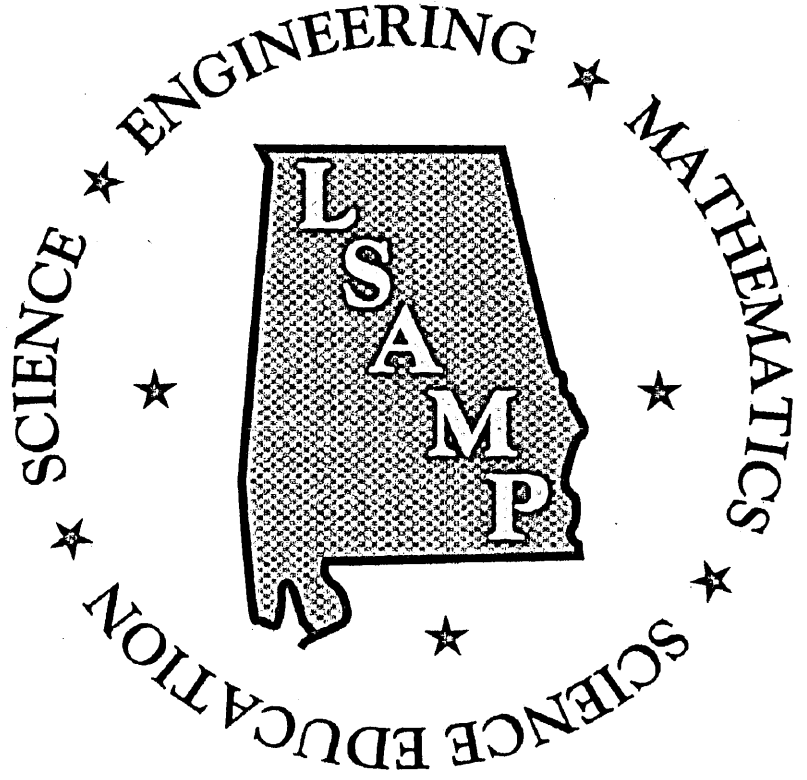
Alabama Louis Stokes Alliance for Minority Participation

ALSAMP Scholars and Bridge to the Doctorate Fellows 2011 Spring Research Conference

ABSTRACTS



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Montgomery, Alabama

ALSAMP SCHOLARS AND BRIDGE TO THE DOCTORATE FELLOWS ABSTRACTS

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ALABAMA A&M UNIVERSITY

ALSAMP SCHOLAR ABSTRACTS

Determining how the Sun's Corona is Heated by Examining the Light Curves of Coronal Loops

Roderick Gray

The solar corona is a region surrounding the sun that is around one million kilometers above the sun's surface. The solar corona can reach temperatures of more than one million degrees Celsius. Within the sun's corona, there are coronal loops. When studying the solar corona one question is constantly attempted to be answered throughout the astrophysics community: "How is the solar corona being heated when the surface of the sun is so much cooler than the corona?" In this research, we are analyzing individual corona's loops at different temperatures and at different days by using an XRT(x-ray telescope). We find the intensity of coronal loops as a function of time and then determine the temperature as a function of time. From this information, we will attempt to describe the coronal heating mechanism.

Recommendation to Retain and Support Community Health Workers

Candis Johnson

Community health advisors (CHA) aid in educating and supporting the medically underserved. Previous studies have investigated the roles and implementation of the CHA, but little has been reported about strategies for support and retention of CHAs. The purpose of this study is to examine past CHA retention strategies and make recommendations for the ENCOURAGE study; an ongoing group-randomized controlled trial to test the effect of a peer support intervention on diabetes control in the Alabama Black Belt. A systematic review of literature was conducted using PubMed search database. Search terms included "community health advisor", "community health worker", "lay health worker", and "support" or "retention". Inclusion criteria 1) conducted in the U.S. 2) implemented CHA model 3) described support and/or retention strategies. In addition telephone interviews were conducted with three county coordinators from the ENCOURAGE study. Two programs were identified meeting original incluslon criterla and one systematic review was identified after search modification. Interviews provided suggestions for support and retention. Reviewed literature and interviews identify similar themes and suggestions for support and/or retention. Based on these findings recommendations were made to enhance CHA retention and support for the ENCOURAGE study.

The Discovery and Development of the Acai Berry and its Benefits to Human Body

Eboni Major

In this research project I will discuss the Acai berry. The research will focus on the discovery and development of the Acai berry and also how it affects the human Body in both positive and negative ways. Acai is a berry that grows on the Acai Palm tree in the Amazon rain forest. The berry is also known as the "super fruit". It has a rich cocoa flavor and is packed with Antioxidants. The berry also has small amounts of protein and dietary fiber. Acai contains several substances called anthocyanin and flavonoid. Anthocyanin and flavonoid are powerful antioxidants that help defend the body against life's stressors. They also play a role in the body's cell protection system. Free radicals are harmful byproducts produced by the body. Eating a diet rich in antloxidants may interfere with aging and the disease process by neutralizing free radicals.

The berry is also used as a dietary supplement. It can't be prepared in a loose powder form or in Acai powder capsules. Marketers of these products make unfounded claims that the berry provides a variety of health benefits, none of which has scientific confirmation to date. False clalms include reversal of diabetes and other chronic illnesses. As of June 2010, there are no scientifically controlled studies backing up any of these claims. These products have not been evaluated by the FDA and their efficacy is questionable. Specifically, there is no scientific evidence that açaí consumption affects body weight or could promote weight loss.

Sirius Constellation

Antoine Mordican

Sirius is a satellite radio company that provides commercial free, high definition digital radio to North America region. Sirius uses

satellites to deliver music and radio talk shows to vary receivers throughout North America. Sirius radio receivers come in 4 different configurations, portable units, plug and play units, home units as well as satellite ready head units. Sirius has launched multiple satellites to orbit the North America region. Subscription for Sirius service is very affordable with more than 130 channels available. The primary aim of this research is to gain more insight and information about Sirius satellite constellation.

Recombinant Leptin: Salvage Potential for Enhancing Fertility Status in Creme D'argent Rabbits

Tahira Nash

Leptin is a 16 kDa protein secreted by adipocytes and decoded from the obesity (ob) gene. The receptor genes and protein have been reportedly identified as loci of mutation in animals. These mutations may lead to obesity, diabetes, and infertility. Rising leptin levels have been associated with initiation of puberty in both humans and animals. Reports in obese, infertile male and female ob/ob mice, given exogenous recombinant leptin showed a reversal in fertility status. In human females, serum leptin levels < 3ng/ml associated with a 15% reduction in body fat ratio, may lead to possible ovarian disorders such as PCOS (Polycystic Ovary Syndrome). The Creme D'argent rabbit is near extinction in all countries except the U.S and United Kingdom. Thus, the American Livestock Conservatory Board has this breed on their watch-care list. The purpose of this project is to determine which factors (low leptin, obesity or leptin resistance, etc.) are attributing to the reduced fertility status of this rabbit breed and the role leptin contributes. In preliminary trials, administration of recombinant leptin to Creme D'argent rabbits may demonstrate a plausible critical link between adipose tissue and the reproductive system, and prove useful in altering fertility to alleviate conception failure.

Applications for Mobile Phones

Dominique Rucker

The purpose of this project is to explore and devise an application for mobile phones. Apps for mobile phones are the latest hype in the technology for cellular devices. The project's intent is to develop and create an app for students enrolled at Alabama A&M University to access their banner account using smartphones and other mobile devices. This project will focus on development of the program as well as the user application to be fully operational. Students will then have access to the information that is available on the school's banner website.

Modeling of Complex Shapes Using Point Cloud Data

Devin Simmons

Various objects will be scanned using the NextEngine Desktop Laser Scanner. After the scan is completed, Point Cloud Data will be generated. Using the generated Point Cloud Data, a CAD Model will be created. During the CAD modeling process, several problems are expected to arise. Converting Point Cloud Data to a solid model can become a challenging task. Missing intermediate steps must be implemented to reach this goal. The purpose of this research is to investigate and explore the intermediate steps.

Data Capturing of Complex Shapes Using a Laser Scanner

Nichelle Stewart

Various objects will be scanned using the NextEngine Desktop Laser Scanner. Once the scanning is completed, various scenarios will be tried and implemented to overcome the problems that are expected to arise from the scanning process. A comparison study will be made between the laser generated image and the original object.

The Life Cycle of a Broiler Chicken

Brian C. Woods

The broiler is a type of chicken bred for the rapid production of meat. The typical broiler breeds currently used are Cornish crosses or Cornish rocks. These species are bred with efficient production of meat in mind. They increase in size at an extremely fast rate. The feed conversion rate is also efficient. One of the contributing factors to this rapid growth is the chicken's low level of activity. They also have a really high feed conversion rate and due to the extreme growth they limited levels of activity. At the time of slaughter the birds usually reach a weight of 4-5 pounds in a 6-7 week time frame (Selle 2006). In 2009 according to the USDA's Poultry-Production and value 2009 summary a total of 8,550,500,000 broiler chickens were produced and they weighed a total of 47,726,500,000 pounds (All Business 2010). As seen in these statistics, the production of broiler chickens although fast is quite tedious.

ALABAMA STATE UNIVERSITY

ALSAMP SCHOLAR ABSTRACTS

How Computers Have Become Weapons

Ayesha Famble

Computers are used to garner confidential information from companies. It shuts down databases; operate drone planes from remote offices and the like. Because computers disguise the identity of the people responsible by providing an often nameless, faceless cover, it is undetected and too often not punishable. This project will uncover the most common methods of cyber attacks used by hackers. Using antivirus software or firewalls as a means to support and block hackers from infiltrating the system.

Preparation of Electrospun Nanofibrous PCL/DND Composite Scaffold for Tissue Regeneration Applications

Renatta Hale

Advisors: Dr. Elija Nyairo, Hasan Carmichael, Amanee D. Salaam and Derrick R. Dean

Scaffold design is an area of focus primarily because tissue scaffolds provides structure for cell attachment, guides cell proliferation and differentiation, and mimic's the native extracellular matrix (ECM) of bone. Biodegradable nanocomposite tissue scaffolds were fabricated by electrospinning PCL with various concentrations (0.1, 0.5, 1.0 and 5.0% w/v) of detonation nanodiamond (DND) in dichloromethane at an electric field of 17 kV over a distance of 20 cm (between Taylor cone and the collector) and at a flow rate of 1.0 mL/h. PCL/DND particle size was confirmed via TEM. TGA and FTIR were used to quantify the DND hard gel's water content and identify surface chemistry, respectively. DSC was used to determine the thermal behavior of the scaffolds (i.e., melting point and change in enthalpy). Modified DNDs were tested for their toxicity in vitro with several cell lines. Thus, our research focuses on the potential use of DND to deliver therapeutics, the compatibility concerns with using carbon based nanomaterials (i.e., cytotoxicity), and the fabrication and characterization of these novel nanocomposite scaffolds.

Compromising VNC's Security

William Phelps III

VNC (Viral Networking Computing) is a system that allows one used to view and control another user's computer. VNC has many applications, such as mobile users interacting with a home computer or teachers demonstrating on their students' computers. However, VNC has a major security flaw that allows unauthorized users access to this system. This presentation will shed light upon how VNC's security can be compromised and how one goes about preventing this through SSH (Secure Shell) tunneling.

AUBURN UNIVERSITY

ALSAMP SCHOLAR ABSTRACTS

Prosthetic Limbs - Getting Better and Better!

Olivia Cook

Over the years biomedical engineers have been working diligently on trying to make prosthetic limbs function more and more like real ones. In 2007 an international team led by the John Hopkins University developed a prosthetic arm that was able to be controlled naturally and also provide sensory feedback (i.e. if you touch a hot stove), the arm will provide nerves to send to your brain and let you know to remove your hand. In addition to this, in December 2009, prosthetic limbs got a nanotech makeover again because a lot of army amputees were complaining about the inefficiency of the limb. This was because a lot of them were receiving infections on their arms because bacteria is easily grown on the plastic surface. Now, researchers will provide a sensor coating on the arm that is biodegradable. The degradation will release an infection-fighting drug embedded within the coat that will

automatically release a drug to treat the infection. This research will elaborate on this outstanding research in biomedical engineering as well as cover the most current research on prosthesis within the last two years and how the amendments to them have benefited society and military personnel as an entirety.

Photonic Computers - The Future of Computing

Arthur Duncan

This poster illustrates the new and upcoming technology in computers called photonic computers, or optical computers. In a photonic computer, photons in the visible light spectrum or infrared beams are used to perform digital computation, instead of electrical current. With the use of light, rather than electrical current, data can be transfer over longer distances. Another advantage of this new technology is the performance increase that it will provide for computers. With further research and development, photonic (optical) computers promises up to ten times faster speeds than traditional electronic computers. Moreover, this research poster will discuss more advantages of this new technology as well as disadvantages. Further analysis will be done to show the performance improvements that optical computing promise, by comparing other devices where optical technology has already been employed.

Redesigning Harbert Engineering Building

Michael Gibson

The purpose of this project is to redesign Harbert Engineering Building to make it LEED accredited. Harbert is currently one of the oldest buildings on Auburn's campus. It is not efficient in energy and atmosphere, water usage, and etc. There are many design changes that need to be made to this building to make it more environmental friendly. Calculations on the current water usage will be acquired and then different innovations will be proposed to the owner (Auburn University). The changes will be slightly expensive but the pay back will be even greater and the building will reduce it carbon footprint on the world.

The Adaptation of Publishers and Advertisers in Online Ad Auctions

Joshua Hale

Internet advertising and especially sponsored search advertising has become very popular in the last few years, generating billions in revenue. Sponsored search is a type of online advertising that is considered targeted advertising, in which query-specific advertisements are placed alongside search-engine results. The placement of the ads is usually ranked by the multiple of their ad-specific effect (e) and their bid price (b). All of the previous research assumes that the estimated ad-specific effect to be correct or the ad-specific effect to be some constant throughout the online ad auction. This research evaluates the idea that the ad-specific effect will change over time or the ad-specific effect estimation is wrong. There are many questions that arise when the ad-specific effect is in fact something different than expected. Those questions include what or if any changes to the rules of the online ad auction are necessary for the publisher to obtain the maximum revenue and how or should the advertiser change their strategy on bidding. This research will give a more realistic recommendation for the decisions that the publisher and the advertisers should make throughout the auction. The main research goal is to use the application of game theory in some sorts to obtain the strategy for the publisher and the advertisers that will result in the highest payoff for each participant.

Obesity Among College Students

Gabriel Howard

Obesity is a major problem in society and people continue to need to be aware of this societal problem. This research focuses on the biological health problems caused by obesity with a focus on college students. Problems such as diabetes, heart disease, stroke, high blood pressure, cancer and others will be discussed along with the current research related to those. Raising awareness by spotlighting the causes and preventions of obesity by talking about the foods and activities that increase and decrease the risks of obesity will be the highlight of this poster presentation.

The Effect of Calcium on Smooth and Skeletal Fiber

Jessica Snead

Smooth muscle contraction is caused by the sliding of myosin and actin filaments (a sliding filament mechanism) over each other. The energy for this to happen is provided by the hydrolysis of ATP. Myosin functions as an ATPase utilizing ATP to produce a molecular conformational change of part of the myosin and produces movement. Movement of the filaments over each other

happens when the globular heads protruding from myosin filaments attach and interact with actin filaments to form cross bridges. The myosin heads tilt and drag along the actin filament a small distance. The heads then release the actin filament and then changes angle to relocate to another site on the actin filament a further distance (10-12 nm) away. They can then re-bind to the actin molecule and drag it along further. This process is called cross bridge cycling and is the same for all muscle contraction. Unlike cardiac and skeletal muscle, smooth muscle does not contain the calcium-binding protein troponin. Contraction is initiated by a calcium-regulated phosphorylation of myosin, rather than a calcium-activated troponin system. In skeletal muscles, the calcium binds to the present on to Troponin C, the actin containing thin filaments of the myofibrils. The troponin then the allosteric modulates. Under normal circumstances, the tropomyosin satirically obstructs binding sites for myosin on the thin filament; once calcium binds to the troponin C and causes an allosteric change in the troponin allow Troponin C and tropomyosin to move, unblocking the binding sites.

Neurophysiology: Proteins Affecting the Hypcampus

Kendra Sutton

Clinical neurophysiology is the study of the functions of the nervous system in the clinical setting, for diagnostics, intensive care, and intraoperative monitoring, etc. It utilizes techniques such as electroencephalography, electromyography, somatosensory evoked potentials, motor evoked potentials, brainstem auditory evoked responses.

The hippocampus is a major component of the brains of humans and other mammals. It belongs to the limbic system and plays important roles in the consolidation of information from short-term memory to long-term memory and spatial navigation. Like the cerebral cortex, with which it is closely associated, it is a paired structure, with mirror-image halves in the left and right sides of the brain. In humans and other primates, the hippocampus is located inside the medial temporal lobe, beneath the cortical surface. It contains two main interlocking parts: Ammon's horn and the dentate gyrus.

In Alzheimer's disease, the hippocampus is one of the first regions of the brain to suffer damage; memory problems and disorientation appear among the first symptoms. Damage to the hippocampus can also result from oxygen starvation (hypoxia), encephalitis, or medial temporal lobe epilepsy. People with extensive, bilateral hippocampal damage may experience anterograde amnesia—the inability to form or retain new memories.

This experiment will show how different proteins affect the excitation and inhibition of the hippocampus.

BD FELLOW ABSTRACTS

Cooperative Communications in Wireless Networks

Nia Bradley

From WiMAX to cellular technologies, wireless systems have become an integral part of today's society. Wireless capacity is growing at a phenomenal rate. Therefore, it is necessary for researchers to evaluate how the increase in wireless communication can contribute to alleviating the deleterious performance of wireless technologies as these networks become more abundant. Channel fading is one of the detrimental occurrences associated with the increasing capacity of wireless technologies. With channel fading being an inevitable phenomenon, researchers look for mechanisms to address this challenge and to increase system robustness and capacity. Cooperative communications combines the relay channel model and diversity technologies to help alleviate fading channels by creating a virtual multi-antenna array. This paper introduces techniques researchers use to improve channel capacity and robustness of wireless systems without sacrificing power and bandwidth in utilizing various cooperative communication techniques.

Coding Scripts of Fuel Slosh

Moses Davis

Fuel slosh is the motion of fuel within a container when the container is exerted by an outside force. In the development of the mechanics of a flying spacecraft, fuel slosh within the tank of a spacecraft is a major barrier. An understanding of the motion involved in fuel slosh and the impact it has on the spacecraft as fuel strikes the walls of the the tanks is necessary to develop means of counter balancing those possibly magnanimous effects. The purpose of this project is to analyze the relationship of fuel slosh on the dynamics of the Magnetosperic Multiscale (MMS) mission spacecraft to determine if fuel slosh will disturb the dynamics of the systems beyond the allotted room for error, a maximum center of mass shift of no more than 3 centimeters, and no interaction

between the thrust plumes and wire boom appendages. This experiment will be simulated using a modifiable simulation of a spacecraft on a Linux machine at various fuel levels. Previous research was conducted with a fuel fill level of 40%.

Coding MATLAB scripts allows input values for the radius, length, and fill fraction thus calculating the fuel level, centroid, and/or moment of inertia of a cylindrical tank with spherical caps at the ends. Completion of the scripts will allow for other various fuel levels' simulations on the Linux machine. From these results, anticipation of a better understanding of the impact fuel slosh play on the MMS spacecraft is expected.

MILES COLLEGE

ALSAMP SCHOLAR ABSTRACTS

Paperless Division

Michelle Adams

Advisor: Mr. Efrem Sharp

The efforts of this research are to achieve the goal of upgrading the Division on Natural Sciences and Mathematics to a paperless state, turning the division in to an "e-division". This will leverage technology in order to improve the division's efficiency and its operating cost. The paperless portfolio project's primary purpose is to enable the Natural Sciences Division to transition its annual faculty portfolios from hardcopy to electronic form. This process will consist of four main components: 1) use of the division's scanner to create PDF documents from hardcopies; 2) a means of merging newly created PDF documents with documents that were previously in electronic form, resulting in one new PDF document, 3) submission of the PDF document using Tk20 to the division chair, and 4) evaluation of the PDF portfolio submission using Tk20. There are six goal specifications that will be researched; Paperless Portfolio Project, Paperless Announcements Project, Electronic Grade book Project, Electronic Forms Project, Document Management System Project, and Electronic Reports Project. Faculty will be able to upload documents to this repository year round, so that in January of the following year, much of the work of compiling the portfolio has already been done. With the development o f the image processing system, faculty will be able to scan in hardcopies that need to be included, but the plan is for most of the documents to be initiated—and kept—in electronic form from the outset. The inquiry of TK20 has been a major asset to the specification on the electronic grade book goal. The research includes a disadvantage and advantage comparison as to why TK20 is or is not suitable for a stable electronic grade book. The research on this project has not been fully finished, but is diligently being worked on.

Identification and Quantification of Emerging Contaminants in Wet Weather Flows by Gas Chromatography Mass Spectrometer

Phalone Clayton

Advisor: Dr. Sam Subramaniam

The objective of the research is to identify the pharmaceutical material present in water sheds. The subject of my research was the Earl Hilliard Wastewater Treatment Plant in Tuscaloosa, Al. The treatment center must properly and effectively remove all harmful materials from the water, according to the E.P.A. standards. Within the research, test and results should give a thorough and accurate account of the effectiveness the cleansing process. The samples for this research are gathered in three different stages of the cleansing process to compare the effectiveness of the cleaning as well as the initial quantities of the pharmaceutical present in water sheds. During the experimental phases the water samples will be separated into acid and base fractions using HBL cartridges and derivatized to make it more volatile with Pentafluorobenzylbromide (PFBBr), and analyzed to GC/MS. This research focuses on five main drugs: Acetaminophen, Fluoxetine, Caffeine, Ibuprofen, and Triclosan. Although the pharmaceuticals cannot be completely removed, the water is safe for recreational usage, but not for drinking. Emerging Contaminants have previously been studied in great detail in the state of Nevada, and have optimized methods well established for HPLC and MS/MS.

The Effective Temperatures on the Circadian Rhythms of *ASPERGILLUS NIGER* and *PENICILLUM NOTATUM*

Talisa Cummings

Advisor: Dr. Margaret Senkoloto

The objective of this research was to conduct a comparative analysis of two Hyphomycete fungi, *Aspergillus niger* and *Penicillum notatum*, to demonstrate the effects temperature had on the circadian rhythms. Spores of *Aspergillus niger* (155945A) and *Penicillum notatum* (156155A) purchased from *Carolina Biological Supply*, were cultured in the nutrient, deoxtrase agar, under three different temperatures: (a) room temperature:18°C, (b) refrigeration: 6°C, and (c) freezer: 0°C. Previous research showed that *Aspergillus niger* exhibited circadian rhythms, while there was no circadian rhythm in *Penicillum notatum* (Sskenkoloto, Adams, Williams, Carwell, Journal of Alabama Academy of Science, October 2002). The diameter of each colony growth was measured every 24 hours for five days. Visual observations were augmented by use of a spectrophotometer. This investigation was to reveal the effective temperature on the circadian rhythms of *Aspergillus niger* and *Penicillum notatum.*

The Solid Phase Extraction and Profiling of Triclosan and PPCPs by GC/MS in Effluents from Fairfield and Moody Municipal Waste Water Treatment Plants in Alabama

Christopher Murphy

Advisor: Dr. Sam Subramaniam

The profiling of pharmaceuticals and personal care products (PPCPs) from composite wastewater samples from the Valley Creek and Moody Treatment Plants in Birmingham, Alabama was taken during the summer and fall months of 2008. Two liters of wastewater were extracted through 6 cc Oasis HLB cartridges using a vacuum manifold, and derivatives of the extracts were made to improve the chances of the samples being detected by the Gas Chromatography /Mass Spectrometer, GC/MS. Among the twelve samples collected, five showed the presence of Triclosan (TCS). Using the SIM mode at 252 m/e, GC/MS analysis showed the presence of TCS in the range of 1.1 to 4.3 μg/L, based on the derivatives of the TCS standards.

OAKWOOD UNIVERSITY

ALSAMP SCHOLAR ABSTRACTS

Mapping the Protein-Protein Interaction of the Dynactin Shoulder/Sidearm

Jacqueline Clemmons

Advisor: Dr. Kenneth LaiHing

Dynactin, a multi-subunit protein complex found only in eukaryotes, interacts with cytoplasmic dynein, a minus-end directed microtubule motor. Dynactin helps to increase the motor processivity of dynein. Together these complexes play a role in intracellular motility and are essential for mitosis in eukaryotic cells. Dynactin has three domains, the Shoulder/Sidearm, the Arp1 mini-filament, and the Pointed-end complex. The Shoulder/Sidearm binds dynein and contains two microtubule binding domains, while the Arp1 mini-filament and Pointed-end complex are the cargo binding domains. The Shoulder/Sidearm is composed of p24, p50, and p150 in a 1:2:1 stoichiometric ratio. Little is known about how these three proteins interact to form the shoulder/sidearm. The purpose of this study is to determine the domains of p24 that are required for its interactions with p50 or p150, with the use of a renaturation assay. Although recombinant p24 is insoluble, preliminary experimental results showed that full-length p24 can be renatured with full-length p50. Further study of the interactions of these proteins will help in determining the structure of dynactin, and will aid in crystallizing this multi-subunit protein.

Analysis of Homopropargyl Alcohol Prepared with Alkynal Halides

Cassandre Coles

Advisor: Dr. Glenn Phillips

Structural determination of organic compounds plays a vital role in Synthetic Organic Chemistry. Of the methods used, nuclear Magnetic Resonance (NMR) spectroscopy, Infrared Spectroscopy (IR) and Mass Spectrometry are among the most popular. In our attempts to synthesize gamma and delta lactones an intermediate alkynal bromide with a homopropargyl alcohol provided an interesting mass spectrum upon analysis. The way an alkyne fragments to form propargyl ions (m/z 39), and can also lose the terminal (or an a-) hydrogen, yielding a strong M - 1 ion. Sometimes a McLafferty rearrangement can occur in alkynes. To undergo a McLafferty rearrangement, a molecule must posses an appropriately located heteroatom, a pi system, and an abstractable hydrogen atom gamma to the carbonyl group. In this experiment a series of homopropargyl alcohols attached with alkynal halide will be prepared, and how the molecules fragment will be viewed under the mass spectrometer. Depending on how the homopropargyl alcohol with the alkynal halide fragments, will determine whether or not it is undergoing a McLafferty rearrangement.

Neurological Phenomena in Synesthesia

Adrienne Green

Advisor: Dr. Kenneth LaiHing

Synesthesia is a neurological wonder, a seeming miscommunication between ones sensory neurons. What one would normally simply touch, they now taste; what they would normally smell, they seem to see. The theory behind Synesthesia, its apparent physiological origins, as well as recent research and the progress made in studying it by various neuroscientists will be presented.

Evaluation of Liposome Nanoparticles Fabrication for Gene Delivery to Optimize Chemotherapy

Lauren Henderson

Advisor: Dr. Kenneth LaiHing

Chemotherapy has strenuous side effects. The use of nanotechonology has been researched to alleviate these distressing side effects. By using coaxial electrohydrodynamic spray, liposomes are created. The size distruibution and lamellarity of the liposomes are varied by using this electrohydrodynamic spray. This creates an exact pulmonary or intravenous injection alternative method for drug delivery. The newly formed lipoplex nanoparticles have a phospholipid bilayer that allows them to hold an aqueous medium. Drugs are then distributed in this phospholipids bilayer. Liposomes nanoparticles will be created by using jet geometry and inverted jet geometry, both a type of electrohydrodynamic spraying method. Various factors will control the particle size. Solvents will be varied by using solvents with different vapor pressures to test for solvent evaporation. Flow rate ratio will be investigated by the driving liquid concept. Initial lipid concentration will affect particle size by varying the initial lipid concentrations with various solvents. Dynamic Light scattering and Atomic Force will be used to collect the size distribution. The purpose of this experiment is to use all these various factors to control nanoparticle size and to manipulate the right properties to allow permeability to move across the phospholipid bilayer of the cell to target the infected cell.

Molecular mechanism for mutated KIF21A underlying CFEOM1

Danielle Hooker

Advisors: Dr. Long Cheng, Dr. Carrie Wu, Dr. Arthur Formanek and Dr. Elizabeth C. Engle

Congenital fibrosis of the extraocular muscles type 1 (CFEOM1) is characterized by nonprogressive bilateral ophthalmoplegia and bilateral ptosis. It is an autosomal dominant disorder associated with defects of the oculomotor nerve and atrophy of the superior rectus and levator palpebrae superioris muscles. CFEOM1 results from missense mutations in *KIF21A*. *KIF21A* encodes a kinesin motor protein that is responsible for anterograde intracellular neuronal transport. The mutations underlying CFEOM1 alter specific amino acid residues located in the third coil-coil domain or the distal motor domain, and approximately 75% of individuals have a 'hot-spot' mutation that results in the R954W substitution. It has been proposed that CFEOM1 mutations alter a specific function of KIF21A, and studies are being conducted to determine the underlying mechanism for this inherited disorder. The hypothesis is that

KIF21A activity is autoregulated through a conformational change, and that CFEOM1 mutations disrupt the KIF21A autoinhibitory conformation by altering key residues involved in intramolecular interactions. Through mutagenesis GFP tagged wildtype, R954W, and truncated KIF21A constructs were developed. These constructs were then overexpressed in Hela cell lines to determine if they associated with microtubules. We were concerned that the large size of the GFP tag could potentially interfere with KIF21A conformational changes, thus we made more constructs tagged with Myc. We tested the amount of association of KIF21A with microtubules by using a microtubule binding assay. Then a similar set of experiments were run using AMPPNP. With addition of AMPPNP any kinesin on the microtubule is locked on in a bound state. Our results confirmed autoinhibition of the wild type and the lack of autoinhibition in the truncation. These results differed for the R954W construct, and appeared similar to the WT using the AMPPNP assay. It has been determined that further experiments must be performed in order to determine the lack of autoinhibition in the mutation. This would include altering the concentrations of the AMPPNP used or using cellular extraction before fixation. When the molecular mechanism of the mutated KIF21A is elucidated, it with further the overall understanding of kinesin regulation related to the oculomotor nerve function in response to the disease state CFEOM1.

Synthesis of Actinolides

Rushelle Julien

Advisor: Dr. Glenn Phillips

Lactones are cyclic esters that are ubiquitous in nature. They can be generally prepared from Acid Lactonization, Grubb's Ring Closing Metathesis, or Heteroatom Diels-Alder reactions. Among the most famous lactones are ascorbic acid (vitamin C), coumarin, nepetalactone (Catnip) and erythromycin. Lactones are most commonly known for their use in food flavoring and apothecary (perfumery). Of a plethora of lactones of varying sizes found in nature, the derivatives of γ and δ lactones have shown to be important to human health more specifically those that possess α,β-unsaturated bonds. In recent studies conducted by Amos Smith and Dale Boger, the fundamental role of the lactone moiety in three natural products: discodermolide, 2,3-anhydrodiscodermilide and fostriecin has been examined. In each case removal or substitution of the lactone ring reduced the cytotoxicity by at least two orders of magnitude. Discodermolide, fostriecin, and methanol extracts *of Actinodaphne lancifolia* all contain lactones and have been shown to be effective in the treatment of ovarian, lung, breast, pancreatic, lymphoid and leukemia cancers. Methanol extracts of *Actiondaphne lacifolia*, which contains actinolides, plays a key role in inhibiting nitric oxide synthase an enzyme that produces nitric oxide. Nitric oxide (NO) is known to increase disease-causing agents leading to carcinogenesis. Inhibitors, such as the methanol extract of *Actinodaphne lancifolia*, of nitric oxide synthesis or the gene that expresses nitric oxide synthesis have been shown to be anti-inflammatory and chemotherapeutic agents. The present study involves the synthesis of Actinolide A one of two γ-lactones isolated from the methanol extract *Actinodaphne lancifolia*. Geraniol and pyruvic acid are used as starting materials and the key steps include organometallic addition, Corey-Fuchs reaction, and a novel lactonization using carbon dioxide.

Nonlinear properties of electrochemical circuits in leaves of *Aloe vera* L.

Lawrence O'Neal

Advisor: Dr. Alexandre Volkov

Plant tissues have electrical circuits and electric fields that regulate their anatomy. Plant electrostimulation can induce gene expression, enzymatic system activation, electrical signaling, plant movement and influences on plant growth and development. Electrostimulation produced by a function generator or a charged capacitator within biologically closed electrical circuits induces electrical solitary waves propogated along leaves of the Aloe Vera plants. In order to generate a nonlinear response there must be a instantaneous increase or decrease in voltage; as demostrated by a square pulse from a function generator. Any stimulation that Is not instantaneous, such as a sinusoidal or triangular function, does not induce solitary waves. These instead result in linear responses in the form of small graded potentials. Amplitude of electrical solitary waves depends on polarity and amplitude of applied voltage during electrostimulation. Uncouplers (CCCP, FCCP) blockers of K+ channels (TEACI) and Cl- channels (A-9-C), prevent the propagation of solitary waves along the leaf. Using the synchronous electrostimulation of a leaf on both sides, the interaction between solitary waves was found.

Preparation of Gamma and Delta Lactones

Jasmine Reedus

Advisor: Dr. Glenn Phillips

The broad scope of the work proposed involves the development of the Chemistry of gamma and delta lactones which are biologically active. The syntheses of gamma and delta lactone derivatives are important to human health but also provide a unique learning tool to investigate principles of organic chemistry. Successful drug candidates of the lactone family can give insight into the structure relationship activity (SAR) of these molecules. The lactones are prepared using aldehydes and propargyl bromide as starting materials. The resulting alcohols are then re-brominated with bromine and potassium hydroxide, and reduced to vinyl bromides using NBSH (Nitrobenzylsulfonylhydrazine). The final step employs cyclization with carbon dioxide. All the synthetic transformations until the vinyl bromides have proceeded in yields of greater than 70%. Upon completion of the library of lactones, each compound will be tested against various cancer cell lines for their cytotoxic activity.

Investigating IgA1 Protease as a Major Virulence Factor in the Pathogenicity of *Neisseria meningitides*

Jeanne D. Rolle

Advisor: Dr. Glenn Phillips

In order for a microorganism to successfully colonize and proliferate within a host, it has to possess certain virulence factors for protection as well as for invasion. *Neisseria meningitidis* is an organism that is capable of successfully colonizing and invading the upper respiratory tract. Research has shown that *N. meningitidis* as well as other organisms that have these capabilities all possess a virulence factor known as IgA1 protease. IgA1 protease is a virulence factor that cleaves IgA antibodies, which are mainly found in human mucosal surfaces. In this study, a comparison was done between *N. meningitidis* strains that were derived from the cerebrospinal fluid and blood of patients with invasive bacterial meningitis, and *N. meningitidis* strains that were obtained from asymptomatic carriers. In each of the groups of strains (of the symptomatic patients and asymptomatic carriers), an enzyme-linked immunoassay (ELISA) was used to measure IgA1 protease activities. It was found that levels of the virulence factor IgA1 protease were significantly higher in symptomatic strains (98%) than in asymptomatic strains (76%) of *N. meningitidis*

STILLMAN COLLEGE

ALSAMP SCHOLAR ABSTRACTS

Vesicular Glutamate Transporter Localization in the Striatum of Rats Treated with Antipsychotic Drugs: A Light and Electron Microscopy Study

Melayna Autery

Advisor: Dr. Keri Mans

Schizophrenia is a severe mental disorder characterized by a wide range of symptoms affecting cognition and emotion, some of which include: hallucinations, altered mood swings, and delusions. The disease is poorly characterized, because of difficulty in animal modeling and the wide range of genetic and environmental factors that play a role. However, the disruption in cognitive ability is generally believed to be partly due to the dysfunction of the glutamate system, possibly caused by a change in vesicular glutamate transporters (vGLUTs), which can affect the number of synapses made between excitatory neurons in the brain. These changes occur in many areas of the brain, but the focus for this project is the striatum, an area widely known to be affected in schizophrenia. It is not yet known if the altered glutamatergic signaling is due to the schizophrenia disease process or the chronic use of antipsychotic drugs that are used to treat schizophrenia. Our previous electron microscopy findings suggest no gross ultra structural changes occur in the brains of rats chronically treated with antipsychotics (suggesting that the disease process is the culprit), but the vGLUTs have not been specifically examined. In this study, tissue from male rats treated (via intraperitoneal injection) with saline, the typical antipsychotic haloperidol, or the atypical antipsychotic clozapine were used. Striatal tissue from the rats were collected and sectioned, stained for vGLUT1 or vGLUT2, and imaged using both light and electron microscopy. Staining

patterns were examined in an attempt to characterize any ultra structural or localization changes (specific to vGLUTs) that occur in the brain with chronic antipsychotic drug treatment.

In Vitro Characterization of PVA Hydrogel/PLGA Microspheres Composites

Courtney Cole

Advisor: Dr. Mary Jane Krotzer

For maximum functionality of implantable silicon biosensors that check small metabolites in the body such as glucose, CO_2, O_2, and lactic acid, there must an anti-inflammatory coating present to prevent the foreign body response. An anti-inflammatory coating has been developed and is composed of PVA hydrogel, and dexamethason loaded microspheres. Because it is already known that the coating is permeable and will allow the small metabolites to pass through, the objective of the present work was to test the permeability of the PVA hydrogel coating without the addition of microspheres and with the addition of microspheres to determine whether there are significant changes in the permeability of the coating once the microspheres are added after the coatings have been incubated in two different types of media, PBS Buffer Solution, and Porcine Serum. Also, the dexamethasone microspheres will be subjected to an accelerated stability study for observation of degradation. Comparison of the blank films with the 75mg microspheres per ml PVA hydrogel films showed that after about 20 days, the glucose flux observed is almost equal. There was no significant difference in glucose flux observed in the comparison of the 75mg/ml film with the 150mg/ml. In comparison of the films incubated in PBS buffer as opposed to Porcine Serum showed a slight decrease in glucose flux in the films incubated in Porcine serum. This could be due to aggregation of proteins and large macromolecules on the surface of the films. After subjection to the accelerated stability study, the microspheres were almost totally degraded with an unsmooth porous surface, which suggests that microspheres cannot be stored under these conditions.

IL-10 Production By T-reg T cell Populations

Jordan Wilbourn

Advisor: Dr. Christine Sestero

Regulatory T cells (T-regs) are responsible for limiting the immune system response. T-reg cells keeps other cells of the immune system from attacking it by giving off chemical signals letting other cells know what's foreign and what's not. IL-10 is a cytokine that is made by the T-reg cell in the defense to help the body against inflammation. In this experiment we use the enzyme-linked immunosorbent assay (ELISA) to see how much IL-10 is produced by three different types of T-reg cells: wild-type T-regs, T-regs lacking the activation regulator CD5 (CD5-/-), or T-regs possessing a form of CD5 incapable of binding the cell signaling enzyme casein kinase 2 (CD5ΔCK2BD). In this experiment the wild type T-reg cells and theCD5-/- T-reg cells produce higher levels of IL-10 compared to the CD5ΔCK2BD T-regs. We can conclude that the wild-type T-regs and the T-regs lacking the activation regulator CD5 produce the same amount of IL-10, while the CD5ΔCK2BD produces far less IL-10.

TALLADEGA COLLEGE

ALSAMP SCHOLAR ABSTRACTS

DNA of Sickle-Cell Anemia

Taylor-Brooke Mosley

Advisor: Dr. Silas Edet

Deoxyribonucleic acid or DNA is a nucleic acid that contains all human genetic information. It consists of two long polymers of simple units called nucleotides with a backbone made of sugars. It is made up of four bases: adenine (A), Cytosine (C), guanine (G) and thymine (T). What gives DNA its special characteristics is how these bases only pair with certain other bases. DNA performs two special tasks: It provides cells with the blueprint for building proteins from the 20 essential amino acids and self-duplicates to transmit traits. Sickle cell anemia is an inherited disease in which the sickling of red blood cells, due to loss of oxygen, results in chronic anemia and the obstruction of the body's smaller circulation system.

For more than 70 years, scientists and groups such as the Human Genome Project have been expanding our knowledge of genetics and its relation to health. My goal in this study is to review and document the link they have established between DNA and Sickle-cell anemia.

The Use of Social Networking to Aid in the Prevention of Obesity

Anissa Watkins

Advisor: Mr. Syed Raza

Users of the social networking sites can share information and communicate with one another. Social networks are very popular among teens and college students worldwide. Despite the rising popularity of social networking sites such as Facebook, the awareness of healthcare issues including obesity have not been highly discussed on Facebook. There is a rising epidemic of obesity among young adults including college students in the United States. Due to the increase of obesity in young children and teens, the popularity of Facebook can be used to make this group more aware of this growing epidemic. Facebook has the potential to be utilized as a prevention tool. The main objective of this research was to organize a group of students, known as "Young Adults Social Networking to Aid in the Prevention of Obesity," to interact through Facebook to reduce the number of obese students at Talladega College. Feedback will be collected through a survey. Preliminary data from a pilot survey showed Facebook can be an effective educational tool to promote the awareness of obesity. The pilot survey showed that there is a need to promote obesity awareness in educational settings. This can be accomplished by actively engaging participants in dialog through Facebook which will help decrease obesity among young adults.

S-4PCG Induced Cell Death in Human Melanoma (MV3) Cells

Tiffany Williams

Advisors: Dr. Brian Sims and Ms. Melinda Clarke

Skin cancer, known as Melanoma, is the most serious type of cancer. It represents 3 percent of all cancers and is the most likely to metasize. Melanoma originates in skin cells called melanocytes. Melanocytes gives skin color and protects skin from UV rays. If the cells receive too much light, they begin to grow abnormally and become cancerous. Melanoma affects adults and infants. Currently, there are no drugs that affect Melanoma in the neonatal population. Neonatal researchers are striving to find answers to save the lives of millions of babies. In human melanoma cells (MV3), the glutamate and L-cystine pump, system Xc, controls the amount of glutamate and L-cystine the cell receives. Elevated levels of glutamine cause cell death. The goal of this research project was to determine if S-4CPG inhibits System Xc causing apoptosis. In this experiment, MV3 cells were treated with s-4carboxypheyl Glycine (S-4CPG) to block system Xc and induce apoptosis. Immunocytochemistry (ICC), a common laboratory technique, uses antibodies that target specific peptides or protein antigens in cells, which allows researchers to evaluate cells in a particular sample expressing the antigen in question. MV3 cells were treated with .1µm, 1µm, 10µm, 100µm, and 1mMof S-4CPG at different dosing times. ICC showed that the cells began to die around 100µm dosing of S-4CPG with 1mM killing the most cells. Thus, ICC seems to show that S-4CPG blocks system Xc causing apoptosis.

TUSKEGEE UNIVERSITY

ALSAMP SCHOLAR ABSTRACTS

Using a Beam as an Acoustic Wave Sensor

Kori L. Benion

Advisor: Dr. Maria Calhoun

The objective of this study is to study the response characteristics of a simple beam to acoustic waves. This is in effort to create a single sensor for detecting sound and the location of that sound. Some parameters that will be studied include the size and aperture of the structure, boundary conditions, material properties, and thickness. The beam will respond to sinusoidal wave excitations and this response will be examined numerically using methods such as wave number spectrum. Finite element software will be used to

model the simple beam and acoustic wave. The configuration parameters that will be varied are the length, thickness, density, and elastic modulus, and the number of sinusoidal cycles. The Fourier Transform will be used to create a frequency spectrum from the temporal wave traveling through the beam.

Measuring the Force of a Standard UAV (Unmanned Aerial Vehicle) at Different Speeds

Christopher W. Cannon

Advisor: Dr. Mohammad Khan

For my project this year I will be measuring the amount of thrust resulting from the various speeds of the UAV. The UAV will be fully operational and checked for any problems through outdoor testing. The UAV will be planted on a man-made stand that was created just for this experiment. By connecting the plane with a wire to a numeral scale, the force of the plane when activated will cause the wire to pull on the scale therefore giving accurate results. We will do this continuously with different speeds until we reach its highest throttle.

Effects of the BP Oil Spill

Katrina S. Crenshaw

Advisor: Dr. Tamara Floyd Smith

On April 20, 2010, British Petroleum (BP) suffered a major loss that affected the world when their drilling rig, Deepwater Horizon, exploded and one of America's worst environmental disasters began. After the rig exploded sending oil rushing into the Gulf of Mexico, BP lost nearly 206 million gallons of crude oil at a rate of 53,000 barrels per day. Beaches, that were once beautiful vacation sites, were damaged. Marine life that was the core of many businesses was killed. Animals that relied on the gulf for survival were poisoned. After several months, BP developed strategies to control and eventually stop the spill. The purpose of this project is to provide information on both the cause of the oil spill and the economic impact of the oil spill, to increase awareness of the environmental issues associated with the spill, and to provide a clear understanding of the importance and impact of chemical engineers in stopping the oil spill.

Induction of Apoptosis using Chemotherapeutic Agents: A Therapeutic Target?

Brittany M. Holt

Advisor: Dr. Marcia Martinez

The principle of apoptosis was first discovered by Carl Vogt, a German scientist, in 1842. However, it was not fully distinguished until 1965 by John Faxton Ross Kerr. Apoptosis, also known as programmed cell death, is a series of biochemical events leading to specific cell morphology characteristics and ultimately cell death. Apoptosis occurs once a cell is damaged beyond repair or it may occur at anytime during development or adulthood. Camptothecin and thapsigargin are two common compounds used to induce apoptosis of cancer cells. Using an immortalized cell line, we tested if the apoptosis marker PARP was cleaved (activated) with camptothecin and thapsigargin treatments. We further tested to see if pro-apoptotic GSK3β would become activated (via dephosphorylation of Serine 9) through these treatments. Proteins were examined using the Western Blotting technique. In the current study, both camptothecin and thapsigargin treatments caused the cleavage of PARP and the activation of GSK3β. Since both these drugs caused an increase in apoptotic markers, these data suggest that camptothecin or thapsigargin may be potential drugs to use in the treatment of some types of cancer.

Solar Powered Display System

Ebony I. Shaw

Advisor: Dr. Marc Karam

The objective of this project is to promote renewable energy. Solar power will be used to energize a display system. The display system will consist of 7-segment LEDs that have been designed using ICs, truth tables, resistors, and switches to implement various numerical and alphabetical values. The final display system will be a simulation of the displays seen while driving.

On the Point of Intersection of Two Lines in Space

Roenika C. Wiggins

Advisor: Dr. Hussain Elalaoui-Talibi

This presentation gives an explicit formula for the point of intersection of two lines in space. A common topic in multivariable calculus is to determine if two lines in space are parallel, skew, or intersecting; and if they intersect, to find the point of intersection. One usually has to solve a system of 3 equations in 2 variables to answer these questions. Even though this is not difficult to do, it is inefficient from a computational point of view. The purpose in this presentation is to give a criterion that tells if two lines intersect, and if they do, we give an explicit formula for the point of intersection.

BD FELLOW ABSTRACTS

Characterization of Nanostructured Epoxy and Phenolic Composites under Pulsed Laser Degradation

Sandrea Brundidge-Young

Advisor: Dr. Heshmat Aglan

Polymers and their nanocomposites are currently being used and have the potential of use in a broad range of applications. Due to their broad range of applications, in service, these materials may be subjected to heat, radiation, moisture and other means that may promote accelerated degradation. Studies on the effect of severe environmental conditions on these systems are essential in order to prevent and/or impede degradation. Understanding the means by which these systems degrade can also aid in the development of methods to hinder the degradation of the polymeric systems. There have been many studies conducted pertaining to the degradation of frequently used polymers, but few on the degradation of nanocomposites of these polymers.

In this study, epoxy and phenolic resins were reinforced with alumina nanofibers (ANFs) and multi-walled carbon nanotubes (MWCNTs). The loading of the nano-reinforcements were kept the same for both the epoxy and phenolic systems at 0.15% by weight. Specimens were notched and exposed to pulsed laser at various times of exposure. The microstructure, mechanical performance, fracture resistance and failure mechanisms of the composites systems were evaluated after exposure. These properties were compared to those of the pristine materials. Overall, the mechanical behavior of the epoxy systems was similarly affected with the addition of nanoparticles, while the type of reinforcement had more of an effect on the mechanical behavior of the phenolic based systems.

Tensile and Compressive Deformation of Polyethylene with Varying Temperature and Strain Rates

Rozlyn Chambliss

Advisor: Dr. Melissa Reeves

Molecular dynamics (MD) simulations were used to determine how the tensile and compressive properties of polyethylene (PE) are altered by changes in temperature and strain rate. The systematic study was designed to develop an empirical relationship between high-strain rate simulations and laboratory experiments at conventional strain rates. The MD was carried out with Daresbury Laboratory's software DL-POLY. The neat PE-like system consisted of a 100-chain polymer system, each chain containing ten CH_2 units modeled with Clarke's intrapolymer potential. These systems were subjected to a uniaxial strain at temperatures of 100K, 70K, 50K, 10K, and 5K. The strain rates that were examined are $1x10^{-2}$, $1x10^{-3}$, $1x10^{-4}$, $1x10^{-5}$ and $1x10^{-6}$ ps^{-1}.

Studies on Glass Epoxy/Nanoclay Nanocomposites Subjected to UV Radiation

Morgan Perry Davis, Jr.

Advisor: Dr. Mahesh Hosur

Recent studies have shown an increase use of fiber reinforced polymer composites (FRP) as an alternative to tradition metal and metal alloys due to desirable properties. Their exposure to harsh environmental conditions may lead to degradation in mechanical

and thermal properties. This study seeks to investigate the effects of UV radiation on mechanical and thermal properties of carbon FRP. The composites used for this study were obtained by vacuum assisted resin transfer molding process (VARTM), using modified SC 15 resin with 1wt%, 2wt% and 3wt% loading of montmorillonite nanoclay (nanocor® 1.28E) and 8 harness satin weave carbon fiber reinforcements. The laminates were cured at room temperature for 24 hours and post cured at 100 °C for 2 hours. Mechanical properties were characterized through static and dynamic compression loading tests; and flexural test using ASTM 695-02a and ASTM 790 respectively. Characterizations of thermal properties were performed using thermogravitational (TGA) and dynamic mechanical (DMA) analysis. Tests were performed on all specimens before and after exposure to UV radiation. Results show an increase in mechanical properties up to 56% for room temperature samples depending on the test and the weight percent loading. Viscoelastic properties were also found to increase with an increase in wt% loading up to 2wt% and decreases for 3wt%. Decomposition temperature was less affected by wt% loading and UV radiation conditioning.

Synthesis of Quantum dots using CdS by Microwave Irradiation

Twaskia Johnson

Advisors: Dr. Vijay Rangari and Dr. Shaik Jeelani

Cadmium sulfide is an important II-VI compound for various applications. It has promising applications, which include photochemical catalysis, gas sensor, detectors, solar cells, and optoelectronic devices. CdS has an energy gap of about 2.4eV and at room temperature have unique physical and chemical properties. Cadmium sulfide nanoparticles were synthesized using microwave irradiation technique. The cadmium (II) acetate and thioacetamide was used as precursors. The beta cyclodextrin was use as a surfactant. The as-prepared cadmium sulfide particles were analyzed using Rigaku, X-ray diffractometer, and transmission and scanning electron microscopy (SEM and TEM). X-ray results show that the as-prepared particles are crystalline nanosized particles. The particles sizes measurements from TEM and SEM are ~ 15nm. Further, we are exploring the synthesis of CdS, CdTe CdTe/SWCNTs and PbS quantum dots using high pressure microwave reactor. These new methodologies will also account for the ability to tune the size, shape, and dimensionality of these nanoparticles to be used for solar cell applications. Cadmium sulfide makes a good n-type window and cadmium telluride is a good p-type absorber. The CdS and CdTe are efficient and have higher performance in short circuit applications as contacts for solar cells.

Influence of non-functionalized and amino functionalized multi-walled carbon nanotube reinforcement on the mechanical and thermal properties of SC-15 epoxy nanocomposites

Vertonica Powell

Advisors: Dr. Zain Shaik, Dr. Mahesh Hosur and Dr. Shaik Jeelani

In this work, SC-15 epoxy resin was modified using 0.1-0.3 wt. % of non-functionalized and functionalized multi-walled carbon nanotubes (MWCNTs) using conventional and solvent based methods. A high-intensity ultrasonic liquid processor was used to disperse MWCNTs in solvent and to obtain a homogeneous molecular mixture of epoxy resin and MWCNTs. Viscosity and flexure tests were performed on unfilled and 0.1-0.3 wt. % MWCNTs filled SC-15 epoxy. Preliminary results indicate increase in viscosity with increase in MWCNTs wt. % loading and 0.2 wt. % MWCNTs epoxy samples showed the highest improvement in flexural properties as compared to the neat system. Transmission and scanning electron micrographs (TEM, SEM) showed improved MWCNT dispersion in epoxy using solvent media. Additionally, better interfacial bonding between epoxy and MWCNTs, rougher fractured surfaces were observed in 0.2 wt. % samples in comparison to unfilled samples. Micrographs of 0.3 wt. % fractured samples showed agglomerated lumps of MWCNTs.

Thermal & Mechanical Properties of Sic and Sio_2 Coated Thermoplastic Microsphere Nanocomposites

Diane Render

Advisors: Dr. Vijay Rangari and Dr. Shaik Jeelani

A Sonochemical technique has been developed to coat SiC and SiO_2 nanoparticles on expandable thermoplastic microspheres (acrylonitrile and methylacrylonitrile polymer, Expanel). These nanoparticles coated polymeric microspheres were further fabricated in to a foam panel using a compression molding technique (MTP-14 programmable compression molding). The test coupons were precisely cut from the foam panel and characterized using thermogravimetric analysis (TGA), differential scanning calorimetry (DSC),

quasi-static compression tests, and scanning electron microscopy (SEM), The TGA results shows no significant differences in the first and second step weight losses. While the third step degradation of 1wt% SiC and 1wt% SiO_2 nanocomposite samples shows 16°C and 34°C respectively increase as compared to the neat foam sample. The compressive stress of the 1wt% SiC and 1wt% SiO_2 nanocomposites shows ~ 86% and 18% respectively increase as compared to the neat foam sample. SEM results shows that all the microspheres expanded uniformly and typical sizes measured are ~40-100□m for neat and 60-120□m for nanocomposite foam.

Effect of Wood Flour Particle Size on the Mechanical and Thermal Properties of Rigid Polyurethane Properties
Gregory Strawder

Advisor: Dr. Mahesh Hosur

Wood flour (WF) reinforced rigid polyurethane (PU) foam composites were prepared via a compression mold technique to study the effects of particle content and size on the morphological, mechanical, and thermal properties. Scanning electron microscopy (SEM) micrographs showed a decrease in cell size for foams containing wood flour. Quasi-static compression tests show an increase in strength for wood flour reinforced composite foams, but only an increase in modulus for foams containing 2.5 wt.%. Three-point bend flexure results yielded no enhancements in modulus and an enhancement in strength for 2.5 wt.% foams containing 20010 grade wood flour. Thermomechanical analysis (TMA) showed a decrease in dimensional stability of foams due to the presence of wood flour. Thermogravimetric analysis (TGA) curves reveal that the incorporation of wood flour didn't alter the thermal stability of foams. Dynamic mechanic analysis (DMA) results show an increase in glass transition temperature (Tg), storage modulus, and loss modulus for 2.5 wt.% foams containing 20010 grade wood flour.

Characterization and Reinforcement of Nylon 6 Polymers Blend via Single Screw Extrusion Melt Compounding
Garry Ware, Jr.

Advisor: Dr. Vijay Rangari

Nylon-6 is a semicrystalline polyamide known for its high toughness, tensile strength, low coefficient of friction and good abrasion resistance make it an ideal replacement for a wide variety of materials from rubber to metal. Based on our previous studies, dispersing carbon nanotubes (CNTs) into a nylon polymer matrix have shown to increase the strength while simultaneously decreasing its toughness at higher percentages of loadings. The blending of UHMWPE at various weight percentages is explored to increase the toughness of nylon 6 while retaining the strength increase by addition of CNTs. Differential Scaning Calorimetry (DSC), Dynamic Mechanical Analysis (DMA), Thermogravimetric Analysis (TGA) and Thermomechanical Analysis (TMA) are used to characterize the polymer blend. Poor dispersion of the UHMWPE in nylon 6 is expected without a compatibilizer. Ultra High Molecular Weight Polyethylene (UHMWPE) and Nylon 6 polymers along with compatibilizer are dried and then melt compounded through single screw extruder process to forming a polymer blend. A variety of compatibilizers is tested to determine which yields the most favorable property improvement. Further, this polymer blend will be infused with CNTs and tested for their mechanical and thermal properties.

THE UNIVERSITY OF ALABAMA

ALSAMP SCHOLAR ABSTRACTS

The Motherboard of Society
Jamarey Carter

Society has reached a point in time where technology has exceeded past a luxury and has moved into a necessity. The innovations in technology have led to machines we depend on daily such as cell phones, computers, automobiles and even light itself. I am willing to bet some of you have never even wondered how is it possible that humans have made such advancement in technology. How is it that we can program airplanes to fly themselves and respond to our command? How is it that I am able to access the internet, listen to music, and play games all from a single device? The answer is simple, circuits. Circuits are the building blocks of all the suited up technology we use today. Sure Benjamin Franklin discovered electricity, but without circuits we would not be able to harness and provide the thousands of implications that we have to improve our way of life. It is amazing how a simple invention can provide so

much. Electrical Engineers specialize in how these circuits are built, how they work, and how to alter the operations to suit their needs. So whenever, you open your phone, flip on a light switch, or turn on your car, keep in mind that an electrical engineer helped make that that happen.

Nickel and Gold Nanowires Encapsulated in PVA and NPIPAM Hydrogels

Brandi Freeman

Advisor: Dr. Nitin Chopra

The Nanomaterials Processing Group, NPG, at University of Alabama focuses on the develop of innovative nanofabrication and microfabrication techniques enabling large scale synthesis of multi-component and functional nanomaterials.[1] NPG is currently working with radially or axially heterostructed graphene, oxide nanowires, carbon nanotubes, and 1-D nanostructures. These nanomaterials can find practical applications in electronics, biocompatible systems, sensors, catalysis, and energy. A focal point has been in the area of metallic nanowire synthesis and their insertion into hydrogels to create biocompatible systems. NPG implemented a microfabrication technique, template synthesis, in which Nickel and Gold nanowires were electrochemically synthesized using a porous material.[2] Upon successful completion of nanowire synthesis, NPG then redirected its focus to creating biocompatible systems with these nanowires capitalizing on Poly-vinyl alcohol (PVA) hydrogel's swelling and shrinking abilities and Poly-(N-isopropylacrylamide) (PNIPAm) hydrogel's temperature-sensitive abilities, ultimately, for employment in biomedical and drug-delivery applications.[3]

BD FELLOW ABSTRACTS

Roles of 14-3-3 Zeta Isoforms in Regulating Tyrosine Hydroxylase Activity

James Anderson

Advisor: Dr. Kim Caldwell

14-3-3 proteins are a group of proteins that are highly conserved in Eukaryotes. They have many diverse functions in cells, playing roles in signal transduction and neurotransmitter biosynthesis. In Drosophila, two 14-3-3 genes are present, encoding for the 14-3-3 epsilon and 14-3-3 zeta proteins. My study focuses on the 14-3-3 zeta isoforms, isoforms that are encoded by the leonardo (leo) gene. Leo encodes for three 14-3-3 zeta isoforms. Previous studies in the O'Donnell lab show that the first two isoforms have antagonistic effects in regulating Tyrosine Hydroxylase activity (TH). LEO I activates TH activity while LEO II inhibits TH activity. The role that LEO III plays in regulating TH is unknown. In my 14-3-3 project I will perform a number of tests to validate the results of the previous 14-3-3 study in the O'Donnell lab. I will perform TH Western blot experiments to compare TH levels in leo mutants to that of controls. Also TH levels in alpha-synuclein overexpressed transgenic flies will be compared to that of controls. I will perform Co-IP experiments of phosphorylated TH and alpha-synuclein. Also I will perform Co-IP experiments of unphosphorylated TH and alpha-synuclein. I will perform pull downs of phosphorylated TH with LEO I and phosphorylated TH with LEO II. I will complete Alpha-synuclein in vitro experiments to show that alpha-synuclein regulates TH. I will compare DOPAC/Dopamine ratios in leo mutants to the ratios seen in controls. I will drive UAS-leo III with TH-Gal4 fly lines in order to measure the effects that leo III overexpression has on regulating TH activity.

Cyclic Groups

Jalonda Coats

Advisor: Dr. Martyn Dixon

In abstract algebra, a cyclic group is a group that can be generated by a single element x (the group generator). Cyclic groups are Abelian. A cyclic group of finite group order n is denoted by C_n, Z_n, etc., and its generator x satisfies $x^n = I$ where I is the identity element. Another notation for the generator of a cyclic group is $\langle a \rangle = \{ x \in G \mid x = a^n \text{ for some } n \in Z\}$. The main point is to examine the Fundamental Theorem of Cyclic Groups through an observation of its proofs and implications from it. The Fundamental Theorem of Cyclic Groups states that every subgroup of a cyclic group is cyclic. Moreover, the order of any subgroup of a cyclic group G of order n is a divisor of n, and for each positive divisor k of n the group G has exactly one subgroup of order k. We will also take a brief examination of applications of this theorem.

A revised phylogeny and study of floral traits in the neotropical genus *Gasteranthus* (Gesneriaceae)

Cassandra Coleman

Advisor: Dr. John L. Clark

The genus *Gasteranthus*, with 40 currently described species, occurs in Central and South America. Species of *Gasteranthus* are brightly colored and have two morphologically divergent corolla shapes (pouched and non-pouched) which is suggestive of co-evolution of the corolla and specific pollinators. Three previous molecular phylogenies of this genus strongly support monophyly of *Gasteranthus*, but the evolution of pouched and non-pouched flowers is not corroborated as a morphological synapomorphy that divides the genus into two monophyletic sections. Morphological cladistic analysis shows one evolutionary shift from pouched to non-pouched flowers while previous molecular-based phylogenies show multiple evolutionary shifts from pouched to non-pouched flowers. A preliminary phylogeny of *Gasteranthus* and closely related genera based on nuclear and chloroplast markers suggests that these shifts are associated between pollinators and floral characteristics and the shifts are the primary reason for convergence of pouched flowers. Initial analysis of over half of the genus with appropriate outgroups has given a solid base for future pollination work and addition of other species from this genus that will give rise to better understanding of floral evolution within this divergent genus. Pollinator shifts may have affected species diversity and further molecular analysis combined with detailed field work will illuminate this quandary. Future direction of this research includes pollination studies to further understand initial molecular phylogenetic outcomes.

Highly Efficient Fully-Electric Vehicles with Induction Motor Propulsion

Tarrell Ezell

Advisor: Dr. Tim Haskew

In today's society, it is a virtual necessity for each household to maintain some sort of vehicle for daily use. Also, with pollution and CO2 levels in the atmosphere steadily increasing, it will be beneficial to grow less dependent on gasoline-powered vehicles. The purpose of this research is to investigate a way to increase operating efficiency of an induction motor while lightly loaded using Direct Torque Control (DTC), and take one more step to help our nation move into a greener future. The method that we will be exploring was developed by Dr. Jerry E. Murphree II, and it is discussed in his 2002 doctoral dissertation from the University of Alabama [1]. Murphree's contribution to SVM-DTC is derived from related high performance control systems, and it was proven to improve induction motor efficiency under light load conditions. The main objective of Murphree, and the many researchers working in the study and improvement of EVs, is to increase their range of operation so that they will be more viable for day to day use. Thus, by using a weighted blending of Murphree's method and traditional DTC-SVM, we propose to develop a method that will increase overall efficiency at all load levels. The idea is to use a field-oriented control (FOC) method and the altered SVM-DTC method discovered by Murphree together in a parallel control structure to reap the benefits that each controller has to offer. The conclusion of this research is going to aid in the further development of electric vehicles.

Iterative Techniques for Solving Linear Systems

Sharniece Holland

Advisor: Dr. Vo Liem

The Jacobi and Gauss-Seidel iterative methods are used in the study of numerical analysis. These are classic methods that date to the late 18th century. Iterative techniques are usually not used for solving linear systems of small dimension since the time required for sufficient accuracy exceeds that required for direct techniques such as Gaussian elimination. For large systems with a high percentage of 0 entries, however, these techniques are efficient in terms of both computer storage and computation. Systems of this type arise frequently in circuit analysis and in the numerical solution of boundary-value problems and partial-differential equations. An iterative technique to solve the $n \times n$ linear system Ax=b starts with an initial approximation $x^{(0)}$ to the solution x and generates a sequence of vectors that converge to x.

Controlling Directionality in Self-Assembled Monolayers

Marcus Johnson

Advisor: Dr. Robert Metzger

The study of molecular electronics started in 1974, when Ari Aviram and Mark Ratner first proposed and provided theoretical models for a one-molecule rectifier. This has led to breakthroughs in the field of molecular electron transport, despite many technical difficulties. It is not easy to measure how an electron migrates through a single molecule in detail, (scanning tunneling microscopy measures current, but had no precise idea of how the molecule is oriented). Most studies of electron transport have been statistical over many thousands of molecules tested. The difficulty that arises naturally is the geometry of the molecules tested. After a thousand readings it is certain that the electron transport has been taking for numerous different orientations in space. Our goal is to specify the orientation of molecules using self-assembled monolayers of contrasting functionally capped molecules. The molecules have been studied using the molecular break junction method which gives a "metal / molecule / metal" junction. Through selective chemisorption there should be selectivity of one cap over the other on the substrate: this will determine which end is up. We next must study the alignment of the molecules. A method to align all of the molecules at the same angle and distance from the substrate must be chosen. If we can accomplish these two aspects then the study of reliable unimolecular electron transport should be attainable.

Exploration of the Role of the Zoospore Fenestrated Cisterna in Calcium Sequestration Using the Marine Chytrid Fungus *Rhizophydium littoreum*

Sharmeka Lewis

Advisor: Dr. Martha Powell

The purpose of this study is to determine how *Rhizophydium littoreum* zoospores respond to environmental cues. To approach this problem, I will explore the function of the zoospore fenestrated cisterna of a marine chytrid fungus. It appears that the fenestrated cisterna is part of the endoplasmic reticulum system, though its ontogeny has not been tracked. Cytochemistry indicates that the fenestrated cisterna stores calcium; however, it is unknown if the cisterna contains calcium-sequestering proteins (Powell 1983). I will isolate the fenestrated cisterna and use biochemical probes to detect potential calcium-binding proteins in these membrane fractions.

Control and Management of Micro Grids

Julio Proano

Advisor: Dr. Shuhui Li

Electricity is becoming more expensive, partly because of the ever-greater need to produce more energy to meet increasing demand. In addition, the dangers posed by carbon emissions have led policy-makers and scientists to find new and more efficient ways to make use of alternative energy sources. To these ends, high-quality micro generation units, also known as distributed energy resource (DER) systems, have been developed in the last ten years. DER systems are small-scale power generation technologies (typically in the range of 3 kW to 10MW) used to provide an alternative to, or an enhancement of, the traditional electric power system. These units usually harvest their power from a variety of alternative and renewable energy sources, including solar PV arrays, wind turbines, fuel cells, and microturbines. The main obstacles to widespread reliance on microgrids are two-fold. Unlike conventional utility systems, energy production from a DER unit is variable and intermittent. Also, the energy conversion principles of microgrids and the main grid are completely different and require load control. This research proposes to address this problem by optimizing an existing DER control system based on novel d-q vector control mechanisms for integration into a conventional utility system. This optimized control system, created via computer simulation, will provide a model for the control system of microgrids of the future. The idea is to simulate all the standard components of a typical microgrid, including distributed generation units, distributed storage units, and controllable loads, using industry standard simulation tools, such as MatLab SimPower Systems.

Silicon Nanowire Photovoltaics

Lyndon Smith

Advisor: Dr. Nitin Chopra

Humankind's production of fossil fuels will eventually peak and begin a slow decline. The decline in oil production is inevitable, but the decline of the industrialized world need not be. Photovoltaic cells are one of many alternative methods of supplying alternative energy. The sun delivers 120,000 terawatts of photon radiation on the surface of the Earth. If these cells can be harnessed at a low enough cost with high efficiency, then they can be used to supplement or even replace fossil fuels in the generation of electricity. Nanowire structures have been created using silicon, gallium arsenide, iron pyrite, cadmium sulfide and zinc oxide have been used in preparing photovoltaic cells. The goal of my proposed research would be to develop silicon nanowires at nanoscale that would function as cheap, very highly efficient photovoltaic cells reliably.

Muscle physiology of androgen receptors as it relates to behavioral plasticity in the Mangrove killifish

Shane Stanley

Advisor: Dr. Ryan Earley

Androgens are powerful drivers of *behavioral plasticity*. Literature suggests, with supportive evidence, that the most potent androgenic (anabolic) compounds modulate increases in volatile behavior (most notably aggression) in vertebrate species. These androgens, (Testosterone, 11-Ketotestosterone), confer their effects via androgen receptors (AR) throughout the body. However, ARs have been most extensively studied in the brain and as a consequence, may have been incontrovertibly linked as the sole regulators of aggression. Furthermore, numerous techniques have imaged large aggregates of up-regulated androgen receptors in the brain after aggressive contests. Nevertheless, I propose that there are other, just as significant androgen receptor locations in skeletal muscle. I would like to advance the notion that androgen receptor densities are augmented in skeletal muscle as a result of hostile, aggressive contests which beneficially contribute to overall species fitness. It is fortunate that my model organism, the Mangrove rivulus (*Kryptolebias* marmoratus), is a genetically tractable naturally clonal organism, that self-fertilizes and produces genetically identical offspring. This is consequential, in that, we can expose identical genotypes to varied environmental conditions (aggressive contests) and quantify diversity of androgen receptor density in skeletal muscle.

Development of Ti-$TiAl_3$ Metallic-Intermetallic Laminate Composites for Structural, Defense, and Aerospace Applications

Derrick Stokes

Advisor: Dr. Viola L. Acoff

Metallic-Intermetallic Laminate Composites (MLCs) are comprised of alternating layers of elemental metals and intermetallic compounds. By combining in this manner, MLCs exhibit properties that make them ideal for consideration for use in ballistics applications. MLCs composed of elemental titanium (Ti) and the intermetallic compound $TiAl_3$ are ideal candidates for these applications. There are a number of processing methods for making Ti-$TiAl_3$ MLCs. MLCs are commonly produced in industry but there are issues with the current manufacturing process. Current methods require high amounts of energy and are also quite costly. In this study, a cost-effective and energy efficient way of producing Ti-$TiAl_3$ MLCs developed by Dr. Acoff's research group at The University of Alabama is investigated. This method involves the process of accumulative roll bonding (ARB) of elemental foils followed by annealing to produce Ti-$TiAl_3$ MLCs. The focus of the results presented here is the as-rolled specimens consisting of alternating layers of elemental titanium and aluminum (Al), prior to annealing which produces the intermetallic compound $TiAl_3$. To measure the impact and residual velocities of the Ti-Al multilayered specimens, perforation testing, using a method developed by Dr. Jones' research group at The University of Alabama was employed. The speed and velocity of the projectiles should provide information that will give the basis of a fundamental, systematic study relating multi-layered structure to mechanical properties.

Epigenetic Mechanisms Involved in Generating the *Curly Tail* Phenotpe

Erica Thompson

Advisor: Dr. Margaret Johnson

The *curly tail* strain of mice has been a widely used mutant model for studying neural tube defects (NTDs) and is one of the best-studied models of spina bifida (1). Homozygous *curly tail* embryos develop spina bifida (15-20% penetrance) and tail flexions (50% penetrance), and less frequently will develop exencephaly (2). Previous studies in Dr. Johnson's laboratory discovered that the biosynthesis of inositol phosphate is developmentally regulated in the mammalian brain and that this regulation is altered in the brain of *curly tail* mutant mice that have identical genes but different susceptibilities to the deregulation of inositol phosphate (3). One mouse exhibits spina bifida, while the other does not, even though both mice have identical genotypes. Inositol phosphate is synthesized, *de novo*, by myo inositol 1-phosphate synthase (MIP). I hypothesize that the constitutive production of inositol phosphate by MIP during brain development causes spina bifida in the mouse that exhibits this diseased phenotype. I will focus on the epigenetic factors that may be-responsible for the constitutive production of inositol phosphate in the diseased mouse and not the other. I will address three questions:

1) Do promoter methylation patterns differ among the three mouse strains used for previous studies?
2) What transcription factors interact with the MIP gene promoter?
3) Is there a relevant link between the grainy head-like 3 transcription factor and the suppression/regulation of MIP? It is hypothesized that the *curly tail* gene corresponds to a hypomorphic allele of the transcription factor grainy head like-3 (4).

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

ALSAMP SCHOLAR ABSTRACTS

The Chemical Properties, Therapeutic Usage, and Inimical Effects Involving NSAIDs

Daveckio Burress

Advisor: Dr. James Patterson

Aspirin, also known as Acetylsalicylic Acid (ASA) is a member of a class of drugs called Non-Steroidal Anti-Inflammatory Drugs (NSAID); these drugs share a commonality of effects. Most NSAIDs can be administered through an oral, rectal, or injection route. These drugs have therapeutic uses and adverse effects. Some drugs can aid in prevention of cardiovascular events such as stroke, heart attacks and cardiovascular disease. Aspirin, naproxen, and ibuprofen are the most common used NSAIDs at this present time. Severe irritation of the mucous membrane lining of the stomach is a major side effect; consequently, over time the usage of these drugs may stimulate the rise of gastrointestinal damage, such as bleeding ulcers, or diseases such as gastritis or pancreatitis. Research has come to the conclusion that certain factors influence the adverse effects from these NSAIDs. Factors such as long term therapy with low doses of the drug maybe highly effective for secondary heart prevention (heart disease); short term administration of low doses may be a factor that may cause gastroiñtestinal damage. These drugs are able to inhibit the use of important enzymes based on their stereochemistry and functional groups. Researchers are currently exploring ways to prevent the harsh side effects and gastro complications of the NSAIDs.

Interpreting the Dynamics of Sickle Cell Treatment with the Use of Hydrocarbamide

ShirDonna Lawrence

Advisor: Dr. Linda Luck

Sickle cell anemia or drepanocytois is an autosomal co-dominant genetic blood disorder characterized by red blood cells that assume an abnormal, rigid, or sickle shape. Sickle cell anemia is caused by a point mutation in the β-globin chain of hemoglobin which caused the hydrophilic amino acid, glutamic acid to be replaced with the hydrophobic amino acid, valine, at the sixth position. Hemoglobin is an iron-containing oxygen transport metalloprotein found in red blood cells. Hemoglobin in the blood is what

transports oxygen from the lungs to the rest of the body. Due to sickle cell anemia affecting the hemoglobin of red blood cells, a form of treatment has been created that deals specifically with increasing the amount of normal red blood cells which then creates more normal hemoglobin. Hydroxycarbamide or hydroxyurea is an antineoplastic drug that is used to reduce the rate of painful attacks in sickle-cell disease by breaking down cell that are prone to sickle, as well as increasing fetal hemoglobin content. While the exact mechanism of how Hydroxycarbamide is not known, it appears that hydroxycarbamide increases nitric oxide level, causing soluble guanylyl cyclase activation which leads to a rise in cyclic GMP and the activation of gammaglobulin synthesis. Gammaglobulin synthesis is necessary for fetal hemoglobin to function Hydroxycarbamide along with erythropoietin, a glycoprotein hormone that controls erythropoiesis or red blood cell production, will be the components looked at throughout the course of research for the treatment of sickle cell anemia.

Mechanism used in Amlodipine to Reduce the Risk of Developing a Myocardial Infraction

Wynesha Miller

Advisor: Ms. Nicole R. Gravitt

Amlodipine besylate, also known as the brand name Norvasc, is used to treat hypertension and angina. Amlodipine besylate is a calcium-channel blocker which works by relaxing blood vessels, and as a result of this, the blood can flow more easily. Calcium-channel blockers can also be used after a myocardial infraction, commonly known as a heart attack, among patients who cannot tolerate beta-blocking drugs, have atrial fibrillation, or require treatment for their angina. A heart attack occurs when blood flow to a section of heart muscle becomes blocked. If the flow of blood isn't restored quickly, the section of heart muscle becomes damaged from lack of oxygen and begins to die. Each year about 1.1 million Americans have heart attacks. Heart attack is a leading cause of death among both men and women in the United States. The purpose of this research is to discover the mechanism of Amlodipine besylate in preventing heart attacks.

Effects of Environmental and Demographic Stochasticity on the Sandhill Crane Population

Deonnia N. Pompey

Advisor: Dr. Jeanne Hutchison

Researchers have recognized the Sandhill Crane as an endangered species, with fear that this Florida native bird will soon become extinct. Florida wildlife management officials have begun studying this species in an attempt to prevent their extinction. Mathematical modeling principles can be implemented and assist in testing and concluding potential outcomes for this population, given certain circumstances. Before testing, assumptions and predictions will be made, and then compared to actual data, which will be tested against the assumptions. Environmental stochasticity analyzes the cranes' habitual environment and natural factors (i.e. natural disasters and catastrophes) impacting birth and death rates. Experimentation using the softwares Stella and Microsoft Excel will provide data about the total population with respect to the impact of natural factors. Demographic stochasticity refers to the birds' ability to continue the population by natural increase, including birth and death rates impacted by fertility, survival rate, and overall health of the bird population. The method described for environmental stochasticity will be used to determine demographic stochasticity. In order to properly identify how both factors impact cranes' population, both stochasticities will be tested in tandem, resulting in a more realistic scenario, as naturally, both factors impact total population. Upon completion of the experiment, graphs and tables will be created, where conclusions will be derived from.

The Role of Epigallocatechin-3-Gallate on High Fat-Induced Inflammation and Insulin Resistance

Simone Ridgeway

Advisor: Dr. Jeonga Kim

Insulin resistance is defined as decreased responsiveness to physiological level of insulin to dispose glucose from blood into insulin target tissues including skeletal muscle and adipose tissue. Insulin resistance is a hallmark of metabolic disorders and a risk factor for diabetes and cardiovascular disease. A high fat diet leads to developing obesity and insulin resistance that may cause cardiometabolic syndrome including dyslipidemia, hypertension, and coronary artery diseases. Previous studies have shown that an elevated fat body mass increases systemic inflammation, which is considered as one of the mechanisms for insulin resistance.

The consumption of green tea is associated with beneficial health effects, one being to prevent cardiometabolic syndrome. It has been shown that the most abundant green tea catechin, Epigallocatechin-3-gallate (EGCG), has anti-inflammatory and anti-oxidative

effects that may reduce the risks of metabolic conditions such as Type II Diabetes and also cardiovascular disease, obesity, and hypertension.

Although there have been many studies proposing mechanisms related to EGCG and how it activates signaling pathways to prevent metabolic diseases, the effects of EGCG in a high fat diet (HFD)-induced insulin resistance model with regard to increased pro-inflammatory response is not completely understood. Thus, we hypothesize that anti-inflammatory effect of EGCG plays a role in improvement of insulin sensitivity in mice fed with a high fat diet.
In this research poster, we will demonstrate research plans to test the hypothesis as well as experimental procedures to be employed to measure metabolic parameters and pro- inflammatory markers.

BD FELLOW ABSTRACTS

The Association Between Risks for Motor Vehicle Crash Related Injury to Children and the Driver: Grandparents versus Parents

Samantha Bromfield

Advisor: Dr. Pauline Jolly

According to the National Highway Traffic Safety Administration (NHTSA), the leading cause of death for children ages 3 to 14 is motor vehicle crashes. During 2008, an average of 4 children under the age of 14 were killed and 529 were injured daily in motor vehicle crashes. The use of restraints such as seatbelts or child safety seats has reduced fatal injury for infants by 71% and for toddlers by 54%. Studies have explored restraint use and its relation to injury in children. One aspect of this relationship that has been explored is restraint use practices and injuries among children in crashes with grandparent versus parent drivers. This study was conducted using data that was collected as part of a cross-sectional study of motor vehicle crashes that involved children that were 15 years of age or younger. The objective of this paper is to further explore this relationship using data collected by the National Automotive Sampling System (NASS) program, which would provide a nationally representative, random sample of crashes. We will explore differences in injury risks to children due to driving in the car with their parents or grandparents. This paper seeks to provide further insight to injury risks to children involved in motor vehicle crashes.

Molecular Dynamic Simulations of Lipid-Free and Lipid-Bound Apolipoprotein (Apo) E

Cordero D. Core

Advisor: Dr. James Patterson

Apolipoprotein E (apoE) is a protein found in the liver and brain that serves several important functions in the body. The ε allele on chromosome 19 codes for the three predominant isoforms of apoE: apoE2 (ε2), apoE3 (ε3), and apoE4 (ε4). ApoE3 has Cys 112 and Arg 158, while apoE4 and apoE2 have Cys112Arg and Arg158Cys mutations respectively; therefore, these differences give rise to isoform-specific function and properties. Genetic predisposition for the ε2 allele causes individuals to be at higher risk for developing hypercholesterolaemia and hyperlipoproteinaemia. Conversely, the ε4 allele is the preeminent marker for risk of developing Alzheimer's disease (AD). However, researchers are still not sure of the role that apoE plays in the development of AD. Crystallographic data and molecular modeling techniques have been used to create a model of the lipid-bound apoE4 particle. The dynamic structure of this model as well as those for the apoE2 and apoE3 isoforms are being investigated using molecular dynamics (MD) simulations and will be compared directly to experimental data on isoform-specific effects to determine the detailed molecular role that the single-point mutations play on the function and properties of apoE. Thus far, atomistic MD simulations have been performed on the lipid-bound apoE4 system; however, a course-grained (CG) model is being developed to complement these early calculations.

Design of Pipe Flow-Through Apparatus for Corrosion Control Studies

Jaquice D. Hughes

Advisor: Dr. Jason Kirby

Pipe corrosion is a problem many water utilities, such as the Birmingham Water Works Board (BWWB), encounter due to the aging of piping materials that comprise current water distribution systems. Corrosion control inhibitors potentially contribute to the

impediment of corrosive properties; this results in more aesthetically pleasing water as well as an overall higher water quality. This effort will utilize a pipe flow through apparatus to research the effects of various corrosion control inhibitors on the drinking water system of Birmingham, Alabama. The apparatus follows the American Water Works Association Research Foundation (AWWARF) Pipe Loop/Rack Model commonly used to simulate plumbing systems to mimic a distribution system. This research will test the effects of three corrosion control inhibitors (sodium silicate, zinc sulfate, and zinc chloride) on the finished water flowing through the designed pipe apparatus for the Carson Filter Plant located in Pinson, Alabama. The system will consist of lead, cast iron, copper and brass fixtures commonly utilized in distribution systems operated by the BWWB. Aged cast iron and lead piping were excavated from the existing water distribution system of the Carson Filter Plant; this was done to give a representative sample of the current pipe conditions. Each of the materials will be attached in series separated by inert polyvinyl chloride (PVC) piping and sample valves. Three parallel systems will assess the effects of each corrosion control inhibitor. Waters will flow through the piping system for twelve hours and stagnate for twelve hours at a maintained velocity of approximately 2 feet per second. Weekly sample will be analyzed for iron, aluminum, sodium, calcium, magnesium, manganese, lead, copper, sulfate, chloride, zinc, silicate, total chlorine, color, turbidity, apparent color, total dissolved solids, hardness, conductivity, and total organic carbon. Corrosion control inhibitors will be administered via a chemical pump. The exposure time for each corrosion inhibitor will be 3 months. Upon completion of this research, the inhibitor that best prevents pipe corrosion and increases the quality of water will be identified. Results of this study will lead to a better corrosion control treatment methods for the Birmingham Water Works Board and ultimately the citizens of Birmingham, Alabama.

Vibration Analysis on Expanded Polypropylene/Polyethylene (EPP/EPE) Foam Sandwich Composites

Samuel Jasper

Advisor: Dr. Uday Vaidya

Sandwich composites are widely used in automotive and transportation applications. Compared to metal components thermoplastic sandwich composites give excellent stiffness, high-energy absorption properties, and light weighting benefits. Manufactured components are often subjected to external vibrations that may cause damage and decrease performance. Vibration analyses on sandwich composites are necessary for characterizing damping properties. A vibration analysis was conducted on Curv™ face sheets, a self reinforced polypropylene to determine, the effects of thickness variations on damping. An optimal thickness of <0.9 mm was determined for the construction of the Curv/ expanded polypropylene system. Sandwich composites of EPP (Curv) were assembled and a vibration study was conducted. The Half-Power Amplitude method was used to determine the damping ratio and the resonant frequency was recorded. The sandwich composites possess an order of magnitude higher damping than metal counterparts.

Impact of Amended Soil on Plant Survival Utilizing Autoclaved Aerated Concrete

TaShundra K. Jones

Advisors: Dr. Robert W. Peters, Dr. Jason T. Kirby, Julie G. Price and Dr. Stephen A. Watts

Green roofs have become more utilized in the U.S. in recent years. They introduce permeable surfaces to often impermeable locations. Many benefits can be observed by utilizing green roofs. In green roof prototypes, autoclaved aerated concrete (AAC) will be used as the substrate. Produced for use in interior and exterior walls, flooring, and roofing applications, autoclaved aerated concrete (AAC) offers many environmental benefits. Some of the benefits of utilizing AAC include ease and cost of construction/transportation, increased safety and provides energy savings. The design considered for this study is by utilizing recycled building materials. The soil and plants selected can provide reductions in peak runoff flows and delay the time to peak flow runs. As sustainable development continues to dominate the headlines, new ways to incorporate more environmentally friendly practices must be developed. The main soil characteristic like structure, texture or organic matter content is related with the pore space system. The pore space content of the soil is called porosity (Afganistan, 2008). Like other matter, soil has density. There are two kinds of soil density: bulk density and real density. Bulk density is the weight of a given volume of soil, including the network of pore spaces, i.e., the gaps between the particles. Real soil density excludes the pore spaces, leaving only the volume of the soil solids (Afganistan, 2008). The pore space of the soil, porosity, gives us important information about its physical characteristics.

Synthesis and Characterization of Mucoadhesive Drug Delivery Platforms

Karmen McPherson

Advisor: Dr. Derrick Dean

Thilated polymers, or thiomers, are a novel approach to the development of mucoadhesive drug delivery systems. Immobilization of thiol groups has been shown to greatly improve mucoadhesive properties. These polymers can be used for a variety of drug delivery systems in the form of patches, gels ointments, sprays, films and nanoparticles. They are utilized in areas of the body where mucus is present. The aim of this study is to synthesize a polymer system with enhanced mucoadhesion properties. Hyaluronic acid was chosen as the polymer backbone because it is a naturally occurring molecule, a chief component of the extracellular matrix and is found throughout connective, epithelial, and neural tissues. In recent studies, hyaluronic acid has been investigated for its use in drug delivery systems via various routes of administration: ophthalmic, topical, nasal, and orally. However, cross-linking of hyaluronic is necessary to overcome its rapid degradation time. The benefits of thiolating hyaluronic acid include biocompatibility, improved bioavailability, and mechanical stability. Using this approach for mucoadhesive drug delivery platforms can enhance the efficacy of therapeutic treatments. Cystic fibrosis, diabetes, and ocular and periodontal diseases are currently being researched to explore the benefits of using mucoadhesive drug delivery systems.

Determining the Effects of the Tribbles Protein Family on Macrophage Foam Cell Formation

Dennis Steverson Jr.

Advisor: Dr. W. Timothy Garvey

Originally discovered in *Drosophila* as a regulator of germ cell development, the function of the Tribbles family in mammals is not fully understood. The Tribbles family, a family of kinase-like proteins, consists of three different homologs, TRIB1, TRIB2, and TRIB3. Various studies are looking into the function of each homolog of the gene. Foam cells are the progenitor cells of atherosclerosis, a disease characterized by the buildup of fatty deposits along the arterial walls eventually leading to blockage of the arteries and ultimately causing emboli which are common causes of heart attacks and strokes. By treating macrophages with oxidized low density lipoprotein we are able to form foam cells. We have found that in the formation of these foam cells the Tribbles expression is increased. By knocking down and over-expressing the different homologs of the Tribble family we hope to elucidate the effects that Tribbles have on foam cell formation.

Determining Ryznar Stability Index (RSI) and Langelier Saturation Index (LSI) For Suitability Predicting Corrosion Potential of Finished Water From a Southeastern U.S. Water Source

Glenn Terrell

Advisor: Dr. Melinda M. Lalor

Source water quality varies regionally in the United States and fluctuates seasonally. These variations can create serious challenges to water utility operators in maintaining a desired finished water quality. Highly corrosive source water can challenge a utility in meeting the required regulations ensuring water that is fit for human consumption. In addition, finished corrosive water leads to premature pipe failure and very costly distribution pipe repair.

This research will attempt to determine if either of the two most widely used corrosion indexes are applicable for raw water sources used by the Birmingham Water Works Board (BWWB). Finished water samples were collected and tested the parameters used to calculate the aforementioned indexes, specifically free and dissolved metals, total dissolved solids, conductivity, and others.

Because of seasonal fluctuations in water characteristics, sampling was performed twice weekly on each pipe-type in the BWWB water distribution system. Both indexes were calculated and preliminary results confirmed that the BWWB finished water was within acceptable corrosion limits. In conclusion, it was determined that finished water produced by BWWB did not directly contribute to expensive distribution pipe main breaks and failures.

This research is particularly relevant to water distribution maintenance cost containment, potable water quality, and federal regulatory compliance of the Clean Water Act.

Efficiency of Optimized Quantum Dot Carnot Engine

Desmond Villalba

Advisor: Dr. Ryoichi Kawai

The Carnot efficiency represents the most efficient operational procedure for a heat engine. In other words, at the Carnot efficiency the maximum amount of work is produced for the minimum amount of input energy. However, at the Carnot efficiency the operation time for the entire cycle must be infinite. The result of this infinite operation time is a power output of zero by the engine. The purpose of the quantum dot engine is to model a heat engine which operates on a finite time scale, therefore producing an output which is non-zero. This heat engine consists of a single level quantum dot system. By bringing a hot and then cold heat reservoir into contact with the system, heat is transferred to or from the quantum dot. This heat flux results from the electrons, which can travel into or out of the quantum dot through a tunneling junction with the reservoir. Work is preformed on the system by modifying the energy level of the quantum dot in a finite amount of time. The maximization is carried out through the use of FORTRAN 95, which was used to find the optimized operational time scheme while in contact with the hot and then cold reservoirs. While maximizing the power in an iterative manner, the efficiency is also calculated at each step. Studying how the efficiency changes as a function of power should provide deeper insight into the underlying thermodynamic properties which apply to this heat engine, and perhaps to more common heat engines such as automobiles or power plants.

Urban Design Methods That Support Heat Island Mitigation

Candace J. Watson

Advisor: Dr. Robert W. Peters

Urban cities are the largest consumers of energy. As global populations continue to increase in these areas, energy consumption is a growing concern for global leaders. Cities in developed countries are expanding beyond their central city-centers, resulting in increased natural resource consumption. This method of population management is referred to as urban sprawl and is the reason for expanding transportation networks, building materials, and fuel. In addition to increases in energy consumption, in recent years, built-up areas have experience higher temperatures than surrounding rural areas. According to the Environmental Protection Agency, these differences can be as high as 22° Fahrenheit. Urban heat islands can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse emissions, heat-related illness and mortality, and adversely affect water quality. It is the goal of this project to determine the best design practices for built-up areas, by supporting the principles of sustainability, by decreasing energy consumption and creating environments that positively contribute to the overall environmental health of communities. Birmingham, Alabama is the project field study, where difference between surface and ambient air temperatures will be recorded to determine which factors have a positive impact on the overall environmental comfort in this city. Surrounding rural/suburban areas ambient air temperature will be recorded and compared to Birmingham. Upon completion of data collection, design methods will be analyzed to determine the best practices, and recommendations will be made to improve the condition of Birmingham, with the intention of being applied in other areas.

Degeneracy of Cubic Invariant Laminations

Kendrick White

Advisors: Dr. John C. Mayor and Dr. Lex Oversteegen

Thurston introduced the notion of geodesic laminations to model connected; locally connected Julia sets for polynomial maps, P(z) with super-attracting fixed points at infinity, by using the Bottcher uniformization of the polynomial in the attracting basin, A_∞. This uniformization conjugates P(z), acting on A_∞, to z^d, acting on the open unit disk, **D**. Thurston's idea was to allow the leaves in a geodesic lamination to correspond to identifications made in the Julia set, the boundary of the super-attracting basin, by the Bottcher linearization. The quotient space obtained by identifying endpoints of leaves would provide a topological conjugacy between the dynamics of P(z) and z^d on the quotient space resulting in a combinatorial model of polynomial dynamics.

Not all d-invariant laminations satisfying Thurston's conditions actually model polynomial dynamics. The aim of this investigation is to take further steps towards precisely describing degree 3-invariant laminations which are compatible with polynomial dynamics.

ALSAMP SCHOLAR ABSTRACTS

Sensitivity Analysis on Radiation Risk Model

Thomas Adams

Advisor: Dr. Mary Van Baalen

The National Aeronautics and Space Administration's (NASA) Radiation Health Office (RHO) determines each astronaut's cancer risk by using a radiation risk model that takes the amount of radiation dose that astronauts receive from spaceflight missions and calculates the amount of damage due to the radiation exposure on the mission. The model uses baryon transport codes (BRYNTRN), high charge (Z) and energy transport codes (HZETRN), and information about the space mission to determine the effective dose received by astronauts in Low Earth orbit (LEO). This model uses an approximation of the Boltzman transport formula. The purpose of the project is to execute the model and test various International Space Station (ISS) flight parameters in order to gain a better understanding of how this model responds to different scenarios. The project will determine how variations in one set of parameters such as, the point of the solar cycle and altitude can affect the radiation exposure of astronauts during ISS missions. This project will benefit NASA by improving mission dosimetry.

A C++ Simulation of Patience Sorting

Joshua Bentley

Advisors: Dr. Leonard Choup and Ms. Deirdre Watts

Patience Sorting is a method invented to sort real decks of cards into piles with rank or order. We seek to compare the process of "winning" by having a small number of piles with C++ simulations to that of the Monte Carlo simulations done by Aldous and Diaconis, the current experts on Patience Sorting.

Identification of the dpy-5 gene in mutant and Wild-Type *Caenorhabditis elegans*

Yasmine Cargill

Advisor: Dr. Lynn Boyd

Caenorhabditis elegans (C. elegans) is a roundworm often studied in many laboratories. For this study, the worm is used to study the differences in gene size of the wild-type and mutant dpy-5 gene. The dpy-5 gene is needed for the worm's body length. The *dpy-5* mutation is a deleted portion of the wild-type DNA sequence. A Polymerase Chain Reaction (PCR) test will take place to closely look at the worms genotypes. The worm will be observed to see if the gene transcripts corresponding to the predicted sizes of the wild-type gene and dumpy mutant gene can be identified from the wild-type and mutant worms. If the PCR matches the predicted phenotypes, then the band size on the gel should also match. We hypothesize that the band sizes for the mutant gene should be shorter than that of the wild-type gene. After creation of the primers, the expected value of the wild-type length was 1236 base pairs and 227 base pairs for the mutant length. The gel showed that the wild-type measurement was 1223 base pairs for the wild-type and 228 base pairs for the mutant. The results showed fragments that were very close to the expected values. This demonstrates that the primers were designed correctly and the PCR was conducted properly.

Separation methods of Superfractions from Zanthoxylum setulosum

Amanda Coleman

Advisor: Dr. William Setzer

Zanthoxylum setulosum is known to contain highly cytotoxic killing agents against breast cancer cells such as MCF-7, MDA-MB-231, and MDA-MB-468 *in vitro* at 100% at 100 mg/ml. Active materials from Zanthoxylum setulosum were extracted and purified to determine active chemical structures. Thin Layer Chromatography was performed to verify purity of fractions collected from

Zanthoxylum setulosum. Superfractions were created for non-purified samples. This research involved extraction and purification of the five superfractions that were found in Zanthoxylum setulosum. The superfractions were separated using preparative think layer chromatography. When Fr 38,40 was added to the Chromatron, it was absorbed into the silica plate forming bands. Once the plate was completely soaked, it been to disperse the different layers of the compounds. The fractions were separated were faster and gave a more pure sample. NMR was taken for Fr 38,40 to determine whether it contained the breast cancer killing agents.

Low Cost Data Acquisition and Temperature Control Using Micro Processors

Jordan Davis

Advisor: Dr. William Heffner

The intent of this project was to develop experiments for youthful scientists and experimenters. A lot of today's learning has shifted away from the "hands on" approach and we wanted to develop experiments that are affordable, "hands on" and use common materials, yet engage students with real glass science activities. Our team focused on building low cost instruments using the Parallax Basic Stamp Micro Processor. My experiment focused on developing thermal control and data acquisition schemes using these micro processors. My focus was on controlling the temperature of an aluminum block to be used as a microscope hot stage. I initially learned how to heat up and control the temperature of the stage with the use of a variac with on/off control. However, this approach exhibited considerable overshoot and ripple in temperature fluctuation. I took on the challenge of developing a P Basic Program that would allow control using only the micro processor without using the variac, and that would allow a fast heating rate with the minimal ripple. Our program included proportional control and allowed the stage to heat up quickly with both a minimum overshoot and excellent control. Data was acquired to demonstrate the improved performance.

Alloxan-Induced Diabetes in Vertebrate Animal Models

Brittani Giles

Advisor: Dr. Adriel D. Johnson, Sr.

Diabetes mellitus is a common metabolic disorder characterized by chronic hyperglycemia. Type 1 diabetes results from insulin deficiency caused by cellular-mediated autoimmune destruction of pancreatic β-cells whereas Type 2 diabetes is classified by insulin deficiency and resistance. Alloxan-monohydrate is chemical compound that induces diabetes in laboratory animals. Raman spectroscopy is an established technique that uses scattered radiation to detect chemical properties of materials and now biological tissues. The objectives of this research are to investigate the physiologic effects of alloxan-monohydrate in rats and to observe if the chemical composition of islets cells differs in alloxan-treated animals versus controls. Sprague-Dawley rats were divided into control and alloxan-treated groups. Physiologic saline (0.9% NaCl) was utilized as the control dose and the treatments were freshly prepared alloxan monohydrate dissolved in saline. Each rat received a single (50-75 mg/kg/bw) i.p. injection of alloxan. Experimental diabetes was determined as ≥200 mg/dL. Blood glucose levels were monitored three times weekly over a period of two weeks. Pancreatic islets were then isolated by liberase digestion from the Sprague Dawley rats. Our preliminary results indicate that Raman analysis can be used for detection of chemical structures within islets cells with a significant peak in the 3000 cm^{-1} range for the control islets. Islets isolated from alloxan-treated animals will be scanned at the completion of the study to compare to the controls. It is our goal that continuance with such studies will ultimately give us new information about pancreatic function and a better understanding of conditions like diabetes.

The identification of waste in the registration process at the University of Alabama in Huntsville using Lean techniques

Ashley Johnson

Advisor: Dr. Barbara Lucius

In this report we analyzed in detail the process of switching from general advising to specific departmental advising. We identify the dominate waste as idle time and over-processing and propose two possible alternatives to improve the process. Our improvements will lean the process and make it more efficient thereby increasing the value the customer, or student in this case, perceives.

Saccromyces cerevisae as a biosensor for detecting potential toxins in food and water

LaChaundra Johnson

Advisor: Dr. Leland Cseke

For some time, current research has been improved and enhanced through the use of living organisms as biosensors. The most common organism used as a biosensor is different types of yeast cells. In this experiment, *Saccromyces cerevisae* is the yeast used as a biosensor for detecting the presence of toxin administered to the colonies of yeast. The experiment involved various growth curves of the cell and further administering various concentrations of toxins to the cells and observing the affects of the toxin on the growth of the *S.cerevisae*. Different mutant strains were tested and observed to conclude which mutant was the most effective of ridding itself of a certain concentration of toxin. Through testing the effects of the toxins on the growth of the cells one can further test toxins present in our everyday drinking water and food and further prevent possible contaminants from harming us.

Electron Cyclotron Resonance Thruster

Thomas Robertson

Advisor: Ms. Barbie Gardner

The ECR better known as an electron cyclotron resonance thruster is a small experimental electric thruster, in which power is supplied via Electron-Cyclotron Resonance (ECR) absorption of microwaves by the propellant gas. Testing of this thruster occurs in a vacuum chamber, where the pressure must be low so that the electron or ions do not equilibrate. The plasma for the thruster is formed from a cold gas (more likely to be argon gas) by the absorption of microwaves through the ECR. The free electrons circle the magnetic field lines at a set frequency, where a charge is then created. The power absorbed through the ECR selectively heats the electrons to a temperature well above that of the ions and neutrals. The heated plasma is then expanded through a magnetic nozzle to produce a high speed jet exhaust. Noble gases are used in this experiment to avoid the complications associated with the laboratory environment. The main objective of the research is to explore the physics of microwaves absorption in an over dense plasma.

Quantitative Biuret Analysis

Kristen Vance

Advisor: Dr. Emanuel Waddell

Our goal in this experiment was to find the concentration of BSA of an unknown sample. By using the spectrophotometer, we discovered that the unknown absorbance was 0.111. By plotting a graph of absorbance versus concentration, we concluded that the unknown concentration was 0.33 mg/mL. I learned that by using a spectrophotometer we can find the absorption of light in proteins.

Testing the Function of RNAi Genes from *Laccaria bicolor*

Jorja Wright

Advisor: Dr. Bruce Stallsmith

RNA interference (RNAi) is a gene silencing mechanism mediated by short double stranded RNAs about 20-25 nucleotides long. The key effector of RNAi is Argonaute, the main component of the RISC complex. Argonaute mediates gene silencing by cleaving or degrading targeted RNA transcripts. Studies have confirmed Argonautes play a role in gene silencing in plants, fungi, and animals. Functional RNAi proteins have not been identified in the ectomycorrhizal fungus *Laccaria bicolor. L. bicolor* forms symbiotic relationships with various North American trees and gene silencing is required for relationship development. However, the mechanism of gene silencing is unknown. We have identified three hypothetical Argonautes from *L. bicolor* and we aim to determine their functional activity by testing their ability to restore cell cycle progression in Argonaute mutants of the fission yeast *Schizosaccharomyces pombe*. Fission yeast *ago* mutants are sensitive to hydroxyurea and thiabendazole treatment, leading to decreased growth due to cell cycle arrest. These mutants exhibit increased binucleation and septation due to cycle arrest. We hypothesize that *L. bicolor* Argonautes will compliment and restore wild type growth in fission yeast ago mutants in the presence of

hydroxyurea and thiabendazole. We will use transgenic techniques to complement fission yeast mutants with *L. bicolor* Argonautes, followed by hydroxyurea and thiabendazole treatment to conduct growth analysis. Complementation and functionality will be further confirmed by light microscopy to quantify binucleation and septation levels in fission yeast. We expect to see restored wild type growth and decreased binucleation and septation in the fission yeast once complimented.

THE UNIVERSITY OF SOUTH ALABAMA

ALSAMP SCHOLAR ABSTRACTS

Detection of Dissolved Organic Nitrogen in Suwannee River Fulvic acid through Immobilized Metal Chromatography and Total Nitrogen Analysis

Priscillia Ajaegbu

Advisor: Dr. Alexandra Stenson

Humic substances are a mixture of organic substances that are composed of animal and plant degradation products which results in varying molecular structure of humic substances due to the geographic location of specific animals and plants. Since humic substances are made of complex mixtures, the SRFA sample must be pre-fractionated before MS analysis. SRFA underwent HPLC separation and were fractionated into 100 fractions called the 800 series. From that series, an early eluting fraction and a late eluting fraction were chosen to test if sample complexity could be reduced by IMAC. After MS analysis and data plotting, there is evidence that the early eluting and later eluting SRFA samples are different. One hypothesis is that the SRFA retained in the IMAC columns contains pre-concentrated DON. Currently attempts to isolate and pre-concentrate Dissolved Organic Nitrogen in NOM have been made in this research. The method used to isolate the DON is Immobilized Metal Affinity Chromatography (IMAC). Past literature stated that DON has a greater affinity towards soft acid metal cations at high pH levels than overall DOM. For this reason, Ni^{+} IMAC columns and buffers at pH 10 have been used to retain the DON from DOM. Once the DON is pre-concentrated, it will undergo Total Nitrogen Analysis.

Diurnal Evolution of Wind Speed and Direction at Dauphin Island during 2009

Jesse Kelley

Advisor: Dr. Sytske Kimball

University of South Alabama Mesonet data from the Dauphin Island weather station will be used to investigate how wind speed and direction varies during a 24 hour (or diurnal) period. Data from 2009 will be used initially; later years will be added as the project continues. The Mesonet weather stations collect wind speed and direction data at 2 and 10 m, every minute. Additionally, wind gusts at 2 and 10 m are automatically derived and stored. Wind direction is measured in terms of compass degrees and, hence, a discontinuity exists at 0 and 360 degrees. Therefore, wind direction cannot be averaged in the traditional sense. To overcome this problem, the individual wind components (zonal and meridional) are calculated for each wind speed/direction observational pair. Those quantities are then averaged instead. These averages can then be converted to an overall average wind speed and direction.

It is likely that diurnal wind speed and direction cycles change by season as well. This will also be investigated. Knowledge of how wind speed and direction varies diurnally and by season can be important to various applications. One important topic is wind energy production. Low-level winds are used to drive ocean models; therefore, deriving realistic diurnal wind cycles will allow more accurate modeling of ocean currents. Ocean currents impact oyster spawning as well as the dispersion of pollutants as was made painfully obvious by last year's Deepwater Horizon oil spill.

Insect Herbivory in Marshes: An Assessment of Methods

Tresher Moorer

Advisors: Dr. Anne Boettcher and Ms. Jessica Dean

Herbivore-plant interactions have been shown to play central roles in determining the structure of salt marsh communities. In order to accurately understand feeding patterns in these systems, we must develop and assess methods for collecting samples. This preliminary study focused on how herbivory varies along three replicate marsh transects, from the shore inland using two methods to assess herbivory. Samples for this assessment were collected in August 2010 from a *Juncus roemerianus* dominated marsh at Big Lagoon State Park, FL. Along each 80 m transect, at the waters edge, mid-transect, and inland, the total number of *J. roemerianus* leaves and leaves grazed within two 0.25m^2 quadrats were counted and the proportion grazed determined. In addition, at adjacent sites along each transect 20 random leaves were collected and assessed for proportion grazed. Level of grazing by these two methods was compared using a paired *t*-test. Differences in grazing from shore inland were compared using a single factor ANOVA. Although there were no differences in level of grazing from shore inland, the two methods for assessment of grazing yielded statistically different results, but similar patterns. Future studies will focus on seasonal differences in grazing and on assessment of a third, volume-based measure of herbivory.

The Synthesis and Use of Zwitterionic Micelles for the Remediation of Aqueous Systems

Adirika J. Obiako

Advisor: Dr. David C. Forbes

Micelles been used over the years in a number of applications. Two would include the remediation of groundwater at contaminated sites and the transport of drug molecules to a site of action. This is due to the surfactants ability to trap materials in micelles that form when the surfactants are present at the critical micelle concentration (CMC). The formation of micelles greatly facilitates the transport of materials in aqueous systems. In addition to organic compounds, micelles have been shown to remove metals from aqueous systems. The focus of our research is to prepare surfactant motifs that are interconvertable between various modes. That is they can be converted between water soluble zwitterions to water insoluble ylide compound. The compound that is being synthesized Is a carboxyl methyl betaine. In this form the compound is in a zwitterionic form, though decarboxylation, it is converted to an ylide. Once we have successfully seen that the surfactant that is being synthesized will form micelles, we plan to explore the fate and transport properties involving organic compounds and metal species.

Evaluation of Current Methods to Determine Submarine Groundwater Discharge

Rebecca S. Webb

Submarine Groundwater Discharge (SGD) is groundwater that flows from underground aquifers to rivers, streams and oceans. The source of the water in underground aquifers is mostly precipitation, and therefore fresh water. SGD has been largely ignored until recently, as it is now recognized as a source of concentrated nutrients in large bodies of surface water. Because of this concentration, it has been shown to be particularly influential in oceanic ecosystems. The device that is currently used to measure SGD is a traditional Lee-type meter device. This type of meter is recharge only, measuring the precipitation run off into the soil. However, because of wave action in coastal regions, there is recharge and discharge in the soil. It has been theorized that this device may yield inaccurate results in coastal regions where waves are present. The long term goal of this research is to test that theory through an experiment that uses three seepage meter devices: one device that is recharge only (into the soil), another that will be discharge only (out of the soil), and the third will be recharge-discharge (two way). These devices will be tested in the University of South Alabama wave basin, an experimental set up in the Civil Engineering Lab. The results will then be compared with theory and practice. This poster summarizes the first year of a multi-year plan.

Notes

Notes

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