STEM
Posters at the Capitol

February 11, 2015

"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 90 students**
- **From 15 Arkansas colleges and universities**
- **Presenting 64 different posters of original work**
- **Encompassing all aspects of natural science and math**

UNIVERSITY OF
Arkansas at Pine Bluff

STEM Posters at the capitol

30 Posters Presented from 10 am—11 am

10 am Poster number……..page for abstract

STEM Posters at the capitol

34 Posters Presented from 11 am—noon

11 am Poster number……..page for abstract

Student presenter (school) …..page with abstract

Student presenter (school) …..page with abstract

presenting
11 am—12 pm

Hometown: Conway, AR

Bose Einstein Condensation – Symmetries of the model equations

Kyle Barker, Danny Arrigo

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

Bose-Einstein Condensates (BEC) are a quantum mechanical phenomenon that produce a state of matter in which atoms or particles are at such a low temperature and have such a low energy state that they condense into a single quantum state. The DeBroglie equation, which determined that the colder an atom is the longer its wavelength is, was used to formulate the Schrödinger equation, which is basis of quantum mechanics. The BEC phenomenon was first predicted by Satyendra Bose and Albert Einstein in the 1920s, and was experimentally shown in 1995 by research groups at MIT and the University of Colorado Boulder, culminating in a Nobel Prize in physics for the leaders of the research groups.

The question is how to measure the dynamics of BEC. These dynamics are described by an equation developed by Eugene P. Gross and Lev Petrovich Pitaevskii in the mid-twentieth century. The Gross-Pitaevskii equation is a nonlinear partial differential equation, which means that it is extremely difficult to get exact solutions. Our research utilizes classical and nonclassical symmetry methods in order to simplify the Gross-Pitaevskii equation with the hope of obtaining new exact solutions.

presenting
11 am—12 pm

Hometown: Truman, AR (BS)

Nonregular Robust Parameter Designs and Applications to Scientific and Engineering Processes

Belina Santos, Debra Ingram

Mathematics and Statistics, College of Sciences and Mathematics, Arkansas State University, Jonesboro, AR

Robust parameter design (RPD) is an engineering methodology for quality improvement and control of products and processes. RPD allows engineers to optimize the settings in a manufacturing process so the effects of uncontrollable variables, called "noise variables," are minimized. Consider the example of a product developer who is improving the quality of a cake mix. Controllable factors during manufacturing, such as the flavoring and the amount of each ingredient, should be set at levels that bring the quality of the cake to target. However, there are also uncontrollable noise variables due to the consumer that affect the quality of the cake. These noise variables include the quality of home ingredients, oven temperature, and cooking time. Fluctuations in these variables are expected but cannot be controlled by the manufacturer. RPD provides investigators with experimental plans to discover the settings of the controllable factors that will minimize the effects of these noise variables. Using these settings during the manufacturing process will make the quality of the cake robust to uncontrollable variability in oven temperature, cooking time, etc.

presenting
10 am—11 am

Hometown: Kigali, Rwanda (GS)

Assessment of Voice Rehabilitation Treatment using Selective-voting in convex hull ensembles algorithm

Gaston Seneza, Don'terrio Gordon, Alexandera Fisher, Jamila Frazier, Javonte Washington, and Chuanlei Zhang

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

Differentiation between two classes for medical data can be accomplished using binary classification techniques. In this work, we investigate the application of 'selective voting in convex hull ensembles algorithm', in which samples of two classes are distributed in convex hulls of positive and negative formed by two selected variables. A high-dimensional voice rehabilitation dataset is chosen and divided into training data and testing data, where the training data labels are known while the testing data labels are set unknown. To have an objective assessment of the algorithm, 10-fold cross validation procedure is adopted. Performance of this classification algorithm is evaluated using indices of accuracy, sensitivity and specificity. The classification result can be used as assess whether voice rehabilitation treatment lead to phonations considered 'acceptable' or 'unacceptable' in Parkinson's disease.

presenting
10 am—11 am

Hometown: Camden, AR (JB)

Development of a secure cloud-based mobile personal health record system

Josiah Brann,[a] Shucheng Yu[a]

[a]Department of Computer Science, University of Arkansas at Little Rock, AR

As a complement to Electronic health records (EHR), personal health records (PHR) represent a promising supporting technique toward patient-centric healthcare. In a PHR system, patients have full control over their health records in terms of who can access and/or contribute to which section of the records. In this project we developed a prototype PHR system. Two basic components were developed; a mobile app framework that allows patients to manage their health information, and a cloud back-end which hosts all the health records and provides access to authorized parties. In addition to the basic components a security solution was begun which implements a strong cryptographic data access control mechanism. Instead of starting everything from scratch, we built the system upon an open source PHR called Indivo, which provides the necessary building blocks (except the security aspect) as web interfaces. The project led to the development of a test framework for the PHR and a much greater understanding of PHRs and their potential use as an alternative to mainstream EHRs.

presenting
10 am—11 am

Hometown: Monticello, AR (AM)
Pine Bluff, AR (HH)

Longitudinal Study Tracking the Body Mass Index of Children in Clark County, Arkansas

Alex Morrison, Hunter Heird, Detri Brech

Ouachita Baptist University, School of Natural Sciences, Nutrition and Dietetics Program, Arkadelphia, AR

According to the Centers for Disease Control and Prevention National Health and Nutrition Examination Survey data obtained in 2011-2012, 17% (12.5 million) of children/ adolescents aged 2-19 years are obese. Racial and age disparities exist with higher levels among Hispanic (22.4%) and non-Hispanic black (20.2%) children. Obesity rates increase as a child ages: 8.4% of 2-to-5-year-olds, 17.7% of 6-to-11-year-olds, and 20.5% of 12-to-19-year-olds. In response to the childhood obesity epidemic, a longitudinal study began in 2007 and has tracked the BMI percentiles of children aged 3-to-12 years in Clark County for seven years. Each summer treatment and control groups were weighed and measured. BMI and BMI percentile were calculated. The treatment group participated in weekly nutrition/physical activity classes and parents obtained nutrition/physical activity information. Groups were reassessed, and comparisons were made within and between groups. 545 children were followed in the study with 2% of children in the underweight percentile, 49% in the healthy weight percentile and 49% in the overweight/obese percentiles. BMI improvements were seen between pre- and post-testing. Implications from the study support continued efforts and funding at the local level.

presenting
11 am—12 pm

Hometown: San Antonio, TX (SM)

CLA-rich Soy Oil Shortening Production and Characterization

Sarah Mayfield,[a] Koen Dowettinck,[b] Andrew Proctor[a]

[a] Department of Food Science, University of Arkansas, Fayetteville, AR [b]Department of Food Technology and Nutrition, University of Gent, Belgium

Conjugated linoleic acid (CLA) has been shown to have numerous health benefits, including anti-obesity and anti-carcinogenic properties. We have produced a CLA rich oil in our laboratory from soy oil which was used it to produce a CLA-rich margarine that provided the recommended daily value of CLA. The appearance and texture was similar to those of commercially available margarine. The objective of this study was to produce CLA-rich shortening and analyze its physical properties relative to those of commercially available shortenings and soy oil control shortenings. The oil and shortenings were prepared at University of Arkansas and the texture, thermal behavior, solid fat content, and microstructure were determined and compared to the commercial samples at the University of Gent. The CLA-rich shortening samples showed similar textural properties to those of the commercial samples and exhibited more solid-like behavior than the soy oil control samples. The CLA-rich shortenings had higher solid fat contents than the soy oil controls. There were no observed differences between the microstructure and thermal behaviors of the CLA and soy oil samples. CLA-rich oil could be used in shortenings to provide the health benefits of CLA.

presenting
10 am—11 am

Hometown: N. Little Rock, AR (BC)
Harrison, AR (RP)

Determination of Bispenol A (BPA) in Thermal Recipt Paper and Canned Goods Using Flourescence Spectrophotometry

Bailey N. Chitwood, Rachel H. Pruett, and Sara E. Hubbard

Department of Chemistry, Ouachita Baptist University, Arkadelphia, AR

Bisphenol A (BPA) is widely used in the production of consumer goods. It has come under study recently because it has been linked to adverse health effects in infants and young children, including diabetes, cardiovascular disease, and abnormal maturation. BPA is used in several commercial products, so humans can be exposed to BPA through ingestion or dermal absorption. It is a concern that the exposure could cause serious effects even in small doses. In thermal receipt paper, BPA acts as a color developer, so that writing on the receipt paper will appear after application of heat. However, the BPA can migrate from the paper to any hands that hold it, or any liquid with which it comes into contact. In canned foods, the chemical is made into an epoxy resin to provide a protective lining along the inside of the can. BPA migration occurs when the free BPA moves from the lining into the contents of the can. This study used a standard addition method and fluorescence spectrophotometry to quantify BPA concentrations in thermal receipt paper and the linings of canned foods. Also, preliminary tests were performed to test the presence of BPA in Arkansas water samples.

presenting
10 am—11 am

Hometown: Dallas, TX (SA)
Kigali, Rwanda (JI)

Semiempirical Quantum Chemical Calculations of Al^{3+}-bound Amino Acid Complexes Modeled for Neurodegenerative Diseases

Steven Adams, Fontaine Taylor, Jacques Iragena, and Frank Hahn

Department of Chemistry, Division of Natural and Physical Sciences, Philander Smith College, Little Rock, AR

Recent studies have shown that oxidative processes of metal-binding amino acid residues such as methionine (Met), histidine (His), tyrosine, (Tyr), glutamic acid (Glu), etc. have been known to form conformational change of pathogenic proteins for the neurodegenerative diseases such as Alzheimer's disease (AD), Parkinson's disease (PD), etc. In this study, theoretical semiempirical calculations for newly constructed 3-D modeled compounds between pathogenic amino acids and aluminum metal ion (Al^{3+}) were performed by AM1 and MNDO approximations in gas and water phases to investigate thermochemistry of the neuronal degenerative complexes. The obtained thermochemical stability order was Met>Tyr>His>Glu with Al^{3+}. More interestingly, the newly obtained $\Delta H_{reaction}$ revealed the specific coordinated chemical bond information of 4, 3, 2, and 4 for Glu-Al^{3+} His-Al^{3+}, Met -Al^{3+}, and Tyr-Al^{3+}, respectively. The resulting data will have large potential impact on the development of drugs to inhibit those targeted coordinated bonds between the amino acids residues and Al^{3+} during conformation changes of the pathogenic proteins.

presenting
10 am—11 am

Hometown: Hot Springs, AR (CE)

Synthesis and Evaluation of Tautomerically Ambiguous Nucleosides as Potential Anti-HIV agents

Chase Elkin, Cody McLeod, Vincent Dunlap

Department of Chemistry, Henderson State University, Arkadelphia, AR

Antiretroviral therapy for treatment of human immunodeficiency virus (HIV) has developed with great success over the last few decades. While the current therapies are successful, patients often meet with severe side effects and the mutagenic nature of the HIV virus leads to a constant need for new drug development. One such method of development involves incorporation of bases with ambiguous hydrogen bonding faces into the viral genome. We have synthesized a set of nucleosides with such characteristics, which, when incorporated into the viral DNA, will destabilize the DNA. When combined with the high error rate of the RNA polymerase enzymes of the HIV virus, such incorporation may lead to a collapse in stability of the viral genome otherwise known as an error catastrophe. Presented here are the results of the synthesis and a discussion of the initial work on the stability of nucleic acids containing these potential anti-HIV agents.

presenting
10 am—11 am

Hometown: Pine Bluff, AR (AJ)

Generation of Tumor-reactive Cytotoxic T lymphocytes using Chimeric Immune Receptors

Andrea Jenkins[1], Mohammed Haque[2], Jianxun Song[2]

[1]University of Arkansas at Pine Bluff, [2]Penn State Hershey College of Medicine, INTREPID student

Adoptive cell transfer of tumor-reactive cytotoxic T lymphocytes (CTL) has been identified as a promising cancer immunotherapy, but has been hindered by the limitation of functional T cells. We tested the approach using chimeric immune receptors (CIR) gene transduced CTL from the peripheral blood mononuclear cells (PBMC) for potential ACT-based leukemia therapies. We formed a MFG-based retroviral DNA vector encoding CIR which consists of a combination of single chain antibodies specific to CD20, a tumor associated antigen of leukemia, T cell receptor (TCR) signaling elements (CD3 zeta) and T cell costimulatory signaling elements (CD28 and CD137). Using the Plat-E packaging system, we observed CIR gene expression on the packaging cells, and the supernatant of packaging cells transfected with the CIR construct contained viruses that had ability to transduce CIR on CTL from the PBMC. We are expecting that the CIR- transduced CTL will be able to specifically recognize and kill CD20+ target cells in an *in vitro* setting of cytotoxic assay and this CIR-transduced CTL will be a good tumor-reactive effector for ACT- based leukemia immunotherapy.

presenting
11 am—12 pm

Hometown: Eureka Springs, AR

Coumadin (R/S-warfarin) metabolite profiles from anticoagulant patients yield novel insights.

Dakota Pouncey[a], C. Preston Pugh[b], Jessica H. Hartman[b], Drew R. Jones[b], Gunnar Boysen[c], Ralph Kodell[d], Kimberly Dickerson[e], Shawna Owens[e], David Dillinger[e], Thomas E. Goodwin[f] Eugene S. Smith[e], and Grover P. Miller[b]

[a] Department of Biochemistry & Molecular Biology, [f] Department of Chemistry, Hendrix College, Conway, AR
[b] Department of Biochemistry & Molecular Biology, [c] Department of Environmental and Occupational Health, [d] Department of Biostatistics, University of Arkansas for Medical Sciences, Little Rock, AR
[e] Central Arkansas Veterans Hospital System, Little Rock, AR

Coumadin (R/S-warfarin) is a highly effective blood-thinner, yet therapy remains challenging as a result of a narrow therapeutic window in which too much of the drug risks hemorrhaging (overdose) while too little risks the formation of blood clots (underdose). Furthermore, some patients respond differently to the drug over time as a result of numerous clinical factors that impact the elimination of the drug from the body, including age, gender, diet, and concurrent medications. Consequently, it is critical to develop ways to better understand how the liver transforms the active drug warfarin into less active metabolites. We predict that warfarin metabolite levels in the blood capture clinically relevant variations in warfarin metabolism and can be used as a resource to improve strategies to minimize adverse outcomes. We measured parent drugs, R- and S-warfarin, and twelve warfarin metabolites from fifty-nine patient plasma samples using a novel quantification method. Statistical analyses of the metabolite levels identified the relative importance and factors influencing their contributions to warfarin metabolism and supports the capability of metabolite patterns to capture the patient's metabolic fingerprint. These seminal findings provide a promising foundation to employ metabolite patterns as predictors of patient dose-response to warfarin during anticoagulant therapy.

presenting
11 am—12 pm

Hometown: Bentonville, AR (PM)

Site-Specific Incorporation of an Extrinsic Fluorescence Reporter Group to Characterize Protein Interactions of the Ras Protein Rheb

Padma Mana, Paul Adams

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

Because structure-function relationships among proteins underlie the chemical and molecular basis of biological processes, a detailed understanding of protein interactions involved in biochemical regulation are important. Rheb (Ras homology enriched in brain) is a Ras GTPase that cycles between an active GTP form and an inactive GDP form. The biological activity of Rheb is controlled in part by a protein interaction with the Tumor Suppressor Complex protein 2 that stimulates cell growth. We plan to characterize the usefulness of extrinsic reporter group fluorescence in monitoring Rheb protein interactions. Rheb will be over-expressed, purified, and then labeled with environmentally sensitive fluorophore that emits light at a wavelength well-shifted from the intrinsic fluorescence emission maximum of tryptophan in the protein. Once the fluorescence reporter system is developed, it will then be used to characterize protein interactions involving Rheb.

presenting
10 am—11 am

Hometown: Jonesboro, AR (NH)
Hot Springs, AR (PO)
Little Rock, AR (MR)

Modeling Drug Metabolism by Liver Enzymes

Nathanael D. Hall[1], Paige V. Onyuru[1], Michael Rogers[1], Grover P. Miller[2], and Martin D. Perry, Jr.[1]

[1]Department of Chemistry, Ouachita Baptist University, Arkadelphia, AR
[2]Department of Biochemistry and Molecular Biology, University of Arkansas for Medical Sciences, Little Rock, AR

CYP2C9 and CYP2E1 are both human liver enzymes (proteins) that are involved in the metabolism of a vast range of drugs or small molecules. Using molecular modeling software and computers, it is possible to simulate the drug-protein interactions and generate conclusions regarding the arrangement of amino acids, or residues, involved in stabilizing selected drugs. Little is known about the metabolic characteristics of CYP2E1, so it was used to investigate how acetaminophen (Tylenol) and styrene (plastics) bind to the enzyme. Multiple channels through which these small molecules entered the reaction site of the enzyme were explored. Results from the simulations identified the important residues involved in metabolism to aid in examining toxicological effects. About 50% of drugs are mixtures of two different forms of the same molecule. Warfarin (blood thinner) is a prime example with one structural form metabolizing 1000-fold more effectively. Certain protein residues steer metabolism based on the drug's 3D structure. CYP2C9 is known to prefer one structural form of a given drug, but the mechanism remains unknown. The residues that showed significant stabilizing interactions were identified among fourteen drugs with multiple structural forms used in the treatment of acid reflux, type 2 diabetes, cardiac disease, hypertension, and cancer.

presenting
11 am—12 pm

Hometown: Jonesboro, AR

Affordable Science Act: Using Computers to Address Challenging Problems in Chemistry and Physics

T. Ryan Rogers[a], Kai Leong[b], Feng Wang[b], C. Edwin Webster[c], Patrick Desrochers[a]

[a]University of Central Arkansas, Department of Chemistry; Conway, AR
[b]University of Arkansas, Department of Chemistry and Biochemistry; Fayetteville, AR
[c]Mississippi State University, Department of Chemistry; Starkville, MS

Chemistry and physics experiments can be expensive, dangerous, or time consuming. Simple questions like, "What is the shape of this molecule," or "How does this group of molecules behave" are challenging to answer experimentally, because molecules are too small to be viewed even under the best microscope. However, increasingly sophisticated and accurate mathematical models of molecules are being developed. Using these, one should be able to answer such questions by using a realistic model of the system being studied and solving the right mathematical equations. Computers are ideal both for solving complicated, tedious equations and mind-bogglingly-large numbers of equations, and can do so quickly and economically. How can computers predict the steps a single metal catalyst takes to knit molecules together into a polymer chain? How can computers predict the way thousands of liquid water molecules behave at and below their freezing temperature? Knowing how a catalyst fundamentally operates can lead to cheaper materials with desirable properties. Water is everywhere and essential to life on Earth. A better understanding of the surface tension of water helps predict atmospheric phenomena, and could also help us understand environments on other planets. Using computers to answer these questions will be described.

presenting
11 am—12 pm

Hometown: Dallas, TX

Flipped vs. traditional General Chemistry: What did students think and how did they do?

Casey Einfalt and Carla Swearingen

John Brown University, Siloam Springs, AR

The flipped classroom has been rapidly gaining in popularity over the last several years. However, because this method of teaching is relatively new, rigorous data on how well the flipped method functions in terms of student learning and retention of information is scarce. We collected data from seventy-five students who were enrolled in a first semester general chemistry course that was half traditional lecture and half flipped. Test scores were collected and analyzed to determine if student performance was impacted by the method of instruction. In addition to quantitative data, students were also administered open-ended surveys about their experiences. Included were questions about how students used the videos, which delivery method they felt produced greater learning, and if they would prefer to be in a traditional lecture or flipped course. The data showed that on average, most students did better on questions that were derived from the flipped lectures then from the traditional lectures, and felt that they learned more using the flipped method over the traditional method.

presenting
11 am—12 pm

Hometown: Kigali, Rwanda (RN)

Selective Synthesis of Coumadin (Warfarin) Metabolites via Green Chemistry

Robert Nshimiyimana,[a] Linda P. Desrochers,[a] Thomas E. Goodwin,[a] and Grover P. Miller[b]

[a]Department of Chemistry, Hendrix College, Conway, Arkansas
[b]Department of Biochemistry & Molecular Biology, University of Arkansas for Medical Sciences, Little Rock, Arkansas

Warfarin, also commercially known by its brand name of Coumadin, is an anticoagulant drug normally used in the treatment or prevention of thromboembolic events such as the formation of blood clots in the blood vessels and their migration in the body. Thus, warfarin is commonly referred to as a blood thinner. Currently, there are many people in the United States who are using this drug for medicinal purposes. As a result, warfarin has recently proven to be a useful probe for addressing fundamental questions in the field of drug metabolism. However, warfarin metabolism and treatment response vary significantly among individual patients. This is partly because in the body, warfarin is known to exist in several forms, each one of which can have a different metabolic fate. Thus, optimal dosing requires adequate consideration of metabolic pathways that can determine the level of these compound forms. In collaboration with Dr. Grover Miller, UAMS biochemist, we prepared pure samples of warfarin metabolites as standards for metabolic profiling in his research. Warfarin metabolite profiles from patients are being used to improve understanding of the link between metabolism and treatment response. These studies should benefit Arkansans and others who must take Coumadin for their health.

presenting
10 am—11 am

Hometown: Searcy, AR (ZH)

Novel Carbon-Based Supercapacitors

Zachary Hicks, Sunil Kumar Ramasahayam, Saad Azam, and Tito Viswanathan

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

Traditional capacitors have long been used as a means of storing energy for electronic devices. Supercapacitors, otherwise known as ultracapacitors, are an emerging solution to efficiently store greater amounts of energy. Supercapacitors exhibit both the characteristics of batteries (high energy density) as well as capacitors (high power density). They are unique in that they utilize a porous carbon material and thinner dielectric, in order to greatly increase their overall capacitance. Novel phosphorus and nitrogen doped carbon materials (PNDC) prepared in our lab have been used to fabricate supercapacitors and evaluated for their energy storage characteristics. The PNDC-containing supercapacitors have shown to out-perform undoped carbon supercapacitors, and represent environmentally friendly alternate energy storage devices.

presenting
11 am—12 pm

Hometown: Kigali, Rwanda

Synthesis and Characterization of Transition Coordination Polymers for CO_2 Capture from Post-Combustion Flue Gases

Clement Mugenzi, Ethan P. McMoran, Lei Yang

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

The urgent need to control CO_2 concentrations in atmosphere has promoted global efforts to develop new materials for CO_2 capture from post-combustion flue gases of the conventional coal combustion, which is one of the major sources of anthropogenic CO_2 emissions. In Arkansas, the coal-fired electric power plants contribute over half (~53%) of the state's electricity in 2013.[1] Although fruitful results have been achieved, great challenges, such as low partial pressure of CO_2, high temperature, presence of other components (e.g. N_2 and H_2O), and the high energy cost of regeneration, still remain. Inspired by these challenges, our goal in this project is to develop new metal-organic frameworks (MOFs) for selective CO_2 uptake from post-combustion flue gases. Our initial work based on the pyridylamide ligands and transition metal ions have led to the isolation of some very interesting polymeric compounds characterized by single crystal X-ray diffraction. The three-dimensional architecture exhibited by our MOFs showed excellent thermal and moisture stability, which are ideal properties for the potential application of these materials in CO_2 capture.

presenting
10 am—11 am

Hometown: Hot Springs, AR (DC)

Construction of a Large Scale Photovoltaic Hydrogen Gas Generator

Danielle S. Cook and M. Jeffrey Taylor

Department of Chemistry, University of Arkansas, Monticello, AR

Hydrogen gas is a potentially emissions-free source of fuel. There are a variety of methods that can be employed to generate hydrogen gas, however most methods involve expensive catalysts, produce undesirable gases, and can impact the environment negatively. As the population increases, so does the demand for more renewable, sustainable, and inexpensive energy sources. Conventional resources, such as coal, petroleum, and wood are being depleted at an alarming rate and are causing devastating effects on ecosystems. Exploring more efficient ways to produce hydrogen gas will allow clean-burning fuel to become more commercially available and help to counteract negative environmental impacts. Using a photovoltaic panel as an energy source and stainless steel electrodes, hydrogen gas can be produced via photoelectrolysis inexpensively and on a fairly large scale. Passing an electric current through water causes hydronium ions to migrate to the cathode where reduction occurs and hydroxide ions to migrate to the anode where oxidation occurs, thus producing hydrogen and oxygen gas. Construction of a large scale photovoltaic hydrogen gas generator utilizing readily available material is demonstrated.

presenting
10 am—11 am

Hometown: Magnolia, AR (AO)

Comparative study of oil and grease analysis in water samples

Addison Ochs and Dr. Gija Geme

Department of Biochemistry and Chemistry, SAU, Magnolia, AR

The purpose of this project is to introduce student researchers to a comparative study in oil and grease analysis in water samples. The project compared traditional (USEPA method 1664) and updated extraction methods (Xenosep Solid-Phase Extraction (SPE)) for quantifying oil and grease in standards and samples. The traditional method utilized n-hexane as an extracting agent and distillation to determine oil and grease concentrations in samples. Finally, oil and grease in samples was determined gravimetrically. Standards for this method were prepared using acetone, stearic acid, and hexadecane. This method typically yielded a 65%-75% recovery and an analysis time close to seven hours. Liquid-liquid extraction (LLE), and drying process due to the volatility of samples contributed to the major source of errors. The updated method utilized acetone, decreased amounts of hexane, stearic acid, and hexadecane to determine oil and grease concentrations in samples. The major improvement was usage of the SPE, which replaced LLE and significantly decreased analysis time. This method also improved sample recovery. This study is ongoing and water samples are being analyzed in side-by-side studies.

presenting
11 am—12 pm

Hometown: Conway, AR

Ion-Induced Decomposition of the Super Greenhouse Gas SF_5CF_3

Benjamin A. Scheuter, William S. Taylor, Christopher M. Church, Xavier S. Redmon

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

Super greenhouse gases exist in the atmosphere typically in very small quantities, but have a global warming potential of hundreds to thousands of times that of CO-$_2$. Trifluoromethyl sulfur pentafluoride (SF_5CF_3) is one such gas, with a global warming potential 18,000 times that of CO_2. First discovered in 2000, the concentration of this man-made gas has stabilized at 0.15 ppt as of 2002. Understanding how this molecule decomposes is fundamental to understanding its ultimate environmental impact. Our laboratory examined how this molecule reacts with gaseous copper ions in an effort to shed light on this impact.

presenting
10 am—11 am

Hometown: Little Rock, AR

Screening of flathead catfish for heavy metals in Ouachita River, AR

Casey O'Hara and Dr. Gija Geme

Department of Biochemistry and Chemistry, Southern Arkansas University, Magnolia, AR

Metals are being utilized in industries and agriculture; particularly heavy metals such as mercury, cadmium, lead and arsenic constitute a significant potential threat to human health because they are associated with many adverse effects on health. The consumption of fish is recommended because it is a good source of omega-3 fatty acids, which have been associated with health benefits due to its cardio-protective effects.
Southern Arkansas is home to many industrial plants thus there is concern of heavy metal accumulation in fish. Additionally, a new wastewater line was built that combines domestic and industrial waste with water release in the Ouachita River. Forty flathead catfish were collected from Ouachita River, AR. The fish were digested using vanadium (V) oxide and analyzed for arsenic, mercury, lead, copper, and cadmium using ICP-OES. Additionally, fish were analyzed for aluminum, copper, and phosphorus. Elevated concentrations of arsenic and mercury were found in fish.

presenting
10 am—11 am

Hometown: Monticello, AR (TS and DW)

Determination of Fatty Acid Content in native Arkansas Algae

Taylor Snider, Donnell White, and Andrew Williams

University of Arkansas at Monticello School of Mathematical and Natural Sciences

Characterization of algae for their fatty acid content is one of a variety of tests done to determine the applicability of the algae. Applications include use as nutrients for aquaculture, in human consumption, or potential ability as biofuels. A number of freshwater eustigmatophyceae have been tested to determine if there are any differences in fatty acid concentration between species. While there are a number of algaes that have been described in this same manner, we want to compare a native species to these others. In order to do so, modification of previous sample preparation methods have been required, and will be described. Fatty acid content was then determined through GC-MS analysis. Current results show that the fatty acids analyzed compromise 0.7239-1.2217% of the total mass of the dry algae, with additional samples to be analyzed.

presenting
10 am—11 am

Hometown: Bryant, AR (JL)
Hot Springs, AR (DC)
Arkadelphia, AR (HW)

Detection of Mercury in Water, Sediment, and Biological Samples from Historical Mining Sites in Arkansas.

Dylan Campbell, Hunter Wayland, James Lowe, T. David Bateman

Department of Chemistry, Henderson State University, Arkadelphia, AR.

Cinnabar mining for acquisition of mercury was one of the foremost industries in Arkansas from the early 1930s to late 1940s. The southwest quadrant of the state alone has over 250 documented historical mining sites. This project is focused on collecting samples of water, sediment and soil from all over these sites, as well as biological samples statewide, and analyzing the mercury content with a cold vapor atomic absorption instrument. Using the results, the group seeks to trace modern effects of the historical cinnabar mining in Clark and Pike counties.

presenting
10 am—11 am

Hometown: Malvern, AR (OC)
Fort Smith, AR (AB)
Alexander, AR (KG)
Arkadelphia, AR (MB)

Arkansas Plants as Sources of Bioactive Compounds

Oktawia Clem, Alyssa Barnes, Kaitlin Gaiser, Mallory Bell, and Martin J. Campbell

Department of Chemistry, Henderson State University, Arkadelphia, AR

In view of the fact that nearly 50% of current pharmaceuticals trace their origin to a naturally occurring product, our group has started evaluating local native plants as possible sources of medically interesting compounds. Currently we are exploring Deciduous holly (*Ilex deciduas*) and Wooly Croton or Dove weed (*Croton capitatus*). Neither plant has been systematically evaluated for bioactivity. There are several reports of other, phylogenetically related hollies containing compounds of interest. Likewise, some studies have been reported on other Crotons. Plant samples have been collected, dried, and separated into seeds and stems and berries. Some of the components have been extracted by a series of solvents. These solvent extracts are being evaluated for interesting biological activity using a variety of protocols. Samples showing activity will be will be isolated for detailed study in an attempt to purify and identify the active compound.

presenting
11 am—12 pm

Hometown: Conway, AR

Investigating the formation of nodule-like structures in rice roots

Ryan Hiltenbrand[1], Hannah Posey[1], Jacklyn Smith[1], Karl Dykema[2], Mary Winn[2], Arijit Mukherjee[1]

1- Department of Biology, University of Central Arkansas, Conway, AR
2- Bioinformatics and Biostatistics Core, Van Andel Research Institute, Grand Rapids, MI

Together with legumes, cereals have been essential to development of modern agricultural systems. Unfortunately, the high yields of cereals are dependent on nitrogen fertilizers that cause significant environmental and economic problems. Taking better advantage of naturally occurring plant-microbe associations is a promising alternative to improve crop yields while maintaining agricultural sustainability. Legumes can develop a symbiosis with rhizobia that leads to the formation of root *nodules* inside which nitrogen fixation can occur. Unfortunately, this symbiosis is restricted only to legumes. Therefore, cereals are still heavily dependent on fertilizers for their nitrogen demands. Our goal is to improve the efficiency of nitrogen fixation in cereals by using our knowledge on how legumes fix nitrogen in association with rhizobia and recapitulating these events in cereals. Several studies have shown that plant hormones can induce the formation of nodule-like structures (NLS) in legume roots even in the absence of bacteria. Interestingly, in many cereals addition of plant hormones stimulate the formation of similar structures. Unfortunately, our knowledge of NLS formation in cereals is still fragmentary. We are studying the formation of NLS in rice at a developmental level. We are also investigating the regulation of gene expression in rice during formation of NLS.

presenting
11 am—12 pm

Hometown: Atkins, AR (BM)

Seasonal baseline analysis of benthic macroinvertebrate communities within the Lake Maumelle watershed

Brock McFarland, Rosemary A. Burk

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

An analysis of aquatic invertebrate communities within a stream can provide valuable insight into the overall water quality and functioning of an aquatic ecosystem. This study examines benthic macroinvertebrate communities from five Lake Maumelle tributaries in late winter and spring of 2014 to provide a baseline for watershed biological monitoring efforts. The most diverse taxa collected were caddisflies (Order Trichoptera) and mayflies (Order Ephemeroptera). Dominance and the seasonal differences in development of EPT (Ephemeroptera, Plecoptera, Trichoptera) taxa, which were commonly among the most dominant taxa in this study, indicate that these benthic communities exhibit distinct seasonal differences. Although study sites reveal high community similarity, indicators such as % dominance and % EPT are variable. Among the most dominant taxa, Simuliidae (Order Diptera) and Isopoda demonstrate the highest variability between sampling periods. Bringle Creek had the highest % EPT (64.3%) of study sites in March, but by May % EPT had declined to the lowest among study sites (14.8%). Dominant EPT taxa collected in March that exhibited large declines in relative abundance by May were: *Amphinemura* sp., *Clioperla* sp. (Order Plecoptera), and the micro caddisfly, *Hydroptila* sp. Lake Maumelle provides drinking water to approximately 400,000 central Arkansans and this study will support ongoing water resource management efforts.

presenting
11 am—12 pm

Hometown: Greenwood, AR

Stopover Foraging Ecology of Swainson's Thrushes (*Catharus ustulatus*) during Spring Passage Migration through W. Arkansas

Shannon Wiley,[a] Ragupathy Kannan,[a] Douglas A. James,[b] and Anant Deshwal[b]

[a]Department of Biology, University of Arkansas-Fort Smith, Fort Smith, AR
[b]Department of Biological Sciences, University of Arkansas, Fayetteville, AR

The stopover foraging ecology of Swainson's Thrushes on spring passage migration was studied in w. Arkansas in the spring of 2013 and 2014. Observations were made in two forested field sites, one urban and the other suburban. For each foraging observation, three parameters were noted: Foraging Stratum (Ground, Shrub, Sapling, Sub canopy, and Canopy); Foraging Substrate (Ground/Litter, Herb, Foliage, Bark, and Air); and Foraging Maneuver (Glean, Probe, Dive/Glean, Hover, Jump Hover, and Hawking). We tested the hypotheses that these foraging variables differed significantly between the urban and suburban sites, and between the two years. These hypotheses were rejected for all three parameters. The consolidated data from both sites and years revealed that 67% of the observations were on the Ground stratum, followed by Shrub (13.7%) and Sapling (13%) (n=637 observations). 66% of the foraging substrate used was Ground/Litter, followed by Foliage (16.7%) and Bark (15.8%) (n=637 observations). Gleaning was the most common foraging maneuver (71.5%), followed by Probing (12.3%) and Dive Gleaning (8.4%). Swainson's Thrushes are declining significantly in parts of their range. It is hoped that data pertaining to their stopover foraging ecology will offer insights on how to manage forested areas for their conservation.

presenting
10 am—11 pm

Hometown: Yukon, OK (TL)
Malvern, AR (LE)
Arkadelphia, AR (IC)

Genetic Analysis of Bacteria from Cave Crickets from Blanchard Springs Caverns, Arkansas

Taylor Lee, Leah Efird, Itzela Cruz, Charlotte Wetzlar, and James Engman

Biology Department, Henderson State University, Arkadelphia, AR.

This project is using molecular genetic techniques to survey the bacterial flora of *Ceuthophilus gracilipes,* from Blanchard Springs Caverns, Arkansas, considered the most biologically diverse cave in the Ozark Plateau. A survey of cave organisms' bacterial flora has the potential to identify previously unreported/undescribed bacteria. Cave crickets were obtained from various locations in the cave and taken to the lab, where bacterial samples were collected from their body surfaces and digestive tracts. These samples were plated on selective media, with resulting cultures stored at -80 degrees C. A conserved region of ribosomal DNA (16S subunit) from these colonies was amplified by polymerase chain reaction (PCR) and sequenced using universal bacterial primers. Sequences were compared with those in the GenBank database, which is an archive of DNA sequences, allowing identification to genus and species level. Initial work has identified *Pseudomonas protegens* and *Serratia proteamaculans* from the digestive tract. The identification of other samples is ongoing.

presenting
11 am—12 pm

Hometown: Jonesboro, AR (AC)
Hot Springs, AR (ZM)

A Therapeutic Compound Produced in Plants for Improving Aquaculture Fish Health

Alyssa Caparas, Zach Marsh, Maureen C. Dolan

Biological Sciences, College of Sciences and Mathematics, Arkansas State University, Jonesboro, AR

Aquaculture, the farming of fish and other aquatic organisms, often occurs in tanks and ponds. In these environments fish movement is constricted and high density growth conditions promote increased fish stress and disease spread. A fish protein (interleukin-22; IL-22) has been correlated with improving their immune health that could be used in overcoming aquaculture limitations. Introduction of IL-22 to fish, through immersion or feed, may provide a more natural biological therapy, safer than the limited antibiotics and chemicals currently available. Tobacco plants can be used to naturally produce this protein, with potential cost advantages. However, proteins tend to be unstable and inactive in the "harsh" aquaculture pond environment. Applying a protective sugar covering may keep the IL-22 protein therapy functionally active. The *Hyp-O-Glyco* technology, unique to plants, is capable of placing large amounts of sugar on proteins produced in plants. We have employed this technology and have optimized expression and purification of IL-22 in plants. This platform may provide an innovative solution to effectively address issues in fish health management for improved production and increased consumer safety. This research is supported by Student Undergraduate Research Fellowship awards from the Arkansas Department of Higher Education and ASSET II, an NSF EPSCoR initiative.

presenting
10 am—11 am

Hometown: N. Little Rock, AR

Spore Persistence in the Environment Drives Infection Dynamics of a Butterfly Pathogen

Mary-Kate Williams[a,b], Sonia Altizer[b], Richard Hall[b], and Dara Satterfield[b]

[a] University of Arkansas at Little Rock, [b] University of Georgia

The monarch butterfly (*Danaus plexippus)* is a highly recognized and revered species whose populations are seriously declining in Arkansas and North America. Although environmentally transmitted parasites commonly infect humans and wildlife, the environmental factors affecting infectious stages are often poorly understood. Many monarchs are infected by *Ophryocystis elektroschirrha* (OE), a parasite whose populations have recently increased while monarch populations have declined. By using an experimental study and a mathematical model, we examined (1) how environmental conditions affect persistence of the free-living stage of OE, and (2) how pathogen-shedding rate and environmental persistence time affect pathogen prevalence and host population size during the summer breeding season. Increased exposure to environmental conditions by OE spores reduced average infection severity in monarchs, but did not reduce the fraction of monarchs infected by spores. OE parasites remained viable outdoors for at least 15 days. The model showed that, for predicted prevalence to match the minimum prevalence observed in field studies, parasite spores must persist for at least 20 days and be shed at high rate onto host plant leaves. Understanding the OE parasite can be valuable in improving conservation of monarchs and other species in Arkansas and elsewhere.

presenting
10 am—11 am

Hometown: Star City, AR

Effect of Cisplatin on the Zebrafish Embryos and Larvae

Marla Moland[a, b], Elvis Cuevas[b], Jyotshna Kanungo[b]

[a]University of Arkansas at Monticello, [b]Division of Neurotoxicology, National Center for Toxicological Research/FDA, Jefferson, AR

Cisplatin (CDDP) is a chemotherapeutic drug that treats malignant tumors in cancers. Some of the reported side effects of cisplatin include ototoxicity (ear), nephrotoxicity (kidney), and neurotoxicity (nervous system). Cisplatin-induced ototoxicity is usually irreversible resulting in hearing loss. In fishes and amphibians, there are a series of lateral line organs called neuromasts, located along the head and body. The neuromasts detect water current and pressure changes in the surrounding. The zebrafish neuromasts have mechanoreceptive hair cells, similar to those in the inner ear of mammals. We used zebrafish embryos and larvae (from the wild type and hb9-GFP transgenic line) to assess the effects of cisplatin on the early development and the neuromasts. Our results show that cisplatin, in a dose-dependent manner, adversely affects hatching rate, heart rate and survival of the zebrafish embryos. Using neomycin as a positive control for ototoxicity, we also demonstrate that cisplatin induces adverse effects on the neuromasts. Cisplatin also resulted in motor neuron toxicity as revealed by the hb9-GFP transgenic embryos, in which the motor neurons express the green fluorescent protein for efficient identification of the neurons in live embryos. Using various doses, developmental stages and exposure durations, we showed that cisplatin is also a developmental toxicant, as well as a known ototoxicant and neurotoxicant.

presenting
10 am—11 am

Hometown: Pine Bluff, AR (LM)

Gene discovery for bioactive phenylpropanoids in *Echinacea* species

Lauren Morehead[a] and Stephen Grace[b]

[a]Department of Biochemistry and Chemistry, SAU, Magnolia, AR, [b]Department of Biology, UALR, Little Rock, AR

The purpose of this research project is to identify and quantify the phenolic compounds in *Echinacea pallida*, *Echinacea angustifolia*, and *Echinacea purpurea* as well as discover the genes responsible for formation of said compounds. In particular, the aim is to identify homologs of hydroxycinnamoyl -quinate transferases (HQTs), an enzyme family that catalyzes the production of phenylpropanoids. With the protein sequence for a HQT in the tomato plant, we used BLAST (Basic Local Alignment Search Tool) to find protein sequences in the *E. purpurea* transcriptome that were similar. These sequences became the basis of primers to be used on the cDNA extracted from Echinacea samples. With the use of high-pressure liquid chromatography (HPLC) and liquid chromatography-mass spectrometry (LC-MS), we determined what phenolic compounds were significantly present in Echinacea leaves and flowers. These compounds are known antioxidants and are most likely the compounds that give *Echinacea* its medicinal efficacy. At this point, we have identified 4 HQT gene candidates that are consistently expressed in *Echinacea* leaves and flowers. Moreover, understanding the pathway can potentially open the door for bioengineering these compounds in larger amounts.

presenting
10 am—11 am

Hometown: Earle, AR

Mechanism of Nuclear DNA Breaks Induced by Graphene

LaDonna Branch[1], Tariq Fahmi[2], Alena Savenka[2] and Alexei G. Basnakian[2]

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

Recently invented nanomaterial, graphene, consists of monomolecular carbon sheets, which are extremely strong, light and flexible. However, little is known about its potential for being an environmental hazard. Our initial observation was that exposure of cultured rat kidney tubular epithelial NRK-52E cells with graphene (50 μg/ml) resulted in decrease of nuclear polymeric DNA content, a sign of cytotoxicity. The mechanism for the nuclear DNA breaks was unknown. We hypothesized that DNA is degraded by one of the following mechanisms: direct DNA breaks, oxidative injury, or DNases. Quantitative immunocytochemistry (ICC) was used to examine protein markers of oxidative stress: heme oxygenase-1 (HO-1), oxoguanine glycosylase (OGG-1), and inducible nitric oxide synthase (iNOS); and DNases such as caspase-activated DNase (CAD), endonuclease G (EndoG), and apurinic/apyrimidinic endonuclease-1 (APE1). Exposure of graphene with plasmid DNA showed no direct DNA cutting activity of graphene. DNase activity and three ICC markers, HO-1, CAD and EndoG were induced by graphene exposure with the cells. Additionally, HO-1 was over 50% colocalized with the DNase activity. These results indicate DNA fragmentation induced by graphene is likely mediated by oxidative stress through activation of HO-1 and apoptotic DNases, CAD and EndoG. These molecules may be used as markers of graphene injury to cells in the future.

presenting
10 am—11 am

Hometown: Little Rock, AR

Does HIV-1 Manipulate Cellular Stress Responses

Andra L. Bates, Jr.[1]; Jordan Becker, Sr.[2]; and Nathan Sherer, Sr.,

[1]University of Arkansas - Pine Bluff, Pine Bluff, AR and
[2]University of Wisconsin - Madison, Madison, WI

Many different kinds of viruses induce a cellular stress response. Others come up with ways to circumvent the response, such as poliovirus and human rhinovirus. They function by cleaving the eIF4G protein, allowing the mRNA from the virus to circumvent mRNA cap recognition. Whether or not the HIV virus can manipulate cell stress is unknown. To address this question, we tested if HIV-1 can induce or repress stress granule (SG) formation by infecting HeLa cell lines expressing fluorescent markers for stress granules and determined if stress granules formed via fluorescent microscopy. During the experiment, we observed YFP-APOBEC3G, a marker for stress granules and P-bodies (PBs), accumulate in PBs which remained prevalent during infection. The SG marker, YFP-TIA1, showed a transient localization of stress granules during infection. Subsequently, we used the stress inducer, sodium arsenite, in the presence of infection to see if the virus suppresses SG formation. From numerous observations, infection did appear to block SG formation in response to sodium arsenite. This result is consistent with our hypothesis of suppression of SGs by HIV.

presenting
11 am—12 pm

Hometown: Rogers, AR

Characterization of a nucleosomal region required for proper interactions between the transcription elongation factor Spt16 and transcribed genes

Alex B. Cox, Ryan Banning, Eugene Nyamugenda, Sarah Marshall, Andrea A. Duina

Department of Biology Hendrix College, Conway, AR

Within the confined space of a cell nucleus, DNA molecules exist in a condensed form through interactions with histone proteins. DNA wraps around histones to give rise to nucleosomes, which together with other proteins form a DNA-protein structure known as chromatin. In addition to condensing DNA, nucleosomes also perform regulatory functions in a variety of DNA-based processes. Our laboratory focuses on one such process, called transcription, in which DNA segments, or genes, are transcribed into RNA. During transcription, nucleosomes are disassembled to allow the enzyme required for RNA synthesis to access the DNA. One key factor involved in nucleosome disassembly is Spt16, an essential and highly conserved protein. While Spt16 is known to associate with chromatin during transcription, how Spt16 specifically interacts with nucleosomes still remains to be elucidated. Previous research from our laboratory has shown that in *Saccharomyces cerevisiae* a specific region on the side of the nucleosome is required for proper Spt16-gene interactions. Here, we report on studies designed to more fully characterize this nucleosomal region. Given the central importance of the transcription process in most aspects of cell biology and its conservation across organisms, our findings contribute to our understanding of important aspects of human biology.

presenting
11 am—12 pm

Hometown: Rogers, AR

PKC cell signaling in Coxiella burnetii-infected cells

Maria Serrano and Joel Funk

Department of Biology, John Brown University

Q fever is a zoonotic disease caused by the intracellular invasion of the bacterium *Coxiella burnetii* into a host cell. Replication of *C. burnetii* takes place within a parasitophorous vacuole (PV) that develops as host cell metabolism is redirected in favor of the bacteria. To examine the role of PKC signaling during PV maturation, THP-1 cells were infected with *C. burnetii* and harvested over a 96h period. Isoform involvement was determined using immunoblot analysis of infected cell lysates. Our results indicate that host cell PKC-alpha, PKC-beta, and PKC-eta are important for *C. burnetii* proliferation and are involved in cell signaling during the infection. Inhibitors were used to determine which isoforms stalled PV formation. Cells treated with BIM-1 and Gö6976 had smaller sized PV's compared to infected control cells. LY333531 indicated PKC-beta II has less of a role in PV formation than PKC-alpha. PKC activity was also assessed by probing phosphorylation of downstream substrates. A substantial overall increase in total PKC substrate phosphorylation was evident, indicative of kinase activation. Using antibodies to different substrate antigens indicated that phosphorylation of some substrates was highest at 24 hours post infection whereas phosphorylation of other substrates reached a peak at 96 hours post infection.

presenting
11 am—12 pm

Hometown: Batesville, AR (CE)

Engineering “designer” sugar beets for alternative bioenergy and improved human health

Christopher Elms, Jianfeng Xu

College of Agriculture and Technology, Arkansas State University, Jonesboro, AR

The *long term* goal of this project is to genetically engineer emerging “energy beets” with enzymes (e.g., glycosyl hydrolases) that modify cell wall structure. This will facilitate the production of industrial sugars for bioenergy and recovery of value-added products from the beet pulp, such as feruloylated arabino-oligosaccharides (FAOs). FAOs can be used in food and feed applications for healthier colon functioning. This research aims to provide a proof-of-concept by engineering in a model plant a thermostable enzyme (1,4-endo-arabinase, or ABN) that can selectively modify sugar beet pulp during beet root processing so the plant will release functional FAOs. To maximize the function of the ABN enzyme, it was engineered with a novel “designer” molecule (a glycopeptide tag). This designer molecule can presumably function as a “molecular carrier” by directing the accumulation of the ABN enzyme in the plant cell wall matrix and stabilizing the enzyme against degradation. The knowledge obtained from this research will be extended to energy beet engineering in the future and may produce a “healthier” beet. This project is supported by a Student Undergraduate Research Fellowship award from the Arkansas Department of Higher Education.

presenting
11 am—12 pm

Hometown: Amarillo, TX (NB)
N. Little Rock, AR (JS)

Hendrix iGEM: Using synthetic biology to engineer a melanoma detecting yeast.

Noah Beggs, Jay Stanley, Seana Corbin, Chase Davis, Krystal Kim, Alex McIntyre, Jordan Spennato, and Richard C. Murray

Biology Department, Hendrix College, Conway, AR

This summer, Hendrix College entered the first Arkansas team in the International Genetically Engineered Machine competition (iGEM). iGEM is an undergraduate synthetic biology competition, which is dedicated to education and competition, advancement of synthetic biology, and the development of open community and collaboration. The overall goal of our project is to engineer a biological machine that can detect cancer. Skin cancers, such as melanoma, are known to give off volatile compounds (including alkanes) that can be detected by trained dogs. We are engineering a strain of the yeast *Yarrowia lipolytica* to fluoresce in the presence of these volatile compounds. Our strain uses an alkane sensitive promoter from the *Y. lipolytica* genome to drive expression of a fluorescent reporter gene, which will cause the yeast to give off light in the presence of alkanes. It is our hope that we can use this yeast to detect melanoma cheaply and non-invasively (perhaps in a cancer detecting band-aid). If our design is successful, our cancer detecting band-aid could allow for easier and earlier detection of melanoma, a form of cancer with rising incidence in Arkansas.

presenting
11 am—12 pm

Hometown: Hot Springs, AR

Hairy Root Cultures of Muscadine Grape: A Sustainable Bioproduction and Discovery Platform for Therapeutic Agents

Tyler Knapp, Fabricio Medina-Bolivar

Biological Sciences, College of Sciences and Mathematics, Arkansas State University, Jonesboro, AR

Muscadine grape, native to the southeastern US, produces compounds known as stilbenoids as a defense mechanism against environmental stress or attack by pathogens. These compounds have antioxidant, anti-inflammatory and anti-cancer properties and therefore are important for human health. However, the mechanisms affecting their production and accumulation in plants are not known. To this end, we developed hairy root cultures from two cultivars of muscadine grape as a bioproduction platform for stilbenoids. The hairy roots are ideal systems to study the factors that control production of these potential therapeutic compounds. We found that the levels of stilbenoids can be significantly increased when the hairy root cultures were treated with the stress hormone methyl jasmonate. When this stress hormone was combined with a type of sugar molecule (cyclodextrin) the levels of selected stilbenoids were further increased. This method of treating muscadine grape with two other compounds is an effective strategy to induce the production of stilbenoids, and may lead to therapeutic foods or medicines in the future. This work is supported by a Student Undergraduate Research Fellowship award from the Arkansas Department of Higher Education.

presenting
10 am—11 am

Hometown: Colleyville, TX (KB)
Smackover, AR (JB)
Abiline, TX (CP)

The Effects of Ajulemic Acid on Metastasis Models in Ewing's Sarcoma

Kelley Ballard[a], Jamie Barker[a], Chris Price[a], Amy Eubanks[a], Rob Griffin[b], and Lori Hensley[a]

[a]Department of Biology, Ouachita Baptist University, [b]Department of Radiation Oncology, University of Arkansas for Medical Sciences

Ewing's sarcoma (ES) is an aggressive pediatric bone cancer with poor prognosis and low survival rates despite intense chemotherapy and radiation. Ajulemic acid (AJA) is a cannabinoid that is structurally similar to tetrahydrocannabinol (THC), the active compound in marijuana. AJA demonstrates medicinal effects but no psychotropic "high". It has demonstrated the ability to decrease tumor cell viability and invasiveness as well as angiogenesis (formation of blood vessels in the tumor). All of these contribute to the cancer's ability to spread throughout the body. To investigate how cannabinoids disrupt such tumor cell functions, our experiments compare three potential therapeutic cannabinoids: AJA, cannabidiol (CBD), and hemp oil (HO) in a tumor model called spheroids. Spheroids are three-dimensional and mimic tumors found in the body. Using these, we can observe tumor behavior in treated and untreated samples and measure protein levels that may be altered by drug treatment. Because metastasis of ES is largely responsible for the low survival rates, an understanding of the cellular pathways that make these tumors aggressive and the mechanisms cannabinoids use to alter such pathways may lead to new therapies that improve survival rates and quality of life for children in Arkansas and their families.

presenting
10 am—11 am

Hometown: El Paso, TX (BM)
Shreveport, LA (JU)

Ajulemic Acid and Pediatric Cancer: How does it work?

Brian Monk[a], Joel Ubeda[a], Amy Eubanks[a], Rob Griffin[b], Marty Perry[c], and Lori Hensley[a]

[a]Department of Biology, Ouachita Baptist University, Arkadelphia, AR, [b]Department of Radiation Oncology, University of Arkansas for Medical Sciences, Little Rock, AR. [c]Department of Chemistry, Ouachita Baptist University, Arkadelphia, AR.

Ewing's sarcoma (ES) is a pediatric bone cancer that has a 30% five-year survival rate, even with aggressive chemotherapy, radiation, and surgery; therefore, alternative treatment options are needed. Ajulemic acid (AJA) and other cannabinoids are a current topic of interest for this cancer. AJA is structurally similar to tetrahydrocannabinol, the active compound in the marijuana plant, but gives users no high, making it a viable option for pediatrics. It has been shown to induce death in ES cells. However, how it does so is still poorly understood. Receptors act like gates, allowing only certain molecules into the cell or to activate specific cellular pathways that may alter gene expression, thus changing the way cancer cells behave. We are using computational modeling, a leukemia cellular model, and a mammalian-2-hybrid system to test candidate receptors and identify important pathways in tumor cells that may be affected by AJA and other cannabinoids. Because over a ten-year-period the Arkansas Cancer Registry reported 1,409 new cases of childhood cancer that resulted in 193 deaths, it is our hope that data from these models provide the rationale for the development of improved therapies for children in our state with ES and related solid tumors.

presenting
11 am—12 pm

Hometown: Russelville, AR (ZC)
Oden, AR (MN)
Tianjin, China (PF)
McCrory, AR (AN)

Effects of normal activities on cognitive functioning

Zach Crossett, Austin Needham, Peng Feng, Matthew Norman, and Scott Kirkconnell

Biology Department Arkansas Tech University, Russellville, AR

Previous studies showed direct evidence for increased cognitive performance with increased daily exercise. A series of tests were conducted to determine how various daily activities affected cognitive functioning. Cognitive functioning was monitored by two similar tests; the "Stroop Race" which monitors reaction times and the "Speed Color" test which monitors higher level cognitive functioning. Tests were accomplished throughout each day of the study and relationships to heart rate and oxygen content of the blood were evaluated. Results found a strong correlation between increased heart rate and increased cognitive performance. However, when O_2 levels were compared to cognitive functioning there was little or no correlation seen between the two parameters. Association between test scores and time of day were noticed. Late chronotype individuals typically scored higher in the evening than in the morning hours. Enhanced cognitive functioning is of central importance for a broad range of Arkansas citizens, including students, workers, teachers, and the general public.

presenting
11 am—12 pm

Hometown: Conway, AR

Using GIS to Determine Mean Tornado Direction and Path Length During Different ENSO Events

Joshua Bregy, Mary Sue Passe-Smith

University of Central Arkansas, Conway, AR
Department of Geography

El Niño Southern Oscillation (ENSO) is one of the major driving forces behind global weather patterns, including tornadoes, many of which devastate the state of Arkansas. Knowing that ENSO plays a major role, it is essential that we learn more about its influence on tornado dynamics. This serves to not only advance the field of atmospheric science, but also to aid with issues concerning public safety. Using geographic information systems (GIS), I was able to measure the mean direction and path length of tornadoes (1950s-present) for different ENSO events (El Niño, La Niña, and neutral years). The data was sorted into different ENSO event categories and mapped, geospatial analysis tests were run on the data to yield results that indicated variation among the different ENSO events. The statistical significance of the variations in direction was tested, yielding evidence that there is a distinct difference in directional mean across the three event types.

presenting
11 am—12 pm

Hometown: Morrilton, AR

Student Reflection and Problem Solving Strategies in IPLS

Charles Bertram, Andrew Mason

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

A reflective exercise in problem solving was given to an introductory physics for life sciences (IPLS) class every week over the course of the Fall 2013 and Spring 2014 semester. This exercise prompted students to reflect over their thought process in order to analyze what parts of their problem solving process they especially needed to practice. The exercise gave students a rubric that was used to take note of where they struggled in a group problem solving effort. One of the concerns was that students who are not physics majors do not necessarily have the same problem solving skills as physics majors would for the classroom or if the students' views of the usefulness of said skills affect how effectiveness of the exercise. As such, we examine written artifacts from the students' reflection activities as well as audio-visual data gathered from the exercise for evidence of different problem solving strategies. We also describe a comparison of written artifacts to pre-post data collected from diagnostic surveys that evaluate the conceptual understanding and the attitude towards physics demonstrated by the students.

presenting
11 am—12 pm

Hometown: Greenwood, AR

Detecting Tornadoes and Earthquakes in Arkansas

Angela Lamb, Robert Dunn

Department of Physics Hendrix College, Conway, AR

Arkansans face several potential hazards such as tornadoes and earthquakes. Currently, these hazards are being studied using a large ring laser interferometer located at Hendrix College. Typically, tornadoes form from strong thunderstorms and create very low frequency acoustic emissions referred to as infrasound. Infrasound is well below the level of human hearing and can travel for hundreds of miles with minimum attenuation. The Infrasound from two tornadoes is shown in the poster. To demonstrate the distance over which infrasound can propagate, the signature of a tornado that damaged Granbury, Texas and a short time later Cleburne, Texas is presented. A local tornado in Hot Springs Village, AR is also shown. In both cases, the tornadoes were detected over 30 minutes before the respective funnels touched down. Early detection of infrasound from tornadoes when incorporated with Doppler radar may increase the time people have to seek shelter. Arkansans along the New Madrid fault in Eastern Arkansas live under the threat of a major earthquake. The poster will present rotational seismograms from small earthquakes that have occurred in north central Arkansas. The goal of studying these small earthquakes is to gain a better understanding of the propagation characteristics of seismic waves.

presenting
10 am—11 am

Hometown: Pine Bluff, AR

Study of Photovoltaic Characteristics of CIGS/CdS and InGaN Solar Cells through AFORS-HET Simulation

Lafayette TaShon DeRamus, III and Hye-Won Seo

Department of Physics and Astronomy,
University of Arkansas, Little Rock, AR

Copper-Indium-Gallium-Selenium (CIGS)/ Cadmium Sulfide (CdS) and Indium gallium nitride (InGaN) are promising materials for the next-generation solar cell devices due to their high absorption coefficients and bandgap tunabililties. Especially , InGaN offers a direct, and variable bandgap (0.67eV-3.42eV), which almost perfectly matches with the solar spectrum. We used the numerical simulation tool for tandem solar cells (AFORS-HET) to investigate the CIGS/CdS and InGaN solar cell device performances by modifying structural geometry and chemical composition which directly affect the bandgap energy. The open-circuit voltage (Voc), short-circuit current density (Jsc), fill factor (FF) and power conversion efficiency (Eff) were estimated dependent on the simulation input parameters. By conducting the calculations, we were able to optimize the structural, physical and chemical designs of the CIGS/CdS and InGaN solar cell devices.

presenting
10 am—11 am

Hometown: Little Rock, AR

Simulation and Optimization of Geometric Parameters in a Small-scale Updraft Tower

Jeffrey Jones, Shawn Bourdo
Center for Integrative Nanotechnology Sciences,
University of Arkansas at Little Rock, AR

Arkansas is one of the largest producers of wind turbines in the country. Yet, Arkansas only has an average maximum wind velocity of 6 mph, which is not enough wind to efficiently produce energy using wind energy systems. Solar updraft towers utilizes solar irradiance and transfer solar energy into wind energy. They are renewable energy power plants that use solar irradiance at the base to create an updraft through a tower and turbine to generate energy. This technology could increase the demand for wind turbines in Arkansas and elsewhere. I investigated the optimal geometric parameters and performance for a small-scale solar updraft tower. I varied five geometrical parameters with a computer model including chimney height, chimney diameter, chimney divergence angle, solar collector height, and air inlet height. I used the optimum parameters to construct a solar updraft tower. I tested the pilot tower and found that the height and angle of the solar collector were the most important variables for the tower design. My tower had a consistent maximum air velocity and temperature of 1.9 m/s and 72 C, which is 17–31% larger than comparable models. In conclusion, my findings could lower global energy costs with large-scale models.

presenting
11 am—12 pm

Hometown: Fort Smith, AR

The Mars Rover Project (MRP)

Daniel H. Schwartz, and Kevin R. Lewelling

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

A joint research project to design and construct a Mars rover between the University of Arkansas – Fort Smith (UAFS) and Harding University started summer 2012 after receiving funding from the NASA Collaborative Research Program grant and both universities, respectively. This research project is unique due to the rover's capabilities of scanning large areas of the Martian terrain. At this time, a rover has been constructed using an aluminum frame and a 12 V Lithium Ion battery as a power source. The rover is capable of climbing 30 degree inclines carrying a 60 lb payload.

For this rover to be useful on the Martian surface, it must be able to autonomously guide itself. Work completed during the summer 2014 demonstrated this rover can be guided using a WIFI connection and an onboard camera. A credit card size Raspberry PI computer and Arduino microcontroller were linked together to achieve this remote control of the rover. The next step in rover development is to use the live video received from the onboard camera to control the rover's path and avoid obstacles without manual intervention. The work on autonomous guidance is slated to be completed during the summer of 2015.

presenting
11 am—12 pm

Hometown: Fort Smith, AR

Motor Drive Design for a Battery Electric Vehicle (BEV)

Osman A. Martinez and Kevin R. Lewelling

Engineering, University of Arkansas, Fort Smith

This poster describes a novel Battery Electric Vehicle (BEV) motor drive which accommodates fluctuations found in normal driving conditions. A BEV is in the testing phase at the University of Arkansas – Fort Smith (UAFS) using a Baldor H2 drive and a 5-speed transmission. This H2 drive is designed for conveyor belts and air handling applications. The H2 drive disables when speed/torque demands abruptly change due to a varying load such as acceleration, hill climbing, and shifting gears. These abrupt increases in load current and rapid decreases in speed disable the H2 drive for 90 s.

A drive to replace the H2 is currently under development. The main part of the current drive circuit design consists of 6 insulated-gate bipolar transistors (IGBTs) in bridge topology. The bridge receives battery voltage then sends the 3-phase high voltage output to the induction motor. The 3-phase frequency and magnitude is controlled by a microprocessor. The microprocessor signals are known as Sinusoidal Pulse Width Modulation (SPWM). The new motor drive circuit has implemented two different ways to generate SPWM. The first is called sine-triangle pulse width modulation and the second is known as direct digital synthesis (DDS). Using a series of lab power supplies to simulate the high voltage battery, SPWM was generated using the sine-triangle method and the signals were sent to the IGBT bridge which in turn delivered 3-phase high voltage to an induction motor. At this time, a ½ hp 3-phase induction motor can be speed controlled. A scaled version of this drive capable of speed controlling a 10 hp motor should be ready for testing by the end of summer 2015.

presenting
11 am—12 pm

Hometown: Aberdeen, Scotland (RD)
Boyden, IA (JR)
Houston, TX (BA)

The Development of a Small-Scale Solar-Powered Biodiesel Generator

Ryan Duncan, Justin Riepma, Bradley Anga, Susan Newton, Ted Song

Division of Engineering, John Brown University, Siloam Springs, AR

The development of a small-scale solar-powered biodiesel generator which can be built from easily accessible materials is to be presented. As the process of converting waste vegetable oil or cooking oil to biodiesel is still not widely practiced in the State of Arkansas, a small-scale biodiesel generator is developed to raise the awareness of the technology. In addition, generating biodiesel may help reducing the waste by taking a waste feedstock for the conversion process. Moreover, generated biodiesel can then be used in applications such as powering tractors, worksite generators, and grounds crew lawnmowers. For example, currently at John Brown University, this conversion process is used to convert all of the used cooking oil from the cafeteria to biodiesel which is then used to power some lawnmowers and weed eaters on campus, reducing the energy cost for the institution. This model also could be implemented on various sites in the State of Arkansas to reduce energy cost. Furthermore, as the proposed generator uses only solar power to operate, biodiesel can be generated even in the remotest areas where the access to the grid may be limited.

presenting
11 am—12 pm

Hometown: Jonesboro AR

Fabrication of miniaturized thermoelectric device as a renewable energy harvesting source

Stephanie Saenze, Ilwoo Seok

Department of Engineering, Arkansas State University, Jonesboro, AR

Could it be possible to use the temperature gradient between day and night as an alternative renewable energy source? Thermoelectric (TE) materials harness the energy of electrons flowing from warmer to cooler areas. This energy can then be converted into usable electric power. Our research focuses on fabricating miniaturized TE devices using microfabrication processes. These devices are also known as micro-electro-mechanical systems, or MEMS. The MEMS process benefits power generation by reducing the size of traditional TE elements and maintaining the same ratio of geometric size and shape.

We investigated the fundamental physics underlying TE materials to study the conversion efficiency of MEMS using the COMSOL simulation platform and then performed photolithography of the materials. This will allow design and fabrication of TE devices which are efficient in a lower and slower temperature gradient environment. All of the microfabrication work is being performed in the cleanroom facilitated at ASU by the support of an NSF Major Research Instrumentation grant. Also, the student is supported by a Summer Undergraduate Research Fellowship award from the Arkansas Department of Higher Education.

presenting
11 am—12 pm

Hometown: Springdale, AR (EH)
Siloam Springs, AR (HM)

Feasibility Study of a Stand-Alone Photovoltaic System for an Orphanage in Wolaita Soddo, Ethiopia

Ethiopia Haileyesus, Henry Mitchell, Ted Song

Division of Engineering, John Brown University,
Siloam Springs, AR

A feasibility study of a stand-alone photovoltaic (PV) system for an orphanage in Wolaita Soddo, Ethiopia is presented. As the geographical location is close to the equator, insolation in Ethiopia is higher than most places in the world all year round. Although the electricity is provided at the cost of $0.03 per kW for residential use, the grid's relatively low reliability hinders the children from evening studies. This feasibility study is presented for the Aerie Africa's Children Cross Connection (CCC) orphanage which is a home and school for about 64 children. The proposed system will be an off-grid PV system that uses batteries for energy storage. In order to minimize the cost, the PV system is designed to provide electricity for the critical loads of the orphanage such as the lighting unit for the library and study offices. This study will also include calculated return on investment (ROI) and the comparison in terms of costs when other energy sources, e.g., diesel, are used to provide electricity for this demand.

presenting
11 am—12 pm

Hometown: Jonesboro, AR (CN)
Little Rock, AR (BE)
Cabot, AR (RL)
Jessore, Bangladesh (RI)

Efficiency Improvement of Vanadium Redox Flow Battery for Renewable Power Plant Applications

Cameron Nolan, Benjamin Eckerson, Ryan Listenbee, Rabiul Islam, Kwangkook Jeong

Mechanical Engineering, College of Engineering,
Arkansas State University, Jonesboro, AR

It is difficult to determine how much sunlight a field of solar panels will be exposed to in a given time period, which makes it challenging to predict the amount of energy that will be produced. Once energy is harvested it is imperative that there be a stable supply so that it can be distributed to the grid or stored as needed. Stabilization of energy supplied to the grid is one of the significant applications of our current research. We are working to increase the efficacy of a vanadium redox flow battery (VRFB). Our research objective is to increase the efficiency of mechanical components in the VRFB, as it has been largely overlooked in existing VRFB research. This type of battery has significant potential because it is more efficient than batteries which use other materials, can be used for long periods of time, and has the capacity to store large amounts of energy. The results of this research will be less wasted energy and greater viability of natural energy.

presenting
11 am—12 pm

Hometown: The Woodlands, TX

The Effects of Using Different Notch Geometries During Fracture Testing

Rebekah Porter, Andrew Braham

Department of Civil Engineering, University of Arkansas, Fayetteville AR

Asphalt concrete is commonly used as the surface layer on pavements because of its convenience, low cost, and smooth ride. The effects on cracking in asphalt concrete have led to an increasing number of researchers using fracture mechanics to study the resistance of asphalt mixtures. Methods used for fracture testing of asphalt concrete include single-edge notched beam test, disk-shaped compaction test, and semicircular bend test (SCB). The SCB test is used in this research to determine the fracture energy, the amount of energy needed to separate two surfaces, of asphalt concrete. However, there are problems with the current fracture testing methods because they create stress concentrations at the top of a rectangular notch, which forces the crack to initiate from one predetermined place. This may not accurately represent how fracturing occurs out in the field. Researchers need to find ways to isolate and measure the true fracture energy while testing. This research explores the fracture energy using three different notch geometries: a typical rectangular notch, a circular notch, and a fatigue-cracked specimen. Researchers today know there is a problem with roads cracking and understand that what we are doing is not working, and we believe that a step towards better understanding fracture energy is by improving SCB.

presenting
11 am—12 pm

Hometown: North Little Rock, AR

Use of Nanoclays as Alternative Asphalt Modifiers for Building Longer Lasting Pavements

Robert Darrington, Zahid Hossain

Department of Civil Engineering Arkansas State University, Jonesboro, AR

Limited funds for roadway infrastructures in the United States make it very difficult for transportation agencies to keep roads structurally sufficient. Construction and maintenance of US highways costs public sectors over $146 Billion annually. Having longer lasting asphalt pavement materials allows counties, cities and states to improve roads and keep infrastructure updated. Traditionally, synthetic polymers are used to modify base asphalt binders to withstand heavy traffic loads and extreme weather conditions. However, polymer -modified asphalts are about 75% more expensive than the base binders. Nanoclays are naturally abundant very fine clay particles that are environmentally friendly, very inexpensive, and can potentially be an alternative to highly expensive polymers for modifying asphalt binders. This study evaluated rutting (permanent deformation) and moisture resistance (stripping) of nanoclay-modified binders using mechanistic and fundamental science approaches. We found that adding a small amount (about 2% by the weight of binder) of nanoclay increased the rutting resistance by about 30%. Properly treated nanoclay-modified binders were also found to be effective in resisting moisture related damage. Findings of this study will help pavement professionals in developing and using alternative asphalts to building longer lasting pavements.

presenting
10 am—11 am

Hometown: Little Rock, AR

Redesigning Endotrcheal Tube Using CFD Techniques

Silas M. Duke,[a] Srikanth B. Pidugu[a]

[a]Department of Engineering Technology, University of Arkansas at Little Rock, AR

Endotracheal tubes are a vital necessity for unconscious patients and patients with obstructed breathing. The endotracheal tube has proven itself to be a life-saving device for many hospitalized patients. However, current endotracheal tube designs have some problems, despite having been in use for years. One of the problems with current endotracheal tube designs is that fluid can leak past the cuff and into the lungs, potentially causing damage. The cuff of an endotracheal tube is an inflatable seal, which allows for easier patient intubation in its deflated state. After intubation, the cuff is inflated to prevent saliva and other fluids from leaking into the lungs. We plan to use computational fluid dynamics (CFD) techniques to improve the design of the endotracheal tube. The computational modeling will allow us to analyze the performance of a 3D graphically modeled endotracheal tube during. The results of this simulation will give us a better understanding of the airflow taking place. This software will also allow us to make alterations to the graphical representation of the endotracheal tube. We can then reevaluate the design and compare it to the original with simulated testing. This process can be performed less expensively than real world testing.

presenting
11 am—12 pm

Hometown: Bryant, AR

Hollow Fibers for Artificial Lung Applications

Lauren Reed, Jamie Hestekin

Ralph E. Martin Department of Chemical Engineering, University of Arkansas, Fayetteville AR

Due to the shortage of available organs for transplants, extensive research has been conducted to create artificial organs for the body including an artificial lung. Currently there are external artificial lungs circulating blood outside the body, taking out the carbon dioxide, and inserting oxygenated blood back into the body. The research currently being done at the University of Arkansas is an attempt to create a lung that can be inserted in place of the actual failing lung within the body cavity. The materials used for this artificial lung are polysulfone hollow fiber membranes coated with certain proteins to prevent bio fouling and blood compatibility. The goal for my research is to determine the concentration and specific method of protein attachment to hollow fibers that will give the optimal pore size and tensile strength compatible with the human body.

presenting
11 am—12 pm

Hometown: Fayetteville, AR

A Novel Chitosan-based Hydrogel for Intratumoral Release of Immunotherapeutic Cytokines

Ethan Lowry, David Zaharoff

Department of Biomedical Engineering, University of Arkansas, Fayetteville AR

Controlled delivery of interuleukin-12 (IL-12) has been shown to stimulate the immune system to eliminate primary tumors and elicit tumor-specific, protective immunity. We have developed a novel chitosan-based hydrogel that appears capable of further improving cytokine delivery within the tumor microenvironment while preventing systemic dissemination of toxic, pro-inflammatory cytokines. Chitosan-based hydrogels were created using a proprietary formulation. Manipulation of chitosan's chemical properties such as molecular weight, concentration, and degree of acetylation was found to control the time and degree of gelation. Preliminary in vitro release studies indicated a desirable zero-order release profile of a model fluorescent-tagged protein. A bioactivity assay was conducted by growing IL-12-dependent cells in the presence of IL-12/ hydrogel conjugant and IL-12 alone; production of a sensitive activation biomarker (interferon gamma) were statistically similar in each group, suggesting that IL-12-hydrogel interaction does not influence bioactivity. A mouse model anti-tumor study demonstrated complete tumor elimination in mice treated with IL-12/hydrogel conjugant, whereas those treated with saline experience rapid tumor growth and death. These studies demonstrate that chitosan-based hydrogels allow for sustained and effective delivery of IL-12 as an anti-cancer immunotherapy. Current release kinetics trials and preclinical animal studies will further determine viability as a clinical treatment for solid tumors.

presenting
11 am—12 pm

Hometown: Rogers, AR

Targeted Drug Delivery with Peptoid-Based Nanospheres

Kaylee Smith, Shannon Servoss

Ralph E. Martin Department of Chemical Engineering, University of Arkansas, Fayetteville AR

Although medicines have vastly improved over the last few decades, almost all delivery mechanisms are systemic, meaning that they are non- selective, so they damage healthy cells as well as diseased cells. This causes undesirable side effects. Chemotherapy drugs are a specific example of medicines that cause severe side effects including nausea, hair loss, pain, organ damage, nerve damage, and sometimes another form of cancer. By developing a non-systemic drug delivery system, these side effects could be greatly reduced. One possible non-systemic drug delivery system involves peptoid nanospheres. Biocompatible peptoids will be designed and synthesized. After purification, dynamic light scattering (DLS) will be used to determine if sphere formation is likely. The peptoids that have a singular DLS peak will be viewed in solution using cryogenic transition electron microscopy (cryo TEM). If the sphere size predicted by DLS is consistent with the sphere size seen in cryo TEM, it will be concluded that the peptoids form spheres in solution. The peptoids will be designed to incorporate cell specific molecules or will be attached to cell specific molecules.

presenting
10 am—11 am

Hometown: Merritt Island, FL

An Optical NanoSat Detection and Ranging System

Maurisa M. Orona and Edmond W. Wilson, Jr.

Department of Chemistry, Harding University, Searcy, AR

Because of the expense of placing research instruments in orbit around the Earth or other Solar System bodies, many investigators are interested in NanoSat satellites for use as vehicles to take their instrumentation and technology into orbit. We will be developing a method for deploying a constellation of five satellites. A collaboration between investigators at three Arkansas universities, UAF, UALR and Harding, has been created to develop critical technologies for successful NanoSat deployment: micro propulsion systems (MPS) and satellite detection and ranging systems (SADARS). SADARS is being developed at Harding and UALR while MPS is developed at UAF. The NanoSat design parameters for these studies have been defined by partners at Marshall Space Flight Center who are eveloping a 6U satellite bus measuring 10 cm high by 20 cm wide and 30 cm deep. The MPS will require one-third of the space, the avionics, communications and power supply will occupy another one-third leaving approximately one-third of the satellite volume for the SADARS system. Our approach involves the use of LEDs and video cameras for monitoring the position and flight pattern of each of the satellites.

Business Name

PAGE 69
POSTER #18

presenting
10 am—11 am

Hometown: North Little Rock, AR

Remote Control of a Robotic Vehicle Using a Cell phone

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

Department of Chemistry, Harding University, Searcy, AR

The goal of this project is development of a method to operate a mobile robotic vehicle by use of a cell phone. The vehicle was designed for a NASA application to carry an open-path diode laser spectrometer for detecting biogases on the surface of Mars. In order to field test the robotic vehicle with its suite of instruments, a cell phone will be employed. The use of cell phones for wireless communications means that there is no limitation of distance between the human operator and the robot as long as satellite coverage is present. This means we can conceivably control the robot from a different continent should we choose. We are using a Raspberry PI microcomputer to convert the signals received from the cell phone transmitter into operation of the vehicle. This technology is important in the Internet of Things and what is learned here can be used extensively in control many different kinds of devices that contribute to a more pleasant lifestyle.

presenting
10 am—11 am

Hometown: Ravenden Springs, AR

Designing Better Hybrid Rocket Motors

Rachel A. Beeman and Edmond W. Wilson, Jr.

Department of Chemistry, Harding University, Searcy, AR

At the present time, it appears that NASA is awarding contracts to the civilian space industry to build the next generation of space vehicles. Although, NASA is still involved in research and development of large rockets, much of the emphasis of NASA is be directed toward building a viable civilian space industry. The civilian space industry has focused on hybrid rocket motors as their primary means of propulsion. Hybrid rockets based on fuel grains of hydroxy-terminated polybutadiene (HTPB) and using nitrous oxide as the oxidizer are the standard for the civilian space industry. These motors have been shown to be successful, safe, economical and relatively simple in design. The thrust of hybrid rocket motors can be improved by use of fuels composed of fuel grains using more efficient fuel grain designs and addition of components that enhance the combustion efficiency while maintaining the advantages of safety and economy. We are designing fuel grains using additive manufacturing. This is an inexpensive, less complicated and very reproducible way to construct the rocket motor fuel grains. By varying the number and geometry of oxidizer ports, we anticipate development of fuel grains that will match or exceed the thrust characteristics of solid or liquid rocket motors.

Business Name

PAGE 71
POSTER #4

presenting
10 am—11 am

Hometown: Mena, AR

Methane & Ethane Lakes on Saturn's Moon Titan

Connor D. Purvis and Edmond W. Wilson, Jr.

Department of Chemistry, Harding University, Searcy, AR

Titan, the largest of Saturn's nineteen moons, is the only satellite in the Solar System known to have a dense atmosphere. Other than the Earth, it is the only known celestial body to have stable lakes and seas. Titan's diameter is fifty percent bigger than Earth's Moon and is the second largest moon in the Solar System. Experimental simulations give evidence that these surface liquids are primarily methane and ethane. In collaboration with the University of Arkansas Center for Space and Planetary Sciences, we are beginning a study of various compounds of interest dissolved in liquid methane and ethane solvents under conditions found on Titan to learn more about the chemistry and geology of this most interesting place. At the present time, we are building an instrument to be used in the Titan simulation chamber at. Our instrument will use ultraviolet, visible and near-infrared light to measure the solubilities of substances of astrobiological interest.

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General information source
http://campus.murraystate.edu/services/ursa/

with tips on planning poster-at-capitol events

http://faculty.uca.edu/wvslaton/ARposters/

Luncheon Keynote Speaker
Dr. Tom Goodwin
Department of Chemistry
Hendrix College