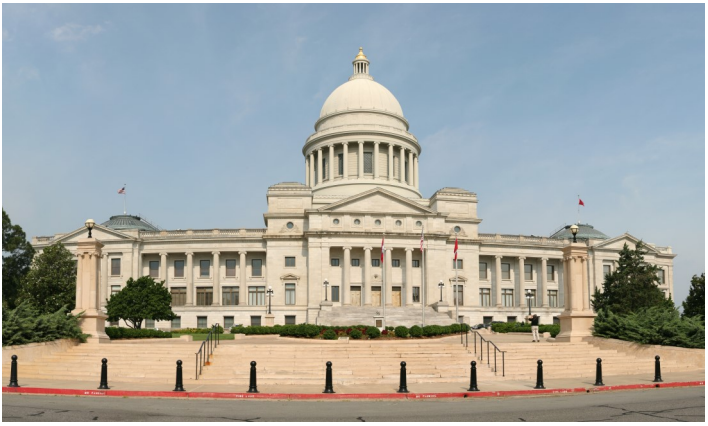
# STEM
# Posters at the Capitol



## February 20, 2019

"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 18 Arkansas colleges and universities**
- **Presenting 70 different posters of original work**
- **Encompassing all aspects of natural science and math**


STATE
ARKANSAS STATE
UNIVERSITY


1871
UNIVERSITY OF
ARKANSAS


1890
HENDERSON
STATE UNIVERSITY


OUACHITA
BAPTIST UNIVERSITY


1876
HENDRIX


ARKANSAS
TECH
UNIVERSITY


UNIVERSITY OF
CENTRAL
ARKANSAS


UALR
UNIVERSITY OF ARKANSAS
AT LITTLE ROCK


UNIVERSITY
of ARKANSAS
AT PINE BLUFF
1873


UAM
THE UNIVERSITY OF ARKANSAS AT MONTICELLO
MONTICELLO • CROSSETT • MCGEHEE


LYON
COLLEGE


JOHN BROWN
UNIVERSITY


CENTRAL
BAPTIST COLLEGE


PHILANDER
SMITH COLLEGE
EST 1877


UAFS
UNIVERSITY OF ARKANSAS
FORT SMITH


SOUTHERN
ARKANSAS
UNIVERSITY


HARDING
UNIVERSITY

STEM Posters at the capitol

# 35 Posters Presented from 11 am—12 pm

**11 am Poster number**……..page for abstract

STEM Posters at the capitol

# 35 Posters Presented from 12 pm—1 pm

**12 pm Poster number**……..page for abstract

Student presenter (school) …..page with abstract

Student presenter (school) …..page with abstract

**presenting**
**12 pm-1 pm**

County: Benton

# Assessing Cuticular Hydrocarbons in *Rhagoletis pomonella*

Melanie Beehler[1], Jackson Jennings[2], William Etges[2]

[1]Lyon College, Batesville, AR 72501
[2]Department of Biological Sciences, University of Arkansas, Fayetteville, AR 72701

Commonly referred to as the apple maggot fly, *Rhagoletis pomonella* has been a pest for farmers' apple crops since the 1860s. Before the introduction of apples to North America, *Rhagoletis pomonella* preferred hawthorn berries as their host plant. Since the majority of flies exhibit host plant affinity, switching to a new plant was unusual and may even indicate speciation. This is a type of sympatric speciation, or development of a new species with no geographical barriers. *Rhagoletis pomonella*, like most flies, emit a waxy substance comprised of hydrocarbons. These cuticular hydrocarbons serve many functions ranging from prevention of desiccation to acting as pheromones for potential mates. However, the cuticular hydrocarbon profile of *Rhagoletis pomonella* has not been investigated previously. By identifying the compounds present and assessing the differences between host plant, location, and sex, a holistic view is created. According to our Multivariate Analysis of Variance Results (MANOVA), significant differences were found for population, sex, host, and population x sex. Significant differences lead to evidence of speciation between *Rhagoletis pomonella* apple flies versus hawthorn flies.

**presenting**
**12 pm-1 pm**

County: Searcy

# Plant Natural Products as a Potential Treatment for Triple Negative Breast Cancer

Hailey Campbell[1], Sepideh Mohammadhosseinpour[2] and Fabricio Medina-Bolivar[1,3].
[1]Arkansas Biosciences Institute, Arkansas State University, Jonesboro, Arkansas.
[2]Molecular Biosciences Graduate Program, Arkansas State University, Jonesboro, Arkansas.
[3]Department of Biological Sciences, Arkansas State University, Jonesboro, Arkansas.

Breast cancer is the most common type of cancer in women worldwide. In Arkansas alone, there are on average 2,160 cases per year. The most deadly type of breast cancer is triple negative, which does not respond to most hormonal treatments. There is an ongoing search for new treatments to increase survival rates for this disease. One potential source of new drugs is the peanut plant. Using "immortalized" peanut roots called hairy roots, a group of anticancer compounds known as stilbenoids can be produced in large quantities. Stilbenoids are produced naturally by the peanut plant when it is stressed. In the laboratory, stilbenoids can be produced by exposing peanut hairy roots cultures to certain chemicals to induce a stress response. We have shown that prenylated stilbenoids extracted from the hairy root cultures show cytotoxicity in triple negative breast cancer cells. Interestingly, the prenyl unit appears to enhance the cytotoxicity of these compounds. Current studies focus on elucidating the signaling pathways affected by these compounds in order to advance our understanding of the anticancer mechanism of these natural products. Research funded by the Arkansas Biosciences Institute.

**presenting**
**11 am-12 pm**

County: Jefferson

# Expression and Purification of Reovirus Protein σ1s

LeKivia Cobb[1], Karl W. Boehme[2]

[1]University of Arkansas at Pine Bluff
[2]University of Arkansas for Medical Sciences, AR

Mammalian orthoreovirus (reovirus) is a segmented double-stranded RNA virus that infects a wide range of hosts, including humans. Although most people become infected during early childhood, the majority infections are subclinical. However, reovirus is associated with disease in immunocompromised individuals and has recently been linked to the development of celiac disease. The goal of our work is to understand the viral determinants that underlie efficient reovirus replication. Previous work from our laboratory revealed that reovirus non-structural protein σ1s facilitates reovirus replication by promoting viral protein synthesis. However, the mechanism by which σ1s enhances reovirus protein synthesis is not known. One of the major roadblocks to understanding σ1s function is the lack of an antibody to detect σ1s. The goal of my project is to synthesize recombinant σ1s protein to use as an antigen for antibody production. Our approach is to use an inducible bacterial expression system to produce the σ1s protein. Past attempts to purify σ1s failed because the full-length protein was insoluble. Here, we divided the protein into two sections, an N -terminal fragment and a C-terminal fragment. We hypothesize that one half will be soluble and amenable to purification. The fragments were cloned into an IPTG-inducible system and 6x His or GST tags were added to facilitate purification. Under normal conditions σ1s is not synthesized, but after addition of IPTG σ1s will be produced. We will assess the induction and solubility of N- and C- terminal fragments of σ1s from two different reovirus strains, type 1 Long (T1L) and type 3 Dearing (T3D). For those constructs that are soluble, we will attempt to purify the protein using nickel- or GST- affinity chromatography. Once the protein is purified, it will be injected into rats to create an antibody that can be used for studies of σ1s. This reagent will help provide insight into how reoviruses translate their proteins in host cells.

**presenting**
**11 am-12 pm**

County: Jefferson

# Serotonin induced vasoconstriction in rat mesenteric arteries

Madison Craig, Robin Jamie Dalton, M.S., M.S.E

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

Systemic hypertension is a leading cause of stokes in Arkansas. This research is focused on a possible cause of vasoconstriction which can lead to hypertension. Previous research suggests that sphingosylphosphorylcholine (SPC) induces vasocontraction of rat mesenteric arteries and voltage-gated calcium entry into vascular smooth muscle via NADPH oxidase 1 (NOX1) and reactive oxygen species (ROS) through phospholipase C (PLC) and protein kinase C epsilon (PKCε) -dependent activation. Similarities with other studies indicate that other Gq protein coupled -receptors (GqPCR) associated with the activation of PLC and PLC-coupled agonists could elicit the same effect with significant implications for vascular regulation and disease. The purpose of this study is to determine if serotonin induced vasoconstriction will occur in rat mesenteric arteries and if it activates the same pathway.

Like SPC, serotonin is released from activated platelets and is known to activate the 5-Hydroxytryptamine$_{2A}$ receptor-coupled PLC pathway. Also, serotonin is known to elicit vasoconstriction in mammary arteries and coronary arteries. For these reasons, we hypothesize that serotonin may follow the same PLC activated pathway as SPC, and that it might also potentiate vasoconstriction in mesenteric arteries. Elucidating the specific pathway for vasoconstriction in mesenteric arteries can lead to drug development to block the pathway and reduce systemic hypertension.

**presenting**
**12 pm-1 pm**

County: Faulkner

# Surveying variability in cyanide production of White Clover (*Trifolium repens*) across an urbanization gradient in Little Rock, Arkansas and Memphis, Tennessee

Savannah Draud, Tristian Wiles , and Adam Schneider

Biology Department, Hendrix College, Conway, AR

White clover (*T. repens*) populations are distinguished by the presence or absence of the ability to produce cyanide as a defense against herbivory (i.e. cyanogenesis). Previous analyses of clover populations in other major cities have shown evidence of cyanogenic clines with respect to urbanization. In this study we sampled individuals from 35 white clover populations across a transect from the inner city of Little Rock, Arkansas to the rural outskirts of its suburbs and 50 populations across a similar transect in Memphis, Tennessee. Individuals from each population were screened for cyanogenesis using the Feigl-Anger assay. We determined the fraction of cyanogenic clover per population in relation to distance from each city center. We also compared our data to previously collected data from other cities to gain a greater understanding of the influence of urbanization on the evolution of clover cyanogenic clines across eastern North America. Locally, using white clover as a model organism, our results are important for recognizing patterns of defense in other plants in the mid-southern part of the United States.

**presenting**
**11 am-12 pm**

County: Pulaski

# Relative Gene Expression Study on *Centruroides vittatus* Investigating Sodium Toxin Gene Activity

Chloe Fitzgerald,[a] John Sisco [a], Samantha Chick [a], Ashlyn Tedder,[a] Alyssa Kool,[a] Taylor Bishop,[a] Aimee Bowman,[a] Cody Chivers,[a] Tsunemi Yamashita[a,b]

[a]Arkansas Tech University, Russellville, AR
[b]INBRE

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

**presenting**
**11 am –12 pm**

County: Saline

# The Role of AFD Gap Junctions in *C. elegans* Magnetotaxis Behavior

Ploy Freebairn , Brenda Houck

Biology Department, Hendrix College, Conway, AR

Magnetoreception is defined as an organism's ability to utilize geomagnetic fields to assist in navigation and spatial orientation. *C. elegans* is thought to have magnetoreceptive abilities that assist in self-positioning during burrowing as well as in basic navigation. Previous research shows that two sensory neurons (RAFD and LAFD) are necessary for correct magnetotaxis behavior (Vidal-Gadea et al., 2015). In an attempt to determine the role of gap junctions in the magnetoreception circuit, we tested the ability of mutant worms to perform magnetotaxis behavior. We employed mutant strains lacking the necessary innexin proteins for gap junction formation, specifically the inx-19 knockout mutant, as it is the only innexin protein found in AFD neurons. Inx-19 mutant worms were exposed to magnetic fields, their movements recorded, and magnetic and polarity indices calculated. Results were compared to wild type and control strains. We have found that in the absence of inx-19, mutant worms differ in their ability to move toward or away from the magnetic field and in their polarity when compared to wild type worms.

**presenting**
**11 am-12 pm**

County: Clark

# MEMBRANE TARGETED YFP SENSOR OF VOLUME REGULATED ANION CHANNELS

Shiloh Goecke[1,2]; Eric Figueroa, B.S.[3]; Jerod Denton, Ph D.[3,4]

[1]Aspirnaut™, Vanderbilt University Medical Center, Nashville, Tennessee, USA; [2]Henderson State University, Arkadelphia, Arkansas, USA; [3]Department of Pharmacology, Vanderbilt University Medical Center, Nashville, Tennessee, USA; [4]Department of Anesthesiology, Vanderbilt University Medical Center, Nashville, Tennessee, USA;

Cells critically regulate their volume in response to hypotonic cell swelling by transporting chloride and small organic osmolytes out of the cell through volume regulated anion channels (VRACs). VRACs are ubiquitously expressed in mammalian cells and have been implicated in diverse cellular functions in addition to cell volume regulation, including endothelial cell calcium signaling and pancreatic beta cell insulin secretion. The lack of potent and specific pharmacological tool compounds represents a critical barrier to evaluating the integrative physiology and therapeutic potential of VRACs. We, therefore, developed a fluorescence-based assay for high-throughput screening (HTS) to identify novel inhibitors of native VRACs expressed in HEK-293 cells. Briefly, HEK-293 cells express a halide-sensitive YFP mutant termed Ozzy. The assay measures the quenching of intracellular Ozzy by iodide influx through VRACs activated by hypotonic-induced cell swelling. Small-molecule inhibitors should block the iodide-induced quenching of Ozzy. The major goal of this project is to compare the pharmacological sensitivity of assays based on soluble Ozzy and an Ozzy variant targeted to the cell membrane where VRACs reside. Our preliminary results report no difference in Pranlukast-dependent inhibition of VRAC between the soluble and membrane-bound Ozzy quenching assays, having an IC50 of 4.4uM and 4.6uM, respectively.

**presenting**
**11 am-12pm**

County: Saline

# Lysogenic host bacterium alters infectivity of *Gordonia* bacteriophage

Gracie Jones, Hayden Bowman, Dr Nathan Reyna, and Dr Ruth Plymale

Ouachita Baptist University

Bacteriophage and their bacterial hosts are constantly interacting in nature, each striving for the reproduction of its own genome. Through these interactions, the bacteriophage and host bacteria promote change in one another; thus, understanding these interactions is necessary to developing a more complete picture of natural phage ecology. We have observed the *in vitro* ability of lysogenic host bacteria to alter the infectivity of progeny virions, and suggest that this differential infectivity is due to changes in protein expression or post-transcriptional modification rather than genetic mutation. Bacteriophage infecting *Gordonia terrae* 3612 or *Gordonia rubripertincta* NRRL B-16540 were isolated from soil samples and the host range of each phage was determined. Most phage were able to infect both *Gordonia* species but displayed a higher plating efficiency on the isolation host. During the host range screening process, we observed lysogen formation by *G. terrae* bacteriophage DelRio and Ruthy on both *G. terrae* and *G. rubripertincta.* We harvested virions from all four lysogens—*G. terrae* (DelRio), *G. rubripertincta* (DelRio), *G. terrae* (Ruthy), and *G. rubripertincta* (Ruthy)—and plated them on both *Gordonia* species. Lysogen bacterial species had a marked influenced on infectivity, with virions isolated from *G. terrae* lysogens exhibiting a drastic reduction in plating efficiency on *G. rubripertincta*, whereas virions derived from *G. rubripertincta* lysogens infected both *G. terrae* and *G. rubripertincta* with similar plating efficiency. This differential infectivity was observed immediately after lysogen creation, suggesting host-induced impacts to phage protein expression or post-transcriptional modification rather than phage genome sequence. Virions harvested from each lysogen are being analyzed using mass spectrometry and results of that analysis will be presented.

**presenting**
**12 pm-1 pm**

County: Pope

# Proteomics of carbon dioxide uptake in *Ht. neapolitanus*

Maria Marasco, David Proffitt, Ilerioluwa Sowande, & Newton P. Hilliard Jr.

Dept. of Physical Sciences, Arkansas Tech University, Russellville, AR

*Halothiobacillus neapolitanus* is a carbon fixing, sulfur-oxidizing microbe unique in its ability to utilize oxidation of a wide variety of sulfur containing compounds to provide energy for carbon dioxide sequestration and fixation. GeLC-MS/MS proteomics of cultures grown utilizing 5mM bicarbonate vs 5% $CO_2$(g) as carbon source clearly demonstrate changes in cellular levels of proteins associated with; the energy producing/sulfur oxidation, carbon uptake/fixation and protein production/stabilization pathways. Of the two putative bicarbonate membrane transporters, only the two-subunit transporter located at gene loci Hneap 0210/0211 shows any significant change in cellular level with an increase with an approximate 4-fold increase when grown using carbon dioxide gas as DIC. This is accompanied by an apparent switch from RuBisCO form II to RuBisCo form I under these conditions. Other than sqrF, soxYZ and soxCD proteins from sulfur oxidation pathways follow a general pattern of increased levels in the presence of bicarbonate. Cytoplasmic chaperone proteins groS, groL, dnaJ and dnaK show moderate decreases even though extracytoplasmic counterparts surA and ompH increase. The ability of the proteomics technique to accurately detect changes in cellular protein levels associated with growth conditions allows the technique to be used to determine optimum conditions for sulfide remediation and carbon dioxide fixation.

**presenting**
**12 pm-1 pm**

County: Craighead

# Biomass-derived Water-Splitting Nanocatalysts Nickel Iron Oxides for Hydrogen Production

Olgaaurora Rodriguez, Emily Anderson, Daniel Nde, Shanzhi Wang, and Wei Zhao

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

Earth-abundant biomass such as algae, cyanobacteria, and silkworm-produced silk and wastes may offer renewable and sustainable nanostructural materials for hydrogen production, an alternative solution to solve the fossil fuel issues. Carbon nanostructures derived from biomass could be an attractive water-splitting catalyst when embedded with nanoscale transition metal oxides. A water-splitting reaction is divided into two half reactions that consist of production of hydrogen (hydrogen evolution reaction, HER) and oxygen (oxygen evolution reaction, OER). Aside from cost effectiveness and abundant availability, however, meeting the aspects of high catalytic efficiency is still challenging. In this work, we report nanostructural NiFe oxides $NiFeO_x$ grown on three-dimensional (3D) carbon nanostructures as efficient OER electrocatalysts. Silk worms ingested with different amounts of Ni and Fe ions were grown and the wastes were collected and treated with pyrolysis to form 3D carbon nanostructures where metal oxides $NiFeO_x$ were embedded. The structures of the composites were measured by scanning electron microscopy and X-ray diffraction analysis. The OER electrocatalytic properties were studied by cyclic voltammetry and linear sweep voltammetry. This research may offer new opportunities using the abundant biomass resources in Arkansas for energy-related applications.

**presenting**
**12 pm-1 pm**

County: Faulkner

# 1-Benzyl-3-Aminopyrrolidine (R,S) Abuse Potential

Sasin Payakachat[1], William E. Fantegrossi[2]

[1]Biochemistry and Molecular Biology Program, Hendrix College, Conway, AR, [2]Department of Pharmacology and Toxicology, University of Arkansas for Medical
Sciences, Little Rock, AR

1-benzylpiperazine (BZP) is a research chemical with psychostimulant effects. In the early 2000s its usage become wide spread in New Zealand as a legal alternative to MDMA. 1-Benzyl-3-Aminopyrrolidine (BZAP) could have similar drug abuse potential because of two reasons: its structural similarity to BZP and the possibility of BZAP metabolizing into BZP. The drug abuse potential of BZAP has not been previously assessed in any models. In this regard, BZAP was assessed for psychostimulant effects in mice. Mice in the experiment underwent telemetry probe surgeries tomonitor their temperature and locomotor activity. Those same mice were subcutaneously injected with increasing doses of BZAP. BZAP did not induce increased locomotor activity in mice at any dose before their LD-50 was reached. There was a dose dependent, temporary hypothermic effect on the mice. The results of the experiment suggest that BZAP has no psychostimulant effects and has no abuse potential.

**presenting**
**12 pm-1 pm**

County: Craighead

# Sexual Assault and Emergency Department Nurses

Brooks J. Propst,[a] Krista Snellgrove,[b] Mollie Manning,[b] Sarah Davidson[b]

[a]Arkansas State University, Jonesboro, AR
[b]Emergency Department, St Bernards Healthcare, Jonesboro, AR

Sexual assault is a major topic of discussion in current media. Because of this, nurses should emphasize extreme importance on their personal perceptions of victims of sexual assault. The emergency room staff is typically the first to have reports of this type of assault. People who come to the hospital are expecting the best care to be provided. But, previous studies have shown that many emergency room staff are reluctant to care for this population due to the forensic aspect of the exam that is needed, and insecurities related to the topic of sexual assault. To address this topic, the researcher sought to determine if sexual assault experiences, whether personal or professional, affects the care that is delivered by emergency room nurses towards patients that are victims of sexual assault. Throughout the survey, questions related to experience as a sexual assault nurse examiner, experience with sexual violence, and morale questions were asked. This research should impact nurses and victims of sexual assault. The care provided to this patient population in Arkansas and throughout the United States is of extreme importance to prevent PTSD and further feelings of revictimization.

**presenting**
**11 am-12 pm**

County: Clark

# Light Effects on *Arthrospira platensis* and *Dictyostelium Discoideum*

Jonathan Rankin, Madison Morrison, and Dr. Jim Taylor

Ouachita Baptist University, Arkadelphia, Arkansas

In the age of advancing technology with thoughts of long term space travel on the horizon, determining how astronauts will obtain food, oxygen, and live in low gravity environments is more relevant than ever. Plants would serve these functions well, but it must first be determined how to cultivate them in the conditions which they would be under. In this study, effects of light intensity and wavelength are examined on a cyanobacteria model system, *Arthrospira platensis* and a fungal model system, *Dictyostelium discoideum.* Additionally, the effects of gravity are studied on *Dictyostelium discoideum.* Preliminary results indicate that red-blue light has the most significant effect on *D. discoideum*, followed by blue light, and finally red light. Results also indicate that gravity does indeed have an effect on the organism, as those in conditions simulating antigravity showed considerably less/more random movement than controls which were stationary in normal gravitational conditions. In *A. platensis,* it was found that higher intensity light will result in greater oxygen production, while a lower intensity light appeared to result in a higher rate of population growth.

**presenting**
**11 am-12 pm**

County: Chicot

# Effects of isolevuglandin, a highly reactive lipid dicarbonyl, on modifying apolipoprotein A-1 and phosphatidylethanolamine in synthetic high-density lipoprotein

Leah Rowe, [a] Linda S. May-Zhang,[b] Sean S. Davies[b]

[a] University of Arkansas at Pine Bluff, Pine Bluff, AR
[b] Department of Pharmacology, Vanderbilt University, Nashville, TN

While cardiovascular disease (CVD) is inversely associated with high density lipoprotein cholesterol (HDL-C), pharmacological interventions aimed to increase HDL-C have failed to reduce disease risk. Recent evidence suggest that CVD risk is more closely related to HDL function than HDL-C. In CVD, increased oxidative stress generates reactive lipid species that alter HDL function. Our laboratory has recently reported that isolevuglandins (IsoLGs), highly reactive lipid dicarbonyls generated in parallel to isoprostanes, cause deleterious consequences to HDL structure and function, including rendering macrophages more inflammatory [May-Zhang LS, et al. (2018) *J Biol Chem*, 293: 9176-9187]. Whether this gain-of-function is due to modification of proteins versus lipid in HDL is unknown. Since IsoLG modified phosphatidylethanolamines (PEs) are reported to activate macrophages [Guo L, et al. (2015) *Antioxid Redox Signal,* 22: 1633-1645], we hypothesize that IsoLG modification of PE in HDL creates an inflammatory particle. The aim of this study is to determine the differential effects of modified apoA-I versus PE on particle size, composition, and function using synthetically engineered HDL. **Methods:** Experimental groups of synthetic HDL particles with IsoLG modified ApoA-I and/or PE compared with unmodified particles as controls were engineered from recombinant ApoA-I, phosphatidylcholine, and free cholesterol, and PE.

**presenting**
**12 pm-1 pm**

County: Crittenden

# "Arkansas wildflower honey is as effective as Manuka honey for the inhibition of antibiotic resistance bacteria."

Shivange Satishbhai, Samantha Hewett, Kari K. Naylor

Department of Biology, University of Central Arkansas, Conway AR

Postoperative infections are a major issue in US hospitals, with high antibiotic resistance rates and accounting for roughly 20% of all hospital-acquired infections yearly. Wound-infecting bacteria in particular have a high rate of drug resistance (up to 85%) and thus complicate and potentiate surgical site treatment. Honey (especially Manuka honey) has been shown in recent research to inhibit several bacterial species. In this study, we demonstrated the ability of several alternative honey types, including raw Arkansas wildflower honeys, to inhibit the growth of bacterial species that are specifically implicated in resistant wound infections and declared by WHO to be in critical need of a new antibiotic. Our results suggest that Manuka honey when compared to other honey types are not statistically different in bacterial inhibition, except against *K. pneumoniae*, where Manuka honey is only more effective than packaged store-bought wildflower. These results could transform wound care in the United States, where Manuka honey can be expensive and difficult to obtain, and where antibiotic resistance remains a troubling concern for surgical site treatment.

**presenting**
**11 am—12 pm**

County: Faulkner

# The impact of *Arabidopsis* light signaling research on cancer

Austin Smith, Kassidy Irwin, Mi-seon Seong

Department of Math and Science, Central Baptist College, Conway, AR

Photomorphogenesis is the light regulated plant development where the growth patterns of organisms respond to different light signals. Photomorphogenesis involves the inhibition of stem elongation, the variation of chloroplasts, growth of chlorophyll, as well as the expansion of leaves. The discovery of light signaling pathway components such as the Constitutively Photomorphogenic1 (COP1) E3 ubiquitin ligase and Constitutively Photomorphogenic9 (COP9) signalosome (CSN) have increased our understanding of protein degradation and the regulation of p53, the mostly mutated tumor suppressor protein in human cancers.

In eukaryotic cells, the Ubiquitin Proteasome System is a key mechanism of selective protein degradation using polyubiquitin as a marker on a target protein. COP1 protein, an E3 ubiquitin ligase, transfers ubiquitin to a p53 protein. It is present at the high level in 81% of breast and 44% of ovarian adenocarcinoma, suggesting the high level of COP1 accelerates the degradation of p53 protein in cancers and inhibits the tumor suppressor function of p53 such as apoptosis and DNA repair.

Presented here are the initial discoveries of COP1 and COP9 signalosome and their relationships with cancer, and our study on one of F-box proteins in *Arabidopsis*.

**presenting**
**12 pm-1 pm**

County: Sebastian

# Standardization of Immunoperoxidase monolayer assay (IPMA) to determine *Lawsonia intracellularis specific immunoglobulin A (IgA) titer in tissue lysates as a measure of mucosal immune response*

Kaitlyn Pflugradt, Ivan Still, Mrigendra Rajput

Department of Biological Sciences, Arkansas Tech University, Russellville, AR, 72801

The majority of pathogens enter into the body through mucous membranes such as those of the gastrointestinal tract, respiratory tract or urogenital tract. An effective mucosal immune response not only destroys the invading pathogens but also neutralizes them before their entry to the host body. Currently, the majority of research measures the mucosal immune response either against an antigen (pathogen) that is administered parentally (by injection) or through total immunoglobulin A (IgA), total or pathogen-specific IgG. In the current study, we standardized an immunoperoxidase monolayer assay (IPMA) which specifically measures *Lawsonia intracellularis* (an intracellular bacteria) IgA antibody in a mucosal tissue lysate.

We orally administered Enterisol® Ileitis vaccine containing live attenuated *L. intracellularis* in twenty-six days old pigs. The *L. intracellularis*-specific IgA antibody was measured in small intestine tissue lysates. Our results showed a significant increase in *L. intracellularis*-specific IgA titer within two weeks of vaccination.

The current standardized protocol could be used to measure the vaccine response against *L. intracellularis* in pigs as well as in research projects which measure the effect of various factors such as stress, nutrition etc. on mucosal immune response in pigs as an animal model.

**presenting**
**11 am-12 pm**

Hometown: Little Rock, AR

# Improving Aquaculture Catfish Health with a Novel Plant-Produced Therapeutic Protein

Madalyn Weiner[1,3], Lana Elkins[2,3], Maureen C. Dolan[1,2,3]

[1]Department of Biological Sciences, [2]Molecular Biosciences Program and [3]Arkansas Biosciences Institute, Arkansas State University, Jonesboro, Arkansas

Arkansas is the birthplace of aquaculture, which includes commercial farming of fish in ponds and tanks. Despite continuing improvements in fish health management, farmed fish remain susceptible to disease that result in economic loses to the farmer. Antibiotics are commonly used to manage disease outbreaks; however, increasing concerns of antibiotic resistance with negative consequences on humans and the environment have emerged. Our lab is working on technology for producing a catfish protein therapeutic as a safer alternative to antibiotics that when delivered by immersion or medicated feed could "naturally" boost the fish's immune system. Plants can be used as biofactories for producing complex proteins like catfish interleukin-22 (IL-22). However the natural instability of IL22 protein results in it quickly being degrading in the harsh aquaculture environment. Therefore this protein therapy was engineered with a partner protein, RTB, to enhance the stability and uptake of the IL22 therapeutic into fish gill epithelial cells. Preliminary data indicates IL22-RTB can be made in plants and successfully triggers an immune response in channel catfish cells used as a model system for testing. Catfish IL22-RTB therapeutic may provide a sustainable, alternative method for limiting disease in aquaculture, benefitting the state of Arkansas economically and ecologically.

**presenting**
**11am-12pm**

County: Jefferson

# Development of a High Throughput Method to Quantify Chalkiness in Milled Rice

Aylin Villalpa-Arroyo1, Chandler Wilson[1,2], Zachary Campbell[1], Nirman Nepal[1], and Argelia Lorence[1,3]

[1]Arkansas Biosciences Institute, Arkansas State University, Jonesboro, AR; [2]University of Arkansas, Pine Bluff, AR; [3]Department of Chemistry and Physics, State University, AR

Chalkiness, the presence of white spots in rice grains, is a major problem for rice producers because it reduces the appearance, milling quality, and the overall price of the grain. Chalkiness is caused by low starch levels in rice kernels. Along with starch levels, the amount of ascorbate a plant biosynthesizes plays a major role in chalkiness. It has been demonstrated that lowering ascorbate content in rice leads to plants with increase grain chalkiness. We hypothesize that increasing ascorbate content in rice will reduce chalk levels. A pre-requisite for testing this hypothesis is for us to develop a method to accurately quantify chalkiness in milled rice. High throughput digital phenotyping technologies permit detailed characterization of seed physical characteristics without risking seed breakage. Using a Scanalyzer HTS system, a high throughput platform, in this work we were able to phenotype multiple rice accessions with known low or high chalkiness using visible, fluorescence, and near infrared cameras. Algorithms were developed to analyze the acquired images with LemnaGrid, a commercial software. Our results indicate that acquiring seed images under a dark background significantly increased the accuracy of chalkiness quantification. The next step on this project will be to test if the high ascorbate lines the Lorence Laboratory has already developed indeed have lower grain chalkiness.

**presenting**
**12pm-1pm**

County: Sebastian

# Controlling the magnetic properties of iron so it can replace costly rare earth metals in high-tech applications

Ali Abdulrahim, Patrick Desrochers

Department of Chemistry, University of Central Arkansas, Conway, AR 72035

Rare earth metals play a pivotal role in the operation of many high tech devices, including computer hard drives, compact speakers and microphones in cell phones, catalytic converters in cars, and even in the medical field as MRI contrast agents. However, these metals are not widely produced in the United States; importing them from other countries has proved to be a challenge based on limit of resources and price. These metals are very expensive because of their high demand and low availability. Other metals like iron, cobalt, and nickel exhibit magnetic properties like rare earth metals, however they need to be tuned for these properties. Iron's magnetism if controlled in the right environment, could give magnetism with similar performance of a rare earth metal, and iron is a fraction of the price of these rare earth metals. Our research focuses on using molecular anchors bonded to different metals to control magnetic properties of cheaper metals. Our goal is to be able to control the magnetic properties of iron to make it a viable replacement to some rare earth metals, thereby cutting down the cost, and providing an alternative selection of resources.

**presenting**
**11am-12pm**

County: Lonoke

# Iron Content in Dried Fruit Chips Versus Pureed Baby Food

Whitney Austin, Victoria Hardin, and Gija Geme

Department of Biochemistry and Chemistry, Natural Resource Research Center, Southern Arkansas University, Magnolia, AR.

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

**presenting**
**12pm-1pm**

County: Sebastian

# Delineating the Structural Forces Responsible for the High Stability and Enhanced Activity of FGF-1 Double Mutant, R136EK126N

Chynna Denham, Shilpi Agrawal, and T.K.S. Kumar

Department of Chemistry and Biochemistry, University of Arkansas, Fayetteville, AR

Fibroblast growth factor (FGF-1) is a powerful and crucial protein involved in angiogenesis and wound healing that has a relatively short half-life and poor thermal stability. The aim of this project is to establish the effect of the double mutation on the structural forces that contribute to the high stability and enhanced function of FGF1-R136EK126N. However, with deliberate amino acid sequence modification, it was shown that the mutant protein exhibits higher thermal stability along with enhanced wound healing ability. This higher stability implicates the possibility of the use of this FGF-1 mutant in pharmaceutical wound healing medications that can be used globally, including countries that do not have access to the cold storage that is currently needed to store and preserve the protein. The effects of the amino acid mutations on the structural forces of the protein were studied by defining the effects of the double mutations at R136EK126N on the secondary and tertiary structure of FGF-1. Understanding how the structural forces in the FGF1-R136EK126N mutant interact to stabilize and strengthen protein function will greatly help in eventually developing a pharmaceutical form of this protein that can help patients with a variety of ailments.

**presenting**
**11am-12pm**

County: Hempstead

# Analysis of run-off water from the local car washes

Jada Fricks and Gija Geme

Department of Biochemistry and Chemistry, Natural Resource Research Center, Southern Arkansas University, Magnolia, AR.

Local municipalities have the responsibility to ensure that all water collected from streets, gutters and drainage ditches do not impair the quality of receiving waters such as our lakes, streams and aquifers.
The pollutant of concern in this study was oil and grease, which is found in the effluent from car washing. Car washing is a non-point source of discharge that has the ability to capture oil and grease that undergo treatment before it is released into our sanitary systems. Data was collected from two self-service car washes in Magnolia, AR in spring of 2018 and fall 2018. The grab samples were collected, preserved with hydrochloric acid and later analyzed using EPA method 1664A. The preliminary data showed that oil and grease concentrations varied from 1.12 mg/L to 17.8 mg/L. Along with samples, blanks and standards were also analyzed. Finally, initial temperature and pH were measured during sampling at both locations.
The collected results from the run –off were compared to oil and grease concentrations in Magnolia, AR influent.

**presenting**
**11am-12pm**

County: Saline

# Identification of Fat Mobilizing Substance (FMS) and Comparison of Lipolytic Activity in Urine of Fasting and Non-Fasting Humans via HPLC

Jake A. Garner; Cindy L. White, PhD.

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

A Fat-Mobilizing Substance (FMS) has been identified in the urine of individuals with lipodystrophy or who have fasted for 36 hours. If identified, this protein could be studied further to reduce the effects of lipodystrophy. Furthermore, being able to create a protein that helps in the bread-down of body fat, without disrupting the body's protein composition, could be a big step in fighting the obesity epidemic that Arkansas is facing today.

**presenting**
**11am-12pm**

County: Pulaski

# Potential role of IgG Effector Functions Mediating Vaccine Efficacy against Oxycodone

Kristen Gregory[ab], April Husbey Kelcher[c] and Marco Pravetoni[cd]

[a]University of Arkansas at Little Rock, [b]University of Minnesota, College of Medicine, Department of Pharmacology, PharmacoNeuroImmunology Program, [c]Hennepin Healthcare Research Institute , [d]Dept. of Medicine and Pharmacology, Center for Immunology, University of Minnesota

Opioid use disorders (OUD) and fatal overdoses are a national crisis in the United States. Current treatments for OUD show sub-optimal efficacy. Vaccines against opioids could be a promising novel therapeutic strategy. Vaccines elicit opioid-specific antibodies that reduce opioid effects in the brain. Vaccines may be used to treat OUD and reduce fatal overdoses. Our lab has found that blockage of interleukin 4 (IL-4) increases vaccine efficacy against oxycodone by altering the quality of the antibody response in mice. This study tests the role of IgG antibody subclasses in mice treated with an oxycodone vaccine combined with an anti-IL-4 monoclonal antibody (mAb). Experiments focused on in vivo and in vitro assessments of IgG-mediated phagocytosis of oxycodone-antibody immune complexes. Here, we initially focused on the role of Fcγ receptor III (FcγRIII), which are expressed on macrophages and monocytes. To this end, wild-type and FcγRIII knock-out (-/-) mice were immunized with an oxycodone vaccine in combination with an anti-IL-4 mAb. Immunized FcγRIII-/- mice showed higher oxycodone-specific IgG titers than wild-type mice, but did not show altered vaccine efficacy. Additionally, we did not observe IgG-mediated phagocytosis of oxycodone-specific antibodies in vitro. Future studies will test the role of other Fcγ receptors (I, II, and IV), or other effector mechanism, in removal of antibody bound opioid or other drugs of abuse.

**presenting**
**12pm-1pm**

County: Benton

# Solvation Studies of Urea and the Halide Series in Water

Eliza Hanson, Dr. Jill Ellenbarger

Department of Chemistry, John Brown University, Siloam Springs AR

Water contamination by various anions can cause long-term health effects. Due to the global prevalence of these health effects, the current research project promotes the development of inexpensive, urea-based detectors of anionic water contamination. Urea has been selected as a lead molecule because it forms multiple hydrogen-bonding interactions with anions. This project seeks to understand urea's behavior when solvated, aided by the use of both implicit and explicit solvation models in order to determine ultimate performance of the sensor in water. The solvation energies of several small, neutral molecules and anions were calculated using a series of implicit solvation models (SMD, PCM, and IEFPCM). The SMD model resulted in particularly precise solvation energies that had fair agreement with experimental results. The importance of the initial interaction distance of urea-chloride complexes in implicit solvent models was explored, and the resulting complexes showed that the anion could end up at a variable and often inaccurate distance from urea depending on the initial urea-chloride interaction distance. These studies inspired further research into exactly how the continuum model differs from the reported energies, and motivated the modeling of urea through an explicit solvation model.

**presenting**
**12pm-1pm**

County: Faulkner

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

Hailey Hayes, Rebecca Parham, Karen Morris, Henry Dana, Cayman Botner, Megan Cassingham, and Courtney D. Hatch

Chemistry Department, Hendrix College, Conway, AR

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

**presenting**
**11am-12pm**

County: Lonoke

# Lead concentrations in soil at the local shooting range.

Zack Hazeslip, Robert Stanley, and Gija Geme

Department of Biochemistry and Chemistry, Natural Resource Research Center, Southern Arkansas University, Magnolia, AR.

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

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

The purpose of this study was to analyze lead concentrations at the local shooting range. The soil was collected and digested using MARS 5 digestion system and analyzed by Graphite Furnace Atomic Absorption Spectrometry (GFAAS). The preliminary results showed that highest lead concentrations were near the mound and the lowest were in the middle of the field. The bullets and shells were also collecting at the site and scanned for different heavy metals using Energy dispersive X ray spectroscopy. The preliminary results showed that majority of the bullets and casings contained copper and only a few bullets contained lead.

**presenting**
**12pm-1pm**

County: Benton

# A Novel Approach to Develop Combination Therapy NanoDrug

Robert Hill,[a] Samantha Macchi,[a] Nawab Ali,[b] Brian Berry,[a] Noureen Siraj[a]

[a]Department of Chemistry, University of Arkansas at Little Rock, Little Rock, AR, [b]Department of Chemistry, University of Arkansas at Little Rock, Little Rock, AR

Cancer is now the second leading cause of death worldwide after cardiovascular diseases. Clearly, it is imperative to develop affordable drugs using new strategies to aid in advancing cancer therapy. Herein, a nanoparticle drug (to improve cellular uptake) with a dual mechanism (combination therapy) is developed for the effective treatment of tumor/cancer. The single step ion-exchange approach used to synthesize the drug is novel, economical, efficient, and produces a product with higher yield as compared to other organic syntheses approaches. A metathesis approach is employed to combine a chemotherapeutic drug, alkyl phosphonium ($P_{66614}^{+}$) and a photodynamic therapy drug, porphyrin ($TCPP^{4-}$). *In vitro*, cytotoxicity of alkyl phosphonium $(P_{66614})_4TCPP$ was investigated in breast cancer cells using MTT-assay. Examination of results revealed that the half maximal inhibitory concentration (IC-50) of the combination nanodrug is much lower (greater cytotoxicity) than the parent drug due to higher cellular uptake of combination nanodrug. Moreover, photodynamic activity which is related to singlet oxygen quantum yield is significantly improved in the combination nanodrug due to the inhibition of aggregation of planer porphyrin molecule in the presence of bulky phosphonium ions. Thus, both chemotherapeutic and photodynamic therapeutic results showed that combination nanodrug is an effective drug for cancer.

**presenting**
**12pm-1pm**

County: White

# Raman Spectroscopy – A valuable Analytical Tool

Drake Jackson, Brandun Barnett, Edmond W. Wilson, Jr., Mentor

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

The development of higher powered, single mode lasers has led to renewed interest in the application of Raman spectroscopy to solve chemical problems. Raman spectroscopy has several advantages compared to traditional infrared spectroscopy:

Samples can be analyzed in aqueous media, sample holders can be glass or quartz, signal does not depend on path length, only concentration, can use fiber optic cables to carry laser light source and feed Raman signal to spectrometer, Raman instruments have no moving parts, Raman instruments are more rugged and can be much smaller.

A Raman spectrometer was built from commercially available, off-the-shelf, (COTS) components. It employed a single mode diode laser emitting at 660 nm for excitation and a StellarNet Black Comet UV/Vis/NIR spectrometer for detection. The in-house Raman spectrometer was built for general -purpose use and applied to the problem of finding the concentrations of BETX: benzene, ethyl benzene, toluene, o-xylene, m-xylene and p-xylene in mixtures containing these substances. Use of this spectrometer will help provide valuable information about pollution and global climate change.

**presenting**
**11am-12pm**

County: Pulaski

# A Green Portable Nanosensor for Nitroaromatic Detection

Thuy Le, Dr. Noureen Siraj

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

The detection of nitroaromatic compounds is extremely vital in many areas including military and civilian safety, chemical industry and environmental monitoring. 4-nitrophenol is listed as a priority pollutant by the US Environmental Protection Agency (EPA) due to its toxicity and environmental persistence. Herein, a new reliable, inexpensive, green and portable colorimetric nanosensor, sodium fluorescein (NaFl), is reported for the detection of a nitroaromatic pollutant, specifically 4-nitrophenol. A prompt, simple, economical and green reprecipitation method is employed to prepare nanoparticles of NaFl. Photodynamics of the NaFl dye solution and NaFl nanomaterial are studied using absorption and fluorescence spectrophotometers. Changes in the absorption and the fluorescence spectra (intensity variation and wavelength shift) of NaFl nanosensor are examined in the presence of different concentrations of nitroaromatics. Different derivatives of nitroaromatics such as 4-nitrophenol, 3-nitrophenol, nitrobenzene, nitrotoluene are tested to understand the mechanism of sensing. Examination of photodynamic results revealed that NaFl nanosensor showed better selectivity towards 4-nitrophenol. The $\pi - \pi$ and hydrogen bonding interactions are the key factors for the selectivity of NaFl nanosensor towards 4-nitrophenol. Furthermore, a paper-based, low cost and portable nanosensor is also developed by coating filter paper with NaFl. This portable green sensor exhibited high sensitivity toward 4-nitrophenol.

**presenting**
**12pm-1pm**

County: Benton

# Investigating Anion Interactions with Tripodal Urea-Based Anion Transporters

Natalie Lowry, Jill Ellenbarger

John Brown University, Department of Chemistry, Siloam Springs, AR

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

**presenting**
**12pm-1pm**

County: Craighead

# Utilization of Click Chemistry to Modify Hydroxynaphthoquinone Scaffolds to Develop Efficacious Drug Leads

Smith, E.; Maloney, T.; Humphrey, M.; Ray, C.; Nawarathne, I. N.

Mathematics and Science Division, Lyon College, Batesville, AR, 72501

Naturally occurring and synthetically derived hydroxynaphthoquinones (juglone, lawsone, phthiocol, plumbagin, laphachol) have a wide range of pharmacological uses such as anti-bacterial, anti-fungal, anti-viral, anti-parasitic, anti-inflammatory, anti-proliferative, anti-cancer, and anti-tubercular. The naphthoquinone scaffold is present in the core structure of many drugs already. Taking advantage of modified Michael Addition reactions, we plan to add various groups with amino functional moiety to the hydroxynapthoquinone to create multitudes of biologically significant 1,4-naphthoquinones with modifications and test them for their various antimicrobial and anticancer properties.

This research is funded by FutureFuel Chemicals LLC. in Batesville and Lyon College.

**presenting**
**11am-12pm**

County: Columbia

# Analysis of Copper in Local Arkansas Wines

Tanner Parrott, Hayden Daugherty, and Gija Geme

Department of Biochemistry and Chemistry, Natural Resource Research Center, Southern Arkansas University, Magnolia, AR.

The purpose of this experiment is to find the concentration of copper in wines from a vineyard in Arkansas and compare to the legal standards for copper in wine. In this study, a Graphite Furnace Atomic Absorption Spectrometer (GFAAS) method was used by direct injection of the wine on to the atomizer of the graphite furnace. For comparative analysis, a digestion was performed on the samples by adding 2.5 mL of two oxidizing agents (cc. $HNO_3$ and cc. $H_2O_2$) to 5.0 mL of the wine. The digestion method yielded a copper concentration ranging from 11.29-49.27 ppb with an average concentration of 35.00 ppb. The addition of the Mg-Pd matrix modifier yielded a copper concentration ranging from 11.0-62.7 ppb with an average concentration of 42 ppb. Furthermore, an analysis of the wine when added with Pd-Mg matrix modifier was conducted by adding 2.5 mL to 5.0 mL of the wine sample. The wines analyzed had a copper concentration ranging from 24.3-124.7 ppb for the direct injection method with an average concentration of 80.9 ppb - falling well within the limit mandated by the US.

**presenting**
**12pm-1pm**

County: Johnson

# Development of Near-infrared Emitting Fluorophores for Potential Biosensing Applications

Siddhi R. Patel[a], Andrew T. Ricketts[a], Maliha Aniqa[a], Rajib Choudhury[a], and Anindya Ghosh[b]

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[b]Department of Chemistry, University of Arkansas, Little Rock, Arkansas, 72204

Quantitative determination of biological molecules is a medical procedure performed to detect, diagnose and monitor diseases. One important example is estimation of protein human serum albumin (HSA) in body fluids. Serum albumin is the most abundant protein in blood plasma. It plays vital roles in maintaining oncotic pressure of blood and serves as a carrier for fatty acids, vitamins, hormones, drugs, etc. Interestingly, it serves as a biomarker for various health conditions. For example, amount of HSA higher than 20 mg/L in urine is an indicator of kidney damage, which is associated with diabetes and cardiovascular disease.

Our project aims to develop suitable fluorophores for quick and cost-effective detection of HSA in biological samples by using a fluorimeter. In this project we have prepared two near-infrared emitting fluorophores. We have studied the photophysical properties and assessed the efficacy of the fluorophores for potential applications in selective and quantitative estimation of HSA in biological fluids. Both fluorophores selectively formed complexes with HSA guided by van der Waals and hydrophobic interactions, which led to ratiometric detection of HSA in buffer and synthetic urine samples.

**presenting**
**11am-12pm**

County: Clark

# What is killing our trees? New approaches for identifying carriers of Oak Wilt

Madison Wilson, Elijah Begin, Ruth Plymale, Nathan Reyna

Department of Chemistry, Ouachita Baptist University, Arkadelphia AR 71998

Oak wilt, *Ceratocystis fagacearum*, is a fungal disease that is treating Arkansas's Oak forest. The fungus is spread by Sap Beetles feeding on wounded Oak trees. Our project centers on using DNA Barcoding as a way to identify the presence of Sap Beetles in Arkansas's forest and parks. Further, once found we will use a molecular technique to determine if these beetles are carrying the Oak Wilt fungus. DNA barcoding is a method of identifying and classifying living things at the genetic level based on short DNA sequences that are about 700 nucleotides in length. This is a pilot project that we hope expand into AR-high schools and freshman Biology courses as a unique way to embed data analysis into the classroom.

**presenting**
**12pm-1pm**

County: Independence

# Using FTIR Spectroscopy in Rapid Screening of the Efficacy of Inhibiting Compounds as Copper and Alumina Etch Protectors

Pruden, John R[a], Issac Goutham[b], Muthappan Asokan[b], Ashish Salunke[b], John Alptekin[b], Dr. Oliver Chyan*[b]

Division of Math and Science, Lyon College, Batesville, Arkansas.
Department of Chemistry, University of North Texas, Denton, Texas.

Using IR spectroscopy and micropattern corrosion screenings (MPCS), we can rapidly assess corrosive conditions and screen the efficacy of potential inhibitors for preventing metallic corrosion.
The corrosion rate of Copper in 0.05 M Ammonium Persulfate is measured via MPCS. The efficacy of Chemical Vapor Deposition (CVD) method is studied with various inhibiting compounds. The effectiveness of deposition is measured via IR spectroscopy, and from MPCS it's discovered that some of these inhibitors do not significantly reduce the corrosion rate, however this could be due to the high oxidation power of our solution. Regardless, this CVD process effectively deposits many compounds and can be used in further screenings using a different solution.
Additionally, IR Spectroscopy is studied as a method of rapidly screening the efficacy of various inhibiting compounds, via analysis of Al-O surface bonds. By measuring how the percentage of Al-O bonds decreases over time, the average etch rate as well as the change in etch rate over time can both be calculated. From this, large numbers of solutions can be accurately screened rapidly, allowing us to isolate effective inhibitors and better control the alumina etch rate.

**presenting**
**12pm-1pm**

County: White

# Photocatalysis as a Means of Disinfecting Water During Space Flight

Shelby Roberts, Jade Toth, Elizabeth Reed, Dennis Province, Ph.D., Cindy White, Ph.D.

Department of Chemistry and Biochemistry, Harding University, Searcy, AR, 72143.

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

**presenting**
**11am-12pm**

County: Pulaski

# The effects of P-glycoprotein inhibition on norbuprenorphine-induced neonatal abstinence syndrome (NAS)

Paloma Salazar[a,b], William T Higgins[a] , Lisa K Brents[a]

[a] Dept. of Pharmacology and Toxicology, University of Arkansas for Medical Sciences, Little Rock, AR
[b] Dept. of Chemistry, University of Arkansas-Little Rock

Treating pregnant, opioid-addicted women with the opioid buprenorphine improves mother-child outcomes, but can cause neonatal abstinence syndrome (NAS), a potentially life-threatening withdrawal syndrome newborns often develop following chronic prenatal exposure to opioids. NAS severity is independent of maternal buprenorphine dose, suggesting that inter-individual variance in the pharmacokinetics of buprenorphine may influence NAS. We previously showed that prenatal exposure to the major active metabolite of buprenorphine, norbuprenorphine (NorBUP), can induce NAS. NorBUP is a substrate of the highly polymorphic placental efflux transporter P-glycoprotein, which transports its substrates from fetal to maternal circulation. We tested the hypothesis that **inhibiting P-glycoprotein increases NorBUP-induced NAS severity.** We administered a subthreshold dose of NorBUP or vehicle to pregnant rats from gestation day (GD) 9 until post-delivery and treated them twice daily with the p-glycoprotein inhibitor Elacridar or vehicle on GD18-21. After delivery, pups were observed for precipitated withdrawal signs following administration of naltrexone or saline. NorBUP and Elacridar together, but not individually, increased naltrexone-precipitated withdrawal signs, providing the first evidence that P-glycoprotein activity can substantially modulate the effects of NorBUP on the fetus and may therefore contribute to the uncoupling of maternal buprenorphine dose and NAS severity.

**presenting**
**11am-12pm**

County: Clark

# BPA in Animal Feeders and Waterers

Malcolm Seay and Sara E. Hubbard, PhD

Department of Chemistry, Ouachita Baptist University, Arkadelphia, AR

Bisphenol A (BPA) is a plastic hardener found in items such as plastic bottles and in the linings of metal food cans. Since most humans come in contact daily with at least small amounts of BPA, researchers have done studies to determine whether BPA could be harmful. Many of these studies have been performed on laboratory animals such as rodents and primates which have genetic and biological characteristics comparable to those of humans. BPA acts like estrogen, disrupting the hormones in laboratory animals and humans. Those who have a higher level of exposure to BPA have an increased risk of cardiovascular disease, diabetes, and reproductive issues.

Since BPA was found to alter the development of laboratory animals, it is likely that domestic pets could respond similarly if exposed high levels of BPA. Many pet owners buy plastic water and food bowls for their animals. While BPA has been removed from several plastics that humans use, these precautions are usually not taken for our pets. For this project, plastic food and water bowls for pets were tested using fluorescence spectrophotometry to determine if BPA was leaching out of the plastic into water samples.

**presenting**
**11am-12pm**

County: Clark

# Developing New Water-Soluble Porphyrins as Potential Photodynamic Cancer Therapy Agents

Catherine Shirley, Travis Hankins, Dr. Joseph E. Bradshaw

Ouachita Baptist University, Department of Chemistry and Physics Arkadelphia, AR 71998

Photodynamic therapy (PDT) is a type of cancer treatment involving the use of light in conjunction with a photosensitive agent- a chemical or series of chemicals designed for activation when exposed to light. This research investigated the synthesis and characterization of two novel photosensitive agents; H2TPP-MorphMeOH, and H2TPP-Pro-OH. To create the novel water-soluble porphyrins, hydroxylamines were added to the porphyrin core. Both morphylin-2-ylmethanol and (S)-(+)-prolinol were added to the tetracarboxyl porphyrin, H2TPPC, to form the final H2TPP-MorphMeOH and H2TPP-Pro-OH products. These compounds were then purified using syringe filtration and column chromatography, and subsequently characterized using infrared (IR), nuclear magnetic resonance (NMR), and UV-vis spectroscopies; and the purity of the final products was determined using high-performance liquid chromatography (HPLC). Finally, the utility of the materials as potential PDT agents was determined by examining the cytotoxicity of both the H2TPP-MorphMeOH and H2TPP-Pro-OH using MTT assays on MDA-MB-231 triple negative breast cancer cells comparing both dark and light exposures.

**presenting**
**11am-12pm**

County: Jefferson

# Optimization of microfluidic paper-based analytical devices to detect low concentrations of tetracycline in agricultural settings

Erica Smith, Nathan Meredith

Department of Chemistry, University of Central Arkansas, Conway, AR 72035

Tetracycline is commonly used in concentrated animal feeding operations, where overuse of antibiotics contributes to the issue of antimicrobial resistance, a significant problem affecting the overall human population today. Current testing for pharmaceuticals in agricultural runoff is time consuming, expensive, and requires experienced users to complete. This project investigates the development of a low-cost microfluidic paper analytical device for the rapid detection of tetracycline based on its native fluorescence and the fluorescence of the europium-tetracycline complex. The limit of detection for each method was $4.1 \times 10^{-6}$ M and $2.8 \times 10^{-7}$ M, respectively. The europium-tetracycline complex was found to be approximately 3 times more sensitive than the native fluorescence, and it has a limit of detection approximately 14.6 times lower. Ongoing work is focused on interferences and testing real world water samples.

**presenting**
**12pm-1pm**

County: Sebastian

# Chemometric Approach to Detection, Purity Analysis, and Quality Assurance of Adulterated Peanut (Arachis *hypogaea*) Oils

Shayla C. Smithson, Boluwatife D. Fakayode, John Nguyen, Siera Henderson, and Sayo O. Fakayode

Department of Physical Sciences; University of Arkansas-Fort Smith, Fort Smith, AR

The intake of adulterated and unhealthy oils and trans-fats in the human diet has had negative health repercussions, including cardiovascular disease, causing millions of death annually. This study reports a simple, fast, accurate and low-cost chemometric approach to the purity analysis of highly refined peanut oils (HRPO) that were adulterated either with vegetable oil, canola oil, or almond oil for food quality assurance purposes. The FTIR spectra of the pure oils and adulterated HRPO samples were measured and subjected to a partial-least-square (PLS) regression analysis. The obtained PLS regression figures-of-merit were impressive, with remarkable linearity ($R^2 \geq 0.994191$). The results of the score plots of the PLS regressions illustrate pattern recognition of the adulterated HRPO samples. Importantly, the PLS regressions accurately determined percent compositions of adulterated HRPOs, with an error of 5.53%, a limit-of-detection as low as 0.02% wt/wt and continued to predict the compositions of newly prepared adulterated HRPOs over a period of two months, with incredible accuracy without the need for re-calibration. The accuracy, sensitivity, and robustness of the protocol make it desirable and potentially adoptable by health departments and local enforcement agencies in the state of Arkansas for fast screening and quality assurance of edible oils.

**presenting**
**11am-12pm**

County: Pulaski

# Use of biochar for methylene blue removal from water

Kennedi Weston[a], Ashlie Adams[b], Kamu Taulelei[b]

[a]Department of Chemistry & Physics, University of Arkansas at Pine Bluff, Pine Bluff, AR
[b]Department of Chemistry, Washington State University, Pullman, WA

The goal of this study was to remove contaminants from aqueous phase solutions using the adsorption approach. We used methylene blue (MB) to mimic water contamination while biochar was the adsorbent. We conducted several isotherm and kinetic experiments to understand the adsorption behavior of the biochars that were used and their removal efficiency. The two biochars, SCOMC and COMBC, were made from agricultural biomass. The effect of pH, adsorbent doses, and contaminant concentrations were all studied in the batch of adsorption set ups. To measure the concentration of MB before and after biochar additions, a spectroscopy method was utilized to track MB concentration. Before that, all samples were agitated for 24hrs (max) at 200 rpm and then filtered using Whitman filter paper 42. The results showed that biochar removes MB up to 98% after only 5 minutes at pH 7. We can conclude that we can design biochar-based adsorbents for water filtration.

**presenting**
**11am-12pm**

County: Clark

# A cost efficient approach to the discovery of new drugs for Chagas disease

An C. Yang, Emily N.H. Tran, and Gregory R. Naumiec

University of Central Arkansas, Conway, AR 72035

Neglected tropical diseases (NTDs) such as Chagas disease and leishmaniasis refer to a group of underfunded global health problems caused by parasitic infections. The term "neglected" came about because they mainly affect people in impoverished regions at or below the equator. There have been some research done in NTDs, however, due to limited funding and resources, only a handful of drugs have received focus. As a result, the entire drug development for NTDs is limited.

The focus of our research is Chagas disease. It is a leading cause of heart failure in Latin America and an emerging disease in the southern United States due to the immigration of infected people. Chagas disease is transmitted through the bite of the kissing bug. Currently drug treatments for this disease are expensive, ineffective, and toxic. Therefore, we aim to synthesize a suitable drug that is inexpensive and effective.

The drugs that we aim to synthesize are known as squaramides. Research has shown that squaramides exhibit antiparasitic activity toward Chagas disease. This class of drugs make an ideal target due to their ease of synthesis and relatively low cost. Currently great progress has been made in the high yielding synthesis of over two dozen potential drugs. Once our drug targets are complete they will be tested for their activity against Chagas Disease.

**presenting**
**11am-12pm**

County: Desha

# Development of Philander Smith College Cafeteria Menu using Software Engineering Theory

Briana Bailey, Kenisha Lewis, Dr. Chuanlei Zhang

Department of Computer Science, Philander Smith College, Little Rock AR

While studying the concepts and techniques in course Software Engineering, a project 'Philander Smith College Cafeteria Menu' was created. This system was designed to be an informative platform for users, e.g. students, faculty, etc, to view hours of operation, contact information, food suggest page for the upcoming week, and weekly menu. A user- friendly webpage interface was aimed and developed to ensure usability and efficiency. The project includes phases of requirement elicitation and gathering, analysis, system design, implementation and testing. Each phase was guided and conducted with the study of software engineering theory, therefore help us to reflect on the construction of basic software system from scatch. As we embrace a new era of technology based systems, the Philander Smith College Menu system provides a user friendly and informative system which can be beneficial for students, faculty and the community.

**presenting**
**11am-12pm**

County: Pulaski

# Usability Assessment of Mobile Application: The Case of Shopping and Dating Apps

Briana Bailey, Kenisha Lewis and Samar Swaid, Ph. D.
Department of Computer Science

Division of Natural and Physical Sciences, Philander Smith College, Little Rock, Arkansas

Mobile applications consist of numerous features and a plethora number of functions that would attract users to mobile apps. When using a mobile application, the end user focuses on purpose of the app and its fit to the user needs. However, users primarily will quit using the app if it is unusable. One set of principles that were developed to assess the usability of software and interfaces is the one developed by Nielsen (1994).This research is geared to analyze and provide usability heuristics that fit the context of mobile apps by adapting the Nielsen's usability to mobile apps. Two usability experts assessed two shopping apps and two dating apps. The shopping apps included are Poshmark and Vinted, which are two of the most leading apps to buy and sell fashionable items such as clothing, accessories, and etc. The study also included the Tinder and Skout apps that are widely used for dating. Although, Nielsen ten heuristics laws are not specifically developed for mobile apps, the study found that the ten rules can be helpful to highlight usability violations in mobile applications and to suggest design improvements for mobile applications.

**presenting**
**12pm-1pm**

County: Crawford

# Using Natural Language Processing to Automate the Categorization of Text Across Disparate Systems Temporally

Cesar Cuevas, John Hightower, Andrew Mackey

University of Arkansas – Fort Smith, Department of Computer and Information Sciences, Fort Smith, AR

As the number of news articles, emails, web pages, social media posts and other text-oriented documents continue to grow, tools which facilitate automatic text categorization have grown in prominence largely due to the increased need for greater organization of this newly generated content. Spam detection, email sorting, sentiment analysis, and online shopping represent a few successful applications of text categorization. As Arkansans and Arkansas-based companies continue to enlist the use of multiple email, social networking, and other text-generating accounts, the need for automated categorization of messages increases to improve productivity and prioritization of key categories. Machine learning algorithms have demonstrated an ability to learn how to classify to which category a document belongs and assign one or more categories automatically. This research presents a system developed to automatically categorize text across disparate systems by applying natural language processing and machine learning models for automatically categorizing messages.

**presenting**
**12pm-1pm**

County: Craighead

# Usage of Try-with-resources Language Feature in Java SE 7+: A Case Study

Takeru Koiwa[a], John Davis[b], Caleb Benbrook[a], and Donghoon Kim[a]

[a]Department of Computer Science, Arkansas State University, Jonesboro, AR, [b]Department of Chemistry & Physics, Arkansas State University, Jonesboro, AR

It is a challenge to teach a programming language to students as their first language. Researchers have endeavored to improve teaching methods with multidisciplinary approaches. This research is especially important to Arkansas Department of Education since Arkansas requires that all public high schools offer classes in computer science with programming emphasis. Throughout this study, we can find practical example codes of each language feature which will be used to teach a programming language. Especially, we analyze try-with-resources feature because it was introduced to Java SE 7 to resolve for automatic resource management that Java SE 6 does not have. We examined six open-source Java projects and evaluated their usage of try-with-resources. We found substantially differing amounts of usage of try-with-resources from similarly sized projects. Some projects had periods where its usage went up drastically in a short amount of time, and other projects showed more gradual increase of usage of the feature. Try-with-resources greatly reduces the lines of code and improves the readability of the program. On the other hand, resources instantiated were relatively low. These findings would help to teach try-with-resources feature as well as other features because we recognize the practical usage patterns for language features.

**presenting**
**11am-12pm**

County: Jefferson

# An Analysis Pipeline Framework for Genome Methylation Studies

Malik Gatson, Laura Hildreth, Karl Walker

Department of Mathematics and Computer Science, University of Arkansas at Pine Bluff, Pine Bluff, AR

The purpose of this research project is to create a methylation pipeline in which schools across Arkansas can use to transfer medical data, such as lung cancer cell data, differences between cancerous kidneys cells and non-cancerous kidney cells, treatment on different types of cancers, etc. This pipeline uses 450K methylation and eventually, EPIC/850K methylation. I came onto the project on June 1, 2017. My first task was to read about the methylation process and see how it all comes together. The methylation process takes the data from one place and analyzes it as it goes through the pipeline. My next task was to read about the GEO database and see how we can incorporate test data from this database into our own database for testing purposes. The GEO database is a huge database in which institutions from across the country use for their own testing purposes. My next task was to download Globus into our server and transfer test data from the GEO database to our own database created in MySQL on the server and to make sure everything is running smoothly. Globus is a third-party data transfer service in which institutions use it to import huge amounts of data from one place to another. As of now, my task is to create a script in which the user can input their test data and Globus transfers it to the test database where it is analyzed and processed and sent off to the next stage of the project.

**presenting**
**11am-12pm**

County: Pulaski

# Mobile Based Attendance System

Paola Vazquez, Peter Joseph, Suzan Anwar

Department of Computer Science, Division of Natural and Physical Science, Philander Smith College, Little Rock, AR.

e-School and e-Learning which was once considered a myth, has found its place today towards education. Many schools are abandoning the manual work involved and are practicing technology. Previously, classes were carried out on boards, assignments were supposed to be written on paper and submitted. Today classes are online or through pictorial presentations, assignments are submitted online, which also calculates the plagiarism. The other step towards educational field is on attendance. Attendance is very important as it helps to know the interest of a student in a particular class. As the attendance is taken manually on sheet by a professor, there are chances for the attendance to be misplaced, or changed by hand. Developing a mobile-based application will help the professor to take attendance easily using a smartphone. In this research an android application Mobile Based Attendance System is proposed. The main aim of MBAS is to eliminate the time and effort drawn whilst taking attendance of students. There will be no need to maintain manual records and the system will be free from fake attendance. Also this system comes with procedure, which calculates up-to-date attendance percentage of a student.

**presenting**
**12pm-1pm**

County: Benton

# A Case Study: Installation of a Solar Farm in an Agriculture Area in Arkansas

Wilfredo Abudeye, Nate Taylor, Dr. Ted Song

Engineering Department, John Brown University, Siloam Springs, AR

A 809.6 kW solar farm was installed in Stuttgart, AR in 2018. This solar farm includes more than 2,300 350 W panels and is used to provide electricity to Stratton Seed Company's power needs. This installation was the first privately owned solar farm over 300 kW in the State of Arkansas. The purpose of this poster presentation is to review the solar farm installation process and analyze financial and environmental benefits gained. This poster will show how the state can promote the additions of solar farms in agriculture areas in Arkansas, and the poster will also discuss the benefits that the state can gain from expansion of solar energy.

**presenting**
**12pm-1pm**

County: Craighead

# Variable Analog Filter

Kyler Dickey, Dr. Shubhalaxmi Kher

Arkansas State University, College of Engineering and Computer Science, Department of Electrical Engineering, Jonesboro, AR

Electronic analog filters are ubiquitous in applications requiring the attenuation or amplification of a certain signal frequency or band of frequencies. Most modern filter systems implement a method to allow the user to select desired frequencies. This concept of a variable filter is implemented intuitively through the use of potentiometers as variable resistive components in a Butterworth filter. Ganged potentiometers allow for all variable resistances in higher order filters to be altered simultaneously, keeping the number of interactive devices in the system constant while still providing steeper transition bands for higher orders. All non-interactive components can be designed as an application specific integrated circuit, with inputs and outputs corresponding to the inputs and outputs of the variable resistances. This form of implementation reduces the overall footprint of the device, while remaining intuitive for users. In particular, such devices could be used to reduce the cost of replacing or implementing communication systems throughout the state of Arkansas.

**presenting**
**12pm-1pm**

County: Sebastian

# Autonomous Guidance of an Electric Rover

Alex L. Cutsinger, Savannah B. Boerjan, Daniel C. Hinkle, and Kevin R. Lewelling

University of Arkansas-Fort Smith

Two electric rovers were designed and constructed as a joint project between the University of Arkansas – Fort Smith (UAFS) and Harding University. Each rover is powered by a 20 Ah Lithium Ion battery and is manually guided over a WIFI connection with the use of an on board HD camera allowing the remote driver to see and make real time adjustments. As this project has evolved, the need for autonomous guidance has become obvious as internet speeds or internet drop outs interrupt the effectiveness of manual control.
This poster will describe the design and implementation of an autonomous guidance system on both rovers. Additionally, the two rovers will communicate with each other as some tasks will require both rovers working together to complete. The autonomous system takes advantage of inexpensive GPS and LIDAR hardware that interfaces easily with a Raspberry PI computer and an Arduino microcontroller. The real challenge will be to develop and test the software needed for autonomous rover guidance and establish reliable communications between both rovers.
This research will find applications in several areas such as self-driving cars and in the agricultural industry for crop inspection and mapping. These Mars rovers are also used to promote STEM education through demonstrations at local public schools emphasizing future engineering and technology advances.

**presenting**
**11am-12pm**

County: Cross

# Wet Air Oxidation of Phenol

Kayleigh Arianna Jordan Johnson[a], Manuel Garcia-Perez[b]

[a] Department of Chemistry & Physics, University of Arkansas at Pine Bluff, Pine Bluff, AR, [b] Department of Biomedical Engineering, Washington State University, Pullman, WA

Phenol is a highly toxic chemical that is very common in oil, gas, and chemical manufacturing. Due to the toxicity of phenol, any aqueous solution that is contaminated with it, has to be properly treated and disposed of.
The objective of this research is to determine if wet air oxidation is an efficient way to treat waste water contaminated by phenol. Applying compressed oxygen to the phenol contaminated water in a closed batch system under pressure and high temperature contributes to the break down of phenol into components: carbon dioxide (CO2), water (H2O) , and other small organic acids.
If complete oxidation is achieved, the aqueous waste can then be further treated with established biological methods found in most wastewater industries. Chemical Oxygen Demand (COD) will be measures in order to evaluate if the complete breakdown of phenol has occurred. High pressure liquid chromatography will also be utilized to assess the composition of the final products after oxidation.
Our experimental technique uses 28 ml stainless steel batch reactors operated at a span of temperatures and residence times. The experimental matrix will help to identify the most effective process conditions for complete oxidation of the phenol solution. The temperatures span from 180-250oC in intervals of 10oC. The gases were tested were nitrogen (N2) and oxygen (O2). The time durations included 5, 10, 15, 20, 30, and 45-minute intervals. These conditions were all tested under a pressure of 120 psi of the tested gases.

**presenting**
**12pm-1pm**

County: Clay

# Silent Metronome Circuit

Enoch Richardson, and Shubhalaxmi Kher

Arkansas State University, College of Engineering and Computer Science, Department of Electrical Engineering, Jonesboro, AR

This project examines the impacts of interchanging different capacitors and observing the multiple effects. More specifically, how different capacitors affect the rate at which the LED will flash. The rate at which the LED flashes can be correlated to the beat per minute ratio. The beats per minute ratio is a musical rhythm parameter that establishes the speed of a song. We will formulate a table that makes a direct relation between the capacitor rating and the resulting beats per minute ratio. This table would allow someone to pick a song and play along on with the song and not hear an annoying beeping sound that a normal metronome emits. This circuit also has many implications for any situation where a timed signal must be repeated.

**presenting**
**12pm-1pm**

County: Sebastian

# Phytoremediation in *Helianthus annuus:* Seedling Establishment Inhibition and Translocation of Cadmium in a Simulated Bioswale System

Ashley R. Barto, Faculty mentors: Katherine Larson and Robert Mauldin

University of Central Arkansas

Bioswales are a type of green infrastructure many cities are utilizing to mitigate the environmental impact of urbanization. Bioswales are a means to prevent urban pollutants from washing into waterways, and they are designed to use phytoremediation to sequester those pollutants. As Arkansas draws businesses into its growing cities, bioswales might become popular means to minimize the impact urban pollutants have on the environment. While research shows bioswales effectively sequester heavy metals associated with urban impervious surfaces like parking lots, there is also evidence that removing heavy metals from aquatic ecosystems recycles those contaminants into terrestrial ecosystems via herbivory and nectary production. Still, the impact of cadmium, a prevalent contaminant in urban stormwater, on the seedling establishment and growth of *Helianthus annuus*, a common bioswale plant, is unclear. As a state with both growing urban spaces and rural, agriculturally productive areas, policy makers in Arkansas need to consider the implications green infrastructure might have on the state's natural health. This research assessed the seedling establishment rate in an assay of cadmium-spiked environments, and it employed atomic absorption spectroscopy to identify the cadmium content in seeds, shoots, roots, and leachate in a simulated bioswale system. Results will be presented.

**presenting**
**11am-12pm**

County: Pulaski

# Environmental Engineering at UA Little Rock: ASCE Environmental Quiz Bowl

Kassandra Castrillo and Lashun Massey

Department of Construction Management & Civil and Construction Engineering, University of Arkansas at Little Rock, Little Rock, AR

The environmental engineering program at the UA Little Rock prepares students to design infrastructure, public works, and processes that protect the environment and public health. At UA Little Rock, students are also encouraged to participate in technical organizations, such as American Society of Civil Engineers (ASCE), to help gain more insight on skills needed for the profession. Each spring, there are several ASCE student conferences and competitions in areas such as surveying, technical paper presentations, concrete canoe, steel bridge, and environmental engineering. This year, UA Little Rock attended the 2018 ASCE Deep South Conference hosted by Lafayette Louisiana University and competed in the environmental engineering event. For the event, students participated in a jeopardy-style quiz bowl format with questions from the following five categories: Laws and Regulations, Remediation, Pop Culture, Wastewater and Drinking Water Treatment, and Hazardous Waste Management. UA Little Rock tied for third place against eleven other universities in the environmental engineering event and came back with more knowledge and confidence for the next year. Participation in the environmental engineering event at the ASCE conference was a great success and helped to enhance and encourage student engagement at UA Little Rock.

**presenting**
**12pm-1pm**

County: Mississippi

# Within Field Spatial Variability of Cotton Productivity Associated with Soil Texture, Irrigation, and Pest Management Practices in a Northeast Arkansas Field

J. L. Krob[a], John Nowlin[a], and T. G. Teague[a,b],

[a]College of Agriculture, Arkansas State University, Jonesboro AR
[b]University of Arkansas Agricultural Experiment Station, Jonesboro AR

Cotton remains an important crop in rural communities in Arkansas. The state ranks 5th in cotton production in the US with 445,000 acres planted in 2017 with a value of $370M. Farmers face challenges to improve profitability as well as to reduce negative environmental impacts. Site-specific approaches in spatially variable fields would enable farmers to use production and protection inputs only where and when they are needed. This would improve efficiency. The goal of this research was to better understand sources and consequences of within field variability associated with soil texture, irrigation practices, insect pest pressure and weed control. We used a combination of soil, plant and pest monitoring methods to evaluate within-field variability in an irrigated, 40-acre commercial field in Mississippi County. Plant and soil monitoring activities included use of the COTMAN system, soil EC measures, and Watermark soil moisture sensors. Soil texture affected plant growth, fiber yield and fiber quality. Feeding damage by *Lygus lineolaris*, a key insect pest of cotton, also varied across soil textures and irrigation regimes. Understanding sources of variability will allow implementation of site-specific practices. Expanded use of such precision agriculture methods using spatial technologies likely will improve production efficiency and overall sustainability.

**presenting**
**12pm-1pm**

County: Johnson

# Upper atoka outcrop to subsurface correlation and sedimentation history using magnetic susceptibility

Hunter Vickers and Hunter Lawhon, Dr. Jacob Grosskopf

Arkansas Tech University Physical Sciences Department, Russellville, AR

The Upper Atoka Formation is Pennsylvanian in age and is shale-rich with interbedded sandstone units. A significant portion of one shale-rich unit is exposed in Hackett, AR in the western Arkansas River Valley region of the state. The purpose of this study was to determine the sedimentation history of the exposure using magnetic susceptibility properties of the shale-rich strata, and link these findings to the regional stratigraphy. Samples were taken from the outcrop at fixed increments of 0.1 and 0.05 m and later processed and analyzed in the lab.

Magnetic susceptibility values correlate well with gamma-ray data from well-logs in the area. These findings will assist in future work linking outcrop and well-log data to solve correlation and structural problems for shale units in the Upper Atoka and throughout the Arkoma Basin, the sedimentary basin the formation comprises.

The magnetic susceptibility data also track Milankovitch-scale depositional cycles in the exposure. The detected cyclicities are eccentricity at 0.129 cycles/meter and 0.5 cycles/meter, and precession at 2.4 cycles/meter and 3.167 cycles/meter. These are the highest frequency sedimentation cycles found in the Atoka Formation.

Magnetic susceptibility is a vital tool in understanding and interpreting sedimentation history and stratigraphy when paired with numerous well-logs already present from Arkoma Basin oil and gas exploration.

**presenting**
**11am-12pm**

County: Faulkner

# Fire history of an unlogged shortleaf pine forest in the Ouachita Mountains, Arkansas

Lillian McDaniel, William Flatley, Cathleen McNutt, Alexander Russell

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

Shortleaf pine-bluestem ecosystems are a fire adapted vegetation community in the Ouachita Mountains that has declined drastically due to fire suppression. Forest managers are using prescribed fires to restore this important habitat. However, they lack information on past wildfire regimes necessary to guide prescribed burns. Our objective was to characterize the historical fire regime across multiple centuries of land use change. We collected wood samples from the Lake Winona Research Natural Area, an unlogged shortleaf pine forest in the Ouachita Mountains of Arkansas. We used tree ring patterns to date wood from 35 trees that spanned the years 1562 to 2018, including 147 annually dated fire scars. Fires were less frequent prior to EuroAmerican settlement (1700-1840, mean fire return interval of 16.8 years) compared to post EuroAmerican settlement (1840-1930, mean fire return interval of 2.31 years). Most fires occurred during the dormant season (77%) indicating that they burned in the late fall, winter, or early spring and suggesting that humans may have been the ignition source. There have been no fires recorded at the site since 1943. This project provides site-specific data to help guide wildfire restoration and conservation of shortleaf pine-bluestem ecosystems in the Ouachita Mountains.

**presenting**
**12pm-1pm**

County: Benton

# Economic and Environmental Benefits of Abandoned Fayetteville Shale Well Reclamation

Varenya Nallur , Matthew Moran

Biology Department, Hendrix College, Conway, AR

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

**presenting**
**11am-12pm**

County: Clark

# Effects of a Nutrition and Physical Activity Intervention on Improving Children's BMI-for-Age Percentiles

Anna Claire Goodroe, Kaycee Patrick, and Detri Brech

Ouachita Baptist University Nutrition and Dietetics, Arkadelphia, AR

This study assessed the impact of nutrition and physical activity education on the body mass index (BMI) and nutrition knowledge of school aged children. The researchers prepared and administered weekly lessons focusing on different food groups and exercises based on the United States Department of Agriculture's MyPlate dietary guidelines. The children's BMIs were calculated at the beginning and end of the study. A written assessment was also given at the beginning and end of the study to evaluate nutrition knowledge. This study saw a significant increase in nutrition knowledge but no decrease in BMI after completion of the program. This research supports the idea of initiating more nutrition education programs for children throughout the state.

**presenting**
**11am-12pm**

County: Ashley

# Comparative Analysis of Different Genres of Music

Jimmy Atkins, Farrokh Abedi

School of Mathematical and Natural Sciences, University of Arkansas at Monticello, Monticello, AR

Comparative Analysis of Different Genres of Music: Work presented will be comparison of lyric composition of different genres of music over the last forty years by measuring the symmetry of the sine waves produced by these songs using Fourier Transforms as well as using other methods to compare the different genres to see how they have progressed and compare to each other (i.e. Spearman rank correlation coefficient, Flesch Kincaid Readability Index, Flesch Kincaid Grade Level Scale, measuring pitch-class symmetry, etc.)

**presenting**
**12pm-1pm**

County: Faulkner

# Exploring Finite-Time Blow-up of Separable Differential Equations

Jacob Hines , Duff Campbell

Mathematics and Computer Science Department, Hendrix College, Conway, AR

As has been previously proven (Jared Williams, Hendrix ‘03), one can determine whether an autonomous differential equation will blow up in finite time (i.e. have a vertical asymptote) without actually solving the equation. However, the autonomous case is extremely narrow and only
covers relatively few cases. Using this result along with a straightforward proposition, I have extended Williams’ result into the separable nonautonomous case, which requires an additional criterion in some cases. We also apply our criterion to quantify some properties of certain differential equations. Specifically, we are able describe a condition under
which a given differential equation will produce a separatrix. Then, constructing such a differential equation, we can apply our results in order to obtain an equation for the separatrix.

**presenting**
**12pm-1pm**

County: Cross

# Fingerprint Analysis of Fatty Acids found in Algae

Hayden Jumper, Victoria Lynn Fox

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

Using FAME data, statistical analysis was performed on algae strains gathered from nine locations in Southern Arkansas. The analysis for the FAME data for the samples shows a potential relationship between the fatty-acid distribution patterns in a strain and the location from which the strain was gathered. Formation and isolation of the fatty acids are being investigated for dietary supplements and even as components of biodiesel fuels.

**presenting**
**11am-12pm**

County: Garland

# Low-Cost Laminar Flow Wind Tunnel Design and Testing

Joseph Dees, Thomas Hodges, Rebecca Voss, Jarvis Warren, Jeremy Brents, Andrew Diehl, Shannon Clardy

Henderson State University, Arkadelphia, AR

A laminar-flow wind tunnel provides the ability to observe both simple and complex aerodynamic phenomena. A small-scale (20-foot), low-cost wind tunnel was designed and fabricated to study laminar flow and turbulence for various airfoil designs at adjustable angles-of-attack. The wind tunnel design was determined by a number of factors including the space required, the cost (limited to $5,000 or less), fabrication methods, and ease of use. An open return system was chosen to reduce construction costs. The motivation for the wind tunnel includes valuable educational and experimental components in both design and application. Additional motivation for the wind tunnel comes from its future placement in the Henderson State University Community Education Center for use by students of multiple departments at Henderson, as well as local K-12 schools, businesses and organizations. This location provides an opportunity for the work to be beneficial to the public and private sectors as well as to the academic realm. Design, fabrication, testing methods, and results are discussed herein.

**presenting**
**12pm-1pm**

County: White

# Generation of Generalized Gaussian Laser Beams

Samantha Dix and Jessica Young

Arkansas Tech University, Russellville, AR

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

**presenting**
**12pm-1pm**

County: White

# Mechanical energy-based amplifiers for probing interactions of DNA with metal ions

Jack Freeland[1], Prabhat Khadka[1], and Yong Wang[123]

Department of Physics[1], Microelectronics-Photonics Graduate Program[2], Cell and Molecular Biology Program[3], University of Arkansas, Fayetteville, AR 72701

DNA is one of the most investigated and talked about subjects in biology, biochemistry, and medicine as it serves as our genetic code and forms the basis of all known life. DNA itself is a very simple yet volatile substance. Along with regular cell cycle changes, various factors such as temperature or ion concentration can alter the state of DNA and its functionality. What various factors affect DNA and their outcomes are of great interest to us for obvious reasons. Things such as repressed replication, mutations, cancer and other diseases are a direct result of DNA changes. Having a better understanding of these factors in turn provides us a better understanding of the consequences they bring.

In this project, we offer a novel, patented, and wide-reaching method to better view and understand DNA interactions. The problems with orthodox methods are they are quite expensive and complex at times. By approaching the issue from a physics perspective, we were able to design a DNA structure that, through the exploitation of mechanical energy, allows us to observe DNA-metal ion interactions with a sensitivity not achievable through regular linear DNA in such a cost-efficient method like gel electrophoresis.

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