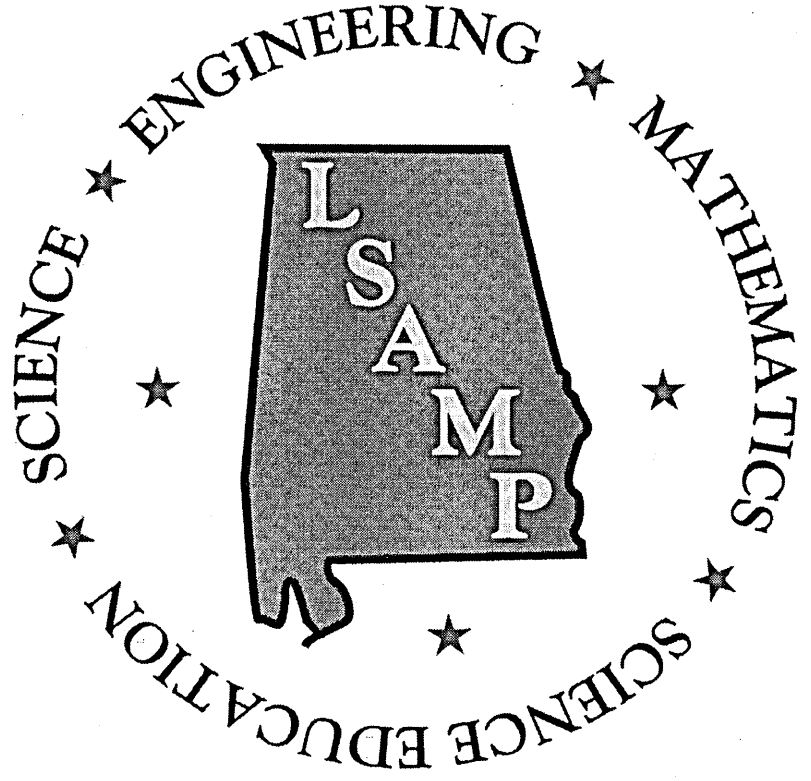
Alabama Louis Stokes Alliance for Minority Participation

ALSAMP Scholars and Bridge to the Doctorate Fellows 2012 Spring Research Conference

ABSTRACTS



April 15-16, 2012

The Hotel at Auburn University and
Dixon Conference Center
Auburn, Alabama

ALSAMP TRANSITION SCHOLARS, UNDERGRADUATES AND BRIDGE TO THE DOCTORATE FELLOWS ABSTRACTS

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ALABAMA A&M UNIVERSITY

ALSAMP TRANSITION SCHOLAR ABSTRACTS

Can Leptin Enhance Fertility of Crème D'Argents?

Jonathan Howard Jr.
Advisor: Dr. Jacqueline Johnson

Rabbit breeders have experienced difficulty maintaining the Crème D'Argent breed and reproducing live offspring over the last few years. Production rates have declined causing the American Livestock Breeds Conservancy (ALBC) to place the crème D'Argents on their watch list. Leptin, a hormone produced by fat cells has recently been shown to enhance fertility in species such as mice, rats, and rabbits. The purpose of this project was to administer recombinant Leptin, observe estrus and mate the does. After the does kindled, assessment of Leptin effects on crème D'Argent and New Zealand white rabbit breeds were determined.

Accurate Reverse Engineering on a 3-D Worn Out Automotive Part

Devin Simmons
Advisor: Dr. Mohamed Gadalla

A weathered automotive part is scanned from a top, bottom, and a 360 degree view using the Next Engine 3D laser scanner. After the scan is completed the laser scanner yields an image of the part with point cloud data. Unwanted datums are removed, and holes are filled using techniques within the software and others. Finally, an accurate solid model is created using the point cloud data and converted to a .stl file. From the .stl file a prototype is created and tested in real life applications.

The Production of Silver Nano Particles

Cheyenne B. Singleton
Advisors: Dr. Vernessa Edwards and Dr. Jacqueline Johnson

Nano-particles have been applied in the following areas: Agriculture, Materials, Telecommunications, Chemicals, Aerospace, Environment, and Defense. It is not surprising that many living organisms, both unicellular and multi-cellular, are producing inorganic materials either intra- or extra-cellularly. Some well-known examples of bio-organisms synthesizing inorganic materials include magneto tactic bacteria, diatoms, and S-layer bacteria. Boil and drain Aloe leaves. You should notice the water change into a very light green color. Throw away the pulp from the Aloe leaves, but keep the aloe juice. Take a small sample to use in the spectrometer. The more time that passes you should notice the color change into a smoky gray. Measure the spectra of the Aloe juice in intervals. Boil 100 mL of distilled water. Take 0.019 grams of silver and stir into water. Take 5 mL of Aloe juice and stir into the silver solution. You should notice a change in color from a pastel green to a dark caramel. Take a small sample to use in the spectrometer The Silver nanoparticles nano fluid produced using Aloe juice had the broad absorption (412-420nm) after 25 minutes. The silver nanoparticles nano fluid produced by Aloe Filtered Broth had the best absorption peak (410nm) after 10 minutes. In conclusion, I was able to discover the production of nano-particles in an interesting fashion- using extracellular biosynthesis process. I was able to go through the process many scientists venture through to get the accurate combinations one may require. I also discovered the many applications of nano-particles.

Something New...Food Industry Product Development

Brian C. Woods
Advisor: Dr. Josh Herring

In the food industry, new product development is the term used to describe the complete process of bringing a new product to market. A product is a set of benefits offered for exchange and can be tangible in this sense. There are two parallel paths involved in the product development process: one involves the idea generation, product design and detail engineering; the other involves

market research and marketing analysis. Companies typically see new product development as the first stage in generating and commercializing new products within the overall strategic process of product life cycle management used to maintain or grow their market share. The product I am creating comprises two of the main trends for 2012 which are gluten free and dairy free. The product will be a white chocolate wafer candy bar.

UNDERGRADUATE ABSTRACTS

Plasma Polymerization, Atmospheric-Pressure Cold Plasma

Roderick Gray
Advisor: Dr. Vernessa Edwards

The protocol for effectively mixing wood and thermoplastics has been extensively studied through-out the scientific community. It is duly noted that wood and thermoplastics are not compatible for mixing: wood is hydrophilic (attracts water) and thermoplastics are hydrophobic (repels water). Plasma polymerization can be used to alter the surface chemistry of the wood; potentially, improving the interaction between wood and thermoplastics. In this experiment we attempt to interpret and model how mass deposition occurs within our atmospheric pressure cold plasma (APCP) reactor. Deposition rates are determined utilizing a microbalance while atomic force microscopy (AFM) and scanning electron microscopy (SEM) will be utilized to identify changes in surface topography. In order to analyze mass deposition as a function of placement within the reactor, the substrates were varied by r (radial distances) and z (depth), throughout the reactor. For the study of z (depth) we select four positions away from the grounded mesh, r (radial distance) points are arbitrarily chosen. The results show a trend for mica, as depth increases so does mass deposition. Whereas for filter paper the mass deposition varies throughout the z (depth) position. Future work involves testing the reproducibility of these results as well as analyzing the data to conclude an acceptable region for continued testing. The goal is to plasma polymerize a surface onto wood particles to create improved compatibility with thermoplastic resin matrix. This potentially will improve the composite performance.

Power Distribution

Antoine Mordican
Advisor: Rob Robinson

Power distribution is the final stage of delivery to customers. Power distribution carries electricity from the transmission stations to our homes and businesses. Electricity voltage has to be reduced before reaching our homes. The primary aim of this research is to share the knowledge and experience I have gained over my summer internship with Alabama Power/Southern Company.

The Prototyping of the Design Process

Nichelle Stewart
Advisor: Dr. Mohamed Gadalla

The Design Process consists of many things, but in this case the focus is on STL (Standard Tessellation Language) a file which is similar to the CAD (Computer Aid Design) format. Almost all of today's CAD systems are capable of producing an STL file. This particular file is normally used for prototyping and manufacturing with a 3D system. This format approximates the surfaces of a solid model with triangles. Prototyping is the method for creation of parts; those parts are then decomposed and loaded to a machine with the use of lasers. The machine used is known as the Spectrum Z510 3D scanner. This machine has the ability to build models with moving parts because parts are separated by loose powder, they can be built up against other parts without joining.

ALSAMP TRANSITION SCHOLAR ABSTRACTS

E-Commerce Security

Jenice Craig
Advisor: Dr. Michelle Foster

Electronic commerce or e-commerce refers to a wide range of online business activities for products and services. It also pertains to any form of business transaction in which the parties interact electronically rather than by physical exchanges or direct physical contact. E-commerce is usually associated with buying and selling over the Internet, or conducting any transaction involving the transfer of ownership or rights to use goods or services through a computer-mediated network. The advantages of e-commerce for business entities is that e-commerce can increase sales and decrease costs. E-commerce also has its disadvantages. For all the advantages of E-commerce, the major stumbling block is security threats. People using the Internet for commercial transactions always remain at risk of their confidential information such as password and credit card details being stolen or their identity hijacked by criminals. We will examine various techniques to prevent hackers from gaining access to this information.

The Analysis of the Kinetic and Potential Energy of a Falling Comet

Zachary Houston
Advisor: Dr. Cleon Barnett

Space exploration has brought about many new discoveries. We intend to examine the kinetic and potential energy of a comet as it falls to the Earth's surface from outer space. Mathematica Software will be used to write a simple program that will assist in this endeavor. We will chart our results and give a detailed analysis of our discovery.

Tracking the Trajectory of an Object in Two Dimensional Space

Eugene Johnson
Advisor: Dr. Cleon Barnett

Every day, mathematicians and engineers alike examine the wonders of projectile motion. We will examine the motion of an object in two dimensional space using Mathematica Software. Through the use of this software, we will explore the movement of an object at various times during flight and with a number of other parameters which will affect the outcome of the projectile's motion.

How Cannibas (Marijuana) helps people cope with the most painful diseases

Jasmine Reese
Advisor: Dr. Dianne Jordan

In this research project I explored that the drug commonly known as Marijuana, yet scientifically classified as Cannibas, has been found to help patients deal with very harmful diseases like HIV/AIDS. For instance, patients have credited the drug with increasing their appetite. This project will help people to understand how this organic drug is able to outperform many of the most frequently prescribed drugs on the market. It will also give information on how it kills pain for some of the most painful diseases.

Effects of Excitatory Inhibitory at Post Impulses at Post Synaptic Neurons

David Stephens
Advisor: Dr. Kartz Bibb

In the human body, the neuron sends messages across membranes to other cells. Impulses sent across membranes are either inhibitory or excitatory. The purpose of this study is to show the effect that the excitatory and inhibitory impulses have on a neuron when both impulses reach the neuron at the same time.

Numerical Solutions of Ordinary Differential Equations A Equation of Numerical Methods

Constance Taylor
Advisor: Dr. Michelle Foster

Ordinary differential equations have unknowns which are functions of only one independent variable and contain one or more of its derivatives. The Euler method, modified Euler method, and the fourth order of the Runge-Kutta method were the numerical methods used to approximate the solution of the initial value problem $y' = 4x-2y$, when $y(0)= 2$.

AUBURN UNIVERSITY

ALSAMP TRANSITION SCHOLAR ABSTRACTS

The Reason We Call Them Man's Best Friend

Darnell Bunch II
Advisor: Dr. Overtoun Jenda

This research has been collected on the relationship between humans and canine friends. This research is based, specifically, on how dogs have evolved to live and react with human activity. In addition, how evolution has shaped them to become our best friend and companion.

Chocolate and a Happy Heart

Kaylah Hagler
Advisor: Dr. Overtoun Jenda

The purpose of this study is to compare the effects of eating chocolate and positive attitudes. It is hypothesized that eating dark chocolate vs. milk chocolate will lead to a more positive attitude and a happy, healthy heart. The group of people for study will be separated into two groups. Group A will eat dark chocolate and be surveyed. Group B will eat milk chocolate and be surveyed. Group A should have a more positive attitude vs. Group B. The results should confirm that eating dark chocolate creates a more positive attitude. This should be consistent with research that states that eating dark chocolate leads to a healthier heart.

Sex Selection: Is It Ethical?

Alexis Jackson
Advisor: Dr. Overtoun Jenda

The growth of technology, as it applies to medicine, has far surpassed expectations in recent years. As new machinery, methods, and ideas are discovered, a variety of new opportunities are presented. *In Vitro* fertilization, also known as a "test tube baby", is the process in which an egg is fertilized outside of the body and then implanted. This method is highly essential for those who are infertile or have difficulties becoming pregnant and has a significantly high success rate. However, *in vitro* fertilization is very costly

and significantly painful. Recent studies have shown the ability to choose the child's gender and physical characteristics through this fertilization mechanism. Initially, the idea of this process was used to prevent serious, genetic diseases. However, it has developed into an ethical case. This research will discuss the economical, biological, and ethical effects of *in vitro* fertilization.

Dangerous Repetition in Workouts Causing Injury to Our Youth

Alexis McMillan
Advisor: Dr. Overtoun Jenda

This research revolves around the effects of the overuse of certain muscles. It focuses on gender and whether or not it plays a role in the amount of injuries resulting from the overuse of muscles. As an athlete, observing injuries of many teammates made this an interesting research topic. Athletes from Auburn's (both women and men) basketball teams that have been injured will be interviewed and prompted to discuss what injuries they had.

Preserving the Mind

Bryshal Moore
Advisor: Dr. Overtoun Jenda

Alzheimer's is a degenerative disease that is the most common form of dementia and the seventh leading cause of death in the United States. It is caused by plaques and tangles in the brain. Despite the prevalence and slow progress of this disease there is no cure for Alzheimer. It is suggested that early detection of Alzheimer is the best to slow the onset of symptoms. Although this disease is caused by genetics, research has found that certain lifestyle behaviors can have an effect on the disease. Physical activity and mental exercise could possibly be helpful to the health and function of the brain. Though research continues on this disease early detection and prevention methods are the best solutions to reducing the prevalence of Alzheimer's disease.

UNDERGRADUATE ABSTRACTS

The Domestication of Animals

Amani Hill
Advisor: Dr. Overtoun Jenda

This research focuses on how humans have come to domesticate animals for all the different purposes and needs throughout time. It is known that ancient Egyptians used to have cats as pets for people of authority; however, through time Europeans bred beagles and other small dog breeds to hunt, horses for transportation before cars and cows, as well as chickens and pigs for food. As humans grew and industrialized, the need for domesticated animals strayed more and more away from transportation, hunting, and food and more towards just pets and companions to the human race.

New Age Stimulants and the Body

Gabriel Howard
Advisor: Dr. Overtoun Jenda

This research involves the stimulants that have been sweeping our generation. Over the past few years, stimulants such as Adderall, Vyvanse, and Ritalin have been popular among students. Even though these stimulants have been prescribed to students for Attention Deficit Hyperactivity Disorder (ADHD), some students abuse these prescriptions. This has been a fairly recent issue that is not talked about much. The research will give the history and background information on the drugs. Most people aren't aware of how these drugs affect the body so the poster will uncover the mystery of these stimulants. Medicines for ADHD affect the body, mind, and mood. Most people don't know the scientific reasoning for these effects such as changes in the recipients' eating habits, changes in flow of neuron transmitters in the brain, and changes in the recipients' mood. All information will be retrieved from the internet as well as experiments done by other universities.

MILES COLLEGE

ALSAMP TRANSITION SCHOLAR ABSTRACTS

Phenols and its Derivatives in Used Tires by UV-Vis Spectrophotometric Methods

Trea 'Vahn Hubbard
Advisor: Dr. Sam Subramanian

Recycling used tires is a challenge in recent years. Several methods have been adopted to recycle the rubber, the metals and the lining of the tires. Incineration and controlled pyrolysis yield smaller organic molecules that can be utilized as fuels. Some of the useful products of controlled pyrolysis include phenol and its derivatives. The viability of using phenolic byproducts as valuable fine chemicals is investigated. A study on the recovery of these compounds from pyrolysis was carried out in our research. After controlled pyrolysis of tires, the residues were extracted with dilute sodium hydroxide solutions and converted to chromophoric compounds (λ_{max} = 625 nm) using ammonia, and hypochlorite. Using UV-Vis spectrophotometric methods, the amount of phenol released at various temperatures during pyrolysis was determined.

An Analysis of Lead Concentrations in Western Jefferson County, Alabama Area Parks and Playgrounds

Andrew Williams
Advisor: Dr. Felicia Cunningham

This ongoing study examines lead concentrations in parks and playgrounds in Western Jefferson County, Alabama. Soil and paint samples were examined for lead content and concentrations. Lead is a heavy metal that is considered toxic to human beings. Lead poisoning is caused by the ingestion or inhalation of lead. Lead-based paint and lead-contaminated dust, soil, water and air are common sources of lead poisoning in children. Children under the age of 6 are especially vulnerable to lead poisoning. Lead poisoning in children can severely affect their mental and physical development. Childhood exposure to lead in the older suburbs of Western Jefferson County has long been an issue of concern.

OAKWOOD UNIVERSITY

ALSAMP TRANSITION SCHOLAR ABSTRACTS

The Synthesis of Gold Nanoparticles and their Relevance in the Future of Alternate Medical Pathways

Kaleem Burton
Advisor: Dr. Kenneth LaiHing

Nanotechnology is gradually being considered the future of medical practices because of the sheer variety in application it offers. In the case of colloidal gold, the applications vary from drugs to tumor detection. The focus of this research is to differentiate the nanoparticles in order to find the most efficient variety for medical application. The variation in the particles is achieved by not only differences in the concentration of the stock solution made, but also by the intensity of heat as well as the vigor of the magnetic stirring bar used. The stock solution was made by dissolving one gram of $H[AuCl_4]$ with 250 mL of water. The stock solution then had to be reacted with Sodium Citrate in order to reduce the Au^{3+} cation to neutral gold atoms. The spontaneous reaction was sped with the aid of heat, and the solution was stirred so that the particles would be evenly dispersed and their sizes uniform. The concentration and size of the particles were determined using UV-Visible spectrometry and Dynamic Light Scattering. These findings will ultimately be used to optimize particles size for application it will be used in.

Electrical and Mechanical Stimulation of Electrotonic Potentials in the Venus Flytrap

Colee Mitchell
Advisor: Dr. Kenneth LaiHing

Electrostimulation of electrical circuits in the Venus flytrap induces electrotonic potentials propagating along their leaves. The instantaneous increase or decrease in voltage of stimulating potential generates a nonlinear response in plant tissues. Any electrostimulation that is not instantaneous, such as sinusoidal or triangular functions, results in linear responses in the form of small graded potentials. The amplitude and sign of electrotonic potentials depend on the polarity and the amplitude of applied voltage during electrostimulation. The duration of electrotonic potentials does not depend on the amplitude of stimulating voltage. Electrical responses in the Venus flytrap were analyzed and reproduced in the discrete electrical circuit. The information gained from this study can be used to elucidate the intracellular and intercellular communications in the form of electrical signals within plants.

The Synthesis of Platinum Nanoparticles and their Relevance in the Future of Alternate Medical Pathways

Iditagar Moise
Advisor: Dr. Kenneth LaiHing

Nanoparticles are particle with dimensions less than 100 nanometers. The use of nanoparticles in the medical field has been gradually increasing because of the many different applications that they present. Platinum is being used to help transform nanofibers by incorporating the nanoparticles into the fibers . Drugs may also be attached to these nanoparticles to transport them to the part of the body that needs to be treated. The focus of this research is to find the best means of transport for drugs, using different types of nanoparticles for the medical application. Platinum nanoparticles are prepared by reducing $PtCl_4$ with sodium citrate. The concentration and size of these particles are determined using Visible Spectroscopy and Dynamic Light Scattering. These nanoparticles average 14nm in diameter. This research ultimately will be used to verify which type of nanoparticles is best suited for medical application.

Protease Modulation in Methicillin-Resistant *S. aureus* (MRSA) in Response to Sub-Inhibitory Concentrations of Selected Antibiotics

Briana Moncur
Advisor: Dr. Kenneth LaiHing

Methicillin-Resistant *Staphylococcus aureus* (MRSA) is a powerful superbug. MRSA infections range from a small abscess to toxic shock syndrome. It is imperative that we find ways to reduce pathologies caused by MRSA. The purpose of our study is to analyze the expression of MRSA virulence factors in the presence of selected antibiotics. It is our hypothesis that *S. aureus* can down-regulate the expression levels of proteases in the presence of sub-inhibitory concentrations of selected antibiotics. MRSA strain 148 grew better in the presence of chloramphenicol and carbenicillin antibiotics (sub-inhibitory) in comparison to the ATCC strain. Total protease assessment showed that in the presence of sub-inhibitory concentrations of carbenicillin (10 ng/ml), ATCC *S. aureus* cell-associated protease activities were decreased by 14% where MRSA protease activity increased by 3%. In the presence of chloramphenicol (1 ng/ml), there was a 20% reduction in *S. aureus* ATCC and a 34% reduction in MRSA strain 148 of total cell-associated protease activities. Analysis of ScpA protease expression in the presence chloramphenicol (1 ng/ml) showed a 66% reduction in cell-associated ScpA in the MRSA strain 148 and a 50% reduction of ScpA expression in the ATCC strain. In the presence of carbenicillin (10 ng/ml), there was a 13% (MRSA 148) reduction and 9% reduction (ATCC) when incubated of ScpA. In conclusion, the data shows that MRSA protease activities are modulated more significantly than the ATCC strain by certain antibiotics. Information obtained through these studies will help the medical community develop new therapeutic targets against *S. aureus*-related pathologies.

Development of New Hydrogen Bond Descriptors for Use in Quantitative Structure – Activity Relationships

Gregory Roper
Advisor: Dr. Kenneth LaiHing

The theory of atoms in molecules is being used to develop hydrogen bond descriptors for modeling solvation related properties. Theoretical descriptors are being derived from a topological analysis of the electron densities of hydrogen bond donors and hydrogen bond acceptors. The electron density of a molecule represents a physical observable. We anticipate that meaningful correlations between electron density-based properties and solvation related properties will be discovered. Those electron density-based properties giving meaningful results will serve as hydrogen bond descriptors that can be easily calculated for any molecule of interest and used in QSAR. This will eliminate the need to perform time-consuming and condition-dependent experiments and calculations that are presently required for hydrogen bond scales and quantum-chemical calculations on hydrogen bond complexes. A set of 50 hydrogen bond donors and 67 hydrogen bond acceptors, each with a single hydrogen bond donor or hydrogen bond acceptor site, were selected along with their $\log K_\alpha$ and $\log K_\beta$ values, where K_α and K_β are hydrogen bonding equilibrium constants of the hydrogen bond donors and hydrogen bond acceptors, respectively. An optimized geometry of each structure was calculated at the Hartree – Fock level of theory with a 6-31G** basis set. This was followed by a single point calculation with a 6-31G++ basis set. The wavefunction files needed for Bader's atoms in molecules (AIM) analysis were generated using the 6-31G++ basis set. All calculations were performed using Gaussian 03W running on a PC workstation.

Photochemistry of Sunscreen

Raschelle Smalley
Advisor: Dr. Kenneth LaiHing

Sunscreens are essential for protecting individuals from ultraviolet radiation, which could result in sunburn, aging and cancer. Sunscreen is frequently used by people who enjoy being in the sunlight as well as in the water. The main function of an effective sunscreen is to strongly absorb UV rays, display good photo stability and show small spectral alterations when exposed to UV radiation. During several experiments, different sunscreens were mixed with Decane oil (which represented the oils of the skin) and distilled water (which represented the body of water individuals get in contact with). After being exposed to both sunlight and darkness, the sunscreen samples were then tested on a GC- mass spectrometer and UV spectrophotometer. The GC mass spectrometer determined the chemical compositions of the different sunscreens and the UV-spectrophotometer determined how well the different sunscreens absorbed UV-A and B light. Overall, an effective sunscreen would be able to preserve its chemical compositions after being in contact with oil, water and sunlight. Photochemical reactions were observed with the various sunscreens.

STILLMAN COLLEGE

ALSAMP TRANSITION SCHOLAR ABSTRACT

Genetic Analysis of Histidine Ammonia-Lyase (HAL) Self-Activation

Lindsey Payne
Advisor: Dr. Rosianna Gray

Histidine ammonia-lyase (HAL) (EC 4.3.1.3) catalyzes the nonoxidative elimination of the alpha-amino group of histidine, which is the first step in histidine degradation. HAL has a catalytically important electrophilic group, which was believed to be dehydroalanine for 30 years but has now been found to be a highly electrophilic 5-methylene-3,5-dihydroimidazol-4-one (MIO) group. The MIO group is formed auto catalytically from consecutive alanyl, seryl, and glycyl residues during protein folding. Randomized mutagenesis was done to identify other amino acids residues that are involved in the folding and self-activation of HAL. A plasmid (P14N39) carrying the cloned *HutH* gene, which encodes HAL of *Pseudomonas acidovorans*, was propagated in *Escherichia*

coli XL1 Red cells, which are deficient in DNA repair and therefore have a high mutation rate. As the plasmid replicated, random mutations occurred in *HutH*. The mutagenized plasmids were recovered in *Escherichia coli* XL-1 Blue cells, which do not have a high mutation rate. These XL-1 Blue cells were tested for a decrease in HAL activity. The mutant plasmids with decreased HAL activity were sequenced to see the residue changes at the DNA and deduced amino acid sequence levels.

TALLADEGA COLLEGE

ALSAMP TRANSITION SCHOLAR ABSTRACTS

The Effects of Acid Rain on the Ecosystem: A Study of the Literature

Jacobi Graham
Advisor: Dr. Leonard Cole

There is growing concern among environmentalists and other scientists over damage caused to the ecosystem by acid rain[1]. Acid rain effects all forms of life. It has been stated that the ecological effects of acid rain are most clearly seen in aquatic, or water environments, such as streams, lakes, and marshes. Acid rain also affects plants. It causes slower growth, injury, or death to forests. The damage to the ecosystem caused by acid rain is due to chemicals that fall from the sky. It has been determined that sulfur oxide (SO2) and nitrogen oxides (NO_x) are the primary cause of acid rain[2]. The difference between acid rain and normal rain is the pH. Pure water has a pH of 7.0. Normal rain is slightly acidic and has a pH of 5.5. Over the years the most acidic rain in the U.S. has a pH of about 4.3. Many organisms including fish, frogs, some animals, and plants do not adapt well to acid rain[3]. As a result, reproductive processes in animals are altered and plants are damaged resulting in stunted growth and death.

The Effect of Chemical Pollutants on the Growth of Brine Shrimp

Amber Perdue
Advisor: Dr. Leonard Cole

The use of fertilizer in the agriculture industry is considered to be one of the main sources of pollution of lakes, streams, estuaries. Due to run off, many of those chemicals end up in salt water habitats. When high fertilizer rates are applied which are not in line with codes of good agriculture practice, nutrient losses, e.g. surface runoff takes place and pollutes land-based and aquatic ecosystems.[1] When it rains, a toxic soup of chemicals and bacteria flows out of our cities and fields and into our waterways.[2] Pollutants reduce oxygen content in lakes, streams, and marine waters. The reduction of oxygen in aquatic environments interferes with normal activities of aquatic organisms. This project determines the effects of fertilizer on hatching and growth of brine shrimp.

The Effect of Carbaryl on the Development of Brine Shrimp

Uniqua Shack
Advisor: Dr. Leonard Cole

Pesticides include all chemicals that are used to kill or control pests. The various types include herbicides, insecticides, fungicides, nematocides, and rodenticides. The primary function is to control pests; however some can damage crops; kill vegetation and poison birds and fish. Chemicals pesticides are not very beneficial to marine organisms. Research has shown that pesticides have caused weight loss, sterility, smaller egg production, low predator avoidance, and even a low resistance to diseases. Various aquatic biotas are at risk of being harmed by water contaminated by pesticides. Applying pesticides to any body of water is predicted to have the ability to kill plants that marine animals depend on for their habitat. Pesticides typically kill small organisms in the food chain that eventually lead to a widespread death of others. This project studies the effect of carbaryl on brine shrimp. Carbaryl is an insecticide used to control insects on garden plants and pets.

Effect of Ethanol on the Development of Brine Shrimp

Gabrielle Webber
Advisor: Dr. Leonard Cole

The use of ethanol has increased the ground water contamination problems. The breakdown of ethanol in surface waters through biological and chemical processes potentially results in the consumption of significant quantities of dissolved oxygen in the surface water body which will adversely affect aquatic life. Increased corn production for ethanol is hazardous to marine life because of nitrogen pollution in the Mississippi Atchafalaya rivers.[1] Coastal marine water are often contaminated by fresh water streams polluted with ethanol. Parental ethanol exposure have been shown to effect the central nervous system of the embyo.[2] This research project was design to determine the effects of ethanol on the hatching and development of brine shrimp. The finding of the project shows that ethanol does affect the hatching and development of brine shrimp from brine shrimp eggs.

TUSKEGEE UNIVERSITY

ALSAMP TRANSITION SCHOLAR ABSTRACTS

The Advantages of Blended Wing Aircraft Over Conventional Tube and Wing Aircraft and the Potentials this Plane has for Future Use

Abra N. Davis
Advisor: Dr. Mohammad Javed Khan

The purpose of this project is to explore the possibilities and advantages of the blended wing aircraft and its potential to become a major aircraft carrier. For nearly a century commercial and some military planes had at base been a tubed fuselage with wings attached to the side and an empennage or tail. This design is inefficient, produces a lot of noise, and outdated. There have been other designs that have been introduced for use such as the flying wing design and have been used for the military but commercial aircraft have mainly stuck with conventional. With the blended wing, fuel usage is cut down by 27.5 percent, it can carry 50% more fuel volume than needed for a mission, and the internal design allows for a maximum occupancy of eight-hundred people not including the pilot and crew. Another advantage is the position of the engines, which are on top of the aircraft and has a decibel reading of 63 DBA at takeoff. This project will explore the advantages and disadvantages of the blended wing body concept and identify the aerodynamic, propulsive and structural design elements.

Analyzing the Necessary Steps to Obtaining a Career as a Successful Consumer Goods Developer

Brittany N. Denton
Advisor: Dr. Nadar Vahdat and Mr. Zachary Phillips

Production of consumer goods is a never declining industry in today's society. Chemical engineers are essential in the development of manufacturing processes for the development of products. Chemical engineers apply the basic principals of chemistry with large-scaled manufacturing problem solving to develop chemicals and other products. In order to obtain a successful career as a Chemical Engineer in the consumer goods industry, there are vital steps to take. Basic education includes at least four years of undergraduate education with summer internship experiences in industry and research. This preparation sets the foundation for graduate education or a career in the industry. Chemical Engineers and chemists are expected to maintain occupational growth over the next ten years. In the industry, chemical engineers can be considered project leads for manufacturing processes. Fortune 500 companies such as Procter & Gamble and Johnson & Johnson are desirable for highly motivated, experienced engineers dedicated to the innovative improvement in chemistry and manufacturing.

Improvements in Mechanical and Thermo-Mechanical Properties of E-Glass/Epoxy Composites Using Amino Functionalized Carbon Nanotubes

Johnathan E. Malone
Advisor: Dr. Shaik Zainuddin

The aim of this research is to enhance the mechanical and thermo-mechanical properties of e-glass/epoxy composites by using multi-walled carbon nanotubes (MWCNTs). At first, 0.1-0.4 wt. % of MWCNTs was dispersed in SC-15 epoxy suspension using a combination of ultra-sonication and calendaring techniques. E-glass/epoxy nanocomposites were fabricated at elevated temperatures with the altered resin using hand layup and compression hot press. 3-point bend and dynamic mechanical analysis tests performed on these samples showed a linearly increasing trend in flexural and viscoelastic properties with increase in MWCNTs wt. % loading. Micrographs of epoxy and e-glass/epoxy samples showed that the MWCNTs was uniformly dispersed, good interfacial adhesion between carbon nanotubes and the polymer, and improved interfacial bonding between fibers and matrix at 0.3 wt. % loading. The improved dispersion of carbon nanotubes in epoxy resin leads to increase in mechanical and thermo-mechanical properties of composites.

Soda Can Battery: The Aluminum-Air Energy Source

Lucius M. Rice IV
Advisor: Dr. Naga Korivi

The objective of this research is to explore the development of a soda can battery as a power source. This battery is based on aluminum-air oxidation and reduction reactions. A test prototype was developed with aluminum soda can acting as anode, and a carbon air cathode. The electrolyte was a solution of house-hold salt containing sodium chloride mainly. This first test device yielded a voltage of 0.9 V and a current of 1 mA. Presently, various methods are being explored to increase the current output. Towards this, different electrolytes are being explored in addition to house-hold salt solution. Present efforts are also focused on evaluating series and parallel configurations of the soda can batteries for optimal power and robustness. Electric circuit simulation software such as PSPICE is being employed to model optimal power delivery conditions. This research has implications on studying the feasibility of power generation from recyclable house-hold aluminum metal waste such as soda cans. On a wider scale, this research is relevant because aluminum is the most abundant metal on the earth's crust and the oceans (salt water) cover a major part of the earth's surface. In this era of increasing power requirements globally, it is relevant to study ways to harness these materials for power.

Equivalent Circuit Modeling of Solar Cells

Kristian R. Thomas
Advisor: Dr. Naga Korivi

The recent decades have seen a tremendous growth in industrialization on a global scale. This coupled with the increasing human population has resulted in increasing electric power consumption globally. This has placed significant demands on the existing power generation schemes and has accelerated the need for alternate and renewable energy sources. Solar cells are devices that convert light energy to electricity. The light energy is typically from the sun. These devices are of great interest in the context of renewable energy. At present, research is on-going at a global level to develop solar cell technology further. In this context, it is useful to understand how solar cells would perform in practical applications, especially in terms of driving a load. One method to achieve this understanding is to represent solar cells as equivalent electrical circuits and model them under load conditions. This research involves the modeling of equivalent circuits of solar cells by means of Pspice electrical circuit simulation software. Results will include the effect of various load conditions on the performance of solar cells.

Biodiesel as an Alternative Fuel

Norris W. Watkins II
Advisor: Dr. Heshmat Aglan

In recent years, the United States has been trying to be less dependent on foreign oil and to become more fuel efficient. An alternative fuel that can solve this problem is biodiesel. Processing of biodiesel from waste cooking oil is a subject of economical and environmental importance. The process that is used to create biodiesel fuel is called transesterification. The process involves

removing the glycerin from the vegetable oil or fat. The byproducts that are left behind from this process are methyl esters and glycerin. Unlike other fuels, it has passed all the health effects testing requirements, which means it meets the standards of the 1990 Clean Air Act Amendments, also meaning it is environmentally friendly. Also the Environmental Protection Agency (EPA) has legally allowed biodiesel to be sold and commercially distributed. Biodiesel is also economically friendly because the resources are readily available as waste. The main feedstock ingredients used are vegetable oil, methanol, and potassium hydroxide. In this research project, the processing of biodiesel from various feed stocks is investigated. The chemical formulation, equipment set-up needed for production, the economical feasibility and environmental impacts related to biodiesel production are also studied. Recommendations are also made on how to produce it locally.

BD FELLOW ABSTRACTS

Theoretical and Experimental Investigation of the Fragmentation Behavior of Ceramics

Sandrea D. Brundidge-Young
Advisor: Dr. Heshmat Aglan

Studying the fragmentation behavior of brittle materials is critical from the design viewpoint in commercial, space and defense applications. Dynamic fragmentation is a process in which a body is subjected to a high intensity force that causes the structure to break up into many fragments. This dynamic event can cause other changes in the material besides size reduction. In some materials the size of fragments may be correlated to the mechanical properties of the material. Shock-induced fragmentation involves both physical and statistical analysis. Although fragmentation of materials has been studied by many researchers, there has not been a generally accepted theory of statistical fragmentation. Due to their brittle nature, ceramic materials lend themselves to the fragmentation phenomenon; making them good candidates for theoretical model validation. In the current work, the fracture resistance properties and fragmentation behavior of three ceramic materials with different mechanical properties are investigated. Drop weight impact testing procedures have been adopted to study the fragmentation behavior. Ceramic panels, 100 mm x 100 mm, were used for impact testing. By varying the drop weight height, the samples were tested at three magnitudes of impact energy. The number of fragments and fragment surface areas were determined for the materials. A correlation between the fracture toughness and fragment surface area was established. Attempts are made to theoretlcally analyze the fragmentation phenomena of ceramic materials in view of experimental results. The results of this study will contribute to the body of knowledge concerning the fragmentation of brittle materlals under dynamic loading, with the long term goal of aiding in the development of a widespread theory of statistical fragmentation.

Mimicking a Polymer's Young's Modulus by Studying a Nanoparticle ... on a Computer

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}. The trend with strain rate was reasonable, with higher Young's modulus at higher strain rate. After performing replicates, a correlation between experimental data at lower strain rates will be made to the high strain rate MD data for the polymer system.

Dynamic Characterization of High Performance Carbon/Eposy-CNF Laminated Composites

Morgan Perry Davis Jr.
Advisor: Dr. Mahesh Hosur

The present work is to study the mechanical properties of nanophased carbon/epoxy laminates. The laminates were fabricated using hand layup and compression mold process. For curing, high temperature (120ºC) was used with a post-cure temperature of 177° C. Epon 862 epoxy was the resin system used for this study. Characterization of these fabricated laminates includes flexural,

dynamic mechanical analysis (DMA), and thermal gravimetric analysis (TGA). The next aim is to improve the mechanical properties of these same carbon/epoxy laminates modified with carbon nanofibers (CNFs). The CNFs will be dispersed in the epoxy resin using a combination of sonication and calendaring techniques with 0.5 and 1.0 wt. % loading. Further testing will be performed tailored to the challenges critical to NASA's material requirements.

Synthesis of Monolayer Transition Metals for Electronic Properties

Twaskia S. Johnson
Advisors: Dr. Shaik Jeelani and Dr. Vijay K. Rangari

Molybdenum and titanium sulfide is an important (IV) and (VI) transitional metals for various applications. The Mo (VI) is the most important for chemistry and industry. Molybdenum disulfide has a structure built of closed pack layers of sulfur atoms stack to create trigonal prismatic interstices occupied by molybdenum. Only weak Vander Waals bonding forces exist between layers for both transitional metals. It has promising applications, which include photochemical catalysis, gas sensor, detectors, and optoelectronic devices. The titanium disulfide has been identified as an active cathode material in lithium batteries. Titanium disulfide is favorable due to its high electronic conductivity and large current capacity. The chalcogens have d orbitals and the metal to chalcogens bonds are more covalent, less electronegative, and have accessible energy for d orbitals for sulfur atoms. Nanoparticles were synthesized using microwave irradiation. Formation of the layered structure were synthesized by decomposition of various precursors of $C_{10}H_{10}Cl_2Mo$, $C_{16}H_{10}Mo_2O_6$, $[(C_2H_5)_2N]_4Ti$, $C_{18}H_{26}Cl_2Ti$, and $TiCl_4$. The dichalcogenides were characterized using Rigaku, X-ray diffractometer, transmission, and scanning electron microscopy (SEM and TEM). X-ray results show the physical structures of crystalline nanosized particles. Raman spectroscopy technique is used for chemical identification. Optical imaging and AFM will confirm that single layer dichalcogenide nanostructures and measure the thickness. Photoconductivity measures the transition metals ability to conduct electricity. Photoluminescence energy will be used to identify the certain defects within the metal semiconductors.

Investigation of Processing and Performance of Composite Made with Bio-based Polymer and Surface Treated Flax Fibers

Vertonica Powell
Advisor: Dr. Mahesh Hosur

In this research project, the goal is to fabricate a bio-renewable composite that would represent an environmentally friendly alternative to conventional reinforced composite, without comprising the advantages of using natural fibers. Potassium hydroxide was used for surface treatment of flax fibers. The flax fiber mats are pre-woven flax fabric purchased commercially. The flax fibers were soaked in the chemical solution for one hour, and then washed until the pH level was rendered neutral. Surface modification is done to remove components of the fiber such as hemicellulose, lignin and pectin. The key is to remove as much of these components as possible to avoid moisture or voids in the composite. The percentage of potassium hydroxide was varied from 0% to 5%, to observe the changes in the fiber at different concentrations. Each mat and / or fibers were allowed to dry for 24 hours at 40°C. Treated and untreated mats will be used to fabricate composites with a bio-based polymer using the vacuum bag molding method. The approach to increase the mechanical and thermal properties of the composites is the addition of nanoclay. Currently XRD, SEM, and FTIR test are being done to observe changes in fiber for different concentrations of potassium hydroxide. Mechanical (flexural, tensile, IFSS, and DMA) and thermal (TGA and DSC) testing will be carried out on composite at each concentration percentage to observe the performance of the composite.

Calcium Carbonate ($CaCO_3$) Nanoparticles for Drug Delivery Applications

Diane Render
Advisor: Dr. Vijay Rangari

Targeted delivery of a cytotoxic drug is beneficial to maximize the efficacy of the drug and to reduce the side effects. Recently, nanoparticle-based drug delivery systems are being developed to control the release of drugs in the body, to protect the drugs from enzymatic or chemical degradation, and to attain organ- or tissue-targeted delivery. Studies have shown that calcium carbonate ($CaCO_3$) nanoparticles are highly porous, biocompatible, biodegradable, and have pH-sensitive properties. Such desirable properties make $CaCO_3$ nanoparticles one of the best candidates for biological drug delivery systems. In this study, we are testing both the biological interactive properties of $CaCO_3$ nanoparticles and the potential of the particles to load drugs for biomedical applications. As biocompatible materials, we hypothesize that the nanoparticles themselves will display minimal cytotoxicity to mammalian cells

in vitro and possibly *in vivo*. Cell viability testing was examined using SW-480 (human colon cancer) and NIH/3T3 (mouse fibroblasts) and Lactate dehydragenase (LDH Assay). A stock suspension of $CaCO_3$ nanoparticles was made as 100mg/ml in phosphate buffer saline (PBS) solution, from which serial dilutions were made to treat the cells. After initial rounds of testing, two fold serial dilutions of nanoparticle suspensions starting at 5mg/ml were prepared for the experiments. Cells were treated with the dilutions, and viabilities were assessed. Preliminary data suggest that high concentrations of the particles above .0390625mg physically overburden the cells, but concentrations at or below .009765626mg show insignificant cytotoxicity to the cells tested, and are well tolerated.

Effects of Natural Fillers on the Thermal and Mechanical of Polyurethane Foams

Gregory T. Strawder
Advisor: Dr. Mahesh Hosur

Sandwich composites have long been utilized commercially and industrially due to their high strength to weight ratio, superior bending stiffness, high energy absorption, and excellent thermal and acoustic insulation capabilities. An important component of a sandwich composite is its foamed core which enhances its energy absorption capabilities during impact, deters failure modes, and increases its moment of inertia and improves its bending stiffness. Polyurethane foams are one of the most commonly used core materials due to their high shear strength, excellent damping characteristics, and high energy absorption capabilities. However major drawbacks of polyurethane foams are their relatively low mechanical strength and low thermal stability. One successful solution to these disadvantages has been to infuse fillers into the polyurethane matrix to improve properties, which in turn enhances the overall performance of the sandwich composite. Hence, the major objective of the proposed research study will be to fabricate sandwich composites containing polyurethane foams infused with nanoclay and wood flour (WF) with the intentions of altering the mechanical and thermal properties of the foams. Three types of commercially montmorillonite nanoclays will be utilized for this study: Nanomer® I.28E, Cloisite® 30B, and Cloisite® 10A. The wood floor used for this study is finely grinded from a maple tree. A rigid polyurethane foam will serve as the host polymeric matrix. The resulting foam materials will be analyzed to examine the effect of density and nanoclay and wood flour fillers on the morphological, thermal, and mechanical properties.

Reinforcement of Nylon 6 with Ultra High Molecular Weight Polyethylene via Extrusion Melt Compounding

Garry Ware, Jr.
Advisor: Dr. Vijay K. 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 metal to rubber. In our previous research results it has been shown that dispersing carbon nanotubes (CNT's) within the polymer will increase its strength while decreasing its toughness. In this present research work we will study the polymer blending and CNT reinforcement to counter this decrease in toughness producing a material that has enhanced strength and toughness properties, expanding the possible commercial and military applications of Nylon 6. Literature has shown that the miscibility of the components that comprise a polymer blend can affect ease of processing and property enhancement. Through Differential Scanning Calorimetry (DSC) analysis of Nylon 6 / Ultra High Molecular Weight Polyethylene (UHMWPE) blend at different concentrations will show how the miscibility is affected by the use of compatibilizer. While Dynamic Mechanical Analysis (DMA) and flexure tests are done to reveal the effectiveness of UHMWPE as a toughening agent within Nylon 6.

ALSAMP TRANSITION SCHOLAR ABSTRACTS

A Hard Drive to A Better State

Artez Amerson
Advisor: Dr. Sandra Wood

With new improvements in computer technology happening every day, some feel that there is a need to make computers more user friendly, which means making a computer's speed faster, while requiring less power and lowering the chances of mechanical failure. The part of the computer which is mainly responsible for the current operations mentioned above is the hard drive. Although the hard drives of computers can be efficient, they do not begin to compare with the effectiveness of the new and improved solid state drives. Electrical/computer engineers, along with computer scientists have created these solid state drives in an effort to improve a computer's speed and create more space through the use of nanotechnology. Much unlike the hard drives, there are no moving parts within the solid state drives which lower the chances of mechanical failure for one's computer. Transferring from the hard drives to the solid state drives provides a computer user with new and improved overall system productivity, faster data speed, and allows the user to save more money over the lifetime of his or her computer. To test my hypothesis, the process of making solid state drives was first researched. Then, a comparison between an Apple computer (one that uses a solid state drive) and a Compaq computer (one that uses a hard drive) was conducted. Results showed that the Compaq tends to be more problematic, had slower internet connectivity, and uses more energy. However, the Apple model tends to be more effective for storing data efficiently, had extremely fast internet connection speeds, and uses less energy.

Disparities in Rural Hospitals

Veronica Coleman
Advisor: Dr. John Wheat

In certain counties, there are no hospitals or primary healthcare facilities. This is mainly due to a lack of preventative and diagnostics medicine and doctors willing to work in rural areas. This research project is based on a group of studies conducted by doctors and social workers in and around the black belt of Alabama. The collected research highlights the current need for doctors in the rural communities. It also assesses the community's health status and shows what improvements need to be made. Various organizations such as Rural Minority Health Scholars and Rural Medical Scholars hosted conferences and created scholarships as an incentive to work at a rural hospital. As a result, more medical chose to work in rural areas and stay there.

Nano Geopolymer Research: Proportions of Fly Ash

Cornelius Johnson
Advisor: Dr. Jialai Wang

In this experiment, different types of fly ash were tested and mixed with certain chemicals in an attempt to make a stronger type of cement. The reason that this experiment was conducted was because OPC, or Ordinary Portland Cement, is the most used cement in the United States. The major drawback in this cement is that it releases large amounts of Carbon Dioxide into the atmosphere every year. Because of the recent increase in attention to Carbon Dioxide emission, there has been an increase in researching the ability to create cement that is more environmentally friendly. This has led scientists and researchers to look at many materials that will be able to accomplish this. One such substance that solves to environmental problems is fly ash. Fly ash is the leftover waste after coal has been used. Tons of fly ash goes unused each year. By using fly ash as well as chemicals and carbon nanotubes, there is a large amount of waste that is actually used to help the environment. During the experiment, there were multiple sources of fly ash that were used as a supplier for the experiments. After testing samples that were created using multiple sources of fly ash, it was realized that different amounts of fly ash produce different results as well as different mines produce fly ash that varies in its ability to make a stronger sample of cement.

BD FELLOW ABSTRACTS

Drosophila Melanogaster: A Model for Studying the Long Term Consequences of Juvenile Exposure to Environmental Neurotoxins

James Anderson
Advisor: Dr. Janis O'Donnell

Parkinson's Disease (PD) is one of the most common neurological disorders in the United States and is characterized by the loss of dopaminergic neurons in the midbrain. Although a few genetic factors are known to contribute to PD, most cases of PD have unknown causes. Epidemiological studies have shown that the use of neurotoxic herbicides, such as paraquat, in rural communities have been associated with a higher incidence of PD. However, because PD is a disease of the aging, individuals who are exposed to environmental neurotoxins early in life may not develop the disease until decades after the initial exposure. We use *Drosophila melanogaster* as a model for studying the long terms effects of early exposure to environmental neurotoxins. We demonstrate that when *Drosophila* larvae are fed paraquat, they exhibit PD like symptoms throughout adulthood such as: degeneration of dopaminergic neurons, mobility defects, and lowered dopamine pool levels. We show that treated larvae are more sensitive to a subsequent exposure to paraquat as adults. Additionally, we demonstrate that paraquat treatment of larvae induces chronic neuroinflammation that persists through metamorphosis and into adulthood. This chronic inflammatory response exacerbates the paraquat induced degeneration of dopaminergic neurons. Our data suggests that early exposure to environmental neurotoxins is a risk factor for developing PD, and altering the inflammatory response may ameliorate the symptoms of PD and potentially is a therapeutic option for treating the disease.

Pricing American Options Using Monte Carlo Methods

Jalonda Coats
Advisor: Dr. Zhijian Wu

In the world of finance, options are financial instruments in which a future transaction will occur. An option gives the holder the right to either buy or sell an asset at a predetermined value called the exercise price. These respective options are defined as calls or puts. Even though many types of options exist, for the purpose of this research, we will examine American options. A differing quality about an American option is that it can be exercised at any point prior to expiration to most maximize the profit of its holder. Due to this quality, the methodology and computation to price this type of option remains difficult. Monte Carlo methods generate results by a continuous random sampling of the data. In the case of pricing options, Monte Carlo simulation entails generating various price paths the underlying asset can take, and then calculating the associated exercise price of the option for each path. Next, this method averages these payoffs and finally discounts the option price to the present day value. Because there are different Monte Carlo methods, we will analyze which provides the best projections of the prices of American options.

A Phylogeny and Study of Pollinator Shifts and Floral Traits in the Neotropical Genus *Gasteranthus* (Gesneriaceae)

Cassandra Coleman
Advisor: Dr. John L. Clark

The genus *Gasteranthus*, with 45 currently described species, occurs in Central and South America. Species of *Gasteranthus* have two morphologically different corolla shapes that are adapted for specific pollinators. The hypocyrtoid shape is defined by an inflated ventral pouch and the campanulate shape is defined by a bell-shaped or funnelform corolla. Previous molecular phylogenies of *Gasteranthus* were equivocal of whether or not hypocyrtoid flowers were an apomorphy or plesiomorphy. Molecular sequence data generated from nrDNA (ITS and ETS) and cpDNA (*matKR* and *trnLF*) were generated for 65 taxa representing 31 species of *Gasteranthus* and 34 species from closely related genera. Our data strongly supports that funnelform flowers are associated with euglossine bee pollination, are symplesiomorphic and have evolved at least three times in *Gasteranthus*. Our results also support that *Gasteranthus dressleri* is more closely related to *Cremosperma* and that funnelform flowers in this taxon are convergent. Pollen presentation and nectar reading schedules, as well as pollinator identification and videography were utilized to better understand the role of pollinator mediated diversification of flower forms.

From Langmuir-Blodgett to Molecular Electronics

Marcus Johnson
Advisor: Dr. Robert Metzger

A novel amphiphilic molecule, 7-((4-((4-(5'-(2-hydroxyethyl)-4,4',6,6'-tetramethyl-5H,5'H-[2,2'-bi[1,3]dithiolo[4,5-c]pyrrolylidene]-5-yl)phenyl)ethynyl)phenyl)ethynyl)-9,10-dioxo-9,10-dihydroanthracene-3-carbonitrile (IM-01), synthesized at the University of Alabama in the Woski group by Dr. Ilias Mahmud has been characterized by Langmuir-Blodgett (LB) pressure area isotherms and atomic force microscopy (AFM) for potential use as a molecular rectifier. Incipient to electrical testing is the formation of a uniform on a conducting substrate. Through LB isotherm studies a concentration dependent (250 µL of 2 mg/mL) maximum surface pressure (~55 mN/m) attained by the LB film has been shown upon compression. A lower concentration (100 µL of 2 mg/mL) of the molecule on the water surface reached a maximum pressure of ~30 mN/m. AFM images of the high concentration, high LB pressure transfer ~43 mN/m shows 40 nm high crystals for a molecule that should stand only 3-4 nm depending on the tilt at the substrate surface while AFM images of the low concentration transfer at a pressure of 20 mN/m showed a monolayer that was uniform in height to ~3 nm. With the findings from the monolayer transfer onto silicon a transfers onto a gold substrate were performed with the ideal conditions being a low concentration high pressure transfer (18-20 mN/m) transfer at a transfer rate of 40 mm/min. At any higher rate no transfer takes place, AFM images show that the monolayer is between 3 – 7 nm which infers slight aggregation which may be a bilayer of IM-01.

Investigation of the Magnetic States of Cubic Particles with Unaxial Anisotropy using the Matlab based Micro Magnetic Code M^3

Angelique Montgomery
Advisors: Dr. C.K.A. Mewes and Dr. MT. Mewes

This work investigated the magnetic states of cubic particles with a uniaxial anisotropy using the Matlab based micromagnetic code M^3. In order to better understand the behavior of magnetic materials, one can use micromagnetic simulations to predict the properties of the materials. The calculations for this project were done using a Matlab based micromagnetic code called M^3, for which test script files to simulate the configurations of moments and how they react to one another in a given solid with different energies and length scales were implemented. M^3 calculates the magnetic field of each moment and uses the Landau-Lifshitz Gilbert equation to evaluate each moment until it reaches its equilibrium state. The simulations in this study resulted in single domain, two-domain or multi domain structures. Single domain states are the most fundamental configurations for this system. For stronger anisotropy energy, a curling appears leading to a two-domain state. By further increasing the size of the cube-shaped particle, the system can further reduce its energy by relaxing into a multi domain state. M^3 was designed to simulate arbitrary micro magnetic problems, however in order to ensure its correctness, the results were compared with problems for which the solutions are known and reported in the literature. The results of the current study were similar to those reported in the literature by previous researchers.

Implementation of the Extended Multivariable Modified Positive Position Feedback (MPPF) Control on an Active Structure

Julio Proaño
Advisor: Dr. S. Nima Mahmoodi

One of the most challenging and interesting areas of mechanical engineering is the control of vibrations of flexible structures. A major difficulty in controlling flexible structures is the requirement of an infinite number of elastic modes to fully describe their behavior. In other words, they are considered to be a distributed parameter system that can only be described by a set of partial differential equations (PDEs). One approach which has met with success has been the implementation of active vibration control of flexible structures using smart materials, especially piezoelectric materials. This study focuses on both analytical and experimental implementation of an extended modified positive position feedback (MPPF) controller on an active structure consisting of an Euler-Bernoulli cantilever beam with bonded collocated piezoelectric sensors and actuators. The proposed method employs a first-order compensator to provide damping control and a second-order compensator for vibration suppression. Stability conditions for MPPF control are derived using a Lyapunov's stability analysis. Although a drastic simplification of a real structure, a damped Euler-Bernoulli beam is dynamically well understood and retains the important characteristics of a real structure. In addition, a thin beam is ideal for an experimental testbed to evaluate the performance of MPPF controllers.

Copper Oxide/ Tantalum Oxide Core/Shell Nanowires: Synthesis and Characterization

Lyndon Smith, Jr.
Advisor: Dr. Viola L. Acoff

Core/shell nanowire are of critical importance for energy applications and warrant fundamental understanding at the growth stage to allow for nanoscale materials manipulation resulting in their unique properties. Towards this end, we report a physical vapor deposition approach to synthesize copper oxide/tantalum oxide core/shell nanowires. A parametric study was carried out to determine the effects of time, working pressure, and power on film growth and morphology. Then, a sample from the parametric study was selected for further study on the effect of annealing temperature on the film composition. The growth mechanism of these nanowires and their morphological evolution is also evaluated here using X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS), transmission electron microscopy (TEM), Raman spectroscopy, X-ray photoelectron spectroscopy (XPS), and UV-vis spectroscopy. It was found that the as-deposited film is β-Ta. This phase was identified using XRD and it was noted that it appeared only after sputtering at higher power or for longer deposition time. Higher working pressure inhibits the growth of β-Ta on our copper oxide nanowire substrate. Crystalline tantalum oxide was produced after annealing the film at high temperatures. Future studies are focused on optimizing the core/shell configuration and studying structure-processing relationships of these novel multi-component nanowires.

Going to Great Lengths: Population and Genotypic Effects on Growth and Development in the Mangrove Rivulus

Shane Stanley
Advisor: Dr. Ryan Earley

The mangrove rivulus (*Kryptolebias marmoratus*) is a powerful model organism in which to evaluate differences in growth rates and morphology among genotypes during ontogeny. Populations of this self-fertilizing hermaphroditic vertebrate are genetically diverse with a mixture of heterozygous and homozygous genotypes. We raised F2 generation offspring derived from 33 homozygous wild-caught fish from seven Florida populations. Every 14 days, subsequent to hatching and preceding maturity (e.g. time to first egg lay), we measured total length (mm), standard length (mm), depth (mm, circumference/girth of individual), and mass (g) allowing for an ontogenetic survey of specific growth rates from lineages throughout rivulus habitats in the Florida mangrove ecosystem. Additionally, morphometric analysis software was utilized to quantify *form*. We employed Procrustes-based geometric morphometrics (e.g. centroid morphometrics) to elucidate developmental changes in *form*, uncover patterns of covariation between geographical origin and various measures of size and shape, and decode the genetic contribution to morphological variation. Preliminary data provides evidence for population-level diversification in the ontogenetic trajectories for growth and form.

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. In this study, a cost-effective and energy efficient way of producing Ti-$TiAl_3$ MLCs developed by researchers 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. To measure the impact and residual velocities of the Ti-Al multilayered specimens, perforation testing, using a method developed at The University of Alabama was employed.

Epigenetic Mechanisms Involved in Generating the *Curly Tail* Phenotype

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. 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. 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. This study 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. The following questions will be addressed: Do promoter methylation patterns differ among the three mouse strains used for previous studies? What transcription factors interact with the MIP gene promoter? 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.

The Synthesis of Zinc Oxide Nanowires through Chemical Vapor Deposition

Joseph L. Waters
Advisors: Dr. Patrick Kung and Dr. Margaret Kim

The critical need for additional renewable energy sources has raised the interest in research on Zinc Oxide based high efficiency solar cells because of its cheap manufacturing costs and abundant elements. Zinc Oxide (ZnO) based devices are presently being considered as an effective replacement for TiO_2 based solar cells due to its large band gap (~ 3.3eV) and large excitation binding energy (~ 60meV). In this study, well-aligned ZnO nanowires (NWs) were fabricated on different substrates using thermal chemical vapor deposition and pre-seeding of zinc acetate. The synthesis and characterization of these nanowires were investigated to provide a greater understanding of the physical properties and their potential application in constructing nano-scale electronic and optoelectronic devices. In order to achieve well-aligned ZnO NWs with optimized optical and structural properties, different growth conditions were studied such as temperate, gas flow and pressure. Through our analysis we were able to determine the optimal growth conditions for well aligned NWs. The nanowires were characterized by scanning electron microscopy, transmission electron microscopy, and room-temperature photoluminescence. Preliminary results and the principle of ZnO NW based photovoltaic devices are presented here. Further studies will involve incorporation of different dopants (Al, Mg, etc) in ZnO and their characterization to improve the nanowire electrical properties. By varying the doping concentration, we expect the conductivity of the materials to be easily controlled for device applications.

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

ALSAMP TRANSITION SCHOLAR ABSTRACTS

Transition Metal Complexes Containing Phosphines

Daveckio Burress
Advisor: James Grimes

Phosphorus-donor ligands in transition metal complexes are preferably used to catalyze several types of reactions, including hydrogenation, and hydroformylation. Phosphorus-31 NMR spectroscopy is an analytical technique used to judge the physical properties of inorganic compounds. A resolved spectrum can be obtained on a relatively dilute sample when using the phosphorus-31 NMR spectrum; for ^{31}P there is 100% of isotopic abundance. Phosphorus also has a spin of ½, so it is visible in NMR spectrometry. This type of NMR spectroscopy has a better way of characterization of organic and inorganic molecular structures. Pairs of phosphorus atoms can couple to each other, and can couple to ^{13}C and ^{1}H atoms. The couplings can be sensitive (more reactive) to

the stereochemistry relationship between the coupling nuclei. Using phosphorous transition metal-coupling patterns, the characterization of geometrical arrangement of the phosphine ligand can be deduced. The phosphine ligands are strong sigma donors and weak pi acceptors. A bulkier ligand tends to have a higher dissociation rate than smaller phosphine ligands. At higher ligand-metal ratios, phosphorus groups may retard the reaction, such as hydroformylation. Phosphines are utilized to induce changes in the outcome of catalytic reactions. Phosphorus-based ligands are important in coordination chemistry.

Testing the Structural Integrity of Various Bridges by Laboratory Analysis Using Balsa Wood

Charletta Hawk
Advisor: Jaquice Hughes

Bridges are used every day as mechanisms to provide people with quicker more sufficient routes to get to their destinations. Before bridges are made engineers must test bridge designs on efficiency such as the weight in which it can with stand. They must also consider the cost of welding involved. The truss bridge is a very efficient bridge that uses triangles to distribute the weight sufficiently. The four different kinds of truss bridges are Howe Truss, Pratt Truss, Warren Truss, and K Truss. Using the truss bridge approach engineers can determine how many joints are necessary to withstand the maximum amount of load at the lowest price. With this engineers can see if joints need to be added or taken away to increase weight tolerance and decrease cost. Future engineering majors will construct and test truss bridge ideas. This experiment will test not only the different types of truss bridges but demonstrate how much weight balsa wood bridges can withstand, while monitoring the number of joints needed. This allows future engineers to first see where their bridges failed and how to make their bridges more efficient. After going back and changing the design by adding or reducing the number of joints, the bridge should become more sufficient. The results will show which types of truss bridge can withstand the most amount of weight and is most cost joint related efficient. This allows engineers to test different truss bridge ideas on a smaller scale and make corrections as needed for future projects.

The Evolutionary Linkage between Sickle Cell and Malaria

ShirDonna Y. Lawrence
Advisor: Dr. Linda Luck

Sickle cell anemia is an autosomal recessive blood disorder. A predominant characteristic of this disease includes crescent-shaped red blood cells. Due to the malformation of the red blood cells, they are not able to hold an appropriate level of oxygen. While sickle cell anemia is a disease, it is due to an evolutionary adaptation. The adaptation is seen in individuals that are heterozygous for the sickle cell trait in which he/she only inherits one allele for the sickle cell and does not display characteristics of the disease. However, when an individual inherits two recessive alleles he/she will have sickle cell anemia. In certain parts of Africa, a disease known as malaria infects many individuals. It is a blood borne infection that is transmitted from one individual to the next by insects, mainly mosquitos. However, the plasmodium that causes malaria cannot enter into the cells of an individual that has sickle cell trait or anemia. The purpose of the research to be done is to understand and emphasize how it was discovered that malaria and sickle cell are evolutionarily connected. Facts about the research process will be explained and the results will be stated. Also, new approaches using the chemistry of both the plasmodium and the sickled cells will be broken down to see if it could aid not only in the disease research, but if it could aid in curing sickle cell anemia.

Effects of Hibiscus Tea on Hypertension

Wynesha L. Miller
Advisor: Ms. Nicole R. Gravitt

The purpose of this project is to determine if Hibiscus Tea, derived from the Hibiscus sabdariffa flower, is an effective treatment for Hypertension. Hypertension affects one in three American adults and two-thirds of people over age sixty-five. Blood pressure is the force of blood as it pumps through your arteries. The more blood your heart pumps and the narrower your arteries are, the higher the blood pressure. Normal blood pressure is defined as an average systolic blood pressure of 120 mm Hg and an average diastolic pressure of 80 mm Hg. Systolic pressure measures the pressure in arteries when your heart beats. Diastolic pressure measures the pressure between beats. Hypertension occurs when the average systolic blood pressure is above 140 mm Hg, the diastolic blood pressure is above 90 mm Hg, or a combination of the two.

An Experimental Model of the Population of the Mosquito Fish

Deonnia N. Pompey
Advisor: Dr. Jeanné Hutchison

Environmental researchers have recognized the mosquito fish as necessary for the control of the mosquito population. Because this fish is essential to the management of the mosquito population it is necessary to model the size and duration of the mosquito fish population given various circumstances. Mathematical modeling principles can be implemented and assist in testing and concluding potential outcomes for this population. Before testing, assumptions and predictions will be made, and then compared to actual data, which will be tested against the assumptions. Experimentation using the software Stella will provide data about the total population with respect to the impact of natural factors. In this experimental model, three scenarios will be used that can best predict the population. The first experimental model will be used to show the growth of the mosquito fish population with no factors counteracting it. The next two scenarios chosen are the most problematic situations for the mosquito fish population. The first factor affecting the population is cannibalism. Cannibalism will be introduced into the population model to determine its effects on the death rate, and the overall survival rate of the population. The next factor affecting the population is competition. Adult mosquito fish must compete with one another for food, space, and reproduction opportunities. In order to properly identify how all the factors impact the mosquito fish population they must be tested concurrently, resulting in a more realistic scenario, as naturally, all factors impact the total population. Upon completion of the experiment, graphs will be created, from which conclusions will be derived.

Diacetyl: A Fatal Popcorn Flavoring

Simone Ridgeway
Advisor: Dr. Craig McClure

Diacetyl is a compound which was used extensively as a microwave popcorn flavoring until 2008. Diacetyl is a vicinal diketone also known as 2,3-butanedione and can be found naturally as a byproduct of fermentation. The commercial production and use of this flavoring agent, which imparts a buttery flavor to foods, has been associated with Bronchiolitis obliterans, which is also known as "Popcorn Workers Lung". Bronchiolitis obliterans is a lung disease that compresses and narrows the bronchioles, or small airway branches, as a result of scar tissue and/or inflammation. This can cause severe shortness of breath, wheezing, and other life threatening conditions related to the lung. In this research poster, we will be investigating the effects of diacetyl exposure as documented in the medical literature, and explore the unintended consequences and legal responsibilities for the production of this deadly popcorn flavoring.

Sickle Cell Mutated Gene Effects on the Black Community in Category I

Obrenka Thompson
Advisor: James Grimes

Sickle cell disease is a genetic condition that is shown at birth, which affects the red blood cells. Through the one mutated gene, Sickle Cell anemia is affecting a large population of Americans, specifically African Americans. This gene affects the hemoglobin gene that carries oxygen in the body. The mutation can be placed in the DNA three different ways and broken down to a chemical level of base to acid changes which cause the mutation. The importance of this research is that Sickle Cell anemia is affecting a large racial group and should be studied more to find a cure and better treatment. Also with finding how to change mutations in this particular gene will help open the path way to cure other diseases that are caused from gene mutations.

The Determination of the Molecular Weight through Viscosity

Brandon L. Williams
Advisors: Jaquice Hughes and Dr. John C. Middleton

The determination of molecular weight is important to the development and classification of polymers. Molecular weight determines many physical properties, such as change from a solid state to liquids known as transition temperatures, as well as determines mechanical properties such as strength and elasticity. Although using viscosity to determine molecular weight is not the most accurate method it is one of the simplest lab procedures used. A solution's viscosity is defined as its resistance to deformity due to stress. This research will test the dissolution of polymers into a solution which allows for the determination of the polymers

molecular weight by analyzing the viscosity of the resulting solution. The procedure runs two series of experiments, the first is done using only the solvent to set a base line and the second series is done using the polymer/solvent pair. The viscometer is cleaned with the solvent then submerged into a water bath at 25°C, and then 10ml of the pure solvent chloroform (CCl_2) is placed into the viscometer. These tests are necessary in order to determine where a polymer can be placed according to its state of matter such as if it is being used as a mesh to culture and simulate cell growth on a ruptured organ it must remain a solid at 98.6°F. The determination of physical properties is crucial to determining where the polymer can be placed or what it can be used for.

BD FELLOW ABSTRACTS

Finding Points on Earth which never have a Solar Zenith Angle of Zero

Jarrod Cunningham
Advisor: Dr. Rudi Weikard

The current position of the Sun over the Earth is a primary factor determining current radio propagation conditions between points on Earth, because energy from the Sun ionizes the ionosphere. Just as the part of the Earth the Sun is directly over tends to receive the most heat, it also tends to receive the most ionizing energy. The sun is at the zenith when it is directly over a given point on earth. The corresponding zenith angle is zero. Given the earth's elliptical orbit around the sun and the earth's rotation about its axis with respect to time, the point on earth at which the sun is directly overhead at any given time throughout the year can be calculated. The purpose of our research is to figure out if there exist points on earth between the Tropic of Cancer and the Tropic of Capricorn in which the sun is never directly overhead. If such points exist, we will find the latitudinal distance between the points at which the sun is directly overhead, given a specific longitude, to see if their respective distances are constant or varying with respect to time in a given year. To solve these problems, we will use mathematical formulas from celestial mechanics, geometry, calculus, and geography.

Interaction between the CFTR Genotype of Mice and Capsular Phenotype in a Mouse Model of Pneumococcal Lung Disease

Evida Dennis
Advisor: Dr. David Briles

Streptococcus pneumoniae (*SP*) is a respiratory pathogen and a leading cause of morbidity and mortality worldwide, but its role in cystic fibrosis (CF) has not been well studied. The major pathogen in CF lung disease, *Pseudomonas aeruginosa,* is associated with worse prognosis when it becomes highly mucoid. *SP* isolated from the sputum of CF patients were collected and highly mucoid isolates were unusually common. We hypothesized that highly mucoid *SP* would cause more serious lung infections in CFTRm1Unc-/-(FABPhCFTR) (CF-mice) than WT-mice. Congenic CF-mice and WT-mice were infected intranasally with *SP* isolated from the sputum of patients with CF. A highly mucoid serotype 3 isolate CHB756, a less mucoid type 3isolate WU2, and a 19A isolate (non-mucoid) CHB1058 were compared. Tracheal lavage fluid, lung homogenates, and blood were collected from mice 5 days post-infection. CF-mice infected with CHB756 had significantly higher bacterial burden than CF-mice infected with WU2 (*P=0.002*). CF-mice infected with CHB1058 had a significantly lower bacterial burden than CF-mice infected with either WU2 or CH756 (*P< 0.005*). Significantly more bacteria were recovered from lungs of CF-mice than WT-mice infected with CHB756 (*P=0.0196*), however no significant difference was observed between CF-mice and WT-mice infected with WU2 or CHB1058. Our results indicate that highly mucoid *SP* cause lung infection more effectively than non-mucoid *SP*, and do so more readily in the lungs of CF-mice than in the lungs of WT-mice. This study supports the association of highly mucoid bacteria with worse prognosis in individuals with CF.

Quantitative Characterization of Calmodulin and Fas Death Domain Interactions

Romone M. Fancy
Advisor: Dr. Yuhua Song

The Fas death receptor-activated death inducing signaling complex (DISC) regulates apoptosis in a variety of normal and cancer cells. Qualitative immunoprecipitation demonstrate that calmodulin (CaM) binds to Fas (J Biol Chem 279, 2004). The interaction of CaM and Fas regulates DISC formation (J Cell Biochem 103(3), 2008). Fas mutations with altered structure and/or function have been detected in many cancers (J Pathol 193(2), 2001; Cancer Res 61(4), 2001). A quantitative understanding of CaM and Fas interaction is

important to design optimized antagonists to regulate CaM and Fas interaction, thus modulating Fas-mediated DISC formation. Here we quantitatively characterize the interactions of CaM with Fas and Fas V254N mutant by measuring the heat change due to binding using isothermal titration calorimetry. Results illustrate an endothermic binding characteristic between CaM and Fas WT and an entropy-driven interaction with binding entropy of 46.7 ± 5.3 cal/mol/deg and a binding constant of $1.6 \times 10^5 \pm 1.6 \times 10^4$ M^{-1} at 37°C. The binding of CaM and Fas V254N mutant was significantly decreased; with binding entropy (33.2 ± 0.001cal/mol/deg) and a decrease in binding affinity ($5.01 \times 10^4 \pm 3.4 \times 10^3$ M^{-1}) at 37°C. The decrease in binding affinity of CaM with Fas by the V254N mutation could be resulted from the conformational change of Fas DD altering interactions between CaM and Fas DD, which was demonstrated in our computational study (Biophys J. 95 (12), 2008). Results from this study provide the thermodynamic basis toward the further identification of novel strategies capable of effectively regulating Fas-mediated apoptosis.

Modeling the Onset of Type-1 Diabetes Using Geometric Phase Transitions

Elais Jackson
Advisor: Dr. Xujing Wang

Experimentally, it has been observed that the onset of type 1 diabetes (T1D) occurs when on average ~70% of β-cells inside pancreatic islets are dead or have lost the ability to couple with other cells in cell clusters. Biological systems, in this case pancreatic cell islets, are well known to be complex and nonlinear. With that in mind, we found that β-cell decay could be described using the Hodgkin-Huxley model of noisy nonlinear oscillators, suggesting that real-world phenomena that lead to the onset of T1D can be described mathematically using well known nonlinear constructions. In our model, we use a Hexagonal Closest Packing (HCP) lattice to describe the islet cell cluster as a network, and a speedy algorithm to simulate percolation across it; the critical percolation probability yielded from our experiments predict that there exists a critical value of β-cell loss leading to islet functional failure that is consistent with laboratory and clinical observations.

The Synergistic effects of Lycopene and Sulforaphane on h(Tert), DNMTs, and HDACs

Samantha L. Martin
Advisor: Trygve O. Tollefsbol

Fruit and vegetable consumption has generally been accepted as an antidote for maintaining a healthy lifestyle as well as curing many diseases. Emerging evidence strongly suggests that bioactive dietary components may play a vital role in cancer prevention and cures. Among the many chemical compounds, this paper will focus primarily on lycopene and sulforaphane, in addition to the different combinations of complementary actions that are involved. Lycopene is a bright red carotenoid pigment and phytochemical found in tomatoes and other red fruits and vegetables, such as red carrots, watermelons and papayas. Sulforaphane is an organosulfur compound that exhibits anticancer, antidiabetic, and antimicrobial properties in experimental models. It is obtained from cruciferous vegetables such as broccoli, Brussels sprouts or cabbages. Recent studies show that both lycopene and sulphoropane individually decrease DNA methyltransferases (DNMTs), however, the synergistic effect has yet to be discovered. This article will mainly focus on the synergistic effects of lycopene and sulforaphane on Human Telomerase Reverse Transcriptase (hTert), DNA methyltransferases (DNMT), and Histone Deacetylases (HDAC). It has not been determined whether lycopene and sulforaphane are complimentary bioactive dietary components; therefore, this work is still in progress.

Effect of the Combined Treatment of TRA-8, an Agonistic DR5 Antibody, and Tamoxifen on Breast Cancer Cell Apoptosis

Tiara Napier
Advisor: Dr. Yuhua Song

Agonistic death receptor 5 (DR5) antibody, TRA-8, has been proven effective in inducing cancer cell death via the death receptor mediated intrinsic and extrinsic apoptotic pathways (Straughn, Oliver et al., 2006). Combining TRA-8 treatment with a chemotherapeutic agent has been shown to reverse cancer cell resistance to TRA-8 (Amm, Zhou et al., 2011]. The goal of this study is to understand the effect of the combined treatment of TRA-8 and tamoxifen (TMX) on breast cancer cell apoptosis. The hypothesis is that TMX will sensitize breast cancer cells to TRA-8. The specific aim is to investigate *in vitro* cancer cell sensitivity to TRA-8 with and without TMX pre-treatment in one estrogen receptor/ progesterone receptor(ER/PR)-positive breast cancer cell line and two human epidermal growth factor receptor 2 (HER2)-positive breast cancer cell lines. Cells were treated with TMX and TRA-8 both separately and in combination, and cell viability was assessed. Insight from this study can be used to exploit the DR5-mediated

apoptotic pathway and increase chemotherapeutic drug efficacy, and enhance targeted anti-cancer cell treatments. Future studies will investigate molecular mechanisms underlying drug sensitization to TRA-8 mediated by TMX.

Resorbable Polymer-*grafted*-Nanodiamond Composites for Fracture Fixation

Harsh Patel
Advisor: Dr. John C Middleton

It has been estimated that 6.8 million fractures occur annually in the US at an estimated cost of 21 billion dollars. Fracture fixation currently consists of implanting metal rods and screws in the most severe cases or bone grafting to repair defects from either autologous or alloegenic sources. All these solutions have drawbacks including stress shielding and the potential for a second surgery from metal implants and the need for two surgeries for autologous bone repair. There is still a need for a resorbable implantable material with sufficient strength and toughness to repair bone defects. We propose developing a resorbable polymer-nanodiamond composite where the nanodiamonds are covalently bound to the resorbable polymer. We expect these nanocomposites to have sufficient strength and toughness to repair bone and eliminate the need for a second surgery. The characterization and biocompatibility of this new class of tailored material will be investigated for fracture fixation materials and bone tissue engineering scaffolds. The physical characterizations will be examined by DSC, NMR, TGA, FTIR, TEM and SEM techniques. The biological response will be investigated by placing the composites in contact with the living cell lines such as Human Mesenchymal stem cells on scaffold prepared by electrospinning and salt leaching methods. This interdisciplinary project will incorporate elements of polymer science, nanotechnology and biomedical engineering providing novel approach to solve crucial issues in orthopedics.

Examination of the Feeding Preferences of the Freshwater Amphipod *Hyalella azteca* for Aquatic Vascular Plants and Macroalgae: The potential roles of prey nutritional quality and structural and chemical defenses

Kevin Scriber
Advisor: Dr. James McClintock

Numerous factors influence the feeding preferences of fresh water and marine invertebrates. Some feed primarily on a single prey species; others feed on a variety of prey. However, most predators display some level of discrimination between the different plants and animals they consume. This research tests the null hypothesis that there is no difference in palatability or feeding preferences of the common omnivorous freshwater amphipod Hyalella azteca for a variety of aquatic vegetation; vascular plants and algae. Non-choice feeding assay will be utilized to identify possible differences in feeding rates (palatability) for a suite of sympatric prey; measuring the amount of food material consumed per unit time. Prey choice assays will be utilized subsequently to differentiate preferences for individual species of aquatic vascular plants and freshwater algae; in the presence of an alternative. If statistical tests indicate that non-choice or choice feeding assays show that amphipods prefer certain species of vegetation, then prey quality will be assessed by measuring levels of protein (a common measure of nutritional quality of plant prey) and aspects of structural and/or chemical defenses. The results will provide insights into the factors that determine prey choice in this common and ecologically important freshwater amphipod.

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

ALSAMP TRANSITION SCHOLAR ABSTRACTS

Sound Card

Joshua Cottingham
Advisor: Dennis Hite

This presentation will cover the architecture and design of computer sound cards. Sound cards typically include an analog-to-digital converter. Early forms of sound cards generated beeps with the utilization of square waves. Modern sound cards utilize Advanced Linux Sound Architecture which is an open source Linux Kernel that provides an Application Programming Interface (API) for device

drivers present on the sound card. This poster will detail some of the basic theory with regard to sound cards and describe current architecture.

AM/FM Radios

Johnathon Taylor
Advisor: Dennis Hite

This work provides an overview of AM/FM radios. The presentation details the theory behind AM/FM reception and signal processing. The history of AM/FM radio, advantages, disadvantages, and modern improvements in technology are discussed. A relationship between electrical engineering and AM/FM radio will be established.

The Mercedes Experience - Robotics in Automotive Engineering

Martez Taylor
Advisor: Dennis Hite

This presentation discusses the use of robotics in Automotive Engineering. The use of robotics has had a tremendous impact on automotive manufacturing. Specifically the use of robotics has resulted in increased quality control and increased efficiencies. Electrical Engineering provides some of the fundamental elements that result in the integration of robotics in the manufacturing process.

THE UNIVERSITY OF SOUTH ALABAMA

ALSAMP TRANSITION SCHOLAR ABSTRACTS

Development of a liquid chromatographic method for the separation of the components of the Brown Spruce Longhorn Beetle lure

Mikael Silas
Advisor: Dr. Coym

The Brown Spruce Longhorn Beetle is an invasive species from Europe. It has been found as nearby as Nova Scotia and New Brunswick in Canada, and it is feared that it may spread in the northeastern and mid-Atlantic United States. This beetle only attacks unhealthy trees in its natural environment, however it has been known to attack and kill healthy trees in Nova Scotia. The primary target of this beetle is red spruce, white spruce and Norway Fir (usually), Pine, Larch (secondary), and Hardwoods (rare) trees. In order to monitor the spread of these beetles, the US Department of Agriculture sets out "traps" baited with a mixture of monoterpenes (9% terpinoline, 44% alpha-pinene, 19% beta-pinene, 10% 3-carene, and 18% limonene) to catch these beetles. This work focuses on development of a liquid chromatographic method for the analysis of these lures. Our current goal is to find a method of separation for the five mixture components, using a mobile phase of either water and methanol or water and acetonitrile. We are also concerned with finding the correct stationary phase, either a Synergi Fusion-RP or Synergy Max-RP liquid chromatography column. Future work will focus on developing a validated method for quantitative analysis of these lures.

Pseudomonas Aeruginosa Infection of Endothelial Cells Decreases pH via Intracellular Injection of Toxins

Chinara Whavers
Advisor: Dr. Alvarez

Pseudomonas aeruginosa is gram-negative bacteria that affect endothelial cells-inner cells lining blood vessels-by injecting intracellular toxins. In endothelial cells, the toxins disrupt the barrier eliciting movement of plasma from the vascular into the interstitial space. Previous studies reported that infection of endothelial cells with *Pseudomonas aeruginosa* decreases pH. Whether *a Pseudomonas aeruginosa*-induced decrease in endothelial pH is dependent upon toxins secreted by the bacteria or by other bacterial components is unknown. Therefore, we hypothesized that *Pseudomonas aeruginosa* decreases pH in endothelial cells via intracellular secretion of toxins. **Methods.** We infected endothelial cells with strains of *Pseudomonas aeruginosa* that either inject-(UT) or lack the ability to inject- toxins (ΔPcrV). Monolayers of endothelial cells isolated from the pulmonary microcirculation were infected with either strain at a concentration of 40 bacteria per cell. Incubation was maintained over 4 hours, and 100 µL samples from the media were collected and measured at 4 hours post infection. pH was assessed on a blood gas instrument. **Results.** Two experiments were conducted with endothelial cells infected and an uninfected control. After four hours, controls' pH were 7.99 and 7.97. ΔPcrVs' pH were 7.74 and 7.70. UTs' pH were 7.80 and 7.85. For the second set, controls' pH were 7.99 and 7.98. ΔPcrVs' pH were 7.86. UTs' pH were 7.85 and 7.80. At the end of 4 hours all monolayers displayed signs of damage. **Conclusion.** Contrary to what is reported, *Pseudomonas aeruginosa* causes endothelial cellular damage, but does not affect the pH.

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