STEM
Posters at the Capitol

February 19, 2020

"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 140 students**
- **From 17 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


UAMS
UNIVERSITY OF ARKANSAS
FOR MEDICAL SCIENCES


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: Mississippi

Influence of Seeding Rates and Termination Timing of Winter Cover Crops on Insect Pest Abundance in Midsouth Cotton

J. L. Krob [1], A. J. Baker [2], J. W. Nowlin [1], T. G. Teague [1,2]

[1] Arkansas State University
[1,2] University of Arkansas System Division of Agriculture

Sustainable crop production practices that increase efficiency and reduce production input costs are needed to improve profitability of US cotton. When producers modify soil and water conservation practices such as winter cover crops, changes may be needed in arthropod pest management. Cotton producers are also interested in reducing production costs. Cotton seed is a significant input cost for producers. In our previous work, reducing seeding rate from 4.5 down to 1.5 seeds per ft. of row had no significant effect on cotton lint yield. In this on-farm study in Northeastern Arkansas, we evaluated impacts of seeding rate, insecticide applications, terminated winter cereal cover crops and edge of field landscape features on maturity and yield of cotton. The study included assessments of thrips (*Frankliniella fusca, Thrips tabaci*) and tarnished plant bug (*Lygus lineolaris*) population densities through the production season. Crop plant effects were also evaluated using in-season plant monitoring with the COTMAN system. A four-way factorial structure was used for analysis of the yield monitor-measured yield with seeding rates, insecticide applications, and termination timing included along with soil EC classifications as a covariate.

presenting
12 pm-1 pm

County: Baxter

Bed-scale stratigraphic study of the structurally complex Upper Atoka Formation exposed at the Paris Reservoir, Paris, AR

DeAtley, Kaitlyn and Strack, Cory, Grosskopf, Jacob

Geology Program, Physical Sciences Department, Arkansas Tech University, Russellville, AR

The Upper Atoka rock Formation, comprised of sandstone and shale rock layers, depict an ancient delta system in the Pennsylvanian-age Arkoma Basin. A significant exposure of the Upper Atoka Formation is present at the Paris Reservoir Spillway in Paris, Arkansas. The purpose of this project was to determine if the rock layers exposed in the spillway could be measured on a bed-scale and if magnetic susceptibility values of rocks from those beds would represent the fine-scale changes in sandstone and shale layers. Samples were collected at fixed intervals of 0.30 m for ~70 m of total section in order to correlate to a stratigraphic column. Magnetic susceptibility values produced a high resolution data set that showed recognizable trends between sandstone- and shale-rich portions of the section as well as broad-scale changes in rock layers, which were assigned as rock unit divisions. There were no problematic effects from sampling bare rock exposed to surface weathering, and the faulted zones were avoided. Magnetic susceptibility values of rocks have proved to be a useful tool for high-resolution correlation throughout portions of the hydrocarbon-rich Arkoma Basin that comprises the west central part of the state.

presenting
12 pm-1 pm

County: Washington

The Research-to-Practice Gap: Differing Attitudes toward Using Evidence-Based Interventions

Madeline Holman, Alexis Downs, Chase Roweton, Amy Hendricks, Kathryn Parisi, Ayla Mapes, Lauren Quetsch

University of Arkansas, Department of Psychological Science, Family and Community Intervention Lab (FCI), Fayetteville, AR

The implementation of evidence-based interventions (EBIs) is essential for the expansion of effective care across the United States. Importantly, understanding trends in the adoption of EBIs by community professionals allows for a more focused approach in future training and implementation efforts (Nelson et al., 2007). The current study examined differences in clinician's attitudes towards EBIs (via the Evidence-Based Practice Attitudes Scale; EBPAS; Aarons, 2004) based on clinician theoretical orientations (behavioral, cognitive-behavioral, psychodynamic), education levels (Ph.D., Master's) and geographical settings (rural, urban). Participants were practicing clinicians (N = 123) who averaged 41 years of age, were largely female (70.3%), and mostly White, non-Hispanic (72.7%). Given the sample size discrepancies, only descriptive statistics were used to compare theoretical orientations; clinicians ascribing to a cognitive-behavioral orientation reported the highest attitudes on the EBPAS. Clinicians reporting a psychodynamic approach reported the lowest attitudes. T-tests indicated there were no significant differences between clinician attitudes from urban or rural settings. T-tests also showed clinicians with a Ph.D. reported significantly higher attitudes towards EBIs as compared to clinicians with their Master's degree ($t(98) = -3.19$, $p = .002$; $d = .725$). Future directions for reducing the research-to-practice gap will be discussed.

presenting
12 pm-1 pm

County: Washington

Disruptive Behavior Differences in Gender and Grade Level in the context of TASC referred adolescents

Grace Staples, Mariah McIntosh, Kate Moeller, Aubry Perronne, Ayla Mapes, Lauren Quetsch

University of Arkansas Family and Community Intervention Lab (FCI), Fayetteville, AR

Disruptive and aggressive behaviors have been shown to predict school difficulties (Bierman et al., 2013). Indicators such as demographic characteristics may provide important information for interventionists to target the most at-risk individuals. For example, teachers perceive boys as engaging in higher amounts of disruptive behavior than girls (Glock & Kleen, 2017). The current study examined the relationship between demographic factors (gender, grade) and engagement in aggressive, defiant, and hyperactive behaviors for children participating in a truancy intervention program, Truancy Assessment and Service Center (TASC). First- through fifth-grade students with five unexcused absences (N = 136,893) from 413 Louisiana schools were referred to TASC staff to receive low- or high-intensity interventions (e.g., attendance monitoring, assessments; Guin et al., 2013). Findings yielded no relation between gender and defiance ($p = .404$), aggressive behavior ($p = .764$), nor hyperactivity ($p = .307$). There was a significant relation between grade and defiance, $X2(14) = 37.23$, $p = .001$, øc = .02, and grade and hyperactivity $X2(14) = 78.88$, $p < .001$, øc = .02, with younger children engaging in more defiant and hyperactive behavior. There was not a significant relation between grade and aggression ($p = .625$). Conclusions and future directions will be discussed.

presenting
12 pm-1 pm

County: Polk

Examination of the current status and distribution of *Etheostoma collettei* in the Ouachita River Basin

Grace Davenport, Ginny Adams, Reid Adams

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

Research on the distribution of fishes tends to focus on the species identified as vulnerable, with fewer data available to assess changes in status for species considered more widespread. Long-term data allows us to detect a species decline prior to reaching critical status. *Etheostoma collettei* is considered stable throughout its range in Arkansas and Louisiana. However, recent collections in the Ouachita River Basin in Arkansas indicated a range contraction in *E. collettei* compared to historical data at the same sites. Contemporary data (collected during 2016 and 2017) revealed *E. collettei* were detected at 16 fewer sites compared to historical collections (during the 1970s and 1980s) using similar collection methods. The objectives of our research were to better understand habitat use and distribution of *E. collettei* as well as assess potential correlates related to reduced detection. We explored macrohabitat use and correlations between land cover/land use and instream habitat at sites where *E. collettei* was detected historically but absent in recent collections. A total of 541 individuals were collected from 24 sites during 2016 and 2017. Sites where *E. collettei* were not detected had significantly higher pasture land use in the upstream catchment. Additional analyses on habitat correlates will be discussed.

presenting
12 pm-1 pm

County: Faulkner

Establishing restoration targets for shortleaf pine-oak forests in the Ouachita Mountains, Arkan

Lillian E. McDaniel, Alexander J. Russell, and Dr. William T. Flatley

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

Shortleaf pine (*Pinus echinata*) ecosystems were severely degraded by logging and fire exclusion in the 20th century. Managers are using prescribed fire to restore these ecosystems, based on our understanding of historical wildfire. However, previous research demonstrates varying fire frequency during the past three centuries. Our objective is to answer two questions: (1) Did forest composition change in response to shifting fire frequency? (2) Do patterns of tree-ring growth indicate changes in forest density in response to shifting fire frequency? We collected tree cores and cross-sections from an unlogged shortleaf pine forest in the Lake Winona Research Natural Area, within the Ouachita National Forest of Arkansas. We crossdated pine and oak samples to identify tree establishment dates and calculate growth changes across three previously characterized historical fire regimes: infrequent fire 1700-1830, frequent fire 1830-1930, and fire exclusion 1930-present. The number of growth releases increased in the frequent fire period suggesting that more fire reduced forest density. Fire-tolerant pine trees dominated establishment during the frequent fire period and fire intolerant species only began to establish during the recent fire exclusion period. Managers will use this research to guide the frequency of prescribed burning in the Ouachita Mountains.

presenting
11 am –12 pm

County: Clark

Isolation of *Centruroides vittatus* Sodium Toxins from GST Tag Through Thrombin Digestion and Protein Analysis

David Banda, Ashton Hale

Centruroides vittatus is found throughout the South Central United States and Northern Mexico. These scorpions produce a sodium toxin which interferes with the closure of neuronal sodium channels. If the sodium channels do not close the neuronal cell cannot open potassium channels to repolarize the cell in preparation for another action potential. Thus, the neuronal cell is stuck in an ionic imbalance preventing movement of the prey. The purpose of this research is to use *Escherichia coli* expression cells to produce a functional sodium toxin for further structural and physiological analysis. We are now in the structural analysis of these sodium toxins produced by the *E. coli* expression cells. This analysis can not begin without first isolating the sodium toxin first from the GST Tag that was used for the whole protein through affinity chromatography. This isolation is performed by Thrombin digestion of the thrombin site that releases the GST Tag from the sodium toxin. Successful digestion is tested through SDS-PAGE gel electrophoresis which should display GST Tag at 30 KDa and the sodium toxin at 7 KDa on the gel. After isolation Heat treatment is used to increase concentration of the sodium toxin by separating it from contaminates found in the samples. Nano Drop analysis is then performed to test this concentration and then mass spectrometry is used to analyze the sodium toxin sample quality by comparing the protein size to naturally produced toxins.

presenting
11 am-12 pm

County: Faulkner

F-box protein-mediated selective proteolysis and its importance in cancer therapy

Austin Anderson, Madelyn R Jameson, Mi-seon Seong

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

Protein degradation is a necessary process that maintains protein equilibrium. Oncogenes, which promote the continuation of the cell cycle, are affected by protein degradation, along with tumor suppressors, which inhibit cell growth. Overexpression of oncogenes and underexpression of tumor suppressors result in the growth of tumors. In eukaryotic cells, the Ubiquitin Proteasome System is a key mechanism of selective protein degradation using polyubiquitin as a marker on a target protein. F-box proteins are the substrate-recognition subunits of Cullin-RING ubiquitin E3 ligases (CRLs).
By understanding the dysregulation of F-box protein-mediated proteolysis which results in the present or absent of certain proteins in cancerous tumors, certain drugs for cancer therapies can be created. Presented here are F-box protein mediated protein degradation and their involvement in cancer, and our discovery of F-box proteins involved in Arabidopsis light signaling.

presenting
11 am-12pm

County: Dallas

Antimicrobial Effects of *Centruroides vittatus* Beta Sodium Toxin Na668

Jackson Gray and Tsunemi Yamashita

Biology, Arkansas Tech University, Russellville, AR

Bacterial resistance is an increasing problem in modern medicine. Antibiotic resistance is associated with increased mortality rates. Venom proteins have been shown to exhibit antimicrobial properties, and one possible solution is the beta toxin protein found in *Centruroides vittatus* (striped bark scorpion), this toxin attacks the voltage-gated sodium ion channels (Navs) 1.4 and 1.5. It does this by binding to segment 4 (which is part of the voltage-sensing domain) and alters the channel in such a way that it lowers its activation energy allowing more ions across. Here we investigate the antimicrobial properties of *Centruroides vittatus* toxin Na668 against bacteria such as MM294 *Escherichia coli.* We selected MM294 *Escherichia coli* in the experiment for its availability. Since it is gram-negative the lipopolysaccharide coating on the outside of the peptidoglycan cell wall reduces antibiotics penetrating the cell wall. We hypothesize that if we see antimicrobial properties against *E. coli*, we will see the same properties against gram-positive bacteria such as *Staphylococcus aureus*. We created multiple LB cultures such as regular broth, and others with treatment. The LB is used as our positive control to compare how the bacteria will grow under normal conditions. An LB and Ampicillin is our negative control to compare how much growth is expected in an antimicrobial environment. We cultured the bacterial cultures and recorded absorption every two hours to determine the growth of the bacteria in the cultures. When we see inhibition of the bacterial growth have been noticed, we plated samples from broth cultures in order to get colony-forming units. The plated samples will give us accurate viable counts for comparison. A one-way ANOVA on the results will help determine the statistical significance of the data.

presenting
11 am-12 pm

County: Faulkner

The Effects of Varying Light Wavelengths and Gravity on Phototaxis of *Dictyostelium discoideum*

Spencer Greer, Savannah Edwards, Dr. Jim Taylor

Dictyostelium discoideum is known as a model organism due to its unique life cycle. When food is present the *Dictyostelium* lives as a unicellular amoeba. However, when food becomes scarce and the cell starves, aggregation of many unicellular amoebae is seen as they form a motile, multicellular "slug". This slug responds to stimuli in its environment, particularly light, and moves to find a more suitable position upon which it forms a fruiting body for spore dispersion. While the means by which the slug moves is not fully understood, response to cAMP waves and varying intensity and quality of light as well as gravity are believed to be the most plausible reasons. In this experiment, slug movement of *Dictyostelium* was examined under the effects of red, blue, and green light, as well as antigravity conditions which were produced by a clinostat. Red and green light were observed to have the most effect on slug movement, while blue light had the least effect on slug movement. Results also exhibit that gravity does affect slug movement. Slugs in stationary (non-gravity manipulated) plates showed affinity toward light, but slugs on a clinostat exposed to the same wavelength of light generally showed a higher affinity for that light. Slugs grown in the dark showed a preference for gravitaxis, indicating gravity has an effect on slug movement, but the slug's response to light appears preferential to gravity.

presenting
12 pm-1 pm

County: Independence

The evolution of novel neuropeptides in Cnidaria: investigating the function of a lineage-specific neuropeptide RPamide during N. vectensis development

Hannah Zang

The process of functionally integrating novel neuropeptides into the pre-existing nervous system during evolution is poorly understood. In Cnidaria, a new neuropeptide known as RPamide likelyemerged in the sea anemone lineage and may illuminate the evolutionary history of the Cnidarian nervous system. RPamide is restricted to sea anemone cnidarians, has different developmental expression patterns, and has a function that is not well characterized. We find that through in situ hybridization and immunostaining that RPamide expression occurs in ectodermal cells in the aboral region during gastrulation, suggesting that RPamide regulates development of the aboral apical organ, a sensory structure of the free-swimming planula for metamorphosis. To investigate the function of RPamide neuropeptides, we utilized CRISPR-Cas9 technology to knockout the RPamide precursor gene. The analysis of F 0 RPamide mutants shows similar rates of metamorphosis relative to the control, suggesting that RPamides may not be necessary for the temporal regulation of life cycle transition. Additionally, despite spatial gene expression analyses suggesting that RPamide regulates development of the apical organ, the F 0 RPamide mutants showed normal apical tuft formation. Ongoing studies will attempt to identify a morphological or temporal phenotype and to conduct rescue experiments by treating F 0 mosaic mutants with synthetic RPamides.

presenting
12 pm-1 pm

County: Pope

Microglia Exhibit Time-Dependent Recovery of Phagocytosis After Ethanol Exposure: A Potential Mechanism Related to Inflammatory Cytokines

Claire Keisling, Allison Harmsworth, David Donely

Harding Biology Department, Harding University, Searcy, AR

Microglial cells are innate immune cells of the central nervous system (CNS) and aid in maintaining homeostasis of this environment. Ethanol is able to cross the blood-brain-barrier and effect on CNS cells. Ethanol in the CNS stimulates a microglial response and may potentially impact glial ability maintain CNS homeostasis. Studies have shown that microglia have a 16% decrease in phagocytosis when exposed to ethanol for 24 hours. There is a dose dependent decrease of phagocytosis due to 2 hours of ethanol exposure, with more than a 40% decrease at the highest concentration, as measured by flow cytometry. After 24 hours post-ethanol stimulation, microglia partially recover with less than a 10% difference in phagocytosis between control and ethanol-stimulated cells. A potential mechanism for this recovery is through pro -inflammatory cytokines such as TNF . Beginning 12 hours after ethanol exposure, TNF mRNA production increased with peak production occurring at 18 hours. TNF significantly upregulates microglia phagocytosis from about 3 beads per cell to about 7 beads per cell. However, phagocytosis recovery still occurred when anti- TNF blocking antibody was applied to cells concurrent with ethanol stimulation. Further research is needed to fully understand the mechanisms underlying recovery of phagocytosis.

presenting
12 pm-1 pm

County: Greene

Extracellular TDP-43 alters microglial polarization

Wilcox, A; Genry, L; Donley, DW.

Harding University, Department of Biology, Searcy, AR

The proper response to protein signals is important for a healthy central nervous system, and protein dysregulation is a feature of neurodegenerative diseases. Transactive response DNA-binding protein-43 (TDP-43) is a protein that is dysregulated in amyotrophic lateral sclerosis (ALS). Buildup of TDP-43 stimulates microglia, the brain-resident immune cells, but the impact of TDP-43 on microglia is still not clear. To address this, microglia were stimulated with TDP-43 or a vehicle. TDP-43 stimulation increased phagocytosis and markers of activation but not proliferation. To address the impact on microglial signaling, we completed proteomic analysis and found over 1,900 differentially expressed proteins in TDP-43-stimulated microglia. Pathways affected include lipid metabolism, inflammatory signaling, and autophagy, suggesting that TDP-43 may alter the response of microglia to other signals. Upon stimulation, microglia polarize to either an M1 (toxic) or M2 (regulatory) phenotype. To understand the effect of TDP-43 on the microglial polarization, cells were concurrently stimulated with TDP-43 and polarizing cytokines. In cytokine-stimulated cells, TDP-43 augmented M1 activation and reduced M2 polarization. These data demonstrate that TDP-43 is an inflammatory stimulus for microglia and alters their ability appropriately respond. Future work will address whether microglia stimulated by TDP-43 contribute to neuronal degeneration in ALS.

presenting
11 am-12 pm

County: Garland

Investigations of possible roles for DNA sequences in promoting dissociation of the Spt16 from genes.

Mattie Nester, Sam Byrd, Brianna Hoyt, Daniel Habenicht, Heather Prowse, Sydney Ozersky, Jennifer A. Harper, Alex Crocker, Claire E. Turkal, Lauren Joseph, and Andrea A. Duina

Hendrix College Department of Biology, Conway, AR

DNA is the blueprint for cells within an organism and contains genes that are copied into RNA molecules and then translated into proteins. The DNA within each human cell is ~2 meters long and is compacted by first coiling around histone proteins, forming nucleosomes. Our lab studies how cells copy genes into RNA molecules, a process known as transcription. During transcription, the enzyme RNA Pol II is assisted by several elongation factors to overcome nucleosomes, which represent roadblocks to its passage. We study how one of these factors, Spt16, interacts with and ultimately dissociates from genes using the budding yeast model system. Our project investigates whether DNA sequences at the ends of genes play a role in Spt16 and Pol II dissociation. To determine this, we have generated 14 internal deletions at the end of the *PMA1* gene and assessed their effects on Spt16 and Pol II dissociation. These studies identified a region required for normal dissociation of Spt16 and Pol II. We are currently exploring how these internal deletions affect nucleosome positioning across the gene. Together, these studies provide insights into the possible roles of DNA sequences in ensuring proper Spt16 dissociation from genes following the transcription process.

presenting
11 am-12 pm

County: Grant

Growth in Porcine Blood Enriched Media Affects Cell Viability and Production of Toxic Shock Syndrome Toxin-1 by *Staphylococcus aureus*

Caitlyn L. Burke[1], Gabrielle Tate[2], and Mark E. Hart[3,4]

[1]Department of Biology, Henderson State University, Arkadelphia, Arkansas,
[2]Department of Chemistry, Oklahoma State University, Stillwater, Oklahoma
[3]Division of Microbiology, National Center for Toxicological Research, Jefferson, Arkansas, and
[4]Department of Microbiology and Immunology, University of Arkansas for Medical Sciences, Little Rock, Arkansas

Prototypic toxic shock syndrome-causing *S. aureus* strains, MN8 and FRI-1169, isolated from vaginal toxic shock syndrome exhibited a modified *in vitro* growth pattern and increased production of the toxic shock syndrome toxin-1 (TSST-1) in media supplemented with porcine blood concentrations representative of the venous blood component in human menses. This suggests components of blood promote production of TSST-1 by *S. aureus*. Strains MN8 and FRI-1169 exhibited 10-fold and 100-fold declines in viability, respectively, within the first two hours when grown in the presence of tryptic soy broth (TSB) supplemented with blood as compared to TSB alone. The strains were then able to recover to levels comparable to growth in TSB alone. This study demonstrates that while the venous blood component of menses serves as a stimulant for toxin production, it may result in a selective pressure on the *in vitro* population dynamics of *S. aureus*. The data obtained from this study provides new insight to the pathogenesis of *S.aureus* and could potentially lead to improvements in prevention and treatment of vaginal cases of toxic shock syndrome, affecting women across the world.

presenting
11 am-12 pm

County: Clark

Investigation of Unique Methane and Sulfur Metabolizing Microbial Communities Within an Incompletely Explored Cave System

Kaylie Wheeless[a], Quincy Gragg[a], Cecily Rodriguez[a], Lauren Camp[a], Chris Taylor[b], James Engman[c], Michael Ray Taylor[d]

[a]Henderson State University, Arkadelphia, AR
[b] University of Arkansas, Graduate Program in Engineering, Fayetteville, AR
[c] Department of Biological Sciences, Henderson State University, Arkadelphia AR
[d] Department of Communication and Theatre Arts, Henderson State University, Arkadelphia, AR

Chemoautotrophic ecosystems have been found in a small number of environments including caves and deep sea hydrothermal vents and seeps. While exploring a cave in the Highland Rim geologic region of Tennessee, microbial communities were collected from a pool in an area named “Petroleum Passage” due to a strong odor of petroleum. The pool has a sandy bottom with scattered patches that emit black droplets of a tar-like substance, and are surrounded by concentric rings of colored sand, suggesting microbial activity. Samples collected include the patches, rings, water, and actively growing cave formations. Six samples have been analyzed using metagenomic DNA sequencing. Using a BLAST database, 494 operational taxonomic units (OTUs) were identified, including both Eubacteria and Archaea. Higher levels of density, diversity and unique taxa were found in the concentric rings. OTU’s from the cave include many unique species that metabolize methane and sulfur, previously associated with terrestrial and deep-sea thermal vents, and others that degrade hydrocarbons. Peaks of methane have been detected in the atmosphere of Mars; results of this study support previous hypotheses that microbial communities associated with cave ecosystems may provide models for possible life in subsurface Mars.

presenting
11 am—12 pm

County: Lonoke

Using Genomics to Design Shine-Dalgarno knockout primers in *Halothiobacillus neapolitanus*

Huey, Fischer and Quattlebaum, Ben, Newton P. Hilliard, Jr.

Biochemistry Program, Physical Sciences Department, Arkansas Tech University, Russellville, AR

Halothiobacillus neapolitanus is an obligate sulfur oxidizing microbe possessing genes for a potentially heterodimeric thiosulfate dehydrogenase (Tsd AB). Evidence for the potential heterodimeric nature of this enzyme resides primarily in its gene structure containing the ATGA co-expression motif between TsdA and TsdB genes at Hneap_1476 and Hneap_1477 gene loci. In order to test the hypothesis that this is indeed a heterodimeric thiosulfate dehydrogenase and that the two genes are co-expressed, PCR based mutagenesis will be used to perform numerous knockouts within the predicted Shine-Delgarno (SD) sequence for the 2nd gene (Hneap_1477). Genomics have been used to ensure that PCR primers designed for these knockouts do not create an alternate SD. This is seen as significant since 270, or 11.3% of the 2414 identified genes in the *H. neapolitanus* genome possess the ATGA co-expression motif. Alignment of identified SD sequences shows significant base distributions in positions 1, 2 and 6. Positions 3, 4 and 5 however show much higher conservation with ≥81% G, A and G respectively. This yields a consensus sequence of A/C, G/C, G, A, G, G/C/A. While this does match the AGGAGG consensus sequence, it does indicate limitations for choices in mutagenic primers.

presenting
12 pm-1 pm

County: Benton

Effect of Ketamine on Parvalbumin Interneurons in the Prefrontal Cortex and Hippocampus during Depression-Like Behavior in Mice

Olivia Lawler[a], Michael Games[a], Vanessa Magana[a], Valeria Armendariz[b], Kevin Mata[b], Katie Deck[a], Alex Brown[a], Daniel Grosselin[b], Kara Odell[a], and Qian Wang[a].

[a]Department of Biology,
[b]Department of Chemistry; John Brown University, Siloam Springs, AR, 72761

Major depressive disorder (MDD) is characterized by lack of motivation, sadness, apathy, and suicidal thoughts and actions. At the cellular level, MDD has been reported to impair parvalbumin (PV) interneuron activity under chronic stress – an inhibitory neuron. In mice, low doses of ketamine (KET) decrease depressive behavior under acute stress. However, KET's specific effect on PV interneuron activity remains unclear. To understand KET's influence on PV interneurons in MDD models, we formed two cohorts of mice to undergo the forced swimming test. The experimental group received a ketamine (10mg/kg) injection and the control group received a saline injection prior to test onset. Brain tissue was labeled with fluorophore-conjugated antibodies for two protein markers: PV (interneuron characterization) and Fos (interneuron activity). Behavioral video analysis indicated similar immobility times between KET mice (n=8) and control (n=7) groups. Surprisingly, numbers of PV and PV+Fos interneurons were significantly higher in the ventral hippocampus of KET mice. In the lateral orbitofrontal cortex, the percentage of PV+Fos interneurons was significantly decreased in the KET mice. These findings suggest PV circuitry is altered with KET administration. Whether this is contributed to KET or the antidepressant effects of KET is to be determined.

presenting
12 pm-1 pm

Hometown: Izard

Impact of Nonpoint Source Pollution on Crustacean Physiology in Northeast Arkansas

Jordan Webb[a], Linda Fowler[a], Allison Mundy[a], Erik Pollock[b], Allyn Dodd[a] and Maryline Bossus[a]

[a]Math and Sciences department, Lyon college, Batesville, AR
[b]University of Arkansas, Fayetteville, AR

Arkansas is one of the country's highest poultry producers with a steady expansion in Northeast Arkansas. Increases in poultry and livestock agriculture can affect nearby surface waters by introducing runoff high in phosphorus and nitrogen, increasing the potential for harmful algae blooms and potentially impacting aquatic life. Our study investigates ways to monitor water quality and invertebrates' health within the Eleven Point and Lower Black River drainages. In order to do so, physiological mechanisms are being assessed in the Ozark crayfish, as crustacean are commonly used as bioindicators. Over the summer, crayfish were sampled from 3 streams, which presented the highest, lowest, and average levels of pollution (nitrate and phosphorus levels) in Northeast Arkansas over 12 sampling sites. Histological analysis on gills, intestine and green gland was used to determine their osmoregulatory and respiratory ability, as well as evaluate the impact of water quality on their survival. This research was part of a larger research project which ultimately will allow us to determine the effects of agricultural pollution in streams in Northeast Arkansas.

presenting
11am-12pm

County: Saline

Assessing Water Quality and Macroinvertebrate Communities along a Gradient of Poultry Agriculture in Northeast Arkansas

Allison Mundy[a], Victoria Prater-Rochier[a], Linda Fowler[a], Olivia Echols[a], Katherine Cruse[a], Jordan Webb[a], Erik Pollock[b], Maryline Bossus[a], and Allyn Dodd[a]

[a] Division of Math and Science, Lyon College, Batesville, AR
[b] University of Arkansas Stable Isotope Laboratory, Fayetteville, AR

Arkansas is currently the nation's second largest producer of poultry. The industry is expanding eastward across the state, with new farms being built in Randolph, Sharp, Lawrence and Independence County. With the addition of new poultry houses to a pastoral landscape as of 2016, sensitive waterbodies are at increased risk of nutrient and sediment pollution and loss of sensitive taxa. The Eleven Point River and the Lower Black River have been identified as potentially sensitive waterbodies because they are the habitat for a number of endangered species including the Ozark Hellbender (*Cryptobranchus alleganiensis bishop*), the Coldwater Crayfish (*Faxonius eupunctus*), and the Pink Mucket (*Lampsilis abrupta*) . In this study, we evaluated nutrient and sediment concentrations as well as macroinvertebrate community structure in twelve tributaries of the Eleven Point River and Black River. We sampled along a gradient of poultry house densities (0.04 to 0.57 poultry houses/km2) with various flow path distances to agricultural operations. Phosphorus concentrations tended to increase with greater subcatchment poultry house density, indicating that even new farms may already be impacting water quality. Our efforts represent the first intensive monitoring program to address the impact of new poultry operations in Northeast Arkansas.

presenting
12pm-1pm

County: Pulaski

Blockade of alpha9-alpha10 nicotinic acetylcholine receptors as a potential novel strategy for migraine

Michaela Stone[1], Mehul M. Shah[2], Jessika Sanz[2], J. Michael McIntosh[3], Frank Porreca[4], Jennifer Y. Xie[2]

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[4]Department of Medical Pharmacology, Arizona Health Sciences Center, University of Arizona, Tucson, AZ, USA

Migraine is the most common neurological disorder and usually associated with nausea, vomiting, and hypersensitivity to environmental stimuli. We aim to identify novel acute and preventative therapies for migraine. Activation of α9α10 nAChRs increases the release of CGRP (calcitonin gene-related peptide), the "biomarker" of migraine pathophysiology. Therefore, blockade of α9α10 nAChRs may represent a viable mechanism for migraine treatment. We tested a highly selective α9α10 nAChR antagonist, RgIA4, in relieving migraine-related pain. Adult female CBA/CaJ mice were injected with inflammatory mediators (IM, 5.0 μl, comprised of bradykinin, serotonin, histamine, and PGE2) on dural surface to induce cutaneous hypersensitivity. Von Frey filaments (0.4 and 1.0 g) were applied 10 times to the periorbital and hindpaw regions and the withdrawal frequency assessed prior to and hourly for 5 h post-IM. Our results showed that dural IM produced 40% and 30% increase of the response frequency for periorbital and hindpaw regions vs. baseline - cutaneous allodynia was developed. Systemic administration RgIA4 (500 μg/kg, s.c.) given at 0.5 h prior to dural IM blocked this effect. α9 knockout mice also showed much-reduced cutaneous allodynia post-IM. These results strongly indicated that blockade of α9α10 nAChR may be a promising new strategy to reduce migraine pain.

presenting
12pm-1pm

County: Pulaski

Characterization of the Potential of a Small Molecule Target Towards a Ras-Related Protein-Protein Interaction

John Lee, Emilio Duverna, Dr. Paul Adams

University of Arkansas, J. William Fulbright College of Arts & Sciences, Department of Chemistry & Biochemistry, Fayetteville, AR .

CUT TEXT

In the state of Arkansas, the three cancer types with the highest mortality rate over the last several years have been Lung, Breast and Prostate Cancer, respectively.[2] Each of these cancer types have been found to correlate with increased levels of the Ras-related protein Cell division cycle 42 (Cdc42) expression or the deregulation of this protein's signaling pathway.[3,4] The Cdc42 pathway is known to regulate the cell's cytoskeletal structure, cell growth, division, tumorigenesis, and motility.[3] Currently, very few therapeutic approaches exist to combat either cancer causing mechanism. An immense amount of recent research aims to develop a small target molecule capable of inhibiting the activation of Cdc42 and its subsequent signaling pathway, thereby restoring regulation to this specific protein.[1] Our primary research efforts thus far have consisted of the purification of Cdc42 and one of its effector proteins, Ack. Ack is known to bind Cdc42 with nanomolar affinity and regulates neuronal signaling, androgen receptor activation, and more importantly for our research drives tumorigenesis. The non-receptor tyrosine kinase, controls these functions through direct phosphorylation of subsequent targets. Protein purification is a fundamental step when attempting to characterize binding interactions between these biomolecules and other small molecules. The small molecule of interest in this research is R3 ADU-PhET a small aromatic compound.

presenting
12pm-1pm

County: Benton

Physical vs. Virtual Dissections in Arkansas' Classrooms

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[b]School of Education/College of STEM, University of Arkansas – Fort Smith, Fort Smith, AR.

Literature shows that there is debate between whether or not virtual or physical dissection is more beneficial to students. A majority of students in the classroom learn kinesthetically, which would involve physically touching and seeing the material they are working with to learn the content. However, with the technological advances over the last decade and the movement of technology into the classroom curricula, many schools have been performing virtual dissections, rather than the physical options. Catering to the minority of students in a classroom can lead to a decrease in not only the student's grade but his/her understanding of the content as well. When choosing what is best for a science classroom, it is important to know your students and what the research supports for the classroom environment.
After receiving UAFS IRB approval, I surveyed 7th-12th grade science teachers from Arkansas classrooms, as well as UAFS anatomy and physiology students, to determine prior dissection experience and preferences.

presenting
11am-12pm

County: Pulaski

Analyzing Infection Control Assessment Recommendations to Improve the Health of Arkansans

Ruby D. Trotter, Rohan Chakravorty, MPH, Jordan Mallard, Trenton Gulley, MPH, Kelley Garner, MPH, MLS, Naveen Patil, MD, MHSA, MA

Healthcare-associated infections (HAI) are infections that develop while receiving medical care. The HAI program at the Arkansas Department of Health (ADH) conducts assessments using the Centers for Disease Control and Prevention's Infection Control Assessment and Response (ICAR) tool. The HAI program utilized qualitative research methods to create a codebook summarizing the feedback and recommendations made in ICAR letters. Codes were entered into a REDCap database and analyzed in Microsoft Excel. Letters from 102 visits to hospitals (n = 48) and long-term care facilities (n = 54) between 2017-2019 were analyzed. Arkansas hospitals have the most room for improvement in policies and practices related to injection safety (98%, n = 47), urinary catheter insertion (96%, n = 45), infection control program infrastructure (94%, n = 45), hand hygiene (94%, n = 45), and multi-drug resistant organism detection (98%, n = 47). For long-term care facilities, the primary deficiencies included hand hygiene (100%), infection control program infrastructure (96%, n= 52), and antibiotic stewardship (98%, n = 53). Quantitatively analyzing data is an innovative methodology for HAI programs. These data will serve as a baseline for future assessments and facilitate further analysis.

presenting
11am-12pm

County: Jefferson

Energy Content of Seeds of Common Sunflower (*Helianthus annuus*) from the Diet of Scaled Quail (*Callipepla squamata*) from Southeastern New Mexico

Dixie Lozano-Lopez, Emily Neilson, Isaac Castillo, John Hunt

University of Arkansas at Monticello, Monticello, AR.

Knowledge of the energy content of food is critical to understanding why an animal might choose one food item over another. We analyzed the energy content of seeds of common sunflower (*Helianthus annuus*) obtained from the crops of scaled quail (*Callipepla squamata*) collected from plains-mesa sand scrub in Lea and Eddy counties, New Mexico. Seeds were removed from crops and dried for 48 hours at 60°C to remove moisture and standardize masses. Seeds were then analyzed for gross caloric value (i.e., energy content) in an oxygen bomb calorimeter. Preliminary results for 14 samples are presented.

presenting
11am-12pm

County: Jefferson

Directional Release of Reovirus in Polarized Lymphatic Endothelial Cells

LeKivia Cobb[a], Michael Eledge[b], Amairani Paredes[b], and Karl W. Boehme[b]

[a]Department of Biology, University of Arkansas at Pine Bluff,
[b]Department of Microbiology and Immunology, University of Arkansas for Medical Sciences

Mammalian orthoreovirus (reovirus) is a segmented, double-stranded RNA virus that infects a wide range of hosts, including humans. Recent data from our laboratory identified lymphatic endothelial cells (LECs) as a cell type that mediates reovirus systemic spread. An important aspect of endothelial cell physiology is the formation of polarized monolayers that line lymphatic vessels. Polarized cells contain distinct apical and basolateral surfaces due to tight junctions that form between the cells, function to maintain the integrity of vessels, and prevent leakage of luminal contents into the surrounding tissue. Previous studies indicate that reovirus is preferentially released from the apical surface of polarized cells. Here, we hypothesized that reovirus will be preferentially released from the apical surface of polarized LECs. We found that tight junction protein zona occludens-1 (ZO-1) localized to the periphery of LECs, indicating the formation of tight junctions. We also found that the transendothelial electrical resistance (TEER), an indicator of barrier establishment, was increased under polarization conditions. When infected with reovirus, progeny virions were only released from the apical surface of polarized LEC monolayers, regardless of whether infection was initiated at the apical or basolateral surface.

presenting
11am-12pm

County: Polk

Microbial Inhibitory Effects of Local Arkansas Honey Types

Stephany Crabtrey[a], Samantha Hewett[a], and Kari Naylor[a]

[a]*Department of Biology, University of Central Arkansas, Conway, AR*

Inappropriate use of antibiotics has led to the development of antibiotic resistant pathogens which pose a serious threat to public health. The vast majority of these antibiotic resistant infections are healthcare-acquired and cost the United States over $20 billion annually. This public health threat and increasing need for alternative antimicrobial strategies has led to the re-evaluation of ancient therapeutic remedies from botanical sources and by-products such as honey. Currently, therapeutic grade Manuka honey is the only FDA approved honey for use in wound treatment and is quite costly. Recent research conducted by Hewett et al., 2019, suggests honeys derived from local Arkansas multi-floral sources are comparable in anti-microbial efficacy to Manuka.
The aim of this project is to determine minimum inhibitory concentrations (MICs) for local Arkansas honey, expanding our sample size and confirming that multi-floral Arkansas honeys are equivalent to Manuka in antimicrobial activities. Overall, eleven new Arkansas honeys had an average MIC of 16% against five different clinically important antibiotic resistant bacterial species. Two additional species were inhibited by 32% honey concentration. These trends are similar to what has been reported for Manuka honey and provides a starting point to identifying potential alternative cost-effective local honey sources.

presenting
12pm-1pm

County: Faulkner

The spatial resolution of object discrimination across echolocation and touch.

Michael Ezeana[a], Elise Rushing[a], Santani Teng[b], Amrita Puri[a]

[a]Department of Biology, University of Central Arkansas, Conway, AR
[b]Smith-Kettlewell Eye Research Institute, San Francisco, CA

Active echolocation involves emitting sounds and listening to the reflected auditory information to localize objects and navigate through surroundings. Although primarily associated with animals like bats and dolphins, some visually impaired humans use active echolocation to differentiate between object locations, sizes, shapes, and compositions. Previous research determined that blind echolocators could detect the relative location of two disks with accuracy comparable to that of viewing the disks at about 35 degrees into the peripheral visual field. Here, we explored object discrimination abilities in blind echolocation practitioners. Participants examined an object using echolocation, and then used touch to identify which of a pair objects was the one they had just examined echoically. Performance was significantly greater than chance level, suggesting cross-modal retention of object information, although overall accuracy was somewhat low (~60%). To determine whether this low accuracy reflects insufficient echo information from these relatively small objects, in additional experiments, objects will be 50% larger. Further, sighted participants will view object images blurred to simulate viewing in various peripheral locations, and then examine object pairs using touch and report which they had initially viewed. Together, these studies will reveal the relative spatial resolution of echo- and vision-based object perception.

presenting
11am-12pm

County: Pulaski

Effects of insulin-like growth factors on glutamate receptors in cortical neurons

Kajal B. Desai[1], Larissa L. Porter[2], Steven W. Barger[3,4]

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Alzheimer's disease (AD) is a neurodegenerative disease that slowly destroys memory and thinking. AD brains are less capable of glucose uptake, resembling the insulin resistance occurring in other tissues in Type 2 diabetes (T2DM). With T2DM the body resists effects of insulin, largely due to dysfunction of intracellular signaling elements. Some symptoms of patients with T2DM are seen in AD; they may extend to insulin-like growth factors (IGFs), which share intracellular signaling elements with insulin. IGFs play an essential role in regulating neurogenesis and they may be involved in regulating antidepressant response. Insulin resistance, as in obesity and T2DM, impairs the activity of these networks. This project explored effects of both IGF-1 and IGF-2 on cortical neurons, specifically their effects on AMPA receptors, a key subtype of receptor for the prominent neurotransmitter glutamate. Glutamate plays an important role in learning and memory, thus modes of cognition compromised in AD could be impacted by effects of IGFs on glutamate receptors or—perhaps more importantly—reductions in IGF signaling that occur under conditions of "insulin" resistance. These studies may help determine the consequences of "insulin" resistance in AD brains.

presenting
11am-12pm

County: Saline

The photodynamic therapy potential of a novel water-soluble gallium porphyrin

Tiffany Koba

Ouachita Baptist University

Photodynamic therapy (PDT) has potential use in the treatment of cancer and other health disorders. PDT utilizes light and a photosensitive agent that once activated by light generates singlet oxygen that affects surrounding cells. Metalloporphyrins have been shown to accumulate in tumors as the result of preferential binding to low-density lipoproteins. Additionally, gallium(III) porphyrins have been shown to be effective potential photosensitizers for PDT. The goal of this research was to synthesize and characterize the novel photosensitive agent, GaTPP-DIPA, as a PDT agent. The GaTPP-DIPA was purified using column chromatography and characterized using IR, UV-Vis, and NMR spectroscopies, purity was determined using HPLC. Cytotoxicity testing of the GaTPP-DIPA using U87 glioblastoma cells in both light and dark conditions determined that novel material has potential as a next generation PDT agent.

presenting
11am-12pm

County: Pike

Preparation and cytotoxicity of a novel carbon nano-onion platinum nanomaterial for potential cancer therapy

Cammie York

Ouachita Baptist University

The applications of carbon nanomaterials (CNM), including graphene and its derivatives such as carbon nano tubes (CNTs) in nanomedicine is well established. These nanomaterials have been widely used as *theranostic* delivery systems with the potential to deliver bioactive agents and simultaneously detect selectively diseased tissues. A rather underexplored CNM for biomedical imaging and theranostics delivery are carbon nano-onions (CNO). CNO are carbon-based nanomaterials that can potentially be used in cancer therapy when they are functionalized. Recent studies on cellular fate of different CNMs, including CNOs, have demonstrated that the surface composition is critical for the *in vivo* application of these CNM. Current research discusses the preparation and characterization a novel CNO-Pt nanomaterial and the cell viability of U87 glioblastoma cells in the presence of this functionalized CNO. In order to form the desired CNO-Pt compound, the CNOs were first oxidized, followed by attachment of the cis-diammine platinum (II) dichloride. The novel CNO-Pt nanomaterial was characterized by IR and UV-vis spectroscopies. Cytotoxicity of the material was tested on U87 glioblastoma cells.

presenting
11am-12pm

County: Pulaski

Modified Michael Addition Leads to Biologically Significant Naphthoquinones

Smith, E. [1]; Humphrey, M.[1]; Maloney, T.[1]; Jenkins, S. V.[2]; Dings, R. P.[2]; Nawarathne, I. N.[1]

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[2]College of Medicine, the University of Arkansas for Medical Sciences, Little Rock, AR, 72205

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 commercially used therapeutics. Taking advantage of modified Michael Addition reactions, we have incorporated various groups to the napthoquinone through amino functional moiety to create multitudes of biologically significant naphthoquinones. The modifications are further extended by utilizing peptide chemistry and click chemistry. We are constantly testing the novel naphthoquinones for their various antimicrobial and anticancer properties.

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

presenting
12pm-1pm

County: Independence

C-8 Modifications of Rifamycin Core Leads to Potential Antibacterial Agents

Teà Mason, Armstrong, D.; Hodge, Z.; Ford, A.; Nawarathne, I. N.

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

Rifamycins are a family of drugs with broad-spectrum antibacterial properties. They are mainly used as first-line drugs in tuberculosis treatment. The precursors for many rifamycins are naturally derived; however, almost all the rifamycins in the current market are semi-synthetically generated. The core-structure of rifamycin family of drugs contains a reactive hydroxyl group that can be activated as a sulfonate ester and then be displaced with selected nucleophiles through an addition-elimination mechanism. Through this process, we have synthesized 8-modified rifamycin S derivatives in our research lab that includes 8-deoxy, 8-amino, and various groups with azido functionality on the rifamycin core. Currently we are purifying these compounds using prep-HPLC and are utilizing click chemistry to make chemical extensions through the azide functionality. Those novel rifamycins will be tested for their anti-tuberculosis and other antibacterial activities. Strategically, we incorporate chemical extensions at the rifamycin core-structure to create additional binding contacts to improve the drug efficacy towards multi-drug resistant tuberculosis strains based on the feedback from the preliminary biological activity assays.

This project was made possible by the Arkansas INBRE program and by the Research Technology Core of the Arkansas INBRE program, support by a grant the National Institute of General Medical Science, (NIGMS), P20 GM103429 from the National Institute of Health.

presenting
11am-12pm

County: White

Synthesis and preparation of biomimetic poly (acrylic acid)-based nanofiber scaffolds for biomedical applications

Kayla Churchwell & Sharon K. Hamilton, Ph.D.

Chemistry Department, Ouachita Baptist University, Arkadelphia, AR 71998

Electrospinning of nanofibers has been explored over the past several decades for a variety of applications. While electrospinning biopolymers may be a challenge, due to their inconsistent rheological and gelling behaviors, the resulting nanofibrous webs could act as a platform for biomedical applications. The incorporation of biomimetic molecules into nanofibrous dressings using synthetic biomolecule analogs will reduce the costs associated with traditionally used biomolecules. The biomimetic molecules in the nanofibrous dressing should be capable of mimicking both the structure and morphology of the body's native extracellular matrix, which can facilitate the natural wound healing process in the human body. The purpose of this research was to develop a collagen strand analog from commercially available poly(acrylic acid) (PAA) via the coupling of functional groups to the carboxylic residues of PAA. The selected functional groups represent the most abundant amino acids in collagen. The resulting biomimic was analyzed by ^{1}H NMR spectroscopy and infrared spectroscopy to verify the attachment of each functional group to the PAA backbone. Once the biomimetic molecule had been synthesized, solutions of the biomimetic-PAA with chitosan and poly(vinyl alcohol) were electrospun and the morphology of the resulting nanofiber scaffolds analyzed. Degradation profiles of the fiber mats were analyzed via *in vitro* studies. Further testing is investigating the cytotoxicity, cell adhesion and proliferation of cells cultured in the presence of nanofibers engineered in this research to assess the application of the nanofiber mat with the novel, synthetic collagen strand analog as a wound dressing. Materials containing this collagen strand analog could potentially provide a low-cost dressing that will promote cell proliferation while inhibiting bacterial infection which could cause complications in the body's wound healing process.

presenting
12pm-1pm

County: White

Analysis of Oxidative Stress on Fatty Acids in K -12 E-coli and Fish Oil by GC/MS

Sydnye L. Shuttleworth, Dennis Province Ph.D.

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

Oxidative stress results in the breaking down of biomolecules as they interact with reactive oxygen species. Reactive oxygen species (ROS) generated from life processes can cause damage to cells, tissues, and organs which lead to disease and loss of cell function. Bacteria, like e-coli, are bound by a cell membrane that is made up in part by both saturated and some unsaturated fatty acids. This experiment exposed these fatty acids to reactive oxygen species from 30 minutes to 2 hours to induce oxidative stress. The ROS were produced by irradiating TiO_2 nanoparticles with light from UVLEDs at a maximum wavelength of 365 nm. Methyl esters were then formed from these fatty acids and analyzed by gas chromatography mass spectrometry. The extent of the reaction was monitored by finding the ratio of the peak area of the methyl esters to an internal standard (Heptadecanoic acid, C17:0). The samples contained substantial amounts of unsaturated Eicosapentaenoic acid (C20:5) (40%) and Docosahexaenoic acid (C22:6) (32%).

presenting
11am-12pm

County: Pulaski

Structure-Based Virtual Screening Studies to Identify Novel GABAA Modulators to treat Epilepsy

Chase P. Smiley[a], Aimee Dycus[a], Megan Perga[a], G. Kwame Yeboah[b], Tuwanda Simmons[a], and Henry North[b]

[a]Arkansas State University- Beebe, Beebe, AR
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The GABA receptor is the most important inhibitory neurotransmitter in the Central Nervous System (CNS) and plays a role in the occurrence and progression of seizures due to an imbalance in excitatory and inhibitory neurotransmission. Despite the optimal use of available antiepileptic drugs, over one-third of patients fail to experience seizure control. Moreover, a large proportion of those that have better outcomes does so only at the expense of significant side effects. Hence the search for novel therapeutic agents with greater selectivity and lower toxicity continues in drug discovery investigation. The purpose of this study, therefore, was to provide a ligand-based drug design (LBDD) and structure-based drug design (SBDD) approach to produce novel $GABA_A$ modulators that may have greater selectivity and lower toxicity. LBDD was used to generate robust and predictive pharmacophore models using $GABA_A$ modulators extracted from the ChEMBL database. The best models were used to screen a commercial chemical library of small molecules and fragments. SBDD was employed in molecular docking to explore and predict the binding mode and key interactions made by the top molecules. Structure-guided hit-to-lead optimization and synthesis will be utilized to continue our design and development of novel therapeutic agents. The top 20 compounds with greater selectivity and lower toxicity will be pharmacologically evaluated.

presenting 12am-1pm

County: Faulkner

Bacterial Quantification and Elimination using TiO2 and UV Light as a means of Disinfection during Space Flight

Hannah Smith, Sidney Brandon, Dr. Dennis Province, Dr. Cindy White

Harding University (Searcy, AR); Arkansas Space Grant Consortium (Little Rock, AR)

The International Space Station (ISS) contains a water treatment system that recycles urine into reusable drinking water. This is one of the most important systems on the ISS and must be maintained in order to sustain the crew in space. One problem that has been occurring is the accumulation of bacteria and biofilm growth within the filtration system. To combat this problem, our team hypothesized that TiO2 and UV light would inhibit bacterial growth without creating toxic bi-products. TiO2 is a photocatalyst, and when hit with UV light, reactive oxygen species (ROS) are formed. ROS are very unstable and destroy anything in their path by breaking chemical bonds. When these oxygen radicals come back together, they form oxygen (O2). The bacterial species used in this experiment was *Ralstonia syzygii*; one of the species found in the original bacterial sample from the water treatment filter of the ISS.

presenting
12pm-1pm

County: Faulkner

Organocatalyzed Carbon-Olefin Metathesis: catalyst reactivity and substrate scope

Laura Mortan, Finn Beruldsen, Heidi Dahlmann

Department of Chemistry, Hendrix College, Conway, AR

Reactions that produce carbon-carbon bonds, such as cyclization reactions, typically require extensive heating or catalysis in order to occur. Compared with other methods, organocatalysts mediate cyclizations under greener and milder conditions. During previous studies on organocatalyzed carbonyl-ene reactions, we observed an unexpected carbonyl-olefin metathesis byproduct. Herein we attempt to optimize the organocatalyzed carbonyl-olefin metathesis reaction. Our lab is developing catalysts that simplify reaction conditions, making them safer, more efficient, and more environmentally friendly.

presenting
11am-12pm

County: Pulaski

CB_2 Receptor-Targeted Computational Drug Design Directed at Pain Relief

Nikhil Nair, Dr. Caitlin Scott

Department of Chemistry, Hendrix College, Conway, AR

Approximately 10% of American adults manage harsh effects of pain daily. Tetrahydrocannabinol (THC) in marijuana activates the cannabinoid CB1 receptor in the central nervous system, causing pain relief as well as some undesirable, psychological side effects. The cannabinoid CB2 receptor plays a role in inflammatory pain but does not have the associated psychotropic effects that CB1 does because the CB2 receptor is located in the peripheral nervous system. There is no pain medication available on the market that targets the CB2 receptor. There is not an experimentally-determined activated CB2 structure, so we are using computational methods to predict it. Our objective is to design pain medications that target the CB2 receptor and eliminate the side effects caused by CB1. We optimized an experimentally-determined crystallized structure of the inactive, antagonist-bound CB2 and ran molecular dynamics of the protein under physiological conditions. We utilized software to optimize a known-CB2 receptor agonist, and we docked it using Glide software and Induced Fit Docking and compared our results with known biochemical data to confirm our predictions. Following confirmation of the activated structure and its residues, we expect to move forward with the activated CB2 receptor structure and use it to potentially design new drugs.

presenting
12pm-1pm

County: Crawford

Water uptake on nanospheres using multiple experimental methods: Bridging experimental methods with atmospheric cloud activation theory

Rebecca Parham, Dr. Courtney Hatch

Department of Chemistry, Hendrix College, Conway, AR

Atmospheric aerosols' influence on activation and growth of cloud droplets are one of the least understood factors that contribute to climate change, and thus accurate climate model parameters must be measured to improve climate models. The leading theory describing the activation of aerosols into Cloud Condensation Nuclei (CCN) and their subsequent formation of cloud droplets is Frankel-Halsey-Hill adsorption activation theory (FHH-AT). Its assumption of smooth, spherical surface morphology for insoluble aerosols, which have microstructure, is purported to introduce inaccuracies in the theory. To validate FHH-AT, nanospheres were used as models to measure water uptake by three methods to determine if the data generated cloud activation parameters that agree. Nanosphere samples were purified, aerosolized, and dried, as well as size-selected. A ratio of the number of activated aerosols at a specific supersaturation to the total number of available aerosol particles was found. The critical supersaturation of the sample, where 50% of the sample activated into CCN, was determined. Additionally, gravimetric and optical methods were used to measure water adsorption under sub-saturated water vapor conditions. These data sets were assessed using FHH-AT to determine climate model parameters from individual experimental methods and compared in order to determine the accuracy of the measurement.

presenting
12pm-1pm

County: Independence

Peanut Hairy Roots: A Potential Source of Natural Products for the Treatment of Triple Negative Breast Cancer

Linh-Chi Ho [1], Sepideh Mohammadhosseinpour [1, 2,] Dr. Fabricio Medina-Bolivar [1, 3]

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Breast cancer is the most prevalent type of cancer in women worldwide. Triple negative breast cancer (TNBC) is one of the deadliest types because it does not respond to hormonal treatments. Therefore, there is an ongoing search for new treatments to increase survival rates for this disease. The overall goal of this study is to evaluate the anticancer activity of prenylated stilbenoids as natural products for the prevention and treatment of TNBC. To induce the production of prenylated stilbenoids, peanut hairy root cultures were co-treated with elicitors and purified via semi-preparative high-performance liquid chromatography. Then, the anticancer activity of the prenylated stilbenoids was evaluated in different TNBC cell lines. Cytotoxicity and flow cytometry assays showed that the prenylated stilbenoids exhibited higher cytotoxicity to the cancer cells than non-prenylated stilbenoids. Furthermore, the increased cytotoxicity correlated with increased levels of the apoptosis markers caspase-3 and caspase-7. Additional studies are being conducted using flow cytometry to determine the effect on apoptosis and cell cycle stage after treatment of the cells with prenylated stilbenoids. Future studies will focus on elucidating the signaling pathways affected by prenylated stilbenoids in TNBC cells in order to advance our understanding of the anticancer mechanisms of these natural products.

presenting
11am-12pm

County: Lonoke

Arkansas State Crime Lab Summer Internship

Emily Harness[a], Mary Lynn Huffington[b]

[a]Henderson State University Chemistry Department, Arkadelphia, AR
[b]Arkansas State Crime Laboratory Toxicology Section, Little Rock, AR

The toxicology section at the Arkansas State Crime Lab routinely tests human tissue and fluid samples for foreign substances. This research shows the detection of known concentrations of meth and the detection of various prescription and over the counter drugs. These detections were performed using gas chromatograph mass spectrometry and were conducted in order to show the exact capabilities of the instrumentation and current laboratory methods, respectively, in use at the crime lab. Information regarding the accuracy and precision of various GCMS instruments was collected along with information regarding how well current laboratory extraction methods work.

presenting
12pm-1pm

County: Logan

Modeling the Interactions and Lipophilicity of Synthetic Anion Transporters for Future Cystic Fibrosis Therapies

Jenna Lowery, Jill Ellenbarger PhD

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

Cystic Fibrosis is a disease caused by the absence or malfunction of the cystic fibrosis transmembrane conductance regulator (CFTR) protein. The CFTR protein is a channel that transports chloride anions out of cells. When chloride is not able to accumulate outside of the cell, then water is not attracted to the cell surface and does not flush away mucus. If mucus is allowed to build up, the blockage of airways occurs and makes it hard to breathe. Current efforts are underway to explore molecules that could act as synthetic anion transporters to take the place of the CFTR protein. In this study, computational chemistry methods were used to explore the interactions of possible synthetic anion transporters with chloride. The compounds being studied are thiourea-based compounds because thiourea is easily modifiable, inexpensive, and able to strongly interact with chloride. All of the thiourea-based transporters showed strong interaction energies with chloride. Lipophilicity is also important when constructing these transporters in order to insure the compound will interact properly with the cell membrane. The lipophilicity of each of the five synthetic anion transporters was also studied with Mcule.

presenting
12pm-1pm

County: White

Refining Slater's Rules of Electron Shielding and Effective Nuclear Charge.

Ethan E. Turner, Carl B. Hollandsworth

Originally published in 1930 by John C. Slater, Slater's Rules apply numerical constants to how negatively-charged electrons of varying shells and distances shield one another from the full positive charge of the nucleus, thus describing their shielding constant (S) and their effective nuclear charge (Z_{eff} or Z^*). Slater's Rules as they are may be applied only up to (not including) Cerium, as only electron shells *s, p,* and *d* are described, and only as broad estimations with the heavier d-block elements; however, by working back Slater's Rules and fine tuning the shielding constants of individual interactions one-by-one, we have refined these long-standing, accepted constants into new values that produce significantly more favorable estimations in all tested species, most notably for the trickier d-block series of chromium through zinc (Cr – Zn). Further continuation of the research at hand will be worked to hopefully not only improve these values further, but also expand them to the lanthanide series, beginning with Cerium itself.

presenting
12pm-1pm

County: Faulkner

Charazterizational Studies of Cdc42 in the presence of the Small Molecule AZA197

Meredith Ott, Paul Adams

Department of Chemistry, University of Arkansas, Fayetteville, Arkansas, 72701

This project will try to determine the stability of the Ras protein Cell Division Cycle protein 42 in the presence of the small protein AZA197. This protein, Cdc42 for short, has been shown to be irregularly expressed in certain cancer cells. Ras proteins are involved in cell signaling, and when overactive they result in cascades that lead to cell proliferation and metastasis. Thus, understanding the interactions between Cdc42 and inhibitors such as AZA197 will be important in discovering therapies for Ras-related cancers. In order to experiments, E. coli cells must be engineered with a plasmid containing an ampicillin resistance gene and the desired protein. The E.coli are then grown in a media with ampicillin, so that the only protein present is the desired protein. This protein will then be subject to gel electrophoresis and purification to ensure it is ready before experimenting. The protein will then be subject to stability studies to understand how stable the secondary structure of the protein is when bound to the small molecule.

presenting
11am-12pm

County: Pulaski

Synthesis, Characterization and Applications of Ionic Materials and Nanomaterials

Nabeel Alwan, Stuti Chatterjee, Taylor Scifres, Caroline Kornelsen, Samantha Macchi, Amanda Jalihal, Dr. Noureen Siraj

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

Ionic liquids (molten salts with melting points below 100oC) have received considerable attention in the last two decades for their outstanding properties (e.g low vapor pressure, high conductivity, high thermal stability etc.). Recently, a new class of compounds that exhibit similar properties as ionic liquids but they are solids rather than liquids. In contrast, room temperature ionic liquids (RTILs) produce very unstable nanodroplets that are not true nanomaterials. Thus, frozen ionic nanomaterials, which do form true nanoparticles, have shown promise for a wide scope of nanotechnology applications. These materials have been used for multiple applications due to their tunability characteristics.

In Siraj' research group, we are interested in designing novel, cost effective, highly efficient, and environmentally friendly tunable ionic materials and nanomaterials of variable shapes, sizes and surface charges for biomedical, sensor and energy applications. We aim to establish the simplistic approach to tailor the properties of a material in terms of cost, labor, and time. These ecofriendly materials are aimed toward provision of tunable photodynamic properties, enhanced stabilities (thermal- and photo-stabilities), and favorable electrochemical characteristics such that these materials are ideally suited for combination cancer therapy, and supercapacitor applications.

presenting
11am-12pm

County: Pulaski

Investigation of Förster resonance energy transfer (FRET) in ionic materials (IMs)

Caroline Kornelsen, Nabeel Alwan, Stuti Chatterjee, Amanda Jalihal, Noureen Siraj

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

Förster Resonance Energy Transfer (FRET) is a type of non-radiative energy transfer between two light-sensitive molecules—a "donor" and an "acceptor"—that is currently exploited in many optical applications. However, conventional FRET-based systems are covalent and often must be generated through complicated and environmentally taxing syntheses. FRET-based ionic materials (IMs) with tunable photophysical properties offer a possible alternative. FRET has previously been reported when room temperature ionic liquids (RTILs) and IMs acted as solvents, donor ions, or acceptor ions. However, FRET has not yet been investigated in IMs that are composed of both donor and acceptor ions. In this study, FRET-based ionic materials providing both donor and acceptor ions were synthesized using a novel metathesis synthesis, which is advantageous over conventional preparations due to its simplicity, low cost, high yield, and eco-friendly characteristics. These synthesized materials were characterized according to their physical and photophysical properties and have the potential for use in bioimaging, photovoltaic systems, photodynamic therapy, and sensors.

presenting
11am-12pm

County: Bradley

Mechanism of Cabbage Inhibiting the Formation of Nitrite in Celery Catalyzed by Human Saliva

Sara Claycomb, Justin Haney, Jinming Huang

University of Arkansas at Monticello, Monticello, AR.

Nitrate from diet such as vegetables is taken up by salivary glands and concentrated into saliva, where it can be converted to nitrite by anaerobic bacteria or enzyme (nitrate reductase). The formed nitrite is then converted to nitric oxide (NO) in blood and tissues and has been found to have therapeutic potential in a variety of cardiovascular conditions.

In previous study, we discovered that cabbage juice can completely inhibit the formation of nitrite in home-made iceberg lettuce juice and celery juice during storage. Here, we report that cabbage juice can inhibit the formation of nitrite in celery juice that catalyzed by human saliva. There is no significant difference between man's saliva and woman's saliva in catalyzing the formation of nitrite in celery juice, cabbage can significantly inhibit the formation of nitrite in celery juice that catalyzed by human saliva. The addition of Na_2WO_4, an inhibitor of nitrate reductase, can completely inhibit the formation of nitrite in celery juice during the catalyzing of human saliva.

These data suggest that nitrate reductase in human saliva is responsible for the formation of nitrite in celery juice, and cabbage may contain inhibitor of nitrate reductase.

presenting
11am-12pm

County: Drew

Determination of Fatty Acid Concentrations in Algae

Rose Mencer, Tye Brown, Makayla Berry, Ruben Martinez, Christopher Metcalf, Kendall Wells, Jordan Kane, Andrew Williams

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

Algae are of scientific and commercial interest due to their ease of culture and high fatty acid content. Fatty acids have a vast array of applications, from omega-3 fatty acids as a nutritional supplement during embryonic development to utilizing the energy released during breakdown of fatty acids for alternative fuel sources. It is reasonable to assume that different strains of algae contain different types and concentrations of fatty acids. Of interest is the fatty acid content contained within various algal strains in the class *Eustigmatophyceae*. Since *Eustigmatophyceae* is easily cultured and produces fatty acids, they are sought after as a possible resource for these materials. Additionally, fatty acid concentrations may be used in the classification of newly discovered algal samples, as the biochemical data may be supplemental in determining the respective phylogeny for these new strains. Algal strains were collected and isolated from a number of sources, including Lake Chicot and Lake Monticello. Preliminary results show differences between algal strains via relative fatty acid concentration.

presenting
11am-12pm

County: Jefferson

Determining Protein to Protein Interactions that Regulate Helicase Activity

Clement Nana Agyemang, [a] John C. Marecki, [b] Jun Gao, [b] Alicia K. Byrd, [b] Binyam A. Belachew, [b] Andrea Edwards, [b] and Kevin D. Raney [b].

[a] Department of Chemistry and Physics, the University of Arkansas – Pine Bluff, Pine Bluff, Arkansas
[b] Department of Biochemistry and Molecular Biology, the University of Arkansas for Medical Sciences, Little Rock, Arkansas.

Saccharomyces cerevisiae Pif1 (Yeast Pif1) is a prototypical member of the Pif1 helicase family and plays multiple vital roles in nuclear and mitochondrial DNA metabolism, such as effectively unwinding quadruplex DNA structures, maintaining telomeric DNA and reducing processivity of telomerase among other functions. Recent studies demonstrate that the human Pif1 enzyme is an important target in cancer therapy, therefore, understanding the mechanisms of scPif1 helicase can help understand mechanistic features that may aid in the development of therapeutic agents. In this study, we propose that amino acid sequence in the protein-protein interaction domain is critical for enzyme function, and by mutating the glutamine to an alanine will result in altered enzyme activities including its affinity for DNA, ATPase activity and ability to unwind DNA structures. The helicase activity of scPif1 requires the hydrolysis of ATP, therefore, we assayed the DNA-dependant ATPase activities of both the recombinant wild-type and mutant scPif1. We further characterized scPif1 -E674A with the DNA binding assay using single-stranded DNA (ssDNA) to determine how well scPif1-E674A interacts with DNA. Additionally, we utilized DNA unwinding assays to determine its ability to unwind DNA substrates in a manner similar to the wild type enzyme.

presenting
11am-12pm

County: Jefferson

Reducing the Side-Effects of the Anti-Cancer Drug Cisplatin Using Peptide Foldamers

Jasmine Chappell, Daniel Deleon, Simone Barr, Kevin Krumpton, Clement Agyemang, Zeeshan Habeeb

Department of Physics and Chemistry, University of Arkansas, Pine Bluff 71601

Many therapeutic molecules are not soluble and do not circulate in the body long enough to be fully effective. This research examines the possibility of encapsulating therapeutic molecules, cisplatin in particular, in a peptidic α-helix in order to enhance the effectiveness of the drug and lower the dosage used in patients. Cisplatin is a well-known cancer therapeutic, but it has poor solubility. Alanine was used as it proved to be the most stable amino acid and has a high propensity in regard to making an α-helix. α, β, and γ alanine were used, α to stabilize the alanine chain while β and γ were used to expand it. Additionally, the *Fmoc* and *Boc* groups can be replaced with other molecules that can lead to more targeted chemotherapy, making some side effects less likely. The softwares *Avagadro* and *SYBYL* were used to perform computations and construct models of the molecules to prove that encapsulating therapeutic molecules is possible. The Alanine Chains were then synthesized in a lab and sent for an LC/MS to determine whether double coupling would be required, and if so what part of the chain required it. Results will be further discussed during the presentation.

presenting
11am-12pm

County: Saline

The fight against Chagas disease: Creating an efficient and inexpensive cure

Jessica Allred, Sarah Friedman, Madeleine Peters, and Gregory R. Naumiec

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

Neglected tropical diseases (NTDs) are a worldwide crisis that affects nearly two billion people. One of the major NTDs is Chagas disease, a parasitic infection prevalent in Central and South America, and is now encroaching on the United States (which is ranked 7th in the world for diagnosed cases). This disease, which currently has no vaccine, is caused by the parasite Trypanosoma cruzi and has only one FDA-approved medication -- benznidazole. This treatment is expensive, has harsh side effects, and is nonfunctional in the chronic phase of the illness. Therefore, Chagas disease does not have an effective, inexpensive, or safe cure, and the presence of only one approved medication is leading to treatment failures.

This research focuses on the creation of an inexpensive and effective anti-chagastic drug library from a class of compounds called disquaramides. These drug targets can be synthesized inexpensively. Additionally, these potential drugs have been found to puncture holes in the cell membrane of T. cruzi, thereby killing the parasite. Therefore, the simple and low-cost synthesis, as well as the potential of high effectiveness, allow the facile creation of a diverse and comprehensive drug library to aid in the search for a new viable treatment for Chagas disease.

presenting
11am-12pm

County: Clark

Role of Nutrition Focused Physical Exam in the Identification of Malnutrition in the Elderly

Madeline Wallace, Markie Campbell, Detri Brech, PhD

Jones Science Department, Ouachita Baptist University, Arkadelphia, AR

Sixteen percent of the U.S. population is over 65 years and 50% have malnutrition. The nutrition-focused physical exam (NFPE) allows registered dietitians to determine nutrition status and degree of malnutrition. Six clinical characteristics used to identify malnutrition are energy intake, weight loss, subcutaneous fat loss, muscle loss, fluid accumulation, and reduced function status. Each has a threshold of well-nourished, mild-moderate malnutrition and severe-malnutrition. The research objective was to determine the correlation between the number of positive NFPE findings and the degree of malnutrition. Researchers assessed the role of nutrient intake and body mass index in relation to overall nutritional status. A cohort of 34 adults attending the Arkadelphia Senior Center participated. A bivariate (Pearson) correlation compared age with nutrient intake and a one-sample t test compared nutrient intake with Dietary Reference Intake (DRI).Thirty-three of the 34 subjects met the criteria for mild/moderate and severe malnutrition. Fifty-nine percent had muscle loss in the dorsal hand region, 53% in the temple, 44% in the clavicle, and 32% in the acromion/scapular region. Seventy-nine percent had subcutaneous fat loss in the orbital region, 44% in the upper arm, 41% in the patellar/anterior thigh region and 6% in the thoracic/lumbar region. Thirty-five percent had edema.

presenting
11am-12pm

County: Jefferson

A Look into the Impact of Grant-Based Programs Located in the Echols Building at UAFS

Gillian Johnson,[a] Dr. Shelli Henehan[b]

[a]University of Arkansas – Fort Smith, Fort Smith, AR
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The Echols building on the UAFS campus is an eclectic resource center filled with programs and materials for assisting pre-service teachers, in-service teachers, and community members. There are currently three grant-funded programs operating out of the Echols building: the Early Childhood Preschool Program, the UAFS STEM Education Center, and the Western Arkansas Educational Renewal Zone. Each of these programs is unique in its mission statement, but together make the Echols building a melting pot of resources that share a common goal of improving Birth – 12th grade education in the state of Arkansas. To measure the impact of these grants, I looked at both qualitative and quantitative data. I focused on fiscal years 18 and 19 for both of the programs. The quantitative data includes: Counties served, number of professional development opportunities, and training participants. The qualitative data I have analyzed include: Student letters, interviews, and participant feedback surveys. For the past three years, I have worked in the Echols building, which has provided the opportunity to gain personal insight into the wonder, but ever-changing nature of grants and the impact that they have on not only the university that houses these programs, but the entire region.

presenting
12m-1pm

County: Washington

Manipulatives in Calculus I

Alice Staggs,[a] Jennifer L. Adams, M.A.,[b] Kayla Murray, Ph.D.,[b] Jack L. Jackson, Ph.D.[b]

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Manipulatives are commonly used throughout elementary and high school mathematics courses to aid in students' understanding by allowing them to visually see the concept. The purpose of this study was to investigate if the use of a concrete manipulative in Calculus I would increase conceptual understanding of Calculus concepts. College students enrolled in Calculus I were given an investigative activity involving gum sticks as a representation of Riemann Sums. The activity allowed the students to manipulate the Riemann Sums to gain understanding of the difference between the areas of a Right, Left, and Midpoint Riemann Sum. Two professors who taught two sections of Calculus I participated. Each professor had a control group and a treatment group. A 2x2 ANOVA was used to analyze the data collected from a 3 -part question on a unit exam involving Riemann Sums. Descriptive data such as gender, ACT scores, and majors were also considered when analyzing the data. Extending the use of manipulatives to college Calculus courses could have a positive impact on student learning and degree completion, particularly for STEM majors that require Calculus I.

presenting
12pm-1pm

County: Sebastian

Perceptions of College Course Content among Secondary Mathematics Educators

Darian Wilson,[a] Dr. Myron Rigsby,[b] Dr. Jerry West,[b] Ms. Roberta Parks[b]

[a]University of Arkansas – Fort Smith, Fort Smith, Arkansas
[b]Department of Mathematics, College of STEM, University of Arkansas – Fort Smith, Fort Smith, Arkansas

In-service teachers of 7-12 mathematics in Arkansas were surveyed regarding the importance of proof-related topics in the 7-12 curriculum and their preparation and confidence in their knowledge for teaching these topics. The survey design was based on topics covered in the Arkansas Standards, PRAXIS examinations, and ACT Aspire, including direct proof, indirect proof, visual representations, sequences, properties of relations, and counterexamples. Each parallel section from the survey was analyzed through running correlation tests and creating frequency charts for each question as well as for pairings of questions within each section. Additionally, the difference in importance and prepared values of each participant were analyzed through a matched-pairs t-test. Also, averages were calculated for each question to determine participants' overall perception of that question. On most topics, there was low to moderate correlations between teachers' rating of the importance of a topic and their level of confidence in teaching the topic and/or their expectations of students in most areas. In all six topics, the level of preparation was reported as below the perceived importance of the topic. Recommendations are made for enhancing and broadening the preparation of teacher candidates in the teaching of proof-related concepts.

presenting
11am-12pm

County: Pulaski

Development of a web-based Advising Application using Software Engineering Theory

Timothy Itodo, Funmi Adediwura, Timileyin Adebisi, Zora Talbert, Carson Crouther, Dr. Chuanlei Zhang

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

The purpose of this application is to facilitate the advising process for computer science major students at Philander Smith College. It is a web-based application, the development of which is guided by the theory and practice introduced in software engineering course. This application helps the user, e.g. faculty, to view the courses a student has taken and will need to complete during the advising process. Its main functionalities include: 1) select the catalog year of which the student falls in, 2) select the courses the student has taken, 3) view the courses still need to be completed 4) generate a pdf version of the details for printing. The design incorporates a user- friendly web interface as well as keeps align with the college's web design theme. Each phase was guided with the software engineering theory. This online advising system will be an easy-to-use, efficient and informative tool for advising at PSC CS department.

presenting
12pm-1pm

County: Sebastian

Sentiment Analysis Using Deep Learning for Arkansas-based Organizations

Spencer Atchley, Renae Fisher, Luke Hinton, Austin McFerran, Israel Cuevas, John Hightower, Andrew Mackey

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

Sentiment analysis is a popular research area in the field of natural language processing (NLP) whereby an algorithm is able to determine the sentiments, emotions, opinions, and attitudes toward some entities, generally with a set of predefined classes. Organizations often benefit from sentiment analysis and opinion mining as the views and attitudes of individuals often serve as influential factors in determining the behaviors of others (e.g. movie reviews, product reviews, etc.). Algorithms attempt to extract features that are probabilistically more likely to occur with one class than others. With the advancements in research of deep learning models, new ways of improving the performance of sentiment analysis algorithms have emerged. The goal of this research is to present a deep learning model for sentiment analysis using data extracted from Arkansas-based companies and organizations. A new system is presented that is capable of automatically classifying the expected sentiment for a given review of an Arkansas organization.

presenting
12pm-1pm

County: Sebastian

Improving the Privacy of Text Through Natural Language Processing and Machine Learning

Fernando Estrada, Adrian Cuevas, Kyle Kelly, Israel Cuevas, John Hightower, Andrew Mackey

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

Social media posts, blogs, news, and other text-generating sources have opened the door for individuals across the world to share and exchange information. Billions of users actively participate in the generation of text-related data as evidenced by movie reviews, social media posts, online comments, etc. Under certain situations, individuals may choose to post information anonymously such that the original author remains unidentifiable. This research presents a system that is capable of extracting information from the original document using natural language processing and machine learning techniques that would make the identification of the original author more likely (e.g. age, socioeconomic status, geographic location, etc.). Furthermore, the authors also present a way to obfuscate certain characteristics to help preserve the privacy and anonymity of Arkansans and other individuals against similar attack models that attempt to identify the original author when anonymity is expected.

presenting
12pm-1pm

County: Van Buren

Sun Tracking Solar Panel

Ahmed Alsehali, Shubhalaxmi Kher

Electrical Engineering, Arkansas State University

The nonrenewable energy resources are decreasing, while the use of renewable resources for producing electricity is increasing. Solar panels are becoming more popular day by day. Solar panel absorbs the energy from the Sun, converts it into electrical energy and the energy can be stored in a battery. This energy can be utilized when required or can be used as a direct alternative to the grid supply. To best utilize the solar energy, it is important to keep in view the position of the Sun with respect to the solar panel as it is not fixed due to the rotation of the Earth. For an efficient usage of solar energy, the Solar panels should absorb energy to a maximum extent. This can be done only if the panels are continuously (seamlessly) face towards the direction of the Sun. So, solar panel should continuously rotate in the direction of the Sun. This work presents design and development of a tracking system that continuously changes its direction in accordance with the position of the Sun. The tracking system design will be mounting the solar panels thereby allowing seamless absorption of solar energy. The system was designed, developed and tested in the lab.

Key words: Energy harvesting, robotics, solar sustainability

presenting
11am-12pm

County: Garland

Design of an Underwater Remotely Operated Vehicle to Study Underwater Ecosystems

Joseph Dees, Andew Diehl, Austen Greco and Rick McDaniel

Henderson State University, Arkadelphia, AR. Department of Engineering and Physics

As much as can be learned about lake habitats using satellites, shipboard sensors, and divers, these technologies have their limitations. Over the last few decades, engineers have developed submersible technologies capable of meeting the many challenges of exploring our freshwater lakes and rivers.

The purpose of this project is to design and build an underwater remotely operated vehicle (ROV) to study the underwater ecosystems of Arkansas lakes and rivers. ROVs are remote control underwater robots driven by an individual on the surface. These robots are tethered by a series of wires that communicate between the operator and the ROV. All ROVs are equipped with a video camera, propulsion system, and lights. Other equipment can added depending on the resear

presenting
12pm-1pm

County: Johnson

Implementing Machine Learning in Sample Collection

Joseph Schuster, Bradley Wilson, Dallas Crumley, Austen Greco, and Dever Norman

Department of Engineering and Physics, Henderson State University, Arkadelphia, AR

Machine Learning is the use of mathematical models on inputs to allow a machine to complete tasks without human intervention. This may be used in physical scenarios as well, such as robotic arm manipulation. Many companies have developed similar techniques, but the goal of this project is to create a more efficient version of what others have done in order to accomplish the task of picking up a cube and placing it in a collection bin. To do this, various methods of entry from LiDAR, pressure sensing, and sonar are used to lighten the burden of deep-layer function optimization.

presenting
12pm-1pm

County: Craighead

Molecular Dynamics Investigation of Nanocompression of Al/a-Si Core-Shell Nanostructures: The Effects of a-Si Shell Construction

Shannon Hughes and Robert Fleming

Department of Engineering, Arkansas State University

Aluminum/amorphous silicon (Al/a-Si) core-shell nanostructures are a new, novel material which has been experimentally shown to have a very low coefficient of friction and very high durability. Based on experimental measurements, the unique properties of these nanostructures are theorized to be a result of dislocations dynamics within the nanostructure core. However, in order to utilize the structures in practical applications, a deeper understanding of the physical mechanisms that enable their desirable mechanical properties is required. To accomplish this, molecular dynamic (MD) simulations are employed to study the dynamics of dislocations nucleated in the core of Al/a-Si core-shell nanostructures during nanocompression testing. In this study, the role of a-Si shell construction on the dislocation nucleation/annihilation behaviors in the Al core are studied, specifically looking at the difference between a completely randomized a-Si shell compared to a more "realistic" a-Si constructed using melt-quench dynamics. The goal of this research is to better understand how the a-Si shell construction, as well as the associated core/shell interface, influences the dislocation dynamics observed in Al/a-Si core-shell nanostructures, which will enable further studies into the effects of core shape and material.

presenting
12pm-1pm

County: Benton

What are the Effects of Different Airfoils on Lift, Drag and Pitching Moment?

Bryson Cobb, Selena Fincher, Justin Young, and John Lee

Department of Engineering, John Brown University, Siloam Springs AR

The purpose of this project is to analyze major aerodynamic properties such as lift and drag from data recorded in a wind tunnel test of a miniaturized version of the experimental airfoil. This analysis can be used to determine if a certain airfoil is a suitable design for a specific application such as a propeller plane or a commercial jet aircraft. The airfoil was first designed in a 3D modeling program and simulated using the flow simulator. Next, the airfoil was constructed from balsa wood with heat shrink plastic being utilized for the skin. Finally, it was then mounted on a stinger in a wind tunnel to collect the data required to calculate relevant results. Based on preliminary simulations and results, a cambered airfoil generates greater lift and zero angle of attack drag than uncambered airfoils, allowing for low speed takeoff and a lower required angle of attack.

presenting
11am-12pm

County: Pulaski

A study on impact energy absorption behavior of particulate polymer composites with stiff and compliant phases

Sherif A. Selim, Kailash C. Jajam

Department of Engineering Technology, University of Arkansas at Little Rock, AR

Safety and survival against high-speed collisions, blast and ballistic impacts, traumatic brain injury under rapid accelerations routinely requires high energy absorbing materials having dynamic multifunctionality. For such scenarios, it is important to design lightweight, fracture resistant multiphase composites with optimum stiffness, specific strength and improved shockwave energy absorption characteristics. Keeping this as a central goal, this research is focused on processing and characterization of hybrid particulate polymer composites embedded with random dispersion of micron size silica glass beads as the stiff (hard) phase and CTBN rubber particles as the compliant (soft) phase. Of particular interest the effect of filler particle stiffness on energy absorption response of particle-filled epoxies will be examined. By varying the volume fraction of stiff and tough phases, particulate composites with uniformly dispersed particles in a low viscosity epoxy matrix will be subjected to Charpy impact loading conditions for energy absorption studies. Tensile, fracture and flexural tests will be carried out at low strain rates followed by high resolution microscopic examination of multiscale failure characteristics and associated toughening mechanisms.

This study is novel to the society as it is expected to offer a cost-effective way of designing new materials paradigm for public safety with an aim to completely avoid or minimize any kind of catastrophic failure in automotive, aerospace and defense sectors.

presenting
12pm-1pm

County: Crawford

Master Control Unit for a Large Electric Lunar/ Mars Rover

Abel Medina[a], Brandon K. Dyera, Hunnt M. Hickman[a], Anthony L. Ming[a], and Kevin R. Lewelling, PI

[a]University of Arkansas – Fort Smith, Engineering Department

A large electric Lunar/Mars Rover is being constructed by UAFS students. The rover uses a novel steering design based on a zero turning lawn mower; allowing an astronaut to easily drive while wearing a bulky space suit. This rover is capable of traveling up to 20 miles at 10 mph on a single battery charge. The suspension system is based on a passive Rocker-Bogie design using a differential bar placed on the top of the battery/electronics box behind the rover seat. The rover using 6 in-wheel motors to provide consistent traction on difficult terrain. The 6 motors are controlled by a motor drive that was designed by four UAFS students. The drive is capable of controlling speed and torque using Space Vector Modulation (SVM). SVM allows the motor to be controlled without the use of sensors, thus reducing the number of wires found on the rover. The 6 motors will be part of a Controller Area Network (CAN) that will ensure each motor provides the correct speed and torque.
The 6 motors are controlled by a Master Control Unit (MCU) which is connected to the zero turning steering system. Mechanical encoders are used in the zero turning system to signal direction and speed. When the encoder signals are received by the MCU, the onboard processor analyzes the encoder signal and puts the appropriate messages on the CAN for each motor. As the project progresses, a touch screen will be added to the MCU to add lighting, etc.

This poster will summarize the current work being done on the MCU and steering system by UAFS students.

presenting
12pm-1pm

County: Benton

Behavior of the Friction Force on a Body Exhibiting the Stick-Slip Effect

Arfennee Cordoba, Dr. Kenneth D. Hahn

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

The *stick-slip effect* is a phenomenon that describes the equilibrium (stationary phase) caused by inter-atomic forces between two surfaces in contact with each other. This equilibrium holds one surface against another at rest until the static friction force is not strong enough, causing the stationary phase to convert into kinetic (sliding) friction, where slippage between surfaces occurs. To test this effect on the behavior and interaction between two surfaces, we have developed an inclined plane system which allows us to vary materials, masses and gravitational forces. Precision force and displacement sensors measure the friction forces and relative motion of the surfaces. Sensor readings show very abrupt and significant changes in the force of friction (the stick-slip effect), accompanied by minute (less than 10 micron) motion between the surfaces. After the stick-slip transition, a time-dependent relaxation of force occurs in which there is no discernable motion.

presenting
11am-12pm

County: Jefferson

Budget Freefall

Jacob Bowman, Noah Smith, Matthew Holloway, Ojani Chacon, Ross Burrows.

University of Arkansas at Monticello, Monticello, AR.

Dedicated freefall experiment kits start the timer as the ball is dropped, leading naturally to the most basic form of free-fall due to gravity; but these kits also cost about five hundred bucks a-piece. For our improvised freefall experiment (using equipment we already have) we must drop the ball from a small distance above the first photogate. Thus the ball has a small initial velocity when it starts the clock t = 0, making the situation a bit more complicated for the equations. We show good results are nonetheless obtainable with our improvised set-up. Using a basic model we show air resistance can be neglected under laboratory conditions for finding the acceleration due to gravity by freefall.

presenting
11am-12pm

County: Cross

Bacterial Motility and Chemotaxis at Different Concentrations of Magnesium Sulfate

Kayleigh Johnson[a], Pradeep Kumar[b]

[a]Department of Chemistry & Physics, University of Arkansas at Pine Bluff, Pine Bluff, AR.
[b]Department of Physics, University of Arkansas, Fayetteville, AR.

Europa, one of Jupiter's moons, possesses a thick, icy crust on the surface and a liquid water ocean beneath it running several kilometers deep. If one has to look for life anywhere else in our solar system besides Earth, Europa is probably the best candidate. The life we know of requires liquid water and Europa possesses 2-3 times the volume of liquid water on Earth. It has a solid core and volcanic activity similar to earth and may bring out chemicals in a critical concentration that may have started a life in the ocean. However, the life there must be adapted to high hydrostatic pressure, low temperature and other chemicals present there. Geochemical models suggest existence of high concentrations of magnesium sulfate. Besides the growth and division, motility of bacterial cells is an important characteristic that allows them to search food. We have studied the effect of high salt concentration of magnesium sulfate on the motility of a mesophilic bacteria, Escherichia coli. We find that motility of bacteria depends on the growth stages of the cells for all the salt concentrations studied here. For 0% salt concentration, the motility characterized by average instantaneous velocity increases and then saturates towards a constant value. Similar behavior of the motility was observed for 1% salt concentration.

presenting
12pm-1pm

County: Hempstead

SPS@UCA: Small Parallel Supercomputer at UCA.

Hannah Barry, Shane Doolabh, Chris Geske, John Singel, Dr. Jeremy Lusk

Department of Physics and Astronomy, University of Central Arkansas, Conway, AR.

We have designed and constructed a small parallel supercomputer to support the research and scientific outreach activities of the College of Natural Sciences and Mathematics at UCA. Modern supercomputers are large clusters of commercially-available high performance servers, connected together over a network to allow the combined computational power of many computer processors to be used in a calculation. Our supercomputer is a small, affordable, portable system that will be used to provide researchers and students hands-on experience with the tools and techniques of computationally-intensive research. SPS@UCA consists of 6 mini-ITX motherboards, each with a 4-core, 1.1Ghz processor, 8GB of RAM, and 120GB of on-board storage, connected together through a gigabit Ethernet switch. Construction of the cluster was completed in the Fall of 2019. After a period of initial testing, the cluster will be used in three ways: 1) a development platform for building parallel astrophysics simulation codes, 2) a computational resource for researchers running parallel simulations, and 3) an outreach tool for engaging Arkansas schoolchildren and the public in computational science and high-performance computing. Funding for this project was provided by a Chapter Research Grant from the national Society of Physics Students.

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Arkansas STEM Coalition
Arkansas EPSCoR
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