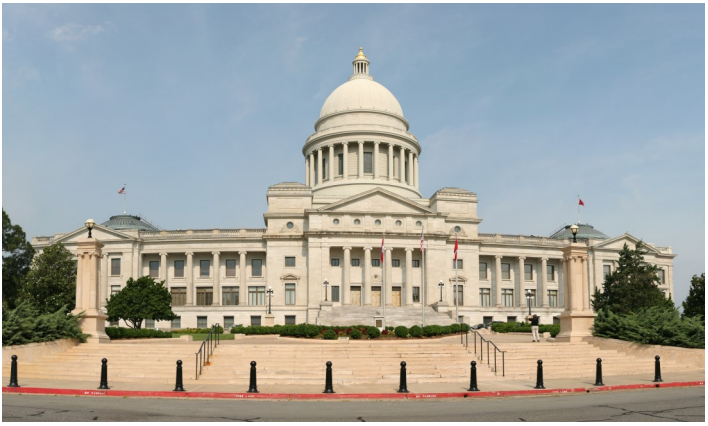
STEM
Posters at the Capitol



February 15, 2017

"It is essential, if we want to continue to reap the benefits of science, to commit as a nation to preparing more young people for extraordinary careers in science."

—Carol W. Greider, 2009 Nobel laureate in physiology & medicine

Highlights

- **Over 100 students**
- **From 15 Arkansas colleges and universities**
- **Presenting 70 different posters of original work**
- **Encompassing all aspects of natural science and math**


STATE
ARKANSAS STATE
UNIVERSITY


1876
HENDRIX


1871
UNIVERSITY OF
ARKANSAS


HARDING
UNIVERSITY


PHILANDER
SMITH COLLEGE
EST 1877


JOHN BROWN
UNIVERSITY


OUACHITA
BAPTIST UNIVERSITY


UAFS
University of Arkansas
Fort Smith


1890


UAM
The University of Arkansas at Monticello
Monticello • Crossett • McGehee


HENDERSON
STATE UNIVERSITY


UALR
University of Arkansas
at Little Rock


SOUTHERN ARKANSAS
1909
UNIVERSITY


ARKANSAS
TECH
UNIVERSITY


LYON
COLLEGE


UNIVERSITY OF
CENTRAL
ARKANSAS


UNIVERSITY
of ARKANSAS
AT PINE BLUFF
1873

STEM Posters at the capitol

35 Posters Presented from 10 am—11 am

10 am Poster number……..page for abstract

STEM Posters at the capitol

35 Posters Presented from 11 am—noon

11 am Poster number……..page for abstract

Student presenter (school) …..page with abstract

Student presenter (school) …..page with abstract

presenting
11 am—12 pm

Hometown: Fort Smith, AR (EH)
Rwanda (JG)
Little Rock, AR (MW)

Robotics Odyssey at Hendrix

Michael Williams[a], Jackson Gakundi[a], Eric Huynh[b], Gabriel Ferrer[b], Ann Wright[a]

[a]Hendrix College, Department of Physics, Conway, AR
[b]Hendrix College, Department of Computer Science, Conway, AR

Robot technology is becoming increasingly sophisticated. This sophistication can be useful for both making an introduction to robotics accessible to beginners as well as challenging the more advanced student. Dr. Gabe Ferrer (Computer Science) and Dr. Ann Wright (Physics) have begun a collaborative project funded by an Odyssey Professor award at Hendrix College. By building upon previous work in robot control theory and machine learning, as well as our collaboration to create the Robotics Explorations Studio course, we will develop a hardware and software system for robot construction and programming. Main goals for this project: to develop a kit of parts from which both beginning students and advanced students can construct a variety of robots, to develop a system of robot control that is accessible to beginning programmers and powerful enough to challenge the advanced student, to redesign an advanced course in robotics for Hendrix College, to offer several undergraduate research for Hendrix students, to establish new contacts at national robotics research facilities, and to offer a summer experience in robotics for middle/high school girls in the community. This presentation will summarize progress made on the first six months of this three year project.

presenting
10 am—11 am

Hometown: Cabot, AR (JB)

Evaluation and Development of Secondary BalloonSAT Payloads

Justin A. Barnes, Dr. Ross Carroll

Department of Chemistry & Physics, Arkansas State University, Jonesboro, AR

We report the research and development of secondary payloads for Arkansas BalloonSAT and the Eclipse Ballooning Project. On August 21, 2017 a total solar eclipse will occur that spans from Oregon to South Carolina. We are one of several dozen teams who will be launching a common set of instruments on high altitude balloons during the eclipse in order to stream live video and still images out to the public. Our team will be launching at least one of these high altitude balloons from central Missouri just prior to totality aiming to be at least at an elevation of 85,000 feet while the moon's shadow passes by. In addition to the common cameras and communication equipment provided by the Montana State University led project, we have been developing secondary payloads with atmospheric sensors, radiation meters, and a spherical camera. Using open-source electronics and digital fabrication tools such as desktop 3d printers and 3d carvers, we are primarily focused on building a spherical camera that uses six GoPro cameras and custom electronics to measure the absolute orientation of the spherical camera in flight. This arrangement will allow for stabilized spherical panoramic videos of the balloon flight to be available to the public. We will describe the current state of our secondary contributions to the Eclipse Ballooning Project, the development of a mobile balloon tracking station, and report results from test launches.

presenting
10 am—11 am

Hometown: Conway, AR (RJ)

Student-Built High-Altitude Balloon Payload with Sensor Array and Flight Computer

Russell Jeffery, Dr. William V. Slaton

Department of Physics, University of Central Arkansas, Conway, AR

A payload was designed for a high-altitude weather balloon. The flight controller consisted of a Raspberry Pi running a Python 3.4 program to collect and store data. The entire payload was designed to be versatile and easy to modify so that it could be repurposed for other projects: The code was written with the expectation that more sensors and other functionality would be added later, and a Raspberry Pi was chosen as the processor because of its versatility, its active support community, and its ability to work easily with sensors, servos, and other hardware. The program collected data from a GPS breakout board, a Raspberry Pi camera, a geiger counter, two thermocouples, and a pressure sensor. The data collected clearly shows that pressure and temperature decrease as altitude increases, while β-radiation and γ-radiation increase as altitude increases. These trends in the data follow those predicted by theoretical calculations made for comparison. This payload was developed in such a way that future students could easily alter it to include additional sensors, biological experiments, and additional error monitoring and management.
This project was made possible by an Arkansas Space Grant Consortium (ASGC) Workforce Development Grant.

presenting
11 am—12 pm

Hometown: Little Rock, AR (KM)

The computational tradeoff between dynamic range and stimulus discrimination in neural circuits near criticality

Kylie McClanahan, Doug Bohlman, Woodrow Shew

Department of Physics, University of Arkansas Fayetteville, Fayetteville, AR

How the brain processes sensory input depends crucially on the collective interactions among neurons in the cerebral cortex and among cortical regions. One important property of how a neural network encodes input is dynamic range, which quantifies the range of input intensities that lead to distinguishable responses. Previous experiments show that dynamic range is maximized when the interactions among neurons are tuned to a special regime, called criticality. However, dynamic range is defined by the average response to many repetitions of the same stimulus. This is unrealistic, because trial-to-trial variability is high, and the brain does not have the luxury of averaging over thousands of repetitions. A more principled approach, which accounts for this variability, is offered by signal detection theory. Here, we study this problem using a network-level computational model of binary, probabilistic, integrate-and-fire neurons. First, we consider a single neural network and show that stimuli discrimination is not optimal at criticality, but is highest in the subcritical regime. However, if we consider a second neural network that receives input from the first, the optimal regime for stimulus discrimination shifts back towards criticality. Essentially, our results demonstrate a computational tradeoff: dynamic range and stimulus discrimination cannot be simultaneously optimized.

presenting
11 am—12 pm

Hometown: Conway, AR (AW)

First Integrals of a Monge-Ampere Equation

Andrea Weaver, Daniel Arrigo

Department of Mathematics, University of Central Arkansas, Conway AR

Moving objects from one place to another is a problem we see in everyday life. For example, suppose we are given a pile of sand which we wish to move and completely fill in a hole. Moving the sand requires some effort, which we model by a cost function $c(x,y)$, a function which tells us how much it costs to transport one unit of mass from location x to location y. Assuming that $c(x,y) = (x-y)^2$, to move the objects from x to y minimizing the efforts is to solve the second order Monge-Ampere equation

$$u_{xx}\, u_{yy} - u^2_{xy} = f(x)/g(\tilde{N}u)$$

where f and g are the density of the materials at locations x and y, respectively, and $T = \tilde{N}u$ is the transportation strategy.

As the transportation problem occurs in many areas such as optimal water distribution in irrigation channel systems, optimal urban planning (i.e. allocation of housing, service and office locations in cities), traffic network planning in cities, internet traffic optimization, the study of this equation is an important one.

Our work with this particular equation is to identify simpler first order equations (first integrals) that automatically satisfy this Monge-Ampere equation and to determine when these first integrals can be used to reduce the Monge-Ampere equation to one that we know how to solve.

presenting
11 am—12 pm

Hometown: Perryville, AR (MW)
Brookland, AR (JP)

Differential Equations as Physical Models

Jacob Perkins and Morgan Webb, Dr. Joseph Stover and Dr. Anthony Grafton

Lyon College, Batesville, AR

Differential equations serve as mathematical models for a variety of physical systems. We investigate the accuracy of using differential equations for modeling liquid solution mixing. We set up an experiment to record the change in the dye concentration in water over time due to the mixing of two different solutions. Then, we constructed and solved differential equations with parameter values derived from our experiments to model the change in dye concentration over time. We compared the theoretical model to the experimental data and found that the differential equation modeled the experimental data accurately in some cases but less so in others. In the future, we would like to further vary some of the independent variables of the liquid solution mixing process, such as mixing speed, to see how this affects the accuracy of our theoretical models.

presenting
10 am—11 am

Hometown: Maumelle, AR (KB)
North Little Rock, AR (AC)

Using GIS to Map *Safe Routes to School* Infrastructure Features Surrounding Forest Park Elementary and Ida Burns Elementary

Kristen E. Barré, Aubree R. Charette, Stephen M. O'Connell

Department of Geography, University of Central Arkansas, Conway, AR

Safe Routes to School (*SRTS*) is a national program used to both educate the public on the value of walkable communities and fund infrastructure projects surrounding local schools. In Arkansas the program is funded by the Arkansas Highway and Transportation Department. Forest Park Elementary, located in Little Rock's Hillcrest neighborhood, has received over $317,000 in funds for infrastructure improvements. We used the program's implementation at Forest Park as a comparative model for other schools in Central Arkansas to partake in *SRTS*, increasing the number of children walking and biking to school. ArcGIS Collector was utilized to collect walkability data within a 0.33 mile radius surrounding Forest Park and Ida Burns Elementary Schools. Points were categorized by street sign type, sidewalk availability, and status of crosswalks, three categories representing primary infrastructure amenities funded by *SRTS*. We selected Ida Burns Elementary in Conway as the comparison school due to its similar layout to Forest Park, location in Central Arkansas, and potential for the implementation of infrastructure to be funded by *SRTS*. The goal of our study is to provide a visual and spatial reference for local schools to utilize when improving the walkability for students in surrounding neighborhoods.

presenting
10 am—11 am

Hometown: Little Rock, AR (EH)

Variations in water quality through an urban watershed and wetland: Fourche Creek in the Little Rock Metropolitan Area

Elizabeth Haralson, Laura Ruhl, and Erik Pollock

Department of Earth Sciences, UALR, Little Rock, AR

Fourche Creek watershed covers 108,800 acres throughout Little Rock, AR. The creek, wetlands, and watershed areas provide pollution control, water purification, and storage for the city's run-off water. Water samples were collected on Fourche Creek upstream and downstream of the wetlands on four occasions over five-months. One sampling event occurred during a storm event lasting three days in March 2016. Water parameters of pH, salinity, conductivity, and temperature were collected. Samples were analyzed for anions and cations by IC, alkalinity by titration, and trace metals by ICPMS. Results show water quality changed based on time of year, amount of precipitation, and influence from the Arkansas River. Certain constituents (Zn, Cr, and nitrate) were common in urban areas. Cation concentrations (Ca, Mg, and Na) generally increased as the creek approached the wetlands, where their concentration decreased. Trace elements showed similar behaviors to cations in the watershed. This indicates that the wetlands reduce concentration of cations and trace elements in Fourche Creek. Arkansas River water mixes with Fourche Creek near the confluence, increasing the concentration of cations and trace elements. Anion concentrations remained constant throughout the system. This investigation has illustrated the effect wetlands have on cleaning water draining from Little Rock.

presenting
10 am—11 am

Hometown: Kansas City, MO (MM)

Earthworm Soil Preference

[a]Malachi Miller and [b]Steven Green

[a]Department of Biology, University of Arkansas at Pine Bluff, Pine Bluff, AR
[b]College of Agriculture, Engineering and Technology, Arkansas State University, Jonesboro, AR

People all over the world may know what an earthworm is, but many may not know the role earthworms play in the agriculture field. Earthworms help to increase the amount of air and water that gets into the soil, and when they eat, they leave behind castings that are a very valuable type of fertilizer for plants and soils. We hypothesized that earthworms have a preference for cover crops. Cover crops are crops planted in between regular crop seasons to prevent soil erosion. We wanted to determine which type of cover crops earthworms are more attracted to in order to help attract more worms and keep the soil healthy. We examined five different soil samples from different cover crop treatments: rye, hairy vetch, rape seed, a cover crop mix, and a chemically sprayed cover crop as a control. Using a Preference Chamber, the worms were placed in chambers, incubated, tallied through statistical analysis. Each test was repeated three times with ten worms each time. In conclusion, we determined that among cover crops: Rye > Vetch > Rape seed > Control was the earthworm's preference and the moisture content of the soil has an effect for earthworm preference.

presenting
11 am—12 pm

Hometown: Fort Smith, AR (KD)

A comparison of the impacts of wind energy and unconventional gas development on land-use and ecosystem services: An example from the Anadarko Basin of Oklahoma, USA

Kendall Davis, Michael N. Nguyen, Maureen R. McClung, and Matthew D. Moran

Department of Biology, Hendrix College, Conway, AR

The United States energy industry is transforming with the rapid development of alternative energy sources and technological advancements in fossil fuels. Two major changes include the growth of wind turbines and unconventional oil and gas. We measured land-use impacts and ecosystem services costs of unconventional gas and wind energy development within the Anadarko Basin of the Oklahoma Woodford Shale, an area that has experienced large increases in both energy sectors. Unconventional gas wells developed three times as much land compared to wind turbines (on a per unit basis), resulting in higher ecosystem services costs for gas. Because wind turbines produced on average less energy compared to gas wells, the average ecosystem cost per gigajoule of energy produced was almost the same. Our results demonstrate that both unconventional gas and wind energy have substantial impacts on land-use, which likely affect wildlife populations and ecosystem services. Although wind energy does not have the associated greenhouse gas emissions, we suggest that the direct impacts on ecosystems and land conservation efforts are similar to unconventional fossil fuels. Considering the expected rapid global expansion of these two forms of energy production, many ecosystems are likely to be at risk.

presenting
10 am—11 am

Hometown: Midlothian, TX (AB)

Biocubes: Cubic Foot Biodiversity Surveys

Amanda Brooks, Dr. Ruth Plymale

Biology Department, Ouachita Baptist University, Arkadelphia, AR

Biodiversity is the scope of all life in a given area; yet working definitions are often limited to plants and animals. Having a more complete understanding of biodiversity and potential human impacts on it is of particular relevance for undergraduate students, as they are developing their own ways of interacting with the world. To that end, I have piloted a biodiversity-themed undergraduate lab based on a one-cubic-foot biocube. I surveyed ten unique cubic foot areas across various ecosystems. In each biocube, I identified and counted a sample of the invertebrate animals and plants present. I also identified the soil texture at each site and quantified culturable soil bacteria. This project will give a better understanding of local biodiversity and will lay the groundwork for future course-based research by freshman biology students.

presenting
11 am—12 pm

Hometown: Rogers, AR (RH)

Dynamic Decision Modeling for Inland Waterway Disruptions

Rachel Holmer, Hueon Lee, Jose Daniel Bracamonte, Dr. Shengfan Zhang, Dr. Heather Nachtmann

Department of Industrial Engineering, University of Arkansas, Fayetteville, AR

There is much uncertainty associated with inland waterway transportation. Natural or man-made disruption on the inland waterway system can have widespread economic and societal impacts, and their consequences can be significant. In this research, a Markov decision process model was developed to identify optimal decisions in the event of a weather-related disruption to minimize the barge owner's loss, incorporating the uncertainty associated with the reopening of the waterway and deteriorating value of the cargo. Historical lock and dam unavailability data and related weather data were collected and analyzed to build a prediction model on lock and dam closure and reopening.

presenting
11 am—12 pm

Hometown: Poteau, OK (TW)

The Mars Rover Project (MRP)

Tyler A. White, Osman A. Martinez, and Kevin R. Lewelling, PhD, PE

Department of Engineering , University of Arkansas – Fort Smith

Students at the University of Arkansas – Fort Smith (UAFS) are currently working on a NASA research project to construct a drivable Mars rover capable of carrying one astronaut. The rover, "Helios", is under construction and expected to be completed before 2017 ends. The Helios project started over a year ago and has involved four engineers and two technicians. Helios uses a "rocker-bogie" suspension system, rarely seen outside of Mars rovers, to provide stability and allow climbing over difficult obstacles. The rover uses six in-wheel motors powered by a 48 volt, 40Ah LI battery for power. It implements a Raspberry Pi microcomputer and Arduino microcontroller for the drive controls, and is driven by two handles near the seat in a fashion similar to what is seen on a zero-turning lawn mower. The zero-turning lever action will make it easier for astronauts to control and maneuver the rover.

presenting
11 am—12 pm

Hometown: Texarkana, TX (MS)
Fayetteville, AR (KB)
Morelia, Mexico (IH)

JBU Wind Turbine Design

Mark Spiropoulos, Kyle Blush, Israel Hernandez, Dr. Jin Xu

John Brown University - Siloam Springs, AR

The purpose of this project was to design and build a functioning wind turbine for John Brown University's Engineering Department that both displayed the accumulated talents of their engineering students, and attracted potential students who were considering enrolling in their program. To that end, the design implemented a nontraditional, aesthetically pleasing blade.

A spiral design based on the shell of a nautilus was chosen, implementing biomimicry into the process. The design was then modeled and simulated using various simulation software. These simulations pointed to a spiral based on a logarithmic equation as being the most efficient way of harvesting the wind energy. With all wind turbines, there is a limit to the efficiency at which it can produce energy, that is, how much energy can be produced based on the strength of the wind passing over the blades. This is called the Betz limit and has proven to be about 59%. Therefore, the goal is to design the blade to produce the highest amount of Torque possible at the average wind speeds in the Northwest Arkansas and Siloam Springs area (approximately 6-10 mph). After running some simulations at those speeds, the torque produced by the logarithmically spiraled blade design turned out to be approximately 175 lbs.

presenting
10 am—11 am

Hometown: North Little Rock, AR (SS)

Android Control of a Robotic Arm

Shelby V. Sorrells and Edmond W. Wilson, Jr.

Department of Engineering and Physics and Department of Chemistry and Biochemistry, Harding University, Searcy, AR

Android Devices are becoming more and more common and important in carrying out tasks that can be controlled remotely. A robotic arm is described that can be operated from any location where there is cell phone coverage using an Android phone. The technology developed here has far-reaching use in many areas. The details of the process will be described.

presenting
11 am—12 pm

Hometown: Piggott, AR (DH)

Design and Development of a Safety System with Bluetooth Capability to Alert the Parent for Unattended child in car Seat

Dylan Howell, Sara Talley, Samwoo Seong, Shubhalaxmi Kher

Electrical Engineering, Arkansas State University, Jonesboro, AR

There have been about 698 child deaths since 1998 caused by leaving children unattended in hot vehicles. Children left unattended in the car seat do not have any way to communicate. We designed a system that can be made integral to the car seat to provide additional safety for the child. This safety and alarm system raises the parent's awareness and provides feedback in terms of multiple alarms on their cell phone to prevent any child being left unattended. The system continuously reads the voltage from the car battery/alternator to see if it is running and uses multiple sensors including pressure sensors to detect if a child is in the car-seat and the car is locked. The system sounds an alarm through a local speaker and uses a bluetooth connection to a smartphone to give a secondary alert in case the parent leaves the child unattended. The system is developed using Atmel microcontroller and provides interface with the mobile cell phone to alert the parent for leaving the child in the car seat. The alarm if unattended, gradually increases in volume and also turns on the car horn.

presenting
10 am—11 am

Hometown: Arkadelphia, AR (LP)
Texarkana, TX (AB)

Analysis of Childhood Obesity Prevention Programs and Assessment of Children's BMIs, BMI-for-Age Percentiles and BMI z -scores

Laura Prince and Alex Bradley

Ouachita Baptist University, Arkadelphia, AR

Approximately 17% (12.7 million) United States (U.S.) children and adolescents aged 2-19 years are obese (Body Mass Index-for -age percentile > 95%). In Arkansas, 21.7% of school age children are obese (Body Mass Index-for-age percentile >95%). Rates are higher for Hispanic (48.3%) and African American (41.8%) children in Arkansas compared to Caucasian (35.8%) children. Obesity-related health issues in Arkansas are trending upward for diabetes (12.7%) and hypertension (38.7%), as well as heart disease and obesity-related cancer. A systematic literature search using EBSCOhost, JSTOR, and ProQuest databases initially yielded 9,359 journal articles published from 2005-2016 about childhood obesity. The literature review was narrowed to focus on 83 research studies published about United States programs targeted to prevent childhood obesity. Articles were read with information and data on program design collated into a spreadsheet and used in planning curriculum for the summer nutrition and physical activity program in Arkadelphia. Height, weight, body mass index (BMI), BMI-for-age percentiles, and BMI z-scores were calculated for 143 children. Four (3%) were underweight less than the 5th percentile, 79 (55%) were within normal weight from the 5th to less than the 85th percentile, 19 (13%) were overweight 85th to less than the 95th percentile and 41 (29%) were obese at or above the 95th percentile. Eighty-four (59%) of the children's BMI z-scores were between +1 and -1, and 124 (87%) of the children's BMI z-scores were between +2 and -2. Seventeen (12%) of the children had BMI z-scores greater than +2.

presenting
10 am—11 am

Hometown: Texarkana, TX (AB)
Arkadelphia, AR (LP)

Assessment of Body Mass Indices of Children Participating in a Nutrition and Physical Activity Program Abstract

Alex Bradley and Laura Prince

Ouachita Baptist University, Arkadelphia, AR

In the United States (U.S.), approximately 17% of children and adolescents are considered obese, having a body mass index (BMI)-for-age percentile above the 95th percentile. That is equivalent to approximately 12.7 million children and adolescents in our country that are affected by childhood obesity. In Arkansas, the percentage of children and adolescents with childhood obesity is equivalent to approximately 21.7%. The rates of childhood obesity nationwide are found to be higher in Hispanics (22%) and African Americans (20%) compared to that of Caucasians (14%). These rates are mirrored in Arkansas with Hispanics having a rate of approximately 48%, African Americans having a rate of approximately 42%, and Caucasians having a rate of approximately 36%. Health issues that stem from obesity are increasing in Arkansas and include the following: diabetes, hypertension, heart disease, and obesity-related cancer. The summer program consisted of a control group which received no intervention and a treatment group which participated in an eight week nutrition and physical activity program. All subjects in both groups were weighed and measured at the beginning and end of the eight weeks. BMIs, BMI-for-age percentiles and z-scores were calculated and used to complete a comparative analysis of the effectiveness of the nutrition and physical activity program.

presenting
11 am—12 pm

Hometown: St. Louis, MO (DC)

A Better CAPTCHA: Are We There Yet?

Dominuqe Crawford, Samar Swaid, Ph. D.

Department of Applied Math and Computer Science
Philander Smith College, Little Rock, AR

CAPTCHA stands for "Completely Automated Public Turing test to tell Computers and Humans Apart". Although CAPTCHA is widely used security application on the web, limited number of studies evaluated the usability of text-based CAPTCHA. In this work, we identify the usability criteria of text-based CAPTCHA based on a content analysis study of more than 90 user-generated comments found in blogs, forums and industry reports. Content analysis study resulted in developing a multi-level framework to measure usability of CAPTCHA.

presenting
11 am—12 pm

Hometown: Marion, AR (CS)
Brookland, AR (CR)

The Adoption Rate of Lambda Expressions in Java Open Source Projects

Christopher Saldivar, Clay Reddick, and Donghoon Kim

Department of Computer Science, Arkansas State University, Jonesboro, AR

Lambda expressions are a new Java language feature introduced in Java 8. The purpose of this project is to determine (1) if lambda expressions usage reduces the total lines of code in a project and (2) if the number of active contributors affects the usage of lambda expressions. To formulate our answer, we examine the use of lambda expressions in Java on 12 open source projects that have been in development before and after lambda expressions released with Java 8. We extracted the usage of lambdas using our existing programming language analysis framework written in Java and Python by extending for lambda expression. We observed that only 7 out of 12 projects contained lambda expression. Our analysis shows that the total lines of code in a project was not reduced by lambdas and that there was no correlation between the number of active contributors and lambda expression usage. One possible explanation for why lines of code were not reduced is that developers were not rewriting old code to use lambdas. We provide other possible explanations to explain these results in this poster.

presenting
10 am—11 am

Hometown: Cathedral City, CA (MM)
Chicago, IL (AL), Jennings, MO (JD)
Nassau, Bahamas (TK)

Usability Heuristics for Visualization Systems

Mnsa Maat; Antwane Lewis, Jasmine Dehart; Trishawna Kelly, Samar Swaid, Ph. D., faculty mentor

Department of Applied Math and Computer Science
Philander Smith College, Little Rock, AR

Visualization tools are developed to enable analyzing data and building visualization entities to get a better cognitive understanding of data. Visualization systems support the visual-information-seeking mantra of "Overview first, zoom and filter, then details-on - demand". In spite of the wide development of visualization tools, the use of such tools by is quite limited due to usability violations. In this study we identify usability heuristics apply heuristics that would fit evaluating visualization software. Heuristics usability is a discount usability evaluation method, where evaluators examine an interface using a set of principles, called heuristics. We extend Nielsen heuristics to develop 12-rule of usability heuristics that can be applied when testing usability of visualization systems. We test our heuristics by inspecting ParaView, an open-source visualization application. We found ParaView violates usability rules of: Consistency; User control, Error prevention, and Customized experience. Some of the usability issues found with ParaView are: dysfunctional reset button, unrestored visualization sessions, and broken color-code function. In this research, we empirically test heuristics usability to evaluate the usability of interactive visualization tools. Future research would focus on other visualization software of varying levels of complexity to test the proposed heuristics.

presenting
10 am—11 am

Hometown: Monticello, AR (ZH)

Modifying Snipe It to Organize Inventory

Zaire Husband and Tom Coffin

Department of Computer Science, University of Arkansas at Little Rock, Little Rock, AR

Managing inventory is a difficult and important task for any business or organization. ”Snipe It” is a database program that allows users to track inventory and usage. It is an open-source inventory management system that operates on the web, primarily through the script language Hyper Preprocessor (PHP) and Structured Query Language (SQL). When I started, the inventory of the Emerging Analytical Center (EAC) at UALR was unorganized. My project was to set up and program Snipe It to organize the EAC inventory. I originally tried to create the program environment on a Windows operating system, but found it difficult. I found another operating system, Ubuntu, which allowed me to send commands from the terminal into Snipe It. To use Snipe It in Ubuntu, I downloaded several mini-PHP programs and an SQL program. Once I got the pre-flight and set up working properly, I inputted all of EAC’s assets into the system. I then inputted information such as license, purchase date, location, and categories into the database. Since Snipe It is an open-source software, any user with some knowledge about PHP and SQL can improve the system. A future improvement could be to allow usage on a mobile platform.

presenting
11 am—12 pm

Hometown: Fort Smith, AR (DH)

Beginning Programing for Arkansas High Schools

David Hotz, Brandon Hutchison

Department of Mathematics, University of Arkansas – Fort Smith, Fort Smith, AR

The Computer Science Bill (HB1183) or act 187, passed by Arkansas Governor Asa Hutchinson in 2015, requires all high schools in Arkansas to offer a computer coding class. The goal of this project is to develop a semester long computer programming class for high school students and make available to all teachers the course resources which include lesson plans, complete working programs for all examples and assignments, and grading rubrics. The practices for Computer Science: perseverance, collaboration, patterns, tools, communication, problem solving, ethics, and impact are emphasized throughout the course which consists of five units. The first three units utilize Scratch, a free web-based program. Scratch is chosen because of its drag-and-drop block coding structure which eliminates syntax difficulties present in traditional coding languages. Programming structures such as branching and loops are introduced incrementally through assignments that include creating games and math functions. The fourth unit introduces Java programming with Crimson Editor which is also available for free. Previous programs are revisited in Java with the hope that familiarity with the assignments will ease the transition to a text-based language which is syntax sensitive. The final unit consists of a student designed final programming project.

presenting
10 am—11 am

Hometown: Little Rock, AR (SG)

When Random numbers Meet Piet Mondrianace

Mnsa Maat, Seneza Gaston, Dr Chuanlei Zhang

Department of Applied Math and Computer Science
Philander Smith College, Little Rock, AR

Random number presents the nature of independency and no-correlations among data points, which suggests an abstract form in math. Neoplasticism displays the pure abstraction of form and color in only primary colors, together with white and black. The form in neoplasticism art works is shaped into vertical and horizontal directions. In this work, we explore sets of random numbers produced by programming language, find the ones that fit into the pattern, e.g. prime numbers; then cast them onto an image work of Neoplasticism artist Piet Mondrian. Relationship between the abstraction of math and art are to be studied.

presenting
11 am—12 pm

Hometown: Greenwood, AR (KD)
Beebe, AR (AG)

Gas-phase measurement of the barrier to cis-trans interconversion of proline in a tetrapeptide

Kylie A. Dickerson[a], Annlee-Taylor E. Glass[a], Tarick A. El-Baba[b], David A. Hales[a], and David E. Clemmer[b]

[a]Department of Chemistry, Hendrix College, Conway, AR
[b]Department of Chemistry, Indiana University, Bloomington, IN

The ability of proline to exist in two distinct conformations (cis and trans) makes it unique among biologically useful amino acids. Interconversion of prolines between these two conformations is influential in the folding process for many proteins and peptides, but the energy costs for these processes are largely unknown. Conversion of proline from one conformation to the other changes the shape of a peptide, which means that the two versions can be separated and individually detected in the gas phase by ion mobility spectrometry-mass spectrometry (IMS-MS). In experiments using a peptide of four amino acid units (histidine-proline-glycine-glycine), the cis and trans conformations of proline were separated and each was individually provided with controlled amounts of energy through collisions with helium atoms. The amount of conversion between the two forms was measured as a function of the amount of collision energy in order to measure the energy barrier to interconversion. Acquisition and analysis of the data are described in detail.

presenting
10 am—11 am

Hometown: El Dorado, AR (SM)

Improving the Synthesis of Scorpionates, Using Cheaper, Faster Methods

Shelby Margis, Dr. Patrick Desrochers

Department of Chemistry and Biochemistry, University of Central Arkansas, Conway, AR

Scorpionates are a type of anchor used to bind to metals to channel and utilize the metal's intricate properties. Metals themselves are typically not useful without the aid of anchors that attach to the metal and hold onto it much like a tweezer. Take for example, the relationship of hemoglobin and iron in our own bodies. Without the binding of hemoglobin to iron, the iron, as pure metal, would cause problems throughout our bloodstreams. Scorpionates have great potential to be useful in similar applications in chemistry, as catalysts and tailored magnetic materials. While scorpionates are produced by some people in our field, we are working to develop a more efficient method of synthesis, making them more available to researchers. Further developing the synthetic method will allow us and future researchers to begin work on applying scorpionates to everyday, practical uses. So far, our relatively easy method of using a microwave synthesizer to produce the scorpionates has been effective and yielded good products. We hope to continue our work and perfect the method using widely available commercial materials to improve the appeal of scorpionates and encourage more research in this field.

presenting
11 am—12 pm

Hometown: Fort Smith, AR (NY)

Few-layered, Nanosized Tungsten (IV) Disulfide Antioxidant and Its ROS Scavenging Abilities

Neden Yacine, Busra Ergul, and Wei Zhao

Department of Chemistry, University of Arkansas at Little Rock, Little Rock, AR

Two-dimensional layered nanomaterials have sparked great interest in whether they possess antioxidant abilities that may be comparable to the natural antioxidants vitamin C, vitamin E, etc. Few-layered, nanosized tungsten (IV) disulfide is the compound of interest. We used a sensitive near infrared probe, single-walled carbon nanotubes (SWNTs) to determine if the nanocompound, prepared by a mild sonication process, possesses antioxidant abilities which can scavenge reactive oxygen species (ROS). The ROS scavenging behavior of the nanocompound is analyzed by measuring the magnitude of spectral recovery of the hydrogen peroxide-suppressed SWNT suspensions. The nanocompound is first purified by a centrifuge and wash process. Concentration-dependent reactions are conducted to examine how the concentration of the few-layered nanocompound functions in the spectral recovery. Further discussion includes an analysis of the spectral data of the nanocompound.

presenting
10 am—11 am

Hometown: Ward, AR (AE)

Evidence of Fe+-Induced Decomposition of Two Significant Greenhouse Gases

Angela B. Eden, Christopher L. Emmerling, William S. Taylor

Department of Chemistry, University of Central Arkansas, Conway, AR

Investigations of the gas phase reactions of Fe+ with the environmentally harmful compounds CF3X (X= I, Br) were performed in order to determine their decomposition pathways. The use of these gases in an industrial setting has resulted in their introduction into the atmosphere. CF3Br is used as a fire suppressant, and CF3I is considered to be a more environmentally-friendly substitute for CF3Br. Although present in the atmosphere in smaller quantities than CO2, both CF3Br and CF3I are still potent greenhouse gases as well as ozone depleters. The experiments described here were conducted to identify decomposition pathways for these species and to explore how the use of Fe+ could break down these gases into something more easily removed from the atmosphere.

presenting
11 am—12 pm

Hometown: Fort Smith, AR (MA)

Synthesis of 2-substituted Quinoline-4-carboxylic acids: Potential Anti-viral, Anti-cancer, and Anti-bacterial Compounds

Mouad Abdulrahim, Linda Desrochers, Tom Goodwin

Department of Chemistry, Hendrix College, Conway, AR 72032

I worked closely with Dr. Tom Goodwin to synthesize a variety of compounds known as quinoline-4-carboxylic acids; this family of compounds is known to have various pharmacological activities. After synthesis of compounds we analyzed samples using NMR Spectroscopy in order to determine whether we had made the correct compound. After purification via recrystallization, compounds were sent for bioassays. We continue to synthesize compounds and sending them to be tested in hopes of finding useful medicinal properties. If successful, we will have found new compounds with anti-viral, anti-cancer, or anti-bacterial properties to augment the ones commercially available, which could potentially impact Arkansas communities and many others seeking more effective medical treatments.

presenting
10 am—11 am

Hometown: Monticello, AR (DW and BJ)
Bearden, AR (JL)

Determination of Fatty Acid Concentrations in Algae

Donnell White, Beth Justice, Drake Palazzi, Jessica Lester, Haley Koenig, and Andrew Williams (P.I.)

University of Arkansas at Monticello—School of Mathematical and Natural Sciences

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

presenting
11 am—12 pm

Hometown: Poplar Bluff, MO (DA)

Synthesis and antimicrobial studies of pyrazole-derived hydrazones against *Acinetobacter baumannii*

Devin Allison, Evan Delancey, Hunter Ramey, Conrad Williams, David Gilmore, Mohammad Alam*

Chemistry and Physics Department, Arkansas State University, Jonesboro, AR.

Acinetobacter baumannii is a Gram negative bacterium with notoriety as a dangerous, nosocomial pathogen causing mortality in as many as 5% of infected patients. Most infections are due to multidrug resistant varieties, thus the development of new antibiotics would be extremely helpful in managing treatment. Pyrazole-containing compounds have been noted as potent medicinal scaffolds with a wide range of biological activity such as antimicrobial, anti-viral, and anticancer properties. Our medicinal chemistry research laboratory has synthesized over 50 derivatives of pyrazole-containing compounds. First, our pyrazole compounds were tested in Kirby Bauer (KB) disk diffusion assays. Positive controls included Ciprofloxacin and Chloramphenicol for comparison purposes. Compounds were also tested for Minimum Inhibitory Concentrations (MIC) in multi-well plates using the same controls. Many of the compounds had zones larger than the positive controls. The most notable zone was measured at 38 mm using compound #18 that was diluted to 0.001 M, a zone size greater than that produced by both reference antibiotics. The most active compounds were selected for minimum inhibitory concentration (MIC) tests. Several of these compounds gave impressive values of ≤ 2 μM, lower or equal to the MICs of the positive controls. Further testing and computational studies will proceed.

presenting
10 am—11 am

Hometown: Pine Bluff, AR (KD)

Lectin affinity chromatography and immunoextraction as a tool to study the effect of glycosylation on drug binding property of α1acid glycoprotein (AGP)

Kenan Dzide[a], Chenhua Zhang[b], and David Hage[b]

[a]Department of Chemistry, University of Arkansas Pine Bluff, Pine Bluff, AR [b]Department of Chemistry, University of Nebraska-Lincoln, Lincoln, NE

There are nearly 3 million cases of Arrhythmia per year in the U.S. Cardiac Arrhythmia occurs when electrical impulses in the heart have an abnormal rhythm. In addition, 610,000 people die annually in the U.S. due to heart attacks. Specific pharmaceuticals such as disopyramide and warfarin are known to alleviate abnormal heart rhythms and heart attacks; respectively. Alpha1- acid Glycoprotein (AGP) is an acute phase glycoprotein of the human body that acts as an important carrier protein for many of these basic pharmaceuticals. AGP has heterogeneous glycosylations which consist of three different types of glycan structures: di-, tri-, and tetra- antennary branched complex-type glycans. It is our long term goal to analyze how these branchings can affect its drug binding properties. Lectin affinity chromatography and immunextraction will be used as a tool to study the effect of glycosylation on its drug binding properties. Concanavalin A lectin affinity chromatography will be used to separate AGP into glycoforms with different degrees of branching. These glycoforms will be collected and further captured into an anti-AGP immunoextraction microcolumn. Disopyramide will be used as a model drug to investigate the interaction of this drug with the captured AGP glycoforms.

presenting
10 am—11 am

Hometown: Mena, AR (LM)
Mckinney, TX (JT)

Finding novel treatments for tuberculosis using deoxygenation reactions

LaShawna Miller, Jordan Trant, Irosha N. Nawarathne (PI)

Lyons College—Batesville, AR

Tuberculosis, which is caused by the bacteria Mycobacterium tuberculosis, is a lung disease which kills roughly 1.5 million people a year. The most common family of antibiotics for this disease is rifamycins, which were developed 40 years ago. Rifamycins work by binding to the RNA polymerase (RNAP) and inhibiting RNA synthesis. The bacteria has since mutated in multiple ways that have decreased the effectiveness of rifamycins. Although there are many rifamycin resistant (RifR) strains of MTB, the mutations of three residues, D435V, H526Y, and S450L, account for 84% of the MTB RifR strains. Our research focused on S450L, which accounts for about 43% of the MTB RifR strains. The mutation causes the replacement of a serine amino acid with a leucine, which is both bulkier and more hydrophobic. This creates steric hindrances between the drug molecule and RNAP, allowing the bacteria to continue RNA synthesis. We are attempting to change the structure of ri famycin so it will bind to the RNAP site better. We hypothesize that we can get the desired result by removing the hydroxy on the C-8 position through chemical deoxygenation being smaller and more hydrophobic, the rifamycin analogue with the hydrogen at C-8 (after deoxygenation) will bind to the MTB RifR strains more effectively. We have used this protocol on 1-hydroxyanthra-9,10-quinone to test the reaction efficiency. Then we continued the deoxygenation at C-8 position of rifamycin S with some measure of success that will be discussed in our presentation. The deoxygenated rifamycins are tested with mutated RNAP in an in vitro transcription assay that is based on rolling circle transcription technology.

presenting
11 am—12 pm

Hometown: Jacksonville, AR (AH)

The synthesis of natural product-based drugs to treat a neglected tropical disease: *Leishmaniasis*

Adam T. Hargis, Sean P. Stokes, Gregory R. Naumiec

Department of Chemistry and Biochemistry, University of Central Arkansas; Conway, Arkansas

There has been little research done in the area of creation of new and improved treatments for neglected tropical diseases. Neglected tropical diseases are communicable diseases that occur in tropical and subtropical areas. These diseases affect more than a billion people around the world. Research into new drugs to combat neglected tropical diseases is important due to the limited and harsh current treatment regimens. Our focus is specifically on the disease *Leishmaniasis*, which is transmitted via an infected female sand fly. The symptoms of leishmaniasis include weakness, decreased production of red blood cells, bleeding, and large open sores. Our research will focus on the development of anti-leishmanial natural product-based drugs to treat this neglected disease. An improved, and safer process for the synthesis of Espinatol, our current natural product of choice, has been developed. A medicinal chemistry approach is now being applied to the production of a variety of Espinatol-type of drugs. Altering the chemical structure of Espinatol can be done to yield new anti-parasitics with enhanced leishmanicidal properties. Our goal is to develop a drug with low toxicity and high potency to treat *Leishmaniasis.*

presenting
11 am—12 pm

Hometown: Beebe, AR (HK)
Lamar, AR (JD)

Using cavity ring-down spectroscopy (CRDS) to measure optical properties of non-ideal aerosols

Haley E. D. Kay, Jessica DeYoung, Amanda N. Jarman, Justin A. Land, and Kristin S. Dooley

Department of Chemistry, University of Central Arkansas, Conway, AR

Aerosols can interact with light in various ways due to their size, composition, and chemical structure. Because of this, they are able to contribute to a warming or a cooling effect on the climate. Current climate models often struggle to accurately predict the effects of aerosol particles because the light interaction calculations are based on ideal particles that are perfectly spherical made of a single material that will be either be purely absorbing or completely scattering in nature. While this model is adequate for some aerosols, others that made of multiple components or are not round are often not described well. This challenge introduces significant uncertainty in predicting the aerosol contribution to climate modeling. More detailed optical measurements of non-ideal particles are needed to correct the models. Cavity ring-down spectroscopy (CRDS) is an optical absorption technique that has been used as an effective technique for measuring the optical properties of aerosols. These properties can then be compared to theoretically predicted values in order to suggest mathematical correction methods that can be used to aid current climate models.

presenting
11 am—12 pm

Hometown: Russellville, AR (FO)
Perry, AR (WW)

An obligate heterodimeric thiosulfate dehydrogenase

Wallace Williamson and Fy'Nisha Oliver, Newton Hilliard

Department of Physical Sciences, Arkansas Tech University, Russellville, AR

Halothiobacillus neapolitanus is an obligate chemolithoautotroph capable of utilizing the extracytoplasmic oxidation of inorganic sulfur compounds as its sole source of metabolic energy. Physiological measurements show loose coupling between substrate oxidation and oxygen reduction with e:O ratios ranging from 1:1.16 to 1:1.6 depending on substrate. ADP depletion is not detected during O_2 consumption measurements, again implying loose coupling between substrate oxidation and ATP generation. Recent genomics data has shown the presence of a gene for a potential heterodimeric thiosulfate dehydrogenase (tsdAB). The tsdAB gene, loci Hneap_1476 and Hneap_1477, contains the ATGA co-expression motif indicating a potential expression stoichiometry of 1:1. In order to verify the tsdAB stoichiometry, PCR was used to amplify the entire gene coding region including the region surrounding the gene fusion site. PCR amplicon was then subcloned into an expression vector and successful transformants identified. Overnight cultures of transformed *E. coli* BL21DE(pLys) were subcultured into fresh media supplemented for anaerobic growth and gene expression induced. SDS-PAGE results clearly show increased relative concentrations of two bands at apparent molecular masses of 32kDa and 24kDa respectively. Quantitation of the ratio of the two bands was accomplished via coomassie blue staining and analysis using Quantity One software. Results were consistent with a 1:1 expression stoichiometry.

presenting
10 am—11 am

Hometown: Pine Bluff, AR (TJ)

Synthesis and Analysis of Superparamagnetic Bridged Lanthanide (III) Complexes

Tia'Asia James[a], Brian S. Dolinar[b], and Kim R. Dunbar[b]

[a]Department of Chemistry, University of Arkansas at Pine Bluff, Pine Bluff, AR [b]Department of Chemistry, Texas A&M University, College Station, TX

Single molecule magnets (SMMs) are a class of molecular compounds that manifest superparamagnetic behavior below a discrete blocking temperature. The development of research in the field of SMMs promises to engender essential advancements in diverse applications, such as data storage, molecular spintronic, and quantum computing. In this project, attempts to synthesize [Dy(hfac)3]2(bptz), [Dy(hfac)3]2(Me4bpym), and [Dy(hfac)3]2 (bmtz) (hfac = hexafluoroacetylacetonate, bptz = 3,6-bis(2pyridyl) - 1,2,4,5-tetrazine, bmtz = 3,6-bis(2-pyrimidyl)-1,2,4,5- tetrazine, Me4bpym = 4,4',6,6'-tetramethyl-2,2'- bipyrimidine) are described. Synthesis of the neutral and radical form of these compounds will facilitate an understanding of the effects the radicals will have on the strength of the large spin-orbit coupling properties of dysprosium. Once both are synthesized, the neutral compound will be used as a comparison to the radical compound to compare their magnetic responses directly. [Dy(hfac)3]2(bptz) compound was structurally characterized by X-ray crystallography and its SMM properties were magnetically characterized by the SQUID magnetometry.

presenting
11 am—12 pm

Hometown: Blytheville, AR (DS)

Synthesis and photocatalytic activity of cellulose-based carbonaceous nanocomposites toward organic pollutants

Dave Soni, Bijay P. Chhetri, Charlette Parnell, and Anindya Ghosh

Department of Chemistry, University of Arkansas at Little Rock, Little Rock, AR

Organic dyes are organic pollutants that cause environmental problems. Commonly used in the textile industries, 10-15 % of dyes are wasted and released with effluent into the water. To remediate the water of these pollutants, various materials, such as cellulose, can be used in filtration devices. We used cellulose, an abundant and renewable polymer, as a carbon source to generate carbonaceous nanocomposites. The materials were produced through solid state mixing of starting compounds and pyrolysis in a tube furnace under inert nitrogen atmosphere. We also synthesized different nanocomposite materials by changing the ratio of cellulose and nitrogen compounds. The doped materials were characterized and analyzed by SEM, TEM, XPS, and BET. The photocatalytic activity of the materials was measured under visible light using various organic dyes. Control studies of the nanocomposites in dye in the absence and presence of light were also performed and the photocatalytic activity measured with an ultraviolet-visible spectrophotometer. We found high levels of dye removal in the experimental studies compared to the controls. Studies with different pH conditions and kinetics studies were also conducted. Results indicated the N-doped cellulose nanocomposites are photocatalytically active towards organic dye removal from water. Therefore, integration of cellulose via a simple synthetic process is sufficient for dye removal and pollution mitigation from wastewater.

presenting
10 am—11 am

Hometown: Texarkana, TX (CC)

Synthesis and Analysis of Tautomerically Ambiguous Cytosine-Based Analogs to Induce Viral Mutagenesis

Carlie M. Clem, Vincent K. Dunlap

Henderson State University, Arkadelphia, AR

Harmful viruses have posed a threat to the human race for generations. In particular, the human immunodeficiency virus (HIV) has been notably damaging to the individual and society alike. Although drugs to treat HIV exist, they are harsh and often result in negative side effects. The low fidelity replication enzymes that the virus replicates with contributes to the relative success of the virus's ability to evade antiviral medications, but can be exploited to develop new antiviral agents. This research focuses on viral mutagenesis, or the introduction of intentional errors in the genome of the virus. These resulting mutations will lead the DNA to reach error catastrophe and ablate. The method by which error will occur is the assimilation of synthesized cytosine-based nucleosides with ambiguous hydrogen bonding faces resulting from tautomeric shift. These shifts will lead to the mispairing of DNA and a decrease in stability of the duplex molecule. Presented here are the details of the designed nucleosides' synthesis and spectroscopy, thermal stability of oligomers containing the nucleosides, and biological assays to demonstrate efficacy.

presenting
10 am—11 am

Hometown: Greenbrier, AR (ME)

Collection, Separation, and Assay of a Fat Mobilizing Substance

Madison Everett and Lance Benson

Harding University Department of Chemistry and Biochemistry, Searcy, Arkansas

FMS (fat mobilizing substance), a protein thought to be produced by the body in response to fasting, induces an accelerated rate of lipolysis and ketosis in order to substitute for the reduced caloric intake. While previous research has been done to identify the effects of FMS via injection into rodents and measuring loss of carcass fat, this study seeks to isolate FMS from the urine of human patients who have undergone the fasting process, initiating the production of the protein. For this research, we isolated crude FMS from urine through gel filtration, ion-exchange chromatography, and HPLC. The resultant purified protein was added to adipocytes to test for fat-mobilizing activity. Several fractions were identified to induce fat-mobilizing activity. We plan to sequence and analyze these fractions via bioinformatic methods. Determining the protein sequence could aid in future studies seeking to induce fat mobilizing activity without submitting subjects to a fasting state. Conversely, isolation of FMS may aid in treatment of patients suffering with lipodystrophy.

presenting
10 am—11 am

Hometown: Prairie Grove, AR (JJ)

A Versatile Raman Spectrometer Design

Jessica L. Johnson and Edmond W. Wilson, Jr.

Department of Chemistry and Biochemistry, Harding University, Searcy, AR

A versatile Raman Spectrometer has been designed and built for use on NASA Space Missions. In particular, for use in learning more about the solubilities of organic substances in Titan's liquid hydrocarbon lakes. Raman spectrometry has several advantages over the universally employed Fourier Transform Infrared spectrometer. Raman samples can be placed in glass instead of salt sample holders, water can be used as a solvent and the instrument can be miniaturized more easily. We describe a Raman spectrometer built in our laboratory that has many attractive features.

presenting
11 am—12 pm

Hometown: Greenwood, AR (CG)

Metagenomic DNA sequencing of bacteria from cave crickets reveals diverse and complex ecological relationships in an extreme environment

Caitlyn Gosch, Brooke Johnson, Brooke Jones, Dr. James Engman

Henderson State University Biology Department

Cave communities provide examples of organisms adapted to extreme environments. The unique adaptations of extremophiles make them excellent candidates for sources of novel biological compounds. We use molecular genetic techniques to survey the bacterial flora of Blanchard Springs Caverns, Arkansas, the most biologically diverse cave in the Ozark Plateau. Recent work concentrates on the flora of the cricket Ceuthophilus gracilipes. Cricket biomass constitutes a significant portion of available energy in the cave, making them a pivotal species in that ecosystem. No previous work on cave cricket microbes has been published. We examined the bacteria of the exoskeleton and the digestive system. Our initial techniques depended on culturing bacteria, and sequencing the DNA of colonies that grew. Recently, we have used metagenomic sequencing, eliminating the need for culturing. This has increased our species identified from 9 to over 200. We have also identified species from a store-bought cricket, giving us a comparison. Many of these have unique adaptations, and provide insight into the energetics and complexity of systems that have traditionally been considered very simple. Some bacteria from our samples have DNA sequences distinct enough from those published to be considered new species.

presenting
11 am—12 pm

Hometown: Dardanelle, AR (EF)
Danville, AR (KC)
Russellville, AR (CC)
Lamar, AR (JK) Oden, AR (MN)

Isolation of Antibiotic Converting/ Enhancing Microbes From Soil

Elvys Ferrufino-Mejia, Katie Crawford, Cody Campbell, Joyce Kuykendall, Melanie Norman, and Scott Kirkconnell

Biology Department, Arkansas Tech University, Russellville, AR

Antibiotic resistance has been a problem since the first of these wonder drugs were developed in the early 1900s, with 2 million in the U.S. falling ill and 23,000 dying from infections by such microbes in 2013. Our studies are directed at using novel methods to isolate soil microbes that produce compounds which either enhance or convert existing antibiotics so that resistant microbes can be killed or inhibited. Progressively higher resistance levels were established in *Pseudomonas aeruginosa, Pseudomonas fluorescenes,* and *Serratia marcescens*. These resistant strains were used to identify soil microbes that enhance effectiveness of the antibiotic against the resistant strains.

presenting
11 am—12 pm

Hometown: Hot Springs, AR (CM)
St. Louis, MO (AP)

Peanut: A Source of Bioactive Compounds for the Prevention and Treatment of Obesity

Christine Matei, Alexis Philippe, Carson Day, Tianhong Yang, Lingling Fang, Luis Nopo-Olazabal and Fabricio Medina-Bolivar

Arkansas Biosciences Institute and Department of Biological Sciences, Arkansas State University, Jonesboro, Arkansas

Obesity has become a major public health concern because of its several associated medical complications. Importantly, Arkansas ranks among the states with the highest rates of obesity. Because of these health concerns, there is an urgent need to identify strategies that prevent and treat this growing health threat. This project aimed to produce and purify stilbenoids from hairy roots cultures of peanut and evaluate their anti-obesity properties using an in vitro cell culture model. Our results showed that selected prenylated stilbenoids exhibited the highest anti-adipocytic activity and could be further explored as a potential anti-obesity compounds.

presenting
11 am—12 pm

Hometown: Russellville, AR (JS)

Expression of Mycoplasma genes in the Striped Bark Scorpion, Centruroides vittatus

Joshua Sumers, Tsunemi Yamashita

Arkansas Tech University, Russellville, AR
Department of Biological Sciences, Arkansas Tech University, Russellville, AR

Mycoplasma bacteria are the smallest of the bacterial cells, distinguished for lacking a cell wall. This lack of a cell wall decreases the effectiveness of modern antibiotics, because these antibiotics target and disrupt cell wall synthesis in order to eliminate bacteria. Mycoplasma are considered cellular parasites, which can be found in livestock, reptiles (eg. Boa constrictor), and humans, resulting in atypical pneumonia and can potentially cause Chronic Fatigue Syndrome and rheumatoid arthritis. During the preliminary genome sequencing of the Striped Bark Scorpion (Centruroides vittatus), we identified three genes (Mycoplasma gyrase A, Atpase B, and RPO) of an unknown and undescribed species of Mycoplasma. We tested for these genes in Striped Bark Scorpions that were collected from the Arkansas River Valley in Arkansas, as well as the Rio Grande and Bonham areas of Texas. The study uses DNA that was extracted from both live and alcohol preserved specimens of C. vittatus using a DNA extraction kit, amplifying these genes using PCR, and running them through Gel Electrophoresis for eventual DNA sequencing. We plan that further research with this project will help us understand the evolution of these Mycoplasma as well as potentially help with treatment of these bacteria in the future.

presenting
11 am—12 pm

Hometown: Russellville, AR (AB)

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

Aimee Bowman, Taylor Bishop, Cody Chivers, Tsunemi Yamashita

Arkansas Tech University, Russellville, AR

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. This study specifically focused on gathering relative quantification data for one neurotoxin in particular, a sodium β toxin variant which alters the kinetics of sodium channel gating in cells where is has been injected, that is produced by the striped bark scorpion Centruroides vittatus. The mechanism by which this was accomplished is called quantitative real-time polymerase chain reaction, or qRT-PCR. The reference gene chosen for this experiment was Ribosomal Protein L 19 and the target gene, named 668, was specifically designed for the gene in question. Preliminary experiments have been conducted and the threshold values yielded from these have been computationally analyzed through the ΔΔCt method which has generated a tentative ratio of activity for this gene variant. The goal of this study was to determine the level of expression of the sodium toxin gene in the telson gland relative to body tissue so that we are better able to understand the moderately toxic effects of this organism comparative to similar organisms.

presenting
10 am—11 am

Hometown: Conway, AR (HK)

Using genomics approaches to study formation of nodule-like structures in land plants

Ha Ram Kim[1], Jackie Thomas[1], Ryan Hiltenbrand[1], Hannah McCarthy[1], Ashley Spurr[1], Karl Dykema[2], Megan Bowman[2], Hamilton Newhart[1], Alexander Howell[1], David Zimulinda[1], Mary Winn[2], Arijit Mukherjee[1]

[1]Department of Biology, University of Central Arkansas, AR
[2]Bioinformatics and Biostatistics Core, Van Andel Research Institute, MI

Legume-rhizobia symbiosis is the most efficient plant-microbe association in which the bacteria fix atmospheric nitrogen for the plant inside specialized root structures, *nodules*. Unfortunately, this is a very species-specific interaction and does not occur in cereals (rice, corn, etc.). Therefore, major agronomic crops are heavily dependent on fertilizers for their nitrogen needs. Our lab established an efficient and high-throughput experimental system to induce the formation of nodule-like structures (NLS) on roots of land plants even in the absence of bacteria. Our results suggest that NLS formation follow a similar developmental program in land plants. Importantly, nitrogen-fixing bacteria can colonize these structures. We are using comparative genomic approaches to identify differentially regulated genes in model grasses, rice and *Brachypodium distachyon,* during NLS formation. We identified several key genes that are involved in anatomical structure development and morphogenesis, cell growth, and regulation of anatomical structure size. Future studies will focus on identifying the genetic switches that control this important process in grasses. We believe these findings will have important implications towards improving nitrogen fixation in non-legumes, especially cereals. This will benefit agriculture not just in Arkansas, but also in the US and beyond.

presenting
10 am—11 am

Hometown: Little Rock, AR (CB)

The Effects of Glucose on the Lifespan of Long-lived *Caenorhabditis elegans*

Caitlyn Barthol, Melina Norris, Dr. Mindy Farris

Department of Biology, University of Central Arkansas, Conway, AR

Diets that are high in glucose have been associated with obesity, type 2 diabetes and cardiovascular diseases, all of which are among leading causes of death in the United States, especially in Arkansas. It is unclear, however, how high levels of glucose accelerate these diseases and in turn decrease lifespan. To study these effects, the model organism *Caenorhabditis elegans* was used due to its striking ability to recapitulate physiological functions of humans, such as susceptibility to glucose toxicity. Lifespans of the wild-type (N2) and *eat-2* mutant strains of *C. elegans* were measured on normal growth media (NGM) and on NGM with glucose (2.5M) added. The mutation in *eat-2* induces dietary restriction, which has been shown to increase lifespan in this species. It was predicted that the N2 and *eat-2 C. elegans* under the effect of glucose would exhibit shorter lifespans than those that were lacking glucose because of glucose's detrimental effects on diet. When glucose was added, a decrease in lifespan indeed occurred. However, when exposed to severe heat stress the addition of glucose led to an extended lifespan in N2 and *eat-2* strains. We show that glucose enrichment may be beneficial under conditions of acute stress.

presenting
11 am—12 pm

Hometown: Jacksonville, AR (KG)

The Toxicity of Nanomaterials in Breast Cancer Cells

Kristen Gregory, Vijayalakshmi Dantuluri, and Zeid Nima

Center for Integrative Nanotechnology Sciences, University of Arkansas at Little Rock, Little Rock, AR

Breast cancer is the second leading cause of cancer deaths in women and kills 40,000 women in the United States each year. Two important risk factors for developing breast cancer are age and family history. The stage of breast cancer determines the treatment a woman receives and can include: chemotherapy, radiation, and surgery. Chemotherapy and radiation have many side effects because they also kill noncancerous cells. With current treatments, there is a chance that cancer cells will persist. Our hypothesis was that nanomaterials can be effective in killing breast cancer cells. We tested the effectiveness of three types of nanomaterials in killing breast cancer cells. Our methods involved culturing breast cancer cells (Cell line MCF7) for 24 hours with different concentrations of low-oxidized graphene, high-oxidized graphene, and gold nanorods. We measured cell growth at three, six, and 24 hours. Our results showed that cell proliferation decreased for all three nanomaterials and as the concentration of nanomaterials increased. The low-oxidized graphene treatment was most effective in killing breast cancer cells. In conclusion, a high concentration of nanomaterials especially low-oxidized graphene will likely decrease cancer cell proliferation. Further work should test a longer time span, different concentrations, and different cancer cell lines.

presenting
11 am—12 pm

Hometown: Maumelle, AR (AH)
Mountain View, AR (KB)

Steroid Signaling Mediates Longevity Responses to Dietary Restriction in *C. elegans*

Ashley Henderson, Christian Mendelez, Kaitlynn Butler, Dr. Mindy Farris

Department of Biology, University of Central Arkansas, Conway, AR

Caenorhabditis elegans is an excellent model for longevity experimentation and has an extended lifespan under dietary restriction (DR) conditions. Additionally, their stress response as a function of age can be measured. We studied DR and heat stress applied to young (1 day old) wild type (N2) worms and mutants in an isoform of 3β-hydroxysteroid dehydrogenase, hsd-3. It was previously shown that worms exposed to a heat stressor exhibit increased thermotolerance under DR using bacterial deprivation (BD), compared to media with a bacterial food source (E. coli). BD conditions can be technically difficult, with worms lost to non-age-related deaths. We used a novel alternative method: minimal media (MM) lacking peptone. We compared lifespans and heat stress resistance for N2 and hsd-3 worms using regular media and MM, with and without E. coli. We found N2 had shorter mean lifespans than hsd-3 on the BD plates, although not statistically significant. Surprisingly, the fed hsd-3 worms lived longer than the hsd-3 worms under DR, suggesting that hsd-3 may be required for DR-mediated lifespan extension. In addition to showing the effects of hsd-3 signaling in DR pathways, we show that the MM condition is comparable to BD, and easier to use in the laboratory.

presenting
11 am—12 pm

Hometown: Beebe, AR (EL)

Uses and Benefits of the MultispeQ to Better Understand the Physiology of Arabidopsis Plants Grown Under Abiotic Stress Conditions

Erin Langley[A], Lucia Acosta Gamboa[A], Argelia Lorence[A,B]

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Because of rising world population, there is a search for strategies that will allow identification of plant varieties that can thrive under abiotic and biotic stresses that are currently limiting plant productivity. The Kramer Laboratory at Michigan State has developed a handheld fluorometer called MultispeQ, a low-cost, non-invasive, open-source instrument that allows quantification of key photosynthetic parameters and simultaneous recording of environmental conditions. This instrument is contributing to fast and easy data gathering of plants grown in laboratory, greenhouse and field conditions. The data gathered is collected in photosynq.org, allowing standardizing, analyzing, and sharing of data among users. We demonstrate the utility and benefits of the MultispeQ prototype to measure photosynthetic efficiency in Arabidopsis plants exposed to water limitation conditions in a growth chamber setting. Wild type Arabidopsis plants were grown under different regimes (100%, 50%, 25%, and 12.5% soil saturation) and the photosynthetic efficiency was measured with the MultispeQ daily. The data obtained showed reduced photosynthetic efficiency in plants grown under lower water availability conditions before there were visible symptoms of plant stress. The incorporation of this instrument in our high throughput phenotyping experiments is helping us better understand plant physiology and measure photosynthetic efficiency under variable conditions.

presenting
10 am—11 am

Hometown: Kirby, AR (HD)

Characterization of Collagen of the Extracellular Matrix of Freshwater Sponge

Hannah Deputy[1,4], Aaron Fidler[1,2], B.A., Carl Darris[1,2], Ph.D., James Engman[4], Ph.D., Julie Hudson[1,3], MD, MA, Billy G. Hudson[1,2], Ph.D.

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The transition from single-cell organisms towards multicellularity was one of the most important events in animal evolution. An extracellular matrix (ECM) innovation enabled the transition, forming complex tissues and organs. Yet, its mechanisms remain unclear. To shed light on these mechanisms, we sought to characterize the collagens of ECM of freshwater sponge (Demosponge), one of the most primitive of extant animals. Demosponge ECM is composed of spongin short-chain collagen (SSCC), a variant of vertebrate collagen IV. Because of the structural similarity of certain regions (domains) on collagen IV and on SSCC, we hypothesized that JK2 antibody, which detects the collagen domain across a wide variety of animals, would bind SSCC in Western blot analyses. Indeed, Spongilla domains bound JK2 antibody and have similar sizes to that of bovine collagen IV, but the banding pattern was distinct. Protein chromatography (FPLC) was used to determine if Spongilla domains formed structures analogous to those of collagen IV. We conclude that SSCC of freshwater sponge displays similar but distinct properties of collagen IV from vertebrate ECM. Further studies may shed light on the evolutionary relationship between them and may provide an understanding of the fundamental mechanisms by which these collagens function in normal tissues and dysfunction in human diseases.

presenting
11 am—12 pm

Hometown: Jonesboro, AR (AW)

Analysis of the Acute Toxicity of Shark Defense Repellent

Ania C. Welman, and Richard S. Grippo

Department of Biological Sciences, Arkansas State University, Jonesboro, AR

The threat of shark attack is a continuing concern to those who use the ocean for economic and recreational purposes (surfers, divers, snorkelers, paddleboarders), including many Arkansans. Previous electrical, magnetic, mechanical, and chemical shark repellents have not been consistently effective. A chemical shark repellent, based on the odor of decomposing sharks, has recently been developed by Shark Defense Technologies (SharkTec) and found to be highly effective for repelling sharks. The manufacturer claims that the repellent "does not harm sharks or wildlife and is safe for the environment." However, no scientific literature supports this assertion. This project tested the hypothesis that SharkTec is non-toxic to wildlife using a standard toxicity test organism (water flea). Range-finding tests were employed to determine the likely range of the LC50 (concentration lethal to 50% of exposed organisms, a standard measure of toxicity), which was found to be between 0.075% and 0.422% by volume. Subsequent duplicated definitive standardized toxicity tests, following US EPA protocols, were used to determine the LC50 as 0.16% ± 0.03%. Further analyses determined the Maximum Allowable Toxicant Concentration (MATC) of 0.143%. These results suggest that this repellant may have significant environmental impacts at extremely low concentrations and should be investigated further.

presenting
10 am—11 am

Hometown: Russellville, AR (WH)
Hot Springs, AR (KB)
North Little Rock, AR (NG)
Rogers, AR (KB)

Investigating Neuronal Differentiation and Growth on Extracellular Matrices

Will Hanna[a], Kori Bullard[a], Nolan Games, Kesley, Brown[a], Morgan Lynch[a], Mackenzie Daughert-y[a] Anindya Ghosh[b], Alexandru Biris[b], Mathai Srivatsan[c] and Nathan Reyna[a]

[a]Ouachita Baptist University, Arkadelphia, AR
[b]University of Arkansas, Little Rock, Little Rock, AR
[c]Arkansas State University, Jonesboro AR

As result of joining the AR-EPSCoR funded Center for Advanced Surface Engineering (CASE) team**,** research at Ouachita Baptist University has begun to explore the role of nano-structures as cellular growth matrices that can be used in regenerative medicine. Currently we are working with guar gum, a plant-derived thermostable polymer that has medical applications as a three-dimensional extracellular matrix that may improve neuron regeneration. Our research in this area has a multifaceted approach. It begins with students in the classroom investigating the role of various growth factors and signaling mechanisms on peripheral neuron (PC12) differentiation and growth. Class results are then used to create student-driven individual research projects that incorporate guar gum as an extracellular matrix. Guar is not currently grown in Arkansas; however, it is ideally suited for our environment and could serve as a high value specialty crop. Further, due to the collaborative nature of our grant we are able to directly connect undergraduate students from AR with graduate programs in the state and further increase the biomedical research infrastructure**.**

presenting
10 am—11 am

Hometown: Monticello, AR (HK)

Regeneration in the Nervous System: Possible Cure for Paralysis?

Hannah Kling[a,b], Sahitya Chetan Pandanaboina[a,b], Malathi Srivatsan[a,b]

[a]Department of Biological Sciences and [b]Arkansas Biosciences Institute, Arkansas State University, Jonesboro, AR

The profuse network of cells and fibers in central nervous system (CNS) that connects and coordinates all bodily functions are derived from Neural Progenitor or Neural Stem Cells (NPC's/ NSC's) having the ability to differentiate into functional neurons. During injury to CNS and neurodegenerative disorders, neurons become prematurely dead or damaged resulting in irreversible functional loss because unlike other cells, neurons do not divide to replace dead neurons. Current challenges in NSC research are: specificity of neural differentiation, making functional connections of newly differentiated neurons to preexisting adult neurons and increasing the number of newly differentiated neurons from progenitor cells. Hence the aims of this study were to increase the number of differentiating neurons at a faster rate by using engineered nanomaterial surfaces, and differentiation factors (conditioned medium, small molecules and enzymes) using rat NSCs. Our cell culture, immunocytochemistry and quantitation experiments show that vascular endothelial cell- conditioned medium, serum devoid of exosomes and the enzyme acetylcholinesterase increased the number of differentiated neurons compared to controls as early as in one week. The implications of this study are far reaching since one day we will be able to transplant functional neurons to restore function lost permanently due to injuries or degeneration.

presenting
11 am—12 pm

Hometown: Alma, AR (NT)

Land-use and Ecosystem Services Costs of Unconventional Oil and Gas in the U.S.

Matthew D. Moran, Nathan T. Taylor, Tabitha F. Mullins, Sehrish S. Sardar, and Maureen. R. McClung

Hendrix College Biology Department, Conway, AR

The dramatic expansion of unconventional oil and gas development in the United States has been controversial because of numerous environmental and social issues, including the conversion, fragmentation, and degradation of natural habitats. Here we describe land-use impacts and ecosystem services costs of recent energy development in the eight major unconventional oil and gas production regions of the U.S. From 2004-2015, there were over 200,000 hectares of land developed or modified. By 2015, the estimated annual ecosystem services costs of this habitat change had risen to 272 million USD, which resulted in a cumulative total of almost 1.4 billion USD, costs that were concentrated in deciduous forest and grasslands/pastures. Depending on future well drilling rates, cumulative ecosystem services costs projected to the year 2040 range from 9.4 billion USD to 31.9 billion USD. These environmental and economic impacts should be considered when governments perform cost-benefit analyses and create regulatory oversight.

presenting
11 am—12 pm

Hometown: Fayetteville, AR (BS)

American Military Children: Discovering Consequences of Trauma and its Biological Effects upon Brain Development

Brianne Smith-Brown, Dr. Shelli Henehan

[a]University of Arkansas – Fort Smith, Fort Smith, AR
[b]College of STEM: School of Education, University of Arkansas – Fort Smith

American military families and their children endure a wide range of consequences that the general public is scarcely aware of, including Arkansans. School systems, educators, and politicians especially require expansive knowledge and understanding of military children's developmental needs in order to promote healthier learning and growth. The military lifestyle not only entails stressors such as deployments, frequent relocations, PTSD, and casualties, but also incredibly higher divorce rates among its spouses. These stressful events leave an imprint on the stress-sensitive cortical and limbic regions of the brain, which can impact the child's ability to regulate stress later in life.Stress this critical, and consistent results in imprints upon the stress-sensitive cortical and limbic regions of the brain. Considering children's brain development is critical during early years and adolescence, this variety of stress imprinting may impact a child's ability to regulate and respond efficiently to stress later in life. The Broca's and Wierneke's areas of the brain, responsible for the development of language and speech processing, may be altered with the secretion of stress hormones as a result of major trauma. Every school district in the United States houses at least ONE military child facing this stress, and Arkansas is no exception.

presenting
11 am—12 pm

Hometown: Berryville, AR (SR)

Mangroves as Nurseries for Caribbean Coral Reef Fish?

Samantha M. Richter, and Richard S. Grippo

Department of Biological Sciences, Arkansas State University, Jonesboro, AR

Coral reefs support the highest diversity of fish on the globe and are of great ecological interest and economic value to tourists, including Arkansans. A recently discovered factor supporting high biodiversity on coral reefs is the use of shoreline mangrove forests as nurseries for coral reef fishes, with the juvenile reef fishes hiding in the tangled prop-roots. This phenomena has been documented on Indo-Pacific reefs, but not yet on Caribbean reefs. We tested whether fish populations on reefs nearer to mangroves forests (<2 km away) were more similar to mangrove fish populations than on reefs at further distances (>5 km away) and thus indicate a supportive relationship between mangroves and corals. Surveys of fish populations on St. John, US Virgin Islands were conducted at mangrove sites, 'near reef' sites, and 'far reef' sites. Similarity, biodiversity, and species richness indices were calculated and compared among the three types of sites. There were no statistically significant differences found in similarity and diversity among the sites, but species richness in the far sites was significantly higher than the mangrove sites. Our results do not support the mangroves as coral reef nurseries hypothesis and suggest other influences on fish populations on Caribbean coral reefs.

presenting
11 am—12 pm

Hometown: Little Rock, AR (AG)

Characterization of an influenza infection model in porcine airway epithelial

Aliyah Glover[a], J Bartlett[b], P. McCray, Jr.[b]

[a]Department of Biology, University of Arkansas at Pine Bluff, Pine Bluff, AR [b]Department of Microbiology University of Iowa, Iowa City, IA

Cystic fibrosis (CF) is an autosomal recessive disease caused by mutations in the gene encoding the cystic fibrosis transmembrane conductance regulator (CFTR). Our goal is to develop an infection model using influenza to study the antiviral responses of cultured airway epithelia from CF and non-CF pigs. Influenza causes acute respiratory infections responsible for seasonal epidemics and occasional pandemics. In a previous study, it was demonstrated that CF airway cells have a delayed/reduced immune response to influenza A infection. We hypothesized that influenza A would have a dose-dependent ability to infect and replicate in well-differentiated primary cultures of airway epithelia from wild-type pigs. We assessed viral infection/replication by performing western blot analysis on the cell lysates. Additionally, we assessed viral replication by performing plaque assays to detect shed virus in the apical washes. The viral infection model developed will help gain insight into antiviral host defense mechanisms in CF airways.

presenting
10 am—11 am

Hometown: Opelousas, LA (BL)

Sewer Effluent in Our Streams: Can aquatic communities survive?

Brittany Lognio, Latonya Jackson, Ph.D.

Department of Biology, Division of Natural and Physical Sciences, Philander Smith College

Domestic sewage effluents represent one of the most common causes of degradation of water quality in stream ecosystems. The effects are especially relevant in ecosystems where water is scarce.

The objectives of this study were to examine the response of the macroinvertebrate community to a STP input in an urban stream during summer when the dilution capacity of streams is lowest and discharge of point sources has higher adverse effects. Effects of the point source on the structure and functional organization of the benthic macroinvertebrate community were examined 500 meters both upstream and downstream of the STP input. Results showed that community dynamics were different at the effluent outflow point compared to the upstream and downstream locations. There was also lower diversity at both the downstream and outflow locations. There was a significant difference in diversity between the upstream and downstream locations. We noted that the greatest abundance of organisms was seen at the outflow point while the least amount of organisms were recorded at the downstream sight. This difference in abundance was significant when compared to the upstream and downstream sites. This suggests that toxicity from sewer effluent does negatively affect community diversity, assemblage and abundance.

presenting
10 am—11 am

Hometown: Conway, AR (LA)
Hot Springs, AR (LW)
Ruston, LA (DP)

Antibiotic Production by Soil Bacteria

Lizzy Adams, Lainey Weatherford, Devin Price, Dr. Ruth Plymale

Biology Department, Ouachita Baptist University, Arkadelphia, AR

Most antibiotics are microbial natural products or semisynthetic derivatives of these products. We identified soil bacteria secreting antibiotic compound(s) that inhibit the growth of the bacterium *Bacillus subtilis*. Since bacteria may be induced to produce antibiotics by stress, such as high population density or limited nutrients, we documented antibiotic production at different bacterial growth phases and across a range of glucose and peptone levels. Further, because antibiotic-producing bacteria are resistant to their own antibiotics, we determined the resistance range of each antibiotic-producing bacterium to selected commercial antibiotics.

presenting
10 am—11 am

Hometown: Benton, AR (JP)

The Use of Ligation Independent Cloining to generate *Escherichia Coli.* Vectors capable of producing Scorpion β-Toxin, as seen in *Centruroides Vittatus,* to allow for further Structural and Physiological Analysis

Jacob Pinkerton, Sara Warrick, David Ryan Williams, Dr. Tsunemi Yamashita

Arkansas Tech University, Russellville, Arkansas

The nervous system is the primary target for the venom produced by Centruroides vittatus, the striped bark scorpion. This organism produces a sodium β-toxin that affects the proper functioning of voltage-gated sodium channels of its victims initiating action potentials in excitable cells. The toxin proteins inhibit the flow of Na^{+}, causing an electrochemical imbalance of the cell. The ultimate goal of this research is to isolate and produce a scorpion β-toxin via protein overexpression, thus understanding how sodium channel toxin variants, labeled Na^{654} and Na^{667}, interact with specific sodium channels. Our research includes producing recombinant plasmids encompassing the gene coding for the β-toxin. In order to develop distinct and specialized vector-compatible overhangs, a purified PCR product was created. The Ek/LIC vector was then annealed and transformed into competent E. coli cells. We will then assess the cell lines to determine over-expression intensities. Once the β-toxin is successfully isolated, future research will include further analysis on substantial samples and an evaluation of protein to determine proteomic 3D structure and specific function. As sodium channels have medical importance, this project can provide further molecular details regarding sodium channel function and their interactions with toxins.

presenting
10 am—11 am

Hometown: West Memphis, AR (BH)
Benton, AR (JE)

Understanding the Role of Exosome Signaling on Cell Growth

Buzz Hardin[a], Jake Edmonson[a], Raj Kore[b], Rob Griffin[b], Nathan Reyna[a]

[a]Ouachtia Baptist University, Arkadelphia AR
[b]University of Arkansas for Medical Sciences, Little Rock AR

In 2015 Ouachita Baptist University (OBU) joined the AR -EPSCoR-funded Center for Advanced Surface Engineering (CASE) team. CASE is a multi-institutional grant that is intended to increase STEM related jobs in the state. Our role on this project is to use RNA sequencing and gene expression assays to help understand the genetic signals involved with neuronal differentiation on engineered surfaces. Students at OBU are looking at the role of exosomes in neuron gene expression. Unlike other cells in our body, when neurons are damaged they cannot be replaced, and the result is loss of feeling or motor control. Exosomes are small membrane-bound vesicles released by cells that carry genetic material and may act as a cell signaling mechanism controlling the differentiation of surrounding cells. Glioma cells (U87) were treated with a neural growth factor, either tumor necrosis factor-alpha (TNF-a) or cytokinin (IC-IB), or they were grown under hypoxic conditions. Exosomes from treated cells were then isolated and added back to untreated U87 cells. Global gene expression analysis was then conducted to identify novel signaling pathways. By taking a multidisciplinary approach that incorporates bioinformatics with newly available RNA sequencing technology, we can help to strengthen the innovative pipeline in our state and directly connect our undergraduate students with graduate programs in AR.

presenting
10 am—11 am

Hometown: Pine Bluff, AR (AH and MM)

The Genetic Code: Pathways of the 20 Standard Amino Acids

Annette Hall-Craig, Makonnen A. Morehead, J.C. Onyilagha

Department of Biology, University of Arkansas at Pine Bluff, Pine Bluff, AR

Our research goal here is to update scientific knowledge on the emergence of a standard alphabet of 20 genetically encoded amino acids. The objectives are to explore the current assertion that the standard amino acid alphabet comprises a mixture of "early" versus "late" members; that is, some amino acids were available prebiotically and were therefore present from the start of genetic coding; others evolved later, as "inventions" of early metabolism; and analyze the metabolic pathways at work in living organisms so as to provide evidence based information into ancient molecular evolution, such as the steps by which life's biochemical framework first emerged. Based on available new research data, we have produced new and/or updated pathways of biosynthesis of each of the 20 standard amino acids of the genetic code. We found that biosynthetic steps in many of the late amino acids are longer than those in the early ones, and longer step means the involvement of many more enzymes. Again, synthesis of some late amino acids is not "a one-way traffic" from early members because some late amino acids can give rise to some early amino acids through well-defined pathways.

presenting
10 am—11 am

Hometown: Hermitage, AR (DB)

Effects of Short-term Oral Metformin on Tumor Biomarkers in Endometrial Carcinoma

Dustin Brown[1], Yanquing Yang[2], Alexander F. Burnett[3], Lorenzo Fernandes[4] and Rosalia C.M. Simmen[2, 5]

University of Arkansas-Little Rock[1]; Departments of Physiology & Biophysics[2] and Obstetrics & Gynecology[3], Interdisciplinary Biomedical Sciences[4] and the Winthrop P Rockefeller Cancer Institute[5], University of Arkansas for Medical Sciences, Little Rock. AR

The anti-diabetic drug metformin has recently attracted interest due to its anti-metastatic effects in pre-clinical studies and its potential to decrease risk of cancer occurrence in patients with diabetes. In this randomized pilot study, we sought to investigate the pre-surgical effects of short-term oral metformin on biomarkers of tumor growth. Obese (BMI≥30) non-diabetic women diagnosed with grade 1-2 adenocarcinoma of the endometrium and consenting to the study were randomly assigned to receive 500 mg metformin twice a day for 14 days, followed by 850 mg metformin twice a day for 14 days or no drug during the pre-surgical window between diagnosis and hysterectomy. Fixed tumor tissues were analyzed for cellular markers of proliferation (Ki67), apoptosis (TUNEL), and for expression of estrogen receptor alpha (ERα), progesterone receptor (PR), and tumor suppressors PTEN and Krüppel-like factor 9 (KLF9) in tumor epithelial and stromal cells. Metformin treatment was associated with higher PR, and KLF9 and lower ERα immunoreactivities in glandular epithelial cells. Metformin treatment also was associated with higher PTEN immunoreactivities in stromal epithelial cells. While more patients are required to definitively evaluate the clinical relevance of these initial findings, the cellular changes are consistent with the anti-cancer actions of metformin.

presenting
10 am—11 am

Hometown: Lake Village, AR (TS)

Impact of Neighborhood Disorder amongst African American Women in Baltimore, MD

Tredijah Sykes[a], Jamila Stockman[b], Jacquelyn Campbell[b], Andrea Cimino[b],

[a]Department of Biology, University of Arkansas at Pine Bluff, Pine Bluff, AR [b]School of Nursing, Johns Hopkins University, Baltimore, MD

Forced sex by a male partner or non-partner disproportionately affects African American women. Baltimore has been named one of the top 10 most HIV impacted areas in the United States. Despite the vast research on forced sex and cortisol levels, no studies have examined potentially modifiable environmental characteristics as contributors to forced sex specifically or the effect of the stress-response resulting from a history of forced sex on HIV risk and STI infection, accounting for environmental factors. The purpose of this project is to examine the relationship between neighborhood disorders and cortisol awakening response and using this information to determine whether that relationship differs between African American women exposed and unexposed to forced sex. Participants were recruited from local STD clinics to screen for eligibility to participate in the study. If eligible, the participants took a survey about their sexual history and saliva samples collected. Regression analyses as well as scatterplots show there is no significant correlation between perceived neighborhood disorder and CAR levels, for either group. The second scatterplot proved that though visually there is a difference, there is no significant correlation between perceived neighborhood disorder and perceived stress level.

presenting
10 am—11 am

Hometown: Puerto Rico (AC)
Little Rock, AR (DB)

DNA Sequence Analysis of Freshwater Eustigmatophyceae from Diverse Locations Reveals Exciting New Taxa

Alice M. Cardona-Otero, Destiny N. Boullie, Lauren A. Morgan, Marvin W. Fawley, and Karen P. Fawley

School of Math and Natural Sciences, University of Arkansas at Monticello, Arkansas.

The algal class Eustigmatophyceae is distinguished from other stramenopile algae by fine structural features and pigment composition. Eustigmatophyceae are found in freshwater, terrestrial, and soil habitats. Until very recently this unique group of coccoid microalgae was considered to have low diversity; however, we recently demonstrated the presence of a new ordinal-level lineage, the clade Goniochloridales. There are well supported lineages in the Goniochloridales that we referred to as Clade IIa, Clade IIb and Clade IIc. In this study, we examined the diversity of Clade IIa. New strains were isolated from sites in Arkansas, Michigan, Minnesota and the Czech Republic. We examined 36 strains using analysis of plastid rbcL sequences and light microscopy. Phylogenetic analysis of the sequence data indicated 19 phylotypes among the 31 strains that are members of Clade IIa. Most of these strains do not match any existing genera and species in the Eustigmatophyceae or Xanthophyceae. The exception is a strain that we identified as Tetraëdriella subglobosa, which had previously been placed in the Xanthophyceae. Our results indicate the presence of multiple lineages within Clade IIa that we will describe as new genera.

presenting
10 am—11 am

Hometown: Monticello, AR (CT)

Comparison of Insectivory by Birds in Urban and Rural Habitat

C. Miguel Taylor[a], Jeffrey A. Stratford[b], and John L. Hunt[a]

[a]University of Arkansas at Monticello, School of Mathematical and Natural Sciences, 397 University Drive, Monticello, AR
[b]Wilkes University, 210 Cohen Science Center, Wilkes University, PA

It has been demonstrated that abundance and species diversity of native birds is lower in urban areas than in rural areas. However, it is unknown how lower abundance and species diversity affect ecosystem services normally provided by these birds. For example, few studies have investigated the effects of urbanization on insectivory (the eating of insects by birds). As part of a larger study, we compared rates of insectivory in urban, rural, and intermediate settings in southeastern Arkansas by using clay models of caterpillars. Transects were constructed consisting of 25 clay models randomly placed among foliage along 50-meter lines. Two transects each were deployed in urban, rural, and intermediate settings. Clay models were left in place for one week, and were then checked for signs of attempted predation. Our results will be combined with those from several other study sites in the eastern United States for statistical analysis. However, in our local area, we seemed to find no significant differences between the habitat types.

presenting
11 am—12 pm

Hometown: Houma, LA (BL)

Assessing the Efficacy of MAPK, AKT, and mTOR Inhibitor Treatments in Novel Cellular Models of Papillary and Follicular Thyroid Cancer

Brianna LeBoeuf and Laura MacDonald

Department of Biology, Hendrix College, Conway, AR

Thyroid cancer is the most common endocrine malignancy, and has been increasing since the 1970s. Worldwide incidence is expected to exceed colon cancer by 2030. The most common types of thyroid cancer are papillary thyroid cancer and follicular thyroid cancer, each of which is associated with different mutations, pathology, and metastasis. Thyroid cancer is typically treated through removal of the thyroid and radioactive iodine ablation of remaining tumor cells. Conventional treatment is nearly 99% effective for individuals with well-differentiated cancer, however, patients receive lifelong thyroid hormone replacement therapy resulting in reduced quality of life. This approach is not effective for individuals with poorly differentiated or anaplastic thyroid cancer, and few chemotherapeutics are available for these patients. These observations highlight a need for increased evaluation of inhibitors for development of chemotherapies. We evaluated the effects of MAPK, AKT, and mTOR inhibitors on cellular proliferation in cellular models of papillary and follicular thyroid cancer. We determined accurate concentrations for these inhibitors using a recent technique that calculates concentrations correcting for cellular growth rates. Additionally, we noted that these inhibitors were more effective used in combination, and assessed the efficacy of alternating use to potentially reduce combination drug therapy associated cytotoxicity.

presenting
11 am—12 pm

Hometown: Fort Smith, AR (MH)

Charged residues located on a small region on the side of the nucleosome influence proper interactions between the transcription elongation factor Spt16 and transcribed genes in S. cerevisiae.

Michelle Huynh, Jacob Pierce, Catey May, Alex B. Cox, Ryan Banning, Eugene Nyamugenda, Sarah Marshall, and Andrea A. Duina

Biology Department, Hendrix College, Conway, AR

During the elongation step of gene transcription, the FACT complex is one of several factors that assist RNA polymerase (Pol II) to ensure accurate and efficient production of RNA molecules. FACT helps remove histone proteins in front of Pol II and facilitate histone reassembly into nucleosomes following Pol II passage. We previously identified three histone residues - H3-L61, H4-R36, and H4-K31 - that are important for ensuring proper interactions between FACT and transcribed genes. Specifically, they cause a dramatic shift in FACT occupancy towards the 3' ends of genes. Interestingly, these three histone residues are located in close proximity on the nucleosome. Based on these and other results, we hypothesize that a nucleosomal region encompassing these residues is involved in interactions with Spt16 that are important for proper Spt16 dissociation from the ends of genes following transcription. To better characterize this nucleosomal region, we have tested the effects of additional histone mutations on Spt16-gene interactions. Mutations in certain charged amino acids near the H3-L61/H4-R36 location significantly perturb interactions between Spt16 and the PMA1 and FBA1 genes. These results suggest that the nucleosomal charge landscape at and in the vicinity of the H3 -L61/H4-R36 location is important for ensuring proper Spt16-gene interactions.

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