space. A key component for this experiment is to standardize the microcarrier bead concentration, cells attachment and the HARV rotation speed to achieve free suspension. This standardization is required in order to prevent damage to the cells during the long microgravity treatment and optimize cell recovery. We discuss standardization techniques to improve cell attachment and microgravity treatment. We share preliminary results that suggest microgravity. Simulated microgravity causes morphological alteration and enhances radiation-induced cell killing. Finally simulated microgravity alters the expression of radiation-induced endothelial dysfunction markers.

P: 69 – Patrick Tribbett
Arkansas State University, Undergraduate Student
Judge: Yes

Stratospheric Ballooning RGB System for LiDAR Measurements
(Co-Author: Rose Carroll)

Academic stratospheric ballooning is an inexpensive alternative for near space and upper atmospheric probing. As part of Arkansas BalloonsAT, this research aims to design and implement a ground and aerial based spectral measurement system to observe atmospheric absorption and attenuation through changes in altitude. This technique and system consists of RGB laser pulses fiber coupled through a 127 mm telescope, which are then reflected off a balloon and back through the atmosphere to the telescope. These gated pulses are then filtered through a spectrometer for analysis. In addition to atmospheric attenuation measurements, bench testing of the intermediate system has enabled speed of light measurements and an inexpensive LiDAR system via the reflection of gated pulses. Preliminary results of this intermediate system demonstrate accurate speed of light measurements, a robust LiDAR system, and laser fluxes that may be capable of reflection from a balloon payload at a distance of 25 km line of sight. Future work will include ballooning field tests and atmospheric attenuation data acquisition.

P: 70 – Paul Niyonkuru
University of Central Arkansas, Undergraduate Student
Judge: Yes

Rutherford Backscattering Spectrometry

In Rutherford backscattering spectrometry the energy ratio of the emitted to the scattered particle beam, called the kinematic factor k shows that the energy after scattering is determined only by the masses of the particle and target atom and the scattering angle. This theory predicts that one could determine the mass, hence, the nature of the target atom by only knowing the energy ratio and mass of the particle, and its scattering angle. In this project we test this theory against the experimental observations by using a source particle beam of Helium +1 ions, with known energy, incident on a foreknown sample target thin film composed of bismuth, silver, and copper deposited onto a silicon substrate. The scattering angle is measured as well as the energy of the scattered particle beam.

P: 71 – Paul Niyonkuru
University of Central Arkansas, Undergraduate Student
Judge: Yes

Analyzing the Changeover from a Macroscopic System to a Nanosystem by Investigating the Moving Boundary Between Two Phases.

In macroscopic thermodynamics, the variables that we deal with are either extensive or intensive. When we explore nano materials some properties that are extensive on the macro scale are no longer extensive, and as systems get smaller some of the intensive properties become less well defined. We will present the results to date of our investigations of the moving boundary between two phases in both a nano system and a macroscopic system of the same material. This is known as the Stefan problem. We analyze this problem for both a macroscopic system and a nano-systems with the method of lines adapted to a MatLab code. The goal of the research is to gain a better understanding of the changeover from a macroscopic system to a nano system. Initial calculations are being made for radially symmetric systems that are gold as there is an extensive literature devoted to the measurement of the properties of gold particle nano systems.