12th Annual SUMMER UNDERGRADUATE RESEARCH SYMPOSIUM

July 31, 2013

Jane S. McKimmon Center - 1:00 PM UNTIL 5:00 PM

Office of Undergraduate Research
Division of Academic & Student Affairs

http://www.ncsu.edu/undergrad-research/
July 31, 2013

Dear Students and Colleagues:

Are you curious and interested in solving problems? Do you look for clues in problem-solving? Do you puzzle over mysteries, whether scientific or literary? If the answer to any of these questions is yes, then you are engaged in research. In every field of human inquiry, moreover, learning is equal to research, and in the end our great research universities are measured by their dedication to being places of learning.

Since 1992 North Carolina State University has supported the Undergraduate Research Symposium as one of the most important ways in which students can take advantage of being part of this large, complex research community. As a result, our University has emerged as a leader among land-grant Research One institutions in providing opportunities to undergraduates to work beside some of the world’s best faculty researchers. Students at North Carolina State have special opportunities that will shape the futures of countless persons. Top-tier research institutions like North Carolina State succeed precisely because they know that the concepts of research, learning, and engagement are reciprocal and reinforcing.

Our university provides unparalleled opportunities to engage in cutting edge developments in a host of disciplines. Participation in research, moreover, gives every student the opportunity to gain an edge in admissions to graduate school, to find a first job, to build a career, and, perhaps most important, to become first-hand participants in the process of discovery.

The enclosed abstracts are a wonderful reminder of the diversity of our research efforts. They are also a vivid demonstration of our intellectual ambitions and our continuing commitment to innovation in undergraduate education.

Each of you - faculty mentors and student researchers - have my personal and professional thanks for making the Symposium a success and for reminding us all of what a special place North Carolina State University is.

Sincerely,

Dr. Christopher M. Ashwell, Director
Office of Undergraduate Research
Division of Academic & Student Affairs
The Symposium will be held in the Jane S. McKimmon Center.

12:00 p.m.  Doors open for registration

12:50 p.m.  All Session I posters must be up and ready to go by this time.

1:00 p.m. – 1:15 p.m.  Welcome and Opening Remarks

Greetings  Dr. Randy Avent  
Interim Associate Vice Chancellor for Research Development  
Office of Research & Innovation

Symposium Overview  Dr. Christopher Ashwell, Director  
Office of Undergraduate Research  
Division of Academic and Student Affairs

1:15 p.m. – 2:30 p.m.  Poster Session I

2:30 p.m. – 3:45 p.m.  Poster Session II

3:45 p.m. – 4:00 p.m.  Poster Take-Down

4:00 p.m. – 5:00 p.m.  Speaker, Reception, and Awards Ceremony

Dr. Sam Pardue  
Interim Associate Dean and Director  
College of Agriculture and Life Sciences

Presentation of Summer Research Certificates and Awards  Program Directors and Program Managers
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<td>Shannon Chiera</td>
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A27 Kristen Elena Eguren  
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A29 Yilin Du Energy and Environmental System Engineering  
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A31 Spencer Ross Rhodes Meteorology  
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Sandra Yuter Marine Earth And Atmospheric Sciences

A32 Syuan-You Lin Horticulture and Landscape Architecture  
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Susana Milla-Lewis Crop Science

A33 Mary Catherine Grosholz Computer Engineering  
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A34 Zhiyuan Zou Electronic and Information Engineering  
Rui Hu Electronic and Information Engineering;  
Yi Zhao Electronic and Information Engineering  
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Srdjan Lukic Elec & Comp Engineering

A35 Mary Helen Austin Animal Science  
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A36 Jillian Claire Hattaway Biological Sciences-  
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B2 Kelsey James Reppert  
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B3 Michelle Marie Greenough  
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B4 Anna Litovskaya  
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<td>Leda Lunardi Electrical &amp; Computer Engineering</td>
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B21 Sasha Harbajan Biology  Functional Senescence in the Rose Lines of Drosophila melanogaster  Trudy MacKay Genetics

B22 Gabriel Eduardo Perez computer science  Increase motivation in Bots, an educational game, by adding a StoryMode  Tiffany Barnes Computer Science

B23 Alexandria Katarina Vail Mathematics / Computer Science / Physics  Identifying Efficient Informal Tutorial Dialogue Techniques through Linguistic Analysis  Kristy Boyer Computer Science

B24 Adrianna R. Cardinal-DeCasas Conservation Biology  Everyone needs friends, why should ants be an exception?  Rob Dunn Biology


B26 Morjan Bassam Rahhal Biological Engineering  Logic Gate Representation of Gene Regulatory Networks: T-helper Cell Differentiation  Cranos Williams Elec & Comp Engineering

B27 Paige Catherine Wendland Food Science; Michelle Borges Biochemistry, Nutrition Science; Lauren Connelly Food Science; Chloe Bream Food Science  Selection of Starter Culture(s) for Commercial Cucumber Preservation Using a Screening Design for Fermentation Potential and Antimicrobial Activity  Ilenys Perez-Diaz Food Science; Suzanne Johanningsmeier Food Science

B28 Xinyi Chen  Effects of Incubation Temperature on Development at E12 in Chick Embryos  H. C. Liu Animal Science

B29 Lian Chengliang Computer Science  Updating Flow Field Visualization Using FLTK  Hong Luo Mechanical & Aerospace Engr

B30 Lingnan Song Optical Engineering  Stretchable RF antenna with Silver Nanowires  Yong Zhu Mechanical & Aerospace Engr

B31 Jason Lee Endries Meteorology  Understanding the Variability of Low Marine Clouds in Three Oceanic Regions  Sandra Yuter Marine Earth And Atmospheric Sciences

B32 Zhengyang Zuo Electronics Engineering; Shining Ma Optical Engineering; Yuanqi Huang Microelectronics Engineering; Yu Yan Optical Engineering  A Cognitive Radio Simulation Framework on PHY/MAC Layers  Huaiyu Dai Electrical & Computer Engineering
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*Chemistry* | Fermentation of Sweet Potato Juice with Probiotic Cultures | Van-Den Truong  
*Food Science*

Suzanne Johanningsmeier  
*Food Science*
D41 Chunqi Wang  
*Mechatronics*

Development of a LabView-based interface for PID control demonstrations on a QET hardware platform  
**Gregory Buckner**  
*Mechanical and Aerospace Engineering*

D42 Joe Andrew Murray  
*Corey Stafford  
*Mathematics; Mike Hamilton  
*Mathematics*

Applying Machine Learning Techniques to Baseball Pitch Prediction  
**Hien Tran**  
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D43 Sterling Gabriel Cave  
*Biology: Integrative Physiology and Neurobiology B.S. and Psychology B.S.*

Visualizing Dynein Light Chain with Green Fluorescent Protein  
**Antonio Planchart**  
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Diary Study of GraphTiles  
**Benjamin Watson**  
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D45 Qianjun Gan  
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The application of PSO in distribution network's optimization  
**Mesut Baran**  
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D46 Miguel Abrantes Rufino  
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**Alexander Dean**  
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D47 Ashton Edward Dyer  
*Physics, Applied Mathematics*

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**John Blondin**  
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Experimental and computational Studies of the activity of the native substrate for the two isoforms of Dehalperoxidase  
**Stefan Franzen**  
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Determination of optical gain in AlGaN and its heterostructures  
**Ramon Collazo**  
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**Christine Grant**  
*College of Engineering-Dean's Office*  
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WolfBot: A Robot Platform for Swarm Applications  
**Edgar Lobaton**  
*Electrical & Computer Engineering*

D52 Carter Keough  
*Industrial and Systems Engineering*

3D Printing For Sustainable Manufacturing  
**Tim Horn**  
*Industrial and Systems Engineering-
Abstracts

Listed by Summer Program
**Poster C43**
**Understanding silk-surface interactions using molecular modeling: a comparison between graphene, graphene oxide, and SiO2 surfaces for nanocomposite materials**

Trisha Lee Dupnock  
*Environmental Engineering and Chemistry*

*Mentors and/or Co-Authors: Yaroslava Yingling, Material Science Engineering*

Natural biomaterials such as silk have recently gained much attention for their use in nanocomposite material fabrication due to their flexibility, biodegradability, and intense strength. When graphene oxide sheets are incorporated into silk matrices, superior toughness, ultimate stress, and tensile modulus values have been recorded that far surpass any nanocomposite to date. In this study, 20ns molecular dynamic simulations were conducted using crystalline GAGAS $\beta$-sheets and amorphous GAGAY segments in long and short forms in attempt to understand the interactions between silk and various composite surfaces. Results from secondary structure analysis of silk show the structural percentage of $\beta$-sheets declined rapidly within 5ns of simulation using graphene, graphene oxide, and SiO2 surfaces, with recovery only evident when graphene oxide was present. Helix formation was noticeable in all cases. Similar results occurred for long silk, however, $\beta$-sheets degraded at a more gradual rate. Trajectories with SiO2 sheets displayed the most severe changes of all composites analyzed; posing the greatest root mean square fluctuations and energy values for both silk strands. These results indicate that silk unravels quickest with SiO2 because the interaction energy was five times larger than graphene and graphene oxide, the use of graphene oxide has the most promise due to $\beta$-sheet recovery, and long stranded silk reduces the rate at which $\beta$-sheets are lost.

**Poster D49**
**Determination of optical gain in AlGaN and its heterostructures**

Brian Bennett Haidet  
*Materials Science and Engineering*

*Mentors and/or Co-Authors: Ramon Collazo, Material Science Engineering*

III-nitrides are semiconductors with a very wide band gap, allowing for their use in low-wavelength optoelectronic devices. Accurate measurement of optical gain in these materials is pertinent to the fabrication of efficient low-wavelength laser diodes. In this study, a process was developed for analyzing data from the variable stripe length (VSL) method. The VSL method determines optical gain in a semiconductor by optically pumping the material with a narrow beam of varying length. A gain value can be calculated for each wavelength based on the change in intensity with illuminated length; larger excited areas give spontaneously generated photons more time to induce stimulated emission, leading to a near-exponential increase in intensity. The data collected from this experimentation technique has three dimensions: intensity against stripe length and wavelength. Software was written that processes this data into a typical “gain curve” for the material (optical gain vs. wavelength). The variable stripe length method, along with the data-processing
methods utilized here, are an improvement in speed and accuracy over other common analysis techniques.

Poster C10  
Atomic Layer Deposition of Vanadium Oxide for Pseudocapacitance Enhancement of Electrochemical Double Layer Capacitors  
Neal Peyton Lewis Materials Science and Engineering  
Mentors and/or Co-Authors: Mark Losego Chemical & Biomolecular Eng  
Gregory Parsons Chemical and Biomolecular Engineering  

Electrochemical double layer capacitors (EDLCs) are a viable technology to improve energy recovery in applications that require high charge/discharge rates. EDLCs store charge physically at the electrode/electrolyte interface. Unlike batteries that store charge chemically, this physical storage mechanism allows for quick energy delivery and longer life cycling. However, even greater energy storage is desired. One promising approach to increasing EDLC energy density is adding pseudocapacitive metal oxide layers. Pseudocapacitance is a Faradaic charge storage mechanism in which transition metal oxides undergo fast, reversible redox reactions on the electrode’s surface. Our project examines carbon-based EDLCs enhanced with vanadium oxide (V$_2$O$_5$) pseudocapacitance layers deposited by atomic layer deposition (ALD). The basic EDLC electrode is made from nanoporous activated carbon and highly conductive carbon black mixtures deposited on nickel foil. These electrodes are immersed in aqueous electrolytes to form the EDLC. We used three electrode cyclic voltammetry (CV) to evaluate the specific capacitance of our electrodes. First, we evaluated untreated carbon electrodes of varying carbon black to activated carbon ratios to optimize capacitance performance. Next, we examined the effects of electrolyte composition (e.g., KCl, NaCl, Na$_2$SO$_4$) and concentration. Finally, using ALD we conformally coated our carbon electrodes with varying thickness of V$_2$O$_5$ varying from 1 to 25 nm. We found negligible effects on capacitance for coatings of 1 nm, but for thicknesses between 6 and 25 nm, we observed as high as a 2-fold increase in capacitance.

Poster B4  
Flexible Sensor Array Using Silver Nanowire  
Anna Litovskaya Mechanical Engineering  
Mentors and/or Co-Authors: Xiaoning Jiang Mechanical & Aerospace Engr  

Flexible sensors have a promising future in various applications including ultrasonic transducers and biomedical sensors. Flexible silver nanowires have been extensively researched and are currently a good candidate for future flexible sensors because of their bendable and elastic qualities. A 1-D array of thickness mode PMN-PT crystals was placed into contact with the bendable and stretchable nanowire electrode and set in PDMS to create a working sensor for this study. The PMN-PT crystal was preliminarily tested with an impedance analyzer using the silver electrodes and was found to have a 10.6057 % decrease in its quality factor and a 4.4039 % increase in electrical loss when channeled through the electrodes. An array of three PMN-PT crystals was subjected to a bend test with a bend diameter ranging from 2.5 centimeters (or no bend) to 1 centimeter in diameter. The resulting average of the three crystals had shown that there was a 5.9301 % decrease in quality factor as the array is bent from 2.5 to 1 centimeter with the electrical loss fluctuating between 5.1 to 5.5 mU. In a future study, an array of five PMN-PT crystals is clamped and stretched to study its resonance. Results are yet to come. After extensive testing of electrical properties such as the impedance spectrum, capacitance, quality factor and electrical loss, it is safe to conclude that this flexible sensor array using silver nanowires works and can be further studied for various applications including 2 dimensional arrays and any practical applications for the sensors.

Poster A11  
The Use of Optical Fibers as Sensors for Superconducting Magnets  
Eleanor G Meisinger Physics  
Mentors and/or Co-Authors: Justin Schwartz Material Science Engineering  
Sasha Ishmael Material Science Engineering  

Quench detection within High Temperature Superconducting (HTS) magnets is a difficult challenge that limits their implementation in to the field. A quench occurs when the superconducting (SC) magnet changes from its SC state to its resistive state due to a localized change in temperature. During the quench a large amount of heat is deposited into the conductor and if it is not quickly removed can...
cause damage to the magnet or even destroy the SC wires of the magnet system. Therefore it is critical to detect the onset of a quench in order to prevent damage to the magnet. Our approach for detection is based on the use of gold-coated optical fibers that serve as sensors for SC magnets, which will ultimately lead to more adequate quench detection over the conventional techniques, which are too slow. It is important that the optical fibers are thermally conductive and have a high coefficient of thermal expansion, which assure that the fibers are sensitive to temperature change. Integration of the fibers with the SC magnet requires good electrical insulation between turns and layers of the magnet winding. Electrically insulating and thermally conductive coatings have been applied to the gold-coated fibers. In this instance oxide coatings were considered, specifically zinc oxide and titanium oxide, because these oxides are commonly notable insulators and also exhibit high thermal conductivity. The oxide-coated fibers have been tested using Rayleigh scattering. The thermal response of these fibers has been tested at cryogenic temperatures. The results are presented.

**Poster A14**

**Exposing Nano-scale Inversion Domains in N-polar Alumina Nitride by Potassium Hydroxide Etching**

Katherine Eileen Osterman  
Mathematics and Applied Physical Analysis

Mentors and/or Co-Authors: Ramon Collazo  
Material Science Engineering

Essential to increasing the quality of N-polar Aluminum Nitride (AlN) is to develop uniformity in its polarity. Previous studies with transmission electron microscopy (TEM) have revealed nano-structural Al-polar inversion domains in N-polar AlN on sapphire. Wet etching with a Potassium Hydroxide (KOH) solution in conjunction with analysis by scanning electron microscopy (SEM) is a more efficient method to examine these inversion domains across a larger sample region. KOH is polar-selective therefore N-polar surfaces etch at a quicker rate than Al-polar material. Thus, Al-polar inversion domains within N-polar AlN can be revealed. The etching conditions to identify and characterize inversion domains within N-polar AlN were investigated. Moderate etch conditions were obtained to avoid removing all of the N-polar AlN while still revealing the nano-scale inversion domains. Time of etch, temperature of solution, and molarity of KOH solution were varied in order to distinguish and relate the inversion domains with the etch conditions. The inversion domains were observed when wet etched at a temperature of 70°C with 0.05M, 0.25M, and 1M KOH solutions. Using SEM imaging to observe morphology, the inversion domains were detected as protruding columns embedded in the pyramidal structure characteristic of an etched N-polar surface. The etching conditions found in this study make it possible to calculate the density of inversion domains in N-polar AlN and to quickly and efficiently monitor the effectiveness of polarity control in the growth process.

**Poster B25**

**Biochemical Methane Potential Tests: Thermal Acclimation of Mesophilic Inocula for Thermophilic Tests**

Ally Lynn Patrick  
Environmental Engineering

Mentors and/or Co-Authors: Morton Barlaz  
Civil, Construction and Environmental Engineering  
Joseph Weaver  
Civil Engineering

Biochemical methane potential (BMP) tests are widely used to measure anaerobic biodegradability. BMP tests are often conducted under mesophilic (37°C) temperatures, but in some cases it is desirable to perform them under thermophilic (52°C) temperatures to accelerate the test for slowly degrading substrates. The purpose of this study is to determine if a standard mesophilic culture can be used as an inoculum in thermophilic tests instead of maintaining a separate thermophilic culture. The experiment was designed to compare thermophilic BMP tests using a pre-adapted inoculum to other tests using unadapted mesophilic or native thermophilic inocula.

A mesophilic inoculum was incubated at 52°C before use in a BMP test, but did not adapt to the higher temperature and was not tested further. The thermophilic inoculum incubated at 52°C produced 129 mL CH₄/dry g and, by day 7, exceeded the ultimate methane yield of 108 mL CH₄/dry g which the mesophilic inoculum incubated at 37°C reached at day 19. The unadapted mesophilic culture in BMP tests incubated at 52°C failed to produce methane after 7 days in a 22 day trial, resulting in a lower average yield of 15 mL CH₄/dry g.

The mesophilic culture used in this work could not be adapted to 52°C before or after inoculation. Instead of maintaining a separate thermophilic culture, acquiring a thermophilic inoculum from a wastewater treatment plant can increase efficiency by reducing time spent on maintaining cultures in the lab and deceasing trial.
length, but may result in higher estimated methane potentials.

**Poster A28**

**Electrode influence on the charge transport through stoichiometric and reduced TiO2**

**Thomas F Podbesek** *MSE*

*Mentors and/or Co-Authors: Elizabeth Dickey Material Science Engineering*

Ali Moballegh *Material Science Engineering*

The goal of this study is to investigate the influence of different types of electrodes on the leakage current of stoichiometric and non-stoichiometric (100)-oriented single crystal TiO2. Comparing the work functions of electrodes with the electron affinity of the TiO2, changes can be seen in the barrier height at the interface. A DC sputtering system was used to deposit the contacts with a 200-300nm thickness on a pair of opposite lateral surfaces. It was observed that for stoichiometric TiO2, the bulk resistivity dominates the leakage current. The current-voltage characteristics of all different deposited contacts are influenced by the ohmic behavior of stoichiometric TiO2. The I-V measurements on the reduced TiO2-x indicate that the leakage current is highly dependent on the contact resistance of the reverse biased electrode.

**Poster D1**

**Fabrication and Characterization of c-YSZ (cubic Yttria-Stabilized Zirconia) on Silicon Substrates**

**Ashley Rene Richmond** *Materials Science and Engineering*

*Mentors and/or Co-Authors: Lewis Reynolds Material Science Engineering*

**Jay Narayan** *Material Science Engineering*

Yttria-stabilized Zirconia (YSZ) is a ceramic material that has generated interest for its optical and electronic properties; it has also been used extensively for thermal barrier coatings in jet engines. The electrical conductivity is controlled by defects within the material. We have grown c-YSZ(001) single-crystalline thin films on Si(001) by using pulsed laser deposition (PLD) and analyzed details of epitaxy interfaces and physical properties. The in-plane and out-of-plane orientations of the thin films were studied by X-ray diffraction θ/2θ and φ scans, respectively. On the basis of X-ray diffraction and cross-section TEM data, the epitaxial relationship across the c-YSZ/Si(001) interface was shown to be (001)[100]cYSZ||(001)[100]Si. The c-YSZ/Si heterostructures were subsequently laser treated by 1, 5, 10, and 15 pulses of KrF excimer laser (pulse duration = 25×10^-9 sec.) at 2.5-3.5 J/cm². Contact angle goniometer measurements revealed that the hydrophobic behavior of the as grown sample became more hydrophilic after laser treatment achieved on the sample that had undergone 5 pulses during laser annealing. XPS was employed to study the effect of laser treatment on surface stoichiometry of the c-YSZ epilayers. The results revealed the formation of oxygen vacancies which are envisaged to control the observed hydrophilic behavior.

**Poster A2**

**First Principles Density Functional Theory Study of Point Defects in BaTiO3 and SrTiO3 Cubic Perovskites**

**Mai Kim Tran** *Materials Science & Engineering*

*Mentors and/or Co-Authors: Douglas Irving Material Science Engineering*

Perovskites have found their place in the world of telecommunication and semiconductor microelectronics because of their superconductivity and wide range of dielectric properties. Cubic barium titanate (BaTiO3) and cubic strontium titanate (SrTiO3) perovskites will be the focus of this research. BaTiO3 exhibits piezoelectric and ferroelectric features making it suitable for capacitors, transducers, and sensors, while SrTiO3 is typically used in oxide-based thin films, varistors, optical windows, and even diamond simulants. Using first-principles calculations based on Density Functional Theory, the objective of this research is to examine intrinsic point defects in these bulk cubic perovskite systems. The bulk band structure and density of states of BaTiO3 and SrTiO3 were calculated using both the Perdew-Burke-Ernzerhof (PBE) exchange-correlation functionals as well as hybrid functionals with the screened exact-exchange approach of Heyd-Scuseria-Ernzerhof (HSE06). While results show both functionals predicting lattice parameter within 1% of experimental values, HSE06 functionals match experimental band gaps more closely than PBE for both systems. In BaTiO3, the experimental band gap energy ranges from 3.2eV – 3.3eV; HSE06 predicts 3.18eV whereas PBE predicts 1.70eV. Similar results are observed in SrTiO3: the experimental band gap energy ranges from 3.22eV – 3.27eV; HSE06 predicts a gap of 3.33eV whereas PBE predicts 1.80eV. Accurate electronic structures are important for predicting accurate defect formation energies. Therefore, HSE06 functionals have been used to
calculate formation energies as a function of Fermi level for vacancies in a variety of charge states on the A, B, and O sites of each of these ABO₃ cubic perovskites.

**Poster C34**  
**Inoculation and detection of Impatiens necrotic spot virus in tomato and cucumbers**  
**Kristin DeeAnn Vickers Biology**  
*Mentors and/or Co-Authors: Linda Hanley-Bowdoin Biochemistry, Natalia Vargas, Mauricio Montero*

*Impatiens necrotic spot virus* is a single-stranded RNA virus within the genus *Tospovirus*, which are transmitted by Thrips and have come to be a major issue in important vegetables, legumes, and ornamental plants throughout the world. Visual symptoms of this virus include necrotic spots/patches, ring formations, interveinal/intraveinal yellowing, and reduction in plant size, longevity, and number. Diagnosis of this virus can be done through enzyme-linked immunosorbent assay (ELISA). During the past few weeks, I performed an experiment with twenty-one tomato and twenty-one cucumber plants using positive samples to perform mechanical inoculation and confirm this using the ELISA virus detection test. It was believed that the mechanical inoculation would result in positive when testing through ELISA. The results of this experiment showed one positive for the tomato plants and one positive for the cucumber plants. This low result in the number of positives could have been a result of many factors, including mechanical applications, use of frozen samples, rejection by defense system of plants, time constraint, and even the selection of samples.
ASSIST - NSF ERC Advanced Self-Powered Systems of Integrated Sensors and Technologies REU

Poster C13
Wearable Electronics System Integration for Hydration Monitoring
Shelby Lenae Alfred  Physics
Mentors and/or Co-Authors: Jesse Jur Textiles

The human body is dependent upon water for survival, as all cells require water for proper functioning. Environmental factors, such as temperature and humidity, affect the amount of water in the body. Neglect in maintaining adequate hydration in changing environmental conditions poses the risk for dehydration, which results in the body functioning improperly. Through the use of a microcontroller stitched upon a fabric, a wearable hydration monitoring system is developed that senses near body environmental changes that affect a user’s hydration level. A user feedback loop is integrated by the use of a set of four LEDs that provides an indication on the need for hydration. In addition, the data acquired from the sensors is sent via wireless communication to enable additional user data analysis on an off-board platform (i.e. cellphone). This analysis is important in the prediction and management of personal health in correlation to environmental exposures.

Poster D7
Patterning Films of Liquid Metal for Shape-Reconfigurable Microsystems
John Harry Bell  Chemical and Biomolecular Engineering
Mentors and/or Co-Authors: Michael Dickey Chemical & Biomolecular Eng

The ability to control, actuate and manipulate liquids is important for many applications on the micro scale, including sensors, actuators, RF electronics, total-analysis systems, and patterning. The aim of this research is to study, control, and pattern the shape of a liquid metal alloy, eutectic gallium-indium (EGaIn), by controlling the properties of its passivating surface oxide layer (skin). This metal is a low viscosity fluid with metallic conductivity and low toxicity. The skin provides mechanical stability to the high-surface-tension liquid metal such that it can be molded into non-spherical shapes. The ability to flow and stabilize EGaIn for shaping it into useful structures (e.g., antennas, switches) relies on the rupture and reformation of its oxide skin. In this research, this oxide skin is harnessed to develop a new method to form films and then subsequently pattern these films in 2D. The key parameters that affect the patterning process were studied and used to develop a model to predict the way the pattern changed with time. Fine-tuning this control method would allow for further development of precision shape-shifting EGaIn structures, such as reconfigurable antennas and electrodes.

Poster C7
Silver Nanowire Based Flexible Impedance Sensor for Hydration Monitoring
Elizabeth Victoria Fortin  Mechanical Engineering
Mentors and/or Co-Authors: Yong Zhu Mechanical & Aerospace Engr

Human skin has two distinct barriers: the dermis and epidermis, and both layers play an important role in preventing water loss. A person’s water content is crucial to the body, as it regulates body temperature, blood pressure, and heart rate. The accepted way to obtain the body water level is through hydration testing. Current hydration tests require equipment not readily available to people outside of a hospital and results often require laboratory equipment for processing. A device that can continuously monitor a person’s hydration level and readily display results could make hydration monitoring much more common in athletes, elderly, and people in warmer climates. Continuous monitoring and readily available results could help prevent the wearer from falling into a severely dehydrated state.

The goal of this research is to develop an electrode consisting of a silver nanowire (AgNW) and polydimethylsiloxane (PDMS) matrix to monitor skin hydration. The electrode is electrically conductive, flexible, and conformable to the human skin, making it the ideal sensor. The focus of this poster presentation is on the ability to obtain skin impedance readings from the electrode to measure skin hydration. Impedance readings are obtained from the electrode secured on the volar forearm and connected to an impedance analyzer. The inverse relationship between skin impedance and skin hydration allows us to instantly determine the wearer’s hydration level. Results from impedance testing with a hydrated (4 oz. water/hr) and dehydrated (2 oz. water/hr) subject were as expected: impedance decreased with hydration, and
increased with dehydration.

**Poster A33**

**Developing a Healthcare GUI for Children and Adults: How Color & Shape Psychology and Mobile Interactions Change Perceptions**

**Mary Catherine Grosholz** Computer Engineering  
*Mentors and/or Co-Authors: Paul Franzon Electrical & Computer Engineering*

Humans are becoming digital natives. Technology has grown into smaller, powerful, and more complex devices. As we continually grow to accept these devices, industry is continually building better products. Now these devices can help connect patients to their doctors for better health care. But how can we make applications engaging to use for children and adults so the product is exciting, rather than a burden?

Mobile interactions, shapes, and color psychology is used to blend the gap between adults and children. An asthma application was created for the Android system using Eclipse, a Java based IDE. Each section represents a page or action. The main page provides sources to the health, symptom, environment, and monitoring pages. Those pages then have options which show data along with a level of intensity symbol. The application serves to provide monitoring and management of the patients asthma.

The design used a center circle formally divided into sections rather than a standard tab based format. Another design process used color psychology, picking blue and white as the color pattern. Most industry producers, particularly in healthcare, choose blue and white as their logo because it is productive but non-invasive—take Blue Cross Blue Shield, Facebook, Wal-Mart, Ford, and so on.

The techniques used produced a rather unique design that seems to have engaged both adults and children. Further implementation methods such as music, more animations, and an interactive splash screen should be added. An engaging application stimulates emotion and the mind—this application does that.
Chemistry Summer Intern Program

Poster D23
A Theoretical Study of Bacteriochlorin-based Light Harvesting Arrays
James H Blew Chemistry, Physics
Mentors and/or Co-Authors: Elena Jakubikova Chemistry

Zinc bacteriochlorins are porphyrin-like molecules derived from naturally occurring bacteriochlorophylls a, b, and g, which are found in phototropic bacteria. Because of their intense absorption band in the near-infrared region (700-900 nm), these complexes are the subjects of interest for their application in light harvesting arrays. We have performed a theoretical study of beta-beta and meso-meso linked bacteriochlorin arrays to investigate their electronic properties near the HOMO-LUMO gap. Arrays of size from monomer to decamer with dialkyne and phenyl linkers were optimized employing density functional theory at the B3LYP level with 6-31G* (C, N, H) and LANL08 (Zn) basis sets and an energy-based fragment method. The HOMO-LUMO gap and band dispersion was then calculated for each array. As the arrays grow in size from monomer to decamer, the HOMO-LUMO gap decreases from 2.10 to 1.60 eV for the beta-beta arrays, and 2.10 to 1.47 eV for the meso-meso arrays. This is in contrast to the phenyl-linked arrays, in which the HOMO-LUMO gap decreases from 2.10 to 2.07 eV for the meso-meso arrays, and from 2.10 to 1.85 eV for the beta-beta arrays. The band dispersion for the dialkyne-linked arrays (0.30 and 0.43 eV for meso and beta decamer) was higher than the phenyl-linked arrays (0.04 and 0.17 eV for meso and beta decamer), suggesting that dialkyne-linked arrays are more strongly coupled than the phenyl-linked arrays. In general, the beta-beta linked arrays appear more strongly coupled than the meso-meso linked arrays.

Poster C16
Synthesis of Novel Analogues of Alotamide A: A Simplification of a Natural Product
Matthew Wesley Boudreau
Biochemistry/Chemistry
Mentors and/or Co-Authors: Joshua Pierce Chemistry

Alotamide A is a cyclic depsipeptide obtained from the marine cyanobacterium Lyngbya bouillonii. Alotamide A displays activation of Ca\(^{2+}\) influx in mouse cerebrocortical neurons. Neuronal cell death that is caused by glutamate neurotoxicity is believed to be a result of overstimulation of Ca\(^{2+}\) influx. Some neuronal diseases are caused by this glutamate neurotoxicity. Since these effects can be
replicated with Ca²⁺ influx activators (i.e. alotamide A), further study of neurological diseases, like Huntington’s disease and Alzheimer’s, can be conducted. Our retrosynthetic approach is to divide the target into a tri-peptide based northern fragment and an aliphatic southern fragment. The northern fragment contains a di-peptide fragment, consisting of proline and serine, which will be thionated and cyclodehydrated to form a thiazoline. The thiazoline is then coupled with N-methyl valine to produce the northern fragment. The southern fragment will be synthesized by coupling two commercially available alkenes to the left and right side of the northern fragment. The desired analogue will then be synthesized via a ring-closing metathesis. Currently, we have synthesized a northern fragment analogue. The successful synthesis of alotamide A and its respective analogues will lead to the elucidation of the target’s absolute configuration (has three unknown stereocenters), increased quantities of the compound for biological evaluation, and the opportunity to synthesize non-natural, potentially simplified analogues.

Poster A27
Student-Generated Instructional Videos for the Organic Chemistry Laboratory
Kristen Elena Eguren Human Biology
Victoria Saraldi-Gallardo Theatre Studies;
Michael Wolfe Chemistry
Mentors and/or Co-Authors: Maria Gallardo-Williams Chemistry

It has been debated whether or not the use of instructional videos as a learning tool holds any effectiveness in the organic chemistry classroom. The use of videos as a supplement to the labs and lectures can be seen as a lackluster way of delivering information, as they are a passive form of instruction. Our aim in this project was to make videos that were tailored to the instrumentation available in the labs at NC State. We wanted to have an instructional aid to help the students get ready for their labs in a short period of time, while providing them with accurate, useful, and easily available information. Videos were initially developed without on-screen captions, but we hypothesized that adding captions would increase the effectiveness of the learning experience, mostly for the students who are visual learners. These student-created short films were tested on groups of CH222 lab students. In general, students that watched the video prior to performing the lab felt well-prepared to use the instrument depicted. However, students that were shown the version of the video with on-screen captions were more likely to be able to use the instrument without any assistance from their TA, and were more likely to recall the correct set of commands for operating the software. The number of students that required extensive assistance from their TA was greatly reduced when they were exposed to the video with on-screen captions.

Poster C23
Separating trivalent Ln/An in nuclear waste using aminocarboxylate and fluorinated ligands
Travis Wrenn Morton Physics
Mentors and/or Co-Authors: Elena Jakubikova Chemistry

The TALSPEAK process is used for separating lanthanides and actinides in nuclear waste in order for it to be reprocessed or stored in a safer fashion. The process involves selective extraction of lanthanides into the organic phase using bis-(2-ethyl(hexyl)) phosphoric acid and retention of actinides in the aqueous phase by means of a holdback reagent - diethylentriamine-N,N,N’,N”-,N”-pentaacetic acid (DTPA). We use density functional theory at the B3LYP level to study interactions of hydrated Ln³⁺/An³⁺ ions with N-methylglycine (nmg), which serves as a simplified model of DTPA, as well as N-methyl-2-fluoroethyl (nmfe), which serves as a model of a fluorinated holdback reagent. We obtained optimized geometries for a full series of [Ln³⁺/An³⁺(H₂O)₈/₉]³⁺ and [Ln³⁺/An³⁺(H₂O)₆/₇(L)] complexes, where L = nmg or nmfe ligands. Finally, we evaluated Gibbs free energies for the ligand exchange reactions [Ln/An(H₂O)₆]³⁺ + L -> [Ln/An(H₂O)₆-L]³⁺ + 2H₂O. Our results indicate that almost all exchange reactions with nmg and nmfe ligands are exothermic. In general, both ligands bind more strongly to lanthanides than actinides, and nmfe binds more weakly than nmg across both lanthanide and actinide series. Current work entails analysis of bonding between Ln/An and the two different ligands employing natural bond orbitals. These results provide a basis for future research of fluorinated holdback reagents that are more resilient to radiation damage in the radioactive environment of nuclear waste.

Poster D36
Three-Dimensional (3D) Super Localization and
Tracking of DNA Molecules at Solid-Liquid Interface

Paul Maciej Tyrlik Chemistry

Mentors and/or Co-Authors: Gufeng Wang Chemistry

Adsorption is an important fundamental process that is used in a variety of applications such as gel electrolysis, chromatography, and purification processes. When the molecules or particles approach a solid-liquid interface, two types of apparent “adsorption” events can be observed: strong adsorption and weak adsorption. The first involves the particles completely immobilized by the surface for an extended period of time. The second shows the particles being retained close to the surface with apparent lateral movement. Here we study the weak adsorption on water-glass surface using a type of macro biomolecules - DNA molecules - by tracking their 3D trajectories around the adsorption site. In order to achieve a high z-resolution, we used a combination of astigmatism-based imaging and super localization techniques. We found that the weakly “adsorbed” DNA molecules are retained near the surface via a combination of long-range attractive and repulsive forces.
GEAR - Global Engagement in Academic Research

Poster A37
Computational Investigation of Zinc Oxide Nanowire Synthesis by CVD
Jinghui Bai Biotechnology
Mentors and/or Co-Authors: Jingyan Dong
E.P. Fitts-Industrl. & Sys Engr

Zinc oxide is high bandgap semi-conducting material exhibiting piezoelectric properties. Using a solid-vapor phase thermal sublimation technique, nanowires of ZnO can be synthesized under certain growth conditions. Among all inorganic semiconductor materials, ZnO is one of the materials that have the richest family of nanostructures from both the structure and property aspects. These nanostructures have novel applications in optoelectronics, sensors, transducers and biomedical sciences. At the present, there are two main setups to synthesize nanowire Zinc oxide including the physical vapor deposition (PVD) and the chemistry vapor deposition (CVD). The CVD system for growing ZnO nanowire generally consists of a furnace with gas supply system. When initiating, the precursor vapor is supplied, transmitted and activated at the crystallization energy at appropriate rate on a particular substrate. A variety of nanowires can be grown in a tube furnace via the transport of evaporated species by a carrier gas toward the collecting substrates. In this poster, we will deposit precursor material on Si substrate using AC Electrohydrodynamic Jet printing method and will utilize the Fluent to investigate the growth environment of CVD system.

Poster B29
Updating Flow Field Visualization Using FLTK
Lian Chengliang Computer Science
Mentors and/or Co-Authors: Hong Luo Mechanical & Aerospace Engr

Currently, FLTK has been a prevailing tool-kit to build graphical user interface providing programmer with convenient object-oriented programming style instead of traditional C code style. It couples with OpenGL perfectly in visualization of data. Our lab provides a ready-made system which could calculate the 2D flow field of given scenes in real time. The system drafts the scene and displays velocity, density and many other output data separately in different windows. Theoretically, it can build as many windows as we want. Originally, the system applies X11 to build multi-window structure, which has been primitive and out-of-date compared to FLTK. Using FLTK will grant us a simpler way to build GUI in connection with both up-to-date operating system and OpenGL library. Updating this system will also make it more agile to display data to users. By applying new feature like triple-buffering, the result will be displayed in a faster and neater way. It will also be a good chance to learn the work flow and data structure of the project, which combines the numerical analysis in computer science with algorithm in dynamic fluid, in a direct way to achieve the goal of inter-subject study.

Poster C32
Fabrication of Plasmonic Nanosensors Using Laser Interference Lithography
Jian Ding Optical Engineering
Mentors and/or Co-Authors: John Muth Electrical & Computer Engineering

Laser interference lithography is a good method for creating precise, periodic structures. A plasmon-based angle of arrival sensor was fabricated using this method. With the Lloyd’s Mirror Interferometer, photoresist can be exposed twice to make a rectangular nanobump array on a glass substrate. A thin layer of gold is then coated onto the substrate using e-beam deposition. This conductive layer excites surface electrons to collectively oscillate, creating surface plasmons. The coupling of the incident photon with the surface plasmon makes it possible for high-sensitivity devices to utilize the relationship between the surface plasmon resonance intensity and the angle of incident light. High sensitivity measurements can be achieved by choosing operating wavelengths with a narrow spectral linewidth. Due to the sensitivity, which is actually an internal physical property of the light-surface plasmon interaction, these sensors have the advantages of being low cost and having a simple structure, enabling a basically two dimensional device that does not need extra lenses or other complex 3D elements to operate. This sensor can be useful when tracking the position of the sun or other collimated bright light sources like lasers. Its performance is controlled by modulating the surface geometry parameters including periodicity and line width. Transmission spectra for polarized and unpolarized light at different incident angles were collected for the 600nm period plasmonic sensor.
**Poster A29**

**Formulation and Analysis on a Reconstructed Discontinuous Galerkin Method for the Euler Equations on Arbitrary Grids**

Yilin Du *Energy and Environmental System Engineering*

*Mentors and/or Co-Authors: Hong Luo Mechanical & Aerospace Engr*

The discontinuous Galerkin (DG) methods are locally conservative, stable and with high-order accuracy, which can handle complex geometries and irregular meshes easily. To enhance the accuracy of the DG method for the solution of the compressible Euler equations on arbitrary grids, a reconstruction-based discontinuous Galerkin (RDG(P1P2)) method is constructed in this research.

By using a high order representation of the reconstructed polynomial solution, RDG is expected to get high order accuracy for the solution of the compressible Euler equations on arbitrary grids, which is similar to the traditional DGM. In this work on RDG, the numerical polynomial solutions are represented using a Taylor series expansion at the center of the cell (it involves only the von Neumann neighborhood). It requires point values and derivatives to be interpolated to obtain a high order polynomial solution. The resulting over-determined linear system of equations is then solved in the least square sense to complete the reconstruction scheme. A number of numerical examples have been conducted to evaluate the accuracy, efficiency, robustness of RDG(P1P2) in comparison with underlying DG(P1) and DG(P2). The results show that this RDG(P1P2) method is third-order accurate and outperforms the DG(P2) in terms of both computing costs and storage requirements.

Further analysis of the dissipation and dispersion errors of the RDG(P1P2) is under consideration, which is mainly focus on dispersion and dissipation relation and influence of the least-squares reconstruction on the dispersion and dissipation relation.

**Poster D45**

**The application of PSO in distribution network's optimization**

Qianjun Gan *Electrical Engineering and Automation*

*Mentors and/or Co-Authors: Mesut Baran Electrical & Computer Engineering*

Reactive power compensation is an important application for operation of a distribution network. Distribution VVC (volt/var control) is an optimization problem which determines the reactive power compensation needed for a given operating condition in order to improve the voltage level and reduce power losses.

This project aims to apply particle swarm optimization (PSO) to solving the optimization problem of distribution VVC. PSO is a computational method that optimizes a problem by iteratively trying to improve a candidate solution with regard to a given measure of quality.

Classic reactive power optimization algorithm is a method based on differential calculus, which is difficult to get the global optimum. With the development of computer science, there're many intelligent algorithms that are more suitable for reactive power optimization. And compared with GA (genetic algorithm), PSO is easier to achieve and has less parameters to adjust.

Based on the principles and applications of PSO, this project will achieve the optimization of distribution VVC with the help of a toolbox of Matlab.

**Poster D34**

**PID Control for Path Tracking of Unmanned Vehicle**

Mingze Gang *Electrical Engineering and Automation*

*Mentors and/or Co-Authors: Mo-Yuen Chow Electrical & Computer Engineering*

A PID control for path tracking of a Lego Mindstorms Unmanned Vehicle is designed and implemented in this project, which is widely used in the field of industrial automatic control. Including designing circuits to properly interface sensors with actuators, writing and compiling programs to achieve path tracking, collision avoidance and platooning, constructing the final part of the project, we have completed this project of UV. Firstly, we researched on the principle and structure of PID controller and made use of it by Mindstorms software (NXT-G). Then we built our own sensors and set up circuits using these sensors to make them work well with the NXT, which is the part of hardware. At last we combined the two parts together to achieve goals as supposed. Based on PID, the Unmanned Vehicle can be controlled well in its route and speed. In
developments nowadays, automating and intelligence is a trend, furthermore, unmanned vehicle systems come to be used more and more widely and that is the reason we focused on it.

**Poster C36**
The structure of VO2 with different thickness in VO2/NiO/cYSZ/Si heterostructures
Sha Han Physics
*Mentors and/or Co-Authors: Jay Narayan Material Science Engineering*

NiO film is an optimal substitute for VO2 single crystal for its more flexible properties which are depended on thickness, doping elements, substrate property, deposition methods and so on. In our experiments, we will focus on the thickness-depended electrical and magnetic properties. Thus five VO2 layers with different thickness are deposited to form the VO2 / NiO / cYSZ / Si(100) heterostructures by pulsed laser deposition. We optimized each layer deposition condition in order to get epitaxial film of VO2. The phase structure and out of plane orientation of each film will be studied by X-ray diffraction and cross-section transmission electron microscopy and the results will be correlated with electrical and magnetic properties.

**Poster C50**
The Research about the Telomere-related proteins
Yuan Jin Optical engineering
*Mentors and/or Co-Authors: Hong Wang Physics*

Telomeres are nucleoprotein structures that cap the ends of linear chromosomes. The function of telomeres rely largely on the work of individual proteins interacting with DNA. Dysfunctional telomeres are important contributing factors in aging and tumorigenesis. To understand the function of telomeres, it is essential to elucidate how individual proteins come together in multi-protein complex to carry out their biological function. At the same time, it is also very important to clarify the mechanism regarding how those proteins find telomeric sequences among a genome of billions of base pairs. The goal of my summer research program is to use two highly innovative and complementary single-molecule imaging techniques (atomic force microscopy and fluorescence imaging) together with quantum dot labeled proteins to investigate how proteins locate TTAGGG telomeric repeats on DNA tightropes. Those proteins we are focusing on are TRF2, Rap1 and SA1. Which are all telomere binding proteins and play irreplaceable roles in the activity of telomeres. Meanwhile, these proteins also function in DNA replication, repair, and transcription. To study dynamic protein-DNA interactions in real time and at the single-molecule level, we learned how to purify DNA, analyze DNA length and protein volume from AFM images. In addition we used a unique DNA tightrope assay which enabled us to visualize movements of individual proteins on DNA in its extended form several micrometers above the surface.

**Poster B35**
Breakup of Liquid Jets under Low Pressure from Non-circular Orifices
Yueming Li Energy and Environment Systems Engineering
*Mentors and/or Co-Authors: Tiegang Fang Mechanical & Aerospace Engr*

Understanding liquid breakup from nozzles is important to achieve fine atomization and better air fuel mixing during fuel delivery processes in engines. Although there have been many research works on breakup of liquid jets from circular orifices, few studies were found from the literature on non-circular orifices. In this project, experiments were conducted to analyze the instability of a low-pressure liquid jet emerging from non-circular orifices including triangle, rectangular and square shapes. This work was mainly focused on the spatial instability analysis to examine the key characteristics of the liquid jet such as jet profile, axis-switching, and breakup length. Water jets were discharged into the ambient air at room temperature under different low injection pressures. A high speed video camera was used to capture the spray images. A Matlab program was developed to calculate the breakup length and surface wave length. Results show that the non-circular orifices yield shorter breakup lengths as compared to the circular jets. What’s more, the rectangular orifice presents an interesting phenomenon called axis-switching due to the competition of surface tension and the inertial force.

**Poster C35**
Improving Sustainability Performance Metrics
Ting Li Mathematics
*Mentors and/or Co-Authors: Al Chen Accounting*

The 21st century business leaders have learned the importance of leveraging a genuine commitment to
sustainability to help their companies grow their leadership in key markets. They need reliable metrics to show how accountability for sustainable development is implemented across business functions.

Many business parameters, for example, product cost, have both a fixed and a variable component. This study compares two different applications of activity-based flexible budgeting advanced by Bacardi Limited for sustainability performance measurement. The main difference is how to account for the fixed component. By accounting for each component separately, the influence of the fixed component can be effectively eliminated any distortion caused by changes in capacity utilization.

This project will use both mathematical induction and simulation to demonstrate that the effect of the fixed component. It is designed to compare the current year performance for the sustainability parameter against what can be achieved had the same set of activities been performed in a different year, typically the base year.

**Poster B33**

**Calibrating VaR Models to Chinese Stock Market**

Feifei Liang  
Quantitative Economics

Hongshan Chu  
Mathematics and Applied Mathematics

Yang Su  
Statistics

Aoyu Wan  
Financial Engineering

*Mentors and/or Co-Authors: Tao Pang Mathematic* 

Risk management is a very important aspect for financial investment. Value at Risk (VaR) is a measure of the risk that has been widely used in financial risk management by both practitioners and regulators. Estimating VaR with empirical data in the real financial markets has been the subject of many academic researches.

In our research, we manage to set up VaR models that can be effectively applied to financial markets in China. In order to estimate VaR, we consider both either non-parametric or parametric methods. As an non-parametric method, historical simulation method with different time weight schemes is considered. In addition, we also consider parametric models like EWMA and GARCH. As to EWMA, we simply need one input parameter - decay factor lambda. Instead of 0.94, widely used in US market provided by JP Morgan, we used the method provided by the Riskmetrics to estimate lambda based on Chinese market data. In the case of GARCH model, we use the maximum likelihood and Markov chain Monte Carlo to estimate parameters. Observing that the model often fails at the high confidence level, we modify VaR forecasting scheme in GARCH by a fat tail distribution rather than classical normal distribution. Several back testing methods, such as unconditional exception-based test, conditional coverage test, Kuiper test, Lopez’ Loss Function method are implemented to verify the performance of our models.

**Poster B34**

**The genetic mechanism of heterosis**

Steven Lin  
Industrial Engineering and Management

*Mentors and/or Co-Authors: Zhao-Bang Zeng Bioinformatics Research Center*

The utilization of heterosis (the superior performance of hybrids relative to the parents) has improved the productivity of various kinds of crops dramatically over the past few decades. Despite the rich literature in studies of heterosis, the genetic basis of heterosis is still not well understood. In this study, we focus on uncovering quantitative trait loci (QTL) that affect heterosis and estimating their effects (additive, dominant and epistatic effects) to study genetic mechanisms of heterosis. We use the ultrahigh-density SNP bin map of an “immortalized F2” population derived from an elite rice hybrid cross population provided by Prof. Qifa Zhang from Huazhong Agricultural University. We use two computational tools to analyze the data. One is Windows QTL Cartographer developed by Prof. Zhao-Bang Zeng’s group at NC State University, a software designed to perform QTL mapping analysis. The other tool we use is SIS, which is a package designed to perform sure independence screening when constructing linear regression model under R programming language developed by Prof. Jianqing Fang of Princeton University. Using the two tools, we mapped QTL of yield and estimate the relative contribution of dominance effects and additive-by-additive epistatic effects (the interaction effect between different QTL) to heterosis. We hope that the identification of these effects could help our understanding of the genetic mechanisms of heterosis.

**Poster A32**

**Mapping QTLs for Cold Tolerance in a St. Augustinegrass (Stenotaphrum secundatum var. Raleigh) self-pollinated population.**
St. Augustinegrass (*Stenotaphrum secundatum* (Walt.) O. Kuntze) is a warm-season, perennial grass widely used in tropical and subtropical regions. In the southeastern United States, it is a popular turfgrass commonly used in home lawns and landscapes because of its excellent shade tolerance and low input requirements. However, St. Augustinegrass cannot survive beyond the northernmost of the transition zone in winter due to its poor cold tolerance. In 1980s, ‘Raleigh’ was released by North Carolina State University and has been the superior, cold tolerant cultivar in the turfgrass industry for the past three decades. Simple sequence repeats (SSRs), a co-dominant and PCR-based molecular marker, is widely applied in plant breeding for genotyping purposes. The objective of this study was to identify quantitative trait loci (QTLs) effecting the cold tolerance of Raleigh, by using SSRs markers and field data to find associations between genotypes and phenotypes in a self-pollinated population of Raleigh. Ninety-five selfed Raleigh plants were genotyped with approximately 50 SSRs markers and alleles were separated by 8% (v/v) polyacrylamide gel electrophoresis (PAGE). Phenotypic data was collected for two years, specifically winter kill in early spring. A genetic linkage map was built using the SSR-based genotypes of the selfed Raleigh population and phenotypic data was used in an attempt to find QTLs related to cold tolerance. The identification of QTLs and the SSR markers associated with them will improve selection in breeding procedures in St. Augustinegrass.

**Poster C33**

The Behavioral and Cortisol Responses in Zebrafish with Divergent Stress Coping Styles

**Yanjing Liu** Biological Science

**Mentors and/or Co-Authors:** John Godwin Biology

Animals encounter a range of stressors and vary in their ways of coping with these stressors. Alternative behavioral responses to stressful situation are described as a coping style (e.g. proactive or reactive). Proactive individuals usually show more exploration to a new environment, less behavioral flexibility and a lower physiological stress response, while reactive individuals exhibit the opposite patterns. Understanding how gene expression and endocrine function influence coping styles are critical for understanding the mechanisms of this behavioral variation. Cortisol is a major glucocorticoid that is released when under stress and is known to alter a variety of physiological and behavioral activities. Zebrafish (*Danio rerio*) is used to study stress, anxiety and gene pathways. We measure the behavioral and endocrine responses in the open field test in two strains of male zebrafish (selectively bred to display either proactive or reactive behavior). Specifically we measured behavioral and cortisol levels from three different times: baseline, and 5 and 30 minutes after stressor. We hypothesize that the reactive fish would a) display less exploration as well as more stationary time in the open field test (OFT), and b) have a higher whole-body cortisol level relative to proactive fish when they encounter novel stressors. Results from this study may help us better understand the mechanism by which reactive fish exhibit a different coping style than the proactive fish. Understanding endocrine and neurobiological mechanisms related to coping style variation in this model organism may help us better understand human variation in reactions to stressors.

**Poster D31**

Have you smelled something phishy? A cross-cultural study on conceptions and experiences of phishing between China and the US.

**Yuqi Liu** Psychology

**Mentors and/or Co-Authors:** Chris Mayhorn Psychology

Phishing is a webpage or email-based deception that targets users’ sensitive information by counterfeiting a legitimate source. Previous evidence indicates that culture is a factor influencing users’ susceptibility to phishing. The goal of this research is to compare Chinese and American computer users’ conceptions and experiences of phishing. It is hypothesized that Chinese participants are more likely to be phished than American participants, and that American participants take protective measures more actively. It is also likely that Chinese participants are more sensitive than American participants to the social ramifications of phishing. The current study will be a pilot study designed to assess differences in cross-cultural phishing susceptibility. Moreover, the results obtained should contribute to our understanding of cross-cultural factors that influence the effectiveness of anti-phishing training and education design as well as web-page design.
Poster B46
Review of the Change’s Impact on Labor Productivity for Construction Projects
Xinyang Liu Civil Engineering
Mentors and/or Co-Authors: Min Liu Civil Engineering

It is commonly acknowledged that change orders, usually negatively affecting on labor productivity, are often inevitable for construction projects and tend to lead to legal disputes. Researches aiming to quantify the impact of change orders have achieved significant progress. The purpose of this research is to revisit the evolving discussion of the impact of change on labor productivity. In this paper, methods for quantifying the impact are reviewed and systemized to help project participants implement to specific circumstances. Reaffirmed or refuted hypotheses and conclusions of the previous literature provide better and comprehensive understanding to the readers. However, two limitations that found within those previous studies request further investigations: (1) objectivity control for many research methods are weak because model training data needs to either rely on actual plans, specifications or properly modified; (2) regression models fail to capture the linear correlation between input-output variables. Moreover, we recommend future research to follow the following directions: (1) an in-depth explanation in the presence of variables in the model and its implication are required to offer management advice for owners and contractors; (2) further investigation is recommended for projects that are unimpacted or positively impacted by change order.

Poster C37
Embedded Battery Management System: Android and Bluetooth
Yiqiu Liu Automation
Mentors and/or Co-Authors: Mo-Yuen Chow Electrical & Computer Engineering

Currently, the PHEV is getting more and more popular for the rising demand to use sustainable energy resources instead of fossil fuels. Battery is an important part of the PHEV system in the purpose of optimizing the functionality of the Electrical Vehicles. However, it is still difficult for PHEV users to get accurate parameters and states of the battery in a user-friendly way. In order to make the full use of the battery and improve the driving experience of the Electrical Vehicles, we implemented a battery management system using ARM board and Android smart phone. With my app, the users can get SOC information easily from the screen of their smart phone as a GUI (graphic user interface) is implemented on the phone. My app connects smart phone to ARM board through Bluetooth and receives SOC (state of charge) information of the battery from the ARM board. On the ARM board side, a Bluetooth module is connected via serial port using virtual serial port technology. The other member of our team developed program in the ARM board to collect, process and transmit data of the battery. Thus, the SOC information is sent to the smart phone and displayed on the screen for the users so that they can know about the battery better and enjoy their trip.

Poster C29
No Cooperation, No Advantages? A differential game of transboundary industrial pollution with emission permits trading
XIANGFEI MENG MATHEMATICS AND APPLIED MATHEMATICS
Mentors and/or Co-Authors: Negash Medhin Mathematics

My research goal consists of two parts. The first part is to learn the mathematical theory of optimal control. The second part is to apply control theory, in particular differential games, to a problem dealing with transboundary industrial pollution.

Currently, pollution is a world-wide problem and no country is able to deal with it alone. To be precise, the pollution produced in one country may not be contained in that country alone. For example, the air or water pollution in country A is likely to cross the border and contaminate neighboring countries B and C. Conversely, countries B’s and C’s pollutions may also affect country A.

In this project, a three-country system is studied in detail. Based on Yeung’s differential game model of transboundary industrial pollution, our purpose is to make use of optimal control theory to investigate three different conditions: non-cooperative, partly cooperative and cooperative, and to examine in each condition the benefits to the three countries. In the case of non-cooperation, A, B and C only care about their own gains, and in the case of partial cooperation only two countries negotiate for better joint benefit, while in the case of cooperation three countries work together to make optimal decision jointly. To better understand the idea appropriate mathematical models will be considered followed by numerical simulation.
**Poster B45**

A method to measure interfacial properties of oxidized liquid metal drops

YeLin Ni, Polymer Materials and Engineering  
**Mentors and/or Co-Authors:** Michael Dickey, Chemical & Biomolecular Engineering

Liquid metals are alloys with low melting points. They exhibit remarkable mechanical properties like low viscosity, large surface tension and non-wetting on glass. With exposure to air, however, these properties are affected by the oxide layer quickly generated on the surface. Conventional ways to measure surface tension of liquid metals, such as eutectic gallium-indium (eGaIn), include Axisymmetric Drop Shape Analysis (ADSA) technique, which calculates the surface tension according to pedant shapes. The problem with this method is that the shape could be maintained by oxidation even if the surface tension between liquid metal and solid oxide layer changes. In the research program, we established a novel approach to measure the interfacial properties of liquid metal alloys that surface oxidize. The challenge with these methods is that the interfacial properties are a combination of classic surface tension and the mechanical effects of a solid skin on the surface. We describe our method, initial results, and interpret the data to distinguish the role of surface tension from mechanical effects.

**Poster B30**

Stretchable RF antenna with Silver Nanowires

Lingnan Song, Optical Engineering  
**Mentors and/or Co-Authors:** Yong Zhu, Mechanical & Aerospace Engineering

Highly conductive silver nanowires (AgNWs) coupled with mechanically flexible and durable polydimethylsiloxne (PDMS) show promising potentials for RF applications. A stretchable antenna with strain sensing capability fabricated with AgNWs and PDMS is demonstrated in this work, where the resonance frequency of the antenna shifts in response to its changing geometry.

The 2D geometry of the RF antenna is designed as a rectangular microstrip patch antenna with the target operating frequency of 3-GHz following the transmission-line model. A dielectric substrate separates the ground plane from conductive antenna patch and an inset microstrip transmission line. The radiation pattern of the nonstretched antenna is analyzed for both near-field and far-field domains based on electromagnetic simulation using the Finite-Element Method (FEM) in COMSOL.

To fabricate the antenna, a thin film of AgNWs is embedded below the surface of PDMS, making an AgNW/PDMS layer with high conductivity. The ground plane and patch antenna layers are fabricated separately following this process, and then bonded together. To test the performance of the stretchable antenna, mechanical stretching is applied by a tensile testing stage, while S11 is measured to find the reflection coefficient and resonant frequency using vector network analyzer. A notable redshift in resonant frequency is observed as the tensile strain increases, which agrees well with the simulation result.

**Poster D28**

TensorReg: A Matlab Toolbox for Statistical Analysis of Tensor Data

Changhan Wang, Mathematics  
**Mentors and/or Co-Authors:** Hua Zhou, Statistics

Modern technologies are producing a wealth of data with complex structures. For instance, neuroimaging studies involve analysis of massive amount of two or higher dimensional image data. Recently a series of regression models have been proposed for the analysis of multidimensional array (aka tensor) data. However currently there lacks a centralized software of these new statistical methods for convenient use by researchers. In this project we develop a Matlab toolbox, TensorReg, that implements some common tools for statistical analysis of tensor data. Tensor principal components analysis, Kruskal regression and its sparse analog, Tucker regression and its sparse analog, and regularized matrix regression are treated in a unified framework. TensorReg toolbox is freely distributed under BSD license.

**Poster B43**

Embedded Battery Management System for PHEV: ARM board Test Bed and LCD Display

Ruiqi Wang, Electronic Engineering  
**Mentors and/or Co-Authors:** Mo-Yuen Chow, Electrical & Computer Engineering

The emergence of Plug-in hybrid electric vehicles (PHEVs) marks the trend of future transportation to reduce cost and greenhouse gas emission. Receiving
accurate information such as the SoC (state of charge) of the battery used in a PHEV is an urgent need. In this project, we migrate the Battery Management System (BMS) for PHEV with accurate on-line SoC estimation developed in ADAC lab from the Matlab/LabView platform to a TS-7800 ARM board. The ADAC ARM board BMS is a standalone platform without the need of specific software support. We use a signal conditioning board to convert the battery voltage and current to the arm board with an Analog to Digital Converter. Based on the data, the ADAC SoC algorithm implemented in the TS-7800 ARM board will provide an accurate SoC estimation of the battery. The estimated SOC value can then be sent to an android phone through Bluetooth, to a LCD or to a computer for display. The Bluetooth and android phone part is done by another member in our group. Through these three different ways, users can easily obtain an accurate SOC of the PHEV’s battery and know when they should charge the battery.

Poster D41
Development of a LabView-based interface for PID control demonstrations on a QET hardware platform
Chunqi Wang Mechatronics
Mentors and/or Co-Authors: Gregory Buckner Mechanical and Aerospace Engineering

The purpose of this work is to develop a LabView-based interface for a Quanser Engineering Trainer (QET) DC Motor Control hardware platform. This interface is designed to demonstrate the effects of proportional+integral+derivative (PID) control terms using a “hands on” approach. PID controllers are the industry standard for process control; they calculate the difference between a measured process variable (in this case motor position) and a desired setpoint, then attempt to minimize this difference by adjusting the process control input (in this case the DC motor voltage).

Our goal is demonstrate PID position control using a customized LabView interface, both in teaching (MAE 435: Principles of Automatic Control) and research environments, as it is visually oriented and easy to understand. Digital motor position is measured using an optical quadrature encoder, whose outputs are available via a 5-pin DIN plug on the QET. Data acquisition and counter boards from National Instruments (specifically the NI-6052E and NI-6601) are used to acquire and analyze the encoder signal, which is displayed on a waveform chart.

Poster C44
Self-Powered Environmental Vapor Concentration Monitoring Wristwatch Based on Microfabricated Tuning Forks
Xiaodan Xi Electronic Information Engineering
Mentors and/or Co-Authors: John Muth Electrical & Computer Engineering

The product of my research is a self-powered chemical monitoring wristwatch based on microfabricated tuning forks. This product is designed for patients and doctors to detect the concentration of chemical vapor (such as ethanol) in the environment and monitor the exposure. We use AD5930 as the frequency generator and generate various frequency input signal for the tuning fork. The frequency changes because the vapor reacts with a chemical coating on the tuning fork i.e. the tuning fork detects the change in mass. To detect the resonant frequency, and control the sampling rate, we use the microcontroller MSP430. For the power supply of the microcontroller and frequency generator, we use solar cells as the energy harvester, and use the DC/DC converter IC LTC3105 to get 2.5V output voltage, storing the power in a super capacitor, and finally get a steady output voltage of 2.5V using the LDO linear regulator IC TLV71325. We will design the circuits and program of the system and simulate to verify it. Finally, we will build prototype to test the performance of the product.

Poster D37
Soot Temperature and Concentration Measurements using Two-color Pyrometry
Shenglan Xiao Energy and environment
Mentors and/or Co-Authors: Tiegang Fang Mechanical & Aerospace Engr

The objective of this study is to gain a better understanding of soot process during diesel spray combustion under different ambient conditions in a constant volume chamber. Three ambient O_{2} concentrations (10%, 15% and 21%) and four ambient temperatures (800 K, 1000 K, 1200 K and 1400K) were used, simulating different EGR levels and injection timing in diesel engines. With a two-
color pyrometry method, the soot temperature and soot concentration (i.e., KL factor) in the spray flame were quantified. The result shows that the KL factor decreases and the flame temperature increases as the ambient temperature increases. On the other hand, a higher ambient O2 concentration leads to a low KL factor and a higher flame temperature. Considering the combined effects of the two ambient parameters, these conditions should be properly selected in order to simultaneously achieve low levels of soot and flame temperature. As for the transient combustion process, before the quasi-steady state combustion process, the KL factor presents a dramatic rise at the beginning, followed by a large reduction with the development of the flame. The flame temperature shows a continued growth as the flame develops. When the flame reaches the quasi-steady state, the KL factor and temperature are both kept in a relatively stable range and then decrease until the end of combustion.

Poster A38

Studying Object Recognition as a Function of Perspective

Tianwei Xing Electronics and Information Engineering

Mentors and/or Co-Authors: Edgar Lobaton Elec & Comp Engineering

Current vision based algorithms for object recognition depend on the extraction and identification of features. However, these features change based on the camera position and shape of the object. This makes the process of object recognition subject to the perspective from which the image was taken, and the shape and pattern of the object itself. In this research, these dependencies are quantified in a detection probability function; furthermore, some general conclusions are drawn, which take the shape, texture and orientation of the object into consideration. In order to construct the detection probability function, images of an object are gathered from various camera positions and orientations using a Kinova’s Jaco robotic arm. We train a classifier using a subset of pictures and test if the object other can be recognized from other perspectives using a standard algorithm. The implementation of the vision processing steps is done using OpenCV. The binary detections are analyzed in a statistical way by performing smooth kernel estimation.

Poster C31

PL Study on ZnO NWs by Tensile Strain

Yu Zhang Physics

Mentors and/or Co-Authors: Yong Zhu Mechanical & Aerospace Engr

The strained ZnO nanowires (NWs) have demonstrated great potentials as optoelectronic flexible nano-devices. The mechanical-optical coupling property of ZnO NWs has received much attraction due to their wide bandgap. Theoretical calculations on the bandgap of strained NWs have been investigated, which indicates that near-band-edge emission peaks would move toward lower energies as the strain increases. The mechanism of the competition between core-dominant and surface-dominant bandgap modulation could be applied to explain the bandgap-shift phenomenon. Experimental
methods include cathodoluminescence (CL), photoluminescence (PL), and Raman spectroscopy. In a typical PL experiment, a semiconductor is excited with a light-source that provides photons with energy larger than the bandgap energy. PL describes the phenomenon of light emission from any form of matter after the absorption of photons (electromagnetic radiation). In this study, ZnO NWs are synthesized by the vapor-liquid-solid (VLS) approach. Before testing, the ZnO nanowires were transferred onto a stretchable polydimethylsiloxane (PDMS) substrate, which is then uniaxially stretched by a tensile stage. Due to the large-strain elasticity of the substrate and the static friction between the NWs and the substrate, the NWs can be stretched to various lengths. We measured PL properties of ZnO NWs under different strains to analyze the mechanical-optical coupling and strain induced bandgap modulation.

Poster B38
PID controlling for Lego Mindstorms Unmanned Vehicle
Zhao Zhao Electronic Science & Technology
Mentors and/or Co-Authors: Mo-Yuen Chow Electrical & Computer Engineering

PID controller is widely used in linear systems whose dynamic characteristics do not change according to time. The goal of this project is to build a PID algorithm to control the movement of a small car assembled and programmed using Lego Mindstorms NXT set. The function that the car accomplishes is listed as following: First, to track a given path; Second, to stop in front of a block without bumping into it while being as close as possible to it; Finally, to follow a TA’s car moving in a varying speed in a certain distance and stop when encountering a red tape on the path while the TA’s car keeps moving. When tracking path, the error in PID algorithm is defined by the difference of the grayscale detected by the left light sensor and the right one. To make the error easier to detect, the height of the light sensor is switched from 3cm to 1cm. Another feature of the car is that the length between the two wheels is designed to be greater than normal so that when controlling steering via the difference of the speed of the two wheels, it would require a less accurate calculation to accomplish the equally satisfactory steering. In addition, the light sensor is 10cm in front of the wheels, leaving adequate time for the program to calculate and for the motors to react. When platooning, two sets of PID parameters are required and they shall all be modified repeatedly.

Poster D29
Determination of the Sensitivity of SEC
Kun Zheng Polymer Engineering
Mentors and/or Co-Authors: Jan Genzer Chemical and Biomolecular Engineering

The surface grafted polymer assemblies (SGPA) are formed by polymer chains which are chemically attached by at least one of their ends to a surface. Such construction can regulate the physicochemical properties of surfaces to which they are attached.

The growth of SGPA can be strongly affected by the type of polymerization, the density of the initiator, the delivery of catalyst and monomer, and the crowding effect of the chains.

My primary goal is to determine the sensitivity of size exclusion chromatography (SEC) using polymers with a range of molecular weights (MWs) and polydispersity indices (PDIs). As the concentration of the polymer in the SEC sample becomes smaller the SEC starts losing some information because of loss in sensitivity. We want to determine what is the critical concentration below which the data is not reliable. This depends on the initial PDI of the polymer.

The polymer with different PDIs will be made by using different types of polymerization schemes. FRP is less controlled and gives high PDI (>1.5). RATRP will give PDI in the range 1.3~1.6. ATRP can give PDI 1.05~1.20. For each PDI we also want to make polymer with varying MWs. In this process I hope to learn procedures and techniques commonly used in polymer lab.

My secondary goal is to learn to prepare surface-grafted polymer assemblies (SGPAs) and characterize them using ellipsometry, contact angle, etc. Because of the limitation of time, I have only finished the first section and participated in part of second part.

Poster D35
Controlled Growth of Novel Cu3Ge Interconnection Thin Film
Jingkui Zheng Optical Engineering
Mentors and/or Co-Authors: Jay Narayan Material Science Engineering

Copper has been widely used as the interconnection
material due to its low electrical resistivity and high electro-migration resistivity compared with the traditional Al metallization. However, copper is one of the fastest diffusing elements in Si with activation energy of 0.43 eV. The diffusion of Cu results in a deep level impurity and trap/recombination center in Si, impairing its electrical performance. The required diffusion barrier preventing Cu diffusion will increase the manufacture complexity and overall resistivity. In addition, the easy oxidation of copper leads to a substantial increase in resistivity as well. Cu$_2$Ge has been considered as an excellent candidate for interconnect material of the next-generation integrated circuits due to its remarkably low resistivity of 5.5$\mu$Ω at room temperature, which is only lower by a factor of three than currently used titanium silicide. Meanwhile, Cu$_2$Ge is stable against oxidation in air up to 520 °C, and it’s chemically stable up to 450 °C, which guarantees no out diffusion of Cu into the substrate. However, only polycrystalline Cu$_2$Ge films have been fabricated so far, where dopan diffusion along grain boundaries presents a serious problem. The epitaxial Cu$_2$Ge phase with no grain boundaries will certainly have a better performance as an interconnection material because of less diffusion paths and lower electrical resistivity. In this project, single-crystal, pure Cu$_2$Ge film is aimed to be fabricated onto Si substrates with appropriate buffer layer by pulsed laser deposition technique, and their electrical characteristics will be studied.

Poster D44
Diary Study of GraphTiles
Wenjia Zhu Geographic Information System
Mentors and/or Co-Authors: Benjamin Watson Computer Science

Our society will soon generate and consume over one zettabyte of information each year. A great deal of this information is consumed using mobile devices, which unlike PCs are always with us. Nowadays, as people get more smartphones, we are now able to search information on mobile devices. However, the existing technique has some constrains; for example, the size of the screen is small and the search speed is slow. We introduce GraphTiles, a visual interface supporting mobile information to better seek information on graphs. It is designed specifically to support imprecise mobile queries of a large database. We also conduct a diary study to better understand different types of search queries and to learn how people search information. We plan to ask participants to fill out a booklet every time they do a search. It includes the date and time of their search, duration of search, which website/application they accessed, what they searched for, and whether they found an answer from their first query. If participants were not able to find an appropriate answer from the first query, they were to provide a specific reason for any unsuccessful searches. Our study will analysis on the result of the search and come to a conclusion.

Poster A46
The improvement of Skimmer
Wenjia Zhu Geographic Information System
Mentors and/or Co-Authors: Benjamin Watson Computer Science

The Skimmer: "Monitoring the Gist of Streaming Text" which is a program that shows how words are associated on different online articles. This done by representing each word as article and show how close each is to another word which we usually use agent represents significant words. When you choose a key word, the screen will appear lots of "agent" that related to the word, if you click on a agent, there will be a frame with written note appear on the screen, the content is the description of the agent. For example, if you click on "Thanksgiving", it will pop out a frame which told you when is the Thanksgiving day and the school vacation time. However, there still some problems on the expression of graphic visualization, such as the color, the frame, because it looks pretty rigid. So my job is to try to improve these deficiencies by using Javascript. We hope that the interface looks more concise and beautiful, thus the user can feel more comfortable in using this program.

Poster A34
Testbed for the New V/f Control Method of Permanent Magnet Synchronous Motor
Zhiyuan Zou Electronic and Information Engineering
Rui Hu Electronic and Information Engineering; Yi Zhao Electronic and Information Engineering
Mentors and/or Co-Authors: Srdjan Lukic Elec & Comp Engineering

Permanent magnet synchronous motor (PMSM) is becoming more and more important because of its merits such as high frequency and high power density. One of the simplest ways to control a PMSM is the open loop V/f control method, which keeps V/f a constant to maintain the same torque-producing
capability. However, this method requires a damping winding to help stabilize the motor, which increases the cost. Other methods (vector control methods) require sensors to measure the speed and position of the motor, which is also undesirable. Blaabjerg et al have proposed a new V/f control method which operates stably without a damping winding. The idea is to adjust the frequency proportional to the power fluctuation. Our work mainly focuses on building up the hardware testbed using a PMSM as the drive and an induction machine as the load to test the effectiveness of this method. The control signal is generated from a Simulink model and implemented on the testbed via Opal-RT, a real time control system which is closely connected with Simulink.

Poster B32
A Cognitive Radio Simulation Framework on PHY/MAC Layers
Zhengyang Zuo Electronics Engineering
Shining Ma Optical Engineering;
Yuanqi Huang Micro-electronics Engineering;
Yu Yan Optical Engineering

Mentors and/or Co-Authors: Huaiyu Dai Electrical & Computer Engineering

Our research is to build a cognitive radio networks (CRN) simulation framework using the NS3 network simulator. We mainly focus on the physical (PHY) and the media-access-control (MAC) layers. We also try to find out a proper mathematical model to describe the operations of CRN and use MATLAB to calculate some performance metrics of CRN. The simulation results will be compared with the numerical results for further discussion. Based on the architecture of CRN, we design the state diagram and flowchart of the operations at the PHY and MAC layers, according to the CSMA/CA protocol and existing spectrum sensing/selection schemes, and simulate the PHY and MAC layers of CRN in NS3. By setting and adjusting network parameters, we get some interesting results (e.g., packet drop probability, end-to-end delay and throughput) for further study. In mathematical modeling, we study some important metrics such as channel utilization, delivery ratio and throughput and related analytical methodologies from relevant research papers. Based on our study, we propose an advanced model that corrects the errors and overcomes the drawbacks in existing ones. This model will be verified and further improved in the following study.
IMSD - Initiative for Maximizing Student Diversity

Poster C28
CD4+CD25+ T regulatory (Treg) cells induce Foxp3 binding to the IL2 promoter in CD8+ lymphocytes from Feline Immunodeficiency Virus positive (FIV+) cats.

Nnenna Okor Akaronu Biological Sciences
Mentors and/or Co-Authors: Jonathan Fogle Population Health and Pathobiology

Using the Feline Immunodeficiency virus (FIV) model for HIV, we have demonstrated previously that CD4+CD25+ T regulatory (Treg) cells from FIV+ cats are constitutively active and suppress CD4+ T helper cells and CD8+ CTL function during acute and chronic infection. Recent evidence from our lab suggests that Treg cells may induce the expression of FoxP3 in CD8+ lymphocyte targets. FoxP3 is a repressive transcription factor that binds to the IL2 promoter preventing transcription of this essential cytokine. FoxP3 has been shown to bind to the IL2 promoter in other lymphocyte subsets. We hypothesize that Treg-induced FoxP3 binds to the CD8+ IL2 promoter thereby repressing the transcription of this essential cytokine. Preliminary results demonstrate that following co-culture with autologous CD4+CD25+ Treg cells, CD8+ lymphocytes from FIV+ cats exhibit increased FoxP3 expression as assessed by intracellular cytokine staining (ICS) and reverse-transcription real-time PCR (RT-PCR). Further, RT-PCR demonstrates decreased IL2 transcription in CD8+ lymphocyte targets. Chromatin immunoprecipitation (ChIP) of FoxP3 followed by IL2 PCR indicates that FoxP3 binding to the IL2 promoter in CD8+ lymphocytes increased following Treg co-culture. Collectively these results suggest that FoxP3 is increased in CD8+ lymphocytes following interaction with FIV+ activated Treg cells and that FoxP3 binds to the IL2 promoter inhibiting IL2 transcription, which is essential for CD8+ lymphocyte function. This may help explain, in part, the CD8+ lymphocyte dysfunction that occurs during the course of AIDS lentivirus infections.

Poster C45
Sex and Strain Variation in the Zebrafish Acoustic Startle Response

Inderpreet Kaur Bajwa Biology-IPN
Mentors and/or Co-Authors: John Godwin Biology Ryan Wong Biology

In nature animals combat stressful circumstances in different ways and the manner and strength of their coping styles varies from individual to individual. When animals experience an unexpected stimuli (i.e. loud noise), they will react both behaviorally and physiologically in a way to prevent possible injury or death. A startle response is characterized by an involuntary reaction after being presented with an unanticipated stimulus, which is followed by elevated physiological and behavioral escape responses. Zebrafish have become a popular model for studying behavioral and neurological systems. Our laboratory has selectively bred wild-caught zebrafish to display either active (i.e. bold) or “freezing”/stationary behavior (i.e. shy) when they are introduced into a new environment. Previous studies in the lab have also shown that females display more stationary behavior than males. In this study we assess the startle response and characterize the recovery period in zebrafish. Specifically, we subjected 40 individual fish (10 of each sex for each strain) to an unexpected acoustic stimuli and quantified behavioral responses using automated software. We hypothesize that “bold” fish as well as males will exhibit less of a startle response when presented with an unexpected stimuli. Studying both intra- and inter-strain differences as well as sexual dimorphisms in acoustic startle responses may give more insight into the ways that animals
Poster A7
Evacuation Via Slime Mold: Physarum polycephalum Maps Hurricane Evacuation Routes in the Southeastern United States
Moriah Camille Barrow Biological Sciences
Mentors and/or Co-Authors: Rob Dunn Biology

Slime mold growth patterns reflect optimal networks for connecting resources and thus, implicitly, moving things among regions. Here we use the slime mold *Physarum polycephalum* to model optimal evacuation routes, assuming that slime molds are capable of optimization that is lacking in our own design of roads and networks. For this project, the plasmodium of *Physarum polycephalum* was used to form a hurricane evacuation system for the southeastern part of the United States. The experiment was conducted on an agar-covered road map placed in a Styrofoam box to emulate an optimal environment for the growth of the slime mold. Oat flakes are used to represent 40 cities in the experimental area, while a single piece of plasmodium is positioned in place of Jacksonville, Florida on the map. Over a period of 5 days, the plasmodium develops an intricate network between the oat “cities”. The links formed between the evacuating cities and their destinations represents hurricane evacuation routes in this scenario.

Poster B44
A Mathematical Representation for the Mechanistic Model of the Lignin Biosynthesis Pathway
Landon DeNorris Blakey Physics
Mentors and/or Co-Authors: Cranos Williams Elec & Comp Engineering

Lignin, a phenolic polymer, resides in the walls of thickened cells. It plays a crucial role in the sustainability of plants by protecting the cell wall from pathogens and microbial degradation. Lignin is also a major limiting factor in the conversion of plant biomass to biofuels. Because of this, efforts have been aimed at reengineering plants that produce lignin that will comply with chemical degradation. Predictive models of lignin biosynthesis would be a valuable supplement for biologists to identify adequate avenues of reengineering of lignin. Complete ordinary differential equation models of lignin, however, are difficult to achieve. The goal of this project is to use known information about the structure of the lignin biosynthesis pathway to implement steady state analysis techniques to assess the primary flow of flux through the pathway. The preliminary findings show that a mathematical model consistent with the mechanistic model of the lignin biosynthesis pathway can be produced by constraining the Vmax values and adding in known information about the enzymes that effect the flux at each point along the pathway.

Poster B9
Characterization of the IPEC-J2 Cell Line
Mary Ashley Brown Biology
Mentors and/or Co-Authors: Anthony Blikslager Department of Clinical Sciences

The IPEC-J2 cell line is an immortalized small intestinal cell line originally derived fro the jejunum of a neonatal piglet. However, it is unclear why the IPEC-J2 cell line has become immortalized, as it is thought to be composed of non-transformed cells. We postulate that the presence of stem cells in the IPEC-J2 cell line explain its ability to continually proliferate despite its non-cancerous origin. Immunochemistry shows that a portion of the IPEC-J2 cells express the stem cell marker SOX9, supporting our claim that the IPEC-J2 line contains stem cells. Currently, little is known about the gene expression and morphology of the IPEC-J2 cell line. Immunofluorescence shows that Occludin is localized to the border of the cells, indicating that the IPEC-J2 cells form tight junctions. In addition, immunofluorescence shows that IPEC-J2 cells express the epithelial marker Villin, as well as Mucin-2, which is a marker for goblet cells. Future studies will be directed at determining whether the IPEC-J2 line contains Paneth cells by evaluating the expression of lysozyme, as well as determining whether the proliferative marker PCNA and surface stem-cell marker CD24 are expressed. We hope to characterize the IPEC-J2 cell line to validate it as an appropriate *in-vitro* model, as well as a potential candidate for stem-cell studies in the pig, particularly as the pig is an excellent translational model given its physiological similarity to the human.

Poster B24
Everyone needs friends, why should ants be an exception?
Adrianna R. Cardinal-DeCasas Conservation Biology
Mentors and/or Co-Authors: Rob Dunn Biology

In many species, some individuals form unique ties
that lead them to interact more than might be expected by chance. In other words, individuals become friends. Most research on friendship focuses on mammals or birds in which memory of individual interactions is a prerequisite for such friendship. The existence of friendships in insects appears to have gone unstudied, perhaps in part because of the difficulty of identifying and following individuals. Here we take advantage of new approaches in tracking individual ants to test for friendships within small sub-colonies of two different species, specifically *Camponotus chromaiodes* and *Formica subsericea*. These ant species have highly different lifestyles: *C. chromaiodes*, polydomous, inhabit more than one nest, and *F. subsericea*, not polydomous. We studied their interactions by numbering them individually and observing each ant’s location over time relative to each other ant. We analyzed the data with the statistical program R; we wrote new commands in R to quantify whether ants were "friends" more often than would be expected on the basis of chance meetings. Both groups of ants were found to have friends, the first evidence, to our knowledge, of the existence of friends among insects. Despite the differences in lifestyle between the two ant species we studied, the size of friend groups was similar for the two species.

**Poster D4**

**Hemostatic properties of tissue engineering scaffolds: the effect of tricalcium phosphate on the porosity of electrospun PLA nanofibers**

Taylor Alexandra Jun Cook Biomedical Engineering

*Mentors and/or Co-Authors: Elizabeth Loboa Biomedical Engineering*

Solutions composed of polyactic acid (PLA) beads in chloroform and dimethylformamide (DMF) are electrospun to form nanofibers commonly used as scaffolds in tissue engineering and wound healing. Doping these PLA solutions with beta-tricalcium phosphate (β-TCP) results in scaffolds with increased proliferation of human adipose-derived stem cells (hASC) and osteogenic differentiation. The addition of β-TCP also creates implications for scaffold porosity and retention rates. The effect of loading 20% wt β-TCP into PLA solution on the porosity and retention properties of electrospun nanofibers is analyzed. Electrospun PLA nanofibers loaded with 0%wt and 20%wt β-TCP are compared based on pore diameter (image analysis software and SEM images) and retention rate (water-uptake experiment). The functional addition of β-TCP to PLA scaffolds is expected to increase the pore diameter of the nanofibers and increase the retention ability of the scaffold. The increase in pore size provides more surface area for hASC proliferation and is thus significant for tissue engineering applications. The increased retention ability is significant for wound healing applications as it indicates β-TCP/PLA scaffolds are capable of mimicking the mechanics of coagulation and hemostasis.

**Poster A40**

**Characterization of Interdigitated Electrodes to Manipulate hASCs / Maria Lourdes Carmela Cruz, Alison Amos, Gregory McCarty**

Maria Lourdes Carmela Gaurano Cruz Biomedical Engineering

*Mentors and/or Co-Authors: Gregory McCarty Biomedical Engineering*

Human Adipose-Derived Stem Cells (hASCs) can differentiate into several cell types associated with structural tissues including bone, cartilage, and muscle. Preliminary studies have shown that external applied potentials using interdigitated electrodes (IDE) can lead to increased differentiation of hASCs into osteoblasts. IDEs are ideal research tools because they are easily reproducible and their open nature allows for cell imaging. This study focuses on optimizing IDE fabrication using ultraviolet lithography and evaluating the electric field associated with the applied external potential using a previous model. The IDEs consist of a glass substrate with gold digits 100 μm apart. In fabricating the IDEs, altering the amount of photoresist applied and the time exposed in UV developer proved to be the most important parameters that yielded IDEs with minimal defects. For validating the electric fields model, electric potentials were recorded at 0, 100, 200, and 500 μm above the surface at 9 different points. Measurements were recorded at 1 V, 10 Hz, and 1 V, 1 Hz on a multimeter and oscilloscope, respectfully. It was found that each IDE exhibited a consistent electrical field up to 500 μm from the surface, which is above the reported height given by the computational model.

**Poster C14**

**Screening of 2-Amino Imidazole Analogues as Anti-Sclerotium Agents of the Plant Pathogenic Soil Fungus Rhizoctonia solani**

Anibal R Davalos Morinigo Chemistry

*Mentors and/or Co-Authors: Marc Cubeta Plant Pathology*

*Rhizoctonia solani* is a pathogen of plants that is
responsible for significant agricultural losses worldwide. The main survival mechanism of the fungus is based on the formation of sclerotia that can remain viable for years until favorable environmental conditions become available to infect the plant. Tools to study and/or inhibit the growth and survival of \textit{R. solani} are extremely relevant for understanding the sclerotium-forming process and developing effective methods for managing plant disease. In this study, we report the screening and evaluation of a group of 2-amino imidazole, analogues of the marine sponge \textit{Agelas sventres} natural product oroidin, as inhibitors of sclerotium formation without inhibition of mycelial growth in \textit{R. solani}. Five genetically different isolates of \textit{R. solani} (AG1-IA, Rhs1AP, 52-B, 30476 and BPIC-1102) were grown on potato dextrose medium and then transferred to Carbohydrate Active Enzyme (CAZY) medium amended with concentrations of 0, 1, 5, 10, 20, 50 and 100 µM of the desired analogue. Complete inhibition of sclerotium formation at 100 µM concentration without inhibition of mycelial growth was observed in strain AG1-IA after 7 days of incubation. Concentrations lower than 100 µM did not affect sclerotium formation and mycelial growth and were comparable to the control treatment. Based on these findings, research is currently in progress to evaluate the biological activity of potential inhibitors of the sclerotium formation process of \textit{R. solani} with additional 2-aminoimidazole compounds.

**Poster A17**

\textbf{And Then There Were Four: Population Divergence among Florida ridges in the ant species \textit{Dorymyrmex elegans} and \textit{Dorymyrmex bureni}}

\textit{Britne Rochele Hackett} Animal Science

\textit{Mentors and/or Co-Authors: Rob Dunn Biology}

\textit{Daniella Sorger Biology}

\textit{Dorymyrex elegans} is one of the rarest ants in North America. It is known from only two ancient sand ridges in Central Florida, the Lake Wales Ridge (LWR) and the Brooksville Ridge (BR). These ridges were formed up to one million years ago, enough time for divergence to occur. Last year we tested whether \textit{D. elegans} populations on these ridges had diverged morphologically and genetically. We found significant morphological differences in body shape, scape length, and color. To determine genetic differences, we used the cytochrome c oxidase I (COX1) gene and \textit{Dorymyrmex bureni} as an outgroup. \textit{D. bureni} is a widespread species along the east coast of the United States and also occurs on the same ridges as \textit{D. elegans}. \textit{D. bureni} resembles \textit{D. elegans} in appearance but can be distinguished by scape length and convexity of promesonotal profile. Behaviorally, \textit{D. elegans} is more timid and cautious in contrast to the readiness of \textit{D. bureni} outside of the nest. Our molecular data reveals no difference between populations of \textit{D. elegans} from BR and \textit{D. bureni} from both ridges and only a 1.8% difference between \textit{D. elegans} on LWR and the other populations. This year additional specimens of \textit{D. bureni} were collected from both ridges to compare morphological traits with \textit{D. elegans}. We found that there are significant differences in morphology between the \textit{D. bureni} and \textit{D. elegans} populations in addition to significant differences between LWR and BR populations of \textit{D. elegans}. Collectively, our results point to complex morphological variation among ridges despite the existence of only modest molecular divergence.

**Poster D15**

\textbf{Do You See What I See? The Fly as a Model System to Study Vision Disorders}

\textit{Kristin Elizabeth Gavin} Industrial Engineering

\textit{Mentors and/or Co-Authors: Mary Carbone Genetics}

More than 3 million Americans over the age of 40 suffer from age related eye diseases. These diseases can affect different levels of visual processing in the eye and can include disorders such as cataracts and glaucoma. Because predicting phenotypes from genotypes is such a difficult process, the genes that hold phenotypic variation in vision disorders naturally are unknown. In this experiment, we used the \textit{Drosophila melanogaster} Genetic Reference Panel (DGRP) as a model to display variation in visual processing by utilizing a phototaxis assay. By performing a genome wide association study (GWAS) using the phototaxis phenotype and whole-genome sequences of the DGRP, we are attempting to identify polymorphisms, candidate genes and genetic networks associated with age related decline in visual processing.

**Poster B21**

\textbf{Functional Senescence in the Rose Lines of \textit{Drosophila melanogaster}}

\textit{Sasha Harbajan} Biology

\textit{Mentors and/or Co-Authors: Trudy MacKay Genetics}

Senescence, increased physiological dysfunction with age, is observed in many organisms and can have a large effect on lifespan. For example, under laboratory conditions, selection for delayed reproductive senescence from a population of \textit{Drosophila melanogaster} shows increase in lifespan. Here we
attempt to understand if the behavioral trait senescence is also affected by this selection process. In this study, phototaxis and feeding behavior assays were carried out over a four week period using fruit flies that were selected for late reproduction and compared to that of the base population to understand the relationship between physiological decline and extended lifespan.

Poster A5
The Relationship Between Variables Among Older African American Adults
Maurita Tifquwana Harris Psychology
Mentors and/or Co-Authors: Jason Allaire Psychology

The current study examined the relationship between subjective health, objective health, self-reported health conditions, well-being, and depression in a sample of 602 African American ranging in age 48-95 years with an average as of 69.12 (SD=9.755). The data used came from the Baltimore Study of Black Aging (BSBA). The results indicated that subjective health and self-reported objective health were significantly and positively correlated. However, self-reported objective health and objective health were not strongly related. Well-being and depression were both positively and significantly related to subjective and self-reported objective health. Discussion will focus on the importance of considering perceptions of health in older African Americans.

Poster D39
The Role of the COP9 Signalosome in Insect Leg Development
Monique Shauntell McLeary Human Biology
Mentors and/or Co-Authors: James Mahaffey Genetics
Nathaniel Grubbs Biological Sciences

The COP9 Signalosome (CSN) is a protein complex that plays major roles in DNA-damage response, cell cycle control, and gene expression in many model species. It was discovered that CSN mutations potentiate the Hedgehog (Hh) signaling pathway in the wing of the fruit fly, Drosophila melanogaster. The Hh pathway is also known to drive leg development in Drosophila. Our lab identified CSN1b, a component of the Drosophila CSN complex, as a candidate gene affecting Drosophila leg development. It was further observed that reduced expression of CSN1b resulted in loss of distal leg segments. However, the process of leg development in Drosophila is specialized due to the differences between larval and adult bodies and may not provide a broad model for understanding the implications of CSN on leg development in other insects, since most other insect species possess larval appendages while Drosophila does not. Hence, we used the red flour beetle, Tribolium castaneum, to study the conservation of CSN on a more general scale. We implemented parental RNA interference to observe the effects of reduced expression of the Tribolium CSN1b ortholog, Tc-CSN1, on leg development in Tribolium. Our results yielded truncated legs and bristles phenocopies, leading us to believe that Tc-CSN1 plays a similar leg development role to that in Drosophila, possibly through Hh signaling. Stronger RNA interference lead to sterility indicating that CSN1 has broader roles than just in appendage development.

Poster B26
Logic Gate Representation of Gene Regulatory Networks: T-helper Cell Differentiation
Morjan Bassam Rahhal Biological Engineering
Mentors and/or Co-Authors: Cranos Williams Elec & Comp Engineering

Modeling biological processes can produce more accurate experimental and statistical data to help predict the behavior of the biological systems. The target of the EnbiSys Lab is to create and strengthen techniques that help transition large quantities of raw data to mathematical models that can be used to attain the depth, understanding, and comprehension needed to manipulate and control biological systems for a defined purpose.

The goal of this project is to build a visual representation of a Boolean model of the well studied differentiation process in Th cells using the National Instruments MyDAQ. By using this model we can verify our approach by comparing our results with those found in the literature. Visually representing biological models will allow us to show the activations and deactivations of the different elements of the model as the system converges from given initial conditions to the appropriate steady state equilibria. Currently, we are simulating the Th cell model using MATLAB in order to simulate the resulting output of Th cell differentiation. Modeling in MATLAB will also allow us to see each step of the differentiating process when starting from a certain initial condition.

Further steps of this project include modeling the Th network using the National Instruments MyDAQ.
Validity of START: AV Assessments in Predicting Adverse Outcomes in Incarcerated Youth
Rasika Usha Rajagopalan Psychology
Mentors and/or Co-Authors: Sarah Desmarais Psychology

The Short-Term Assessment of Risk and Treatability: Adolescent Version (START:AV) is a tool developed for the purpose of determining risk in adolescents in the criminal justice system. This is different from existing measures in that it includes 23 different factors that are each rated for both vulnerability and strength. Additionally, it focuses on eight different short term adverse outcomes (violence, self-harm, suicide, unauthorized leave, substance abuse, self-neglect, victimization, and general offending). The predictive validity of assessments were completed by 21 case managers on 77 adolescent offenders (63 boys and 14 girls) on admission. Data pertaining to adverse outcomes in the institution were coded by research assistants based on progress reports available in the institutional files. Results show that the clinical judgments of low, moderate and high show better predictive validity than estimates based on total scores. Overall, findings suggest that this is still a tool that could assist clinicians in identifying risk in adolescents in juvenile correctional facilities.

D5
Nano Aggregates with Ionically Triggered Disassembly for Advanced Drug Delivery
Divya G. Rao Chemical and Biomolecular Engineering
Mentors and/or Co-Authors: Orlin Velev Chemical and Biomolecular Engineering

The use of stimuli-responsive nanoparticles for biomedical applications has rapidly gained importance since the turn of the century. pH-sensitive drug delivery systems (PSDDS) enable the targeted delivery of therapeutics at a specific time. However, the need for PSDDS with ionic strength responsiveness could improve the efficiency of therapeutics in treatment of diseases. We will report the results of the development and testing of Triggered Disassembly Nano-Aggregates (TDNAs) with pH and ionic strength responsiveness. They have the ability to provide an efficient drug delivery system to target specific cells in the body and on the skin. TDNAs are made from an environmentally benign polymer, modified cellulose, and infused with a biopolymer, which precipitates out nanoparticles. Once synthesized, these nanoparticles can be functionalized with an active agent (drugs, etc). By increasing the ionic strength to physiological levels we can later trigger disassembly so as to release both the biopolymers and the active agent. Dynamic Light Scattering was used to determine the size and stability of these particles over time and as a function of pH and ionic strength. The synthesized TDNA’s diameter ranged from 100 to 300 nm in size and they were pH stable between 3.0-7.5. As ionic strength increased, a gradual swelling of the particles resulted in their prompt disassembly. UV-Vis spectroscopy was used to assess the loading and unloading of the active agent, Rifampicin, which is an antibiotic drug used in conjunction with other medications to treat Tuberculosis.

D48
Experimental and computational Studies of the activity of the native substrate for the two isoforms of Dehaloperoxidase
Supriya Sadagopan Biochemistry
Mentors and/or Co-Authors: Stefan Franzen Chemistry

Dehaloperoxidase (DHP) naturally occurs in two isoforms of A and B in the marine organism Amphitrite ornata. DHP is both a hemoglobin and a peroxidase, with a native substrate of 2,4,6-tribromophenol (TBP). The recent discovery of DHP B has been investigated, although the relationship between the enzyme and the substrate is still unknown with the finding of an internal binding sites in both DHP A and DHP B. This binding site could either be the location to where an inhibitor could bind, or where another substrate could attach, both which would decrease the activity of the enzyme. This is based on the principles of Michaelis-Menten kinetics. Using experimental and computational methods, the binding and chemistry of the DHP B and its binding site will be explored using TBP as the substrate in comparison to DHP A.

C30
MUC2 mucin as a minor mucin in the airway respiratory epithelial cells?
Austin Reese Smith Biochemistry
Mentors and/or Co-Authors: Kenneth Adler Department Molecular Biomedical Sciences

Mucin secretion protects airway epithelial layer while hypersecretion of mucin has been related to diseases that affect simple epithelial tissue. With mucin prevalent amongst illnesses such as colonic cancer, cystic fibrosis, and asthma it is necessary to understand
the general nature of this protein. It has been reported that MUC2, MUC 5AC, and MUC 5B are secreted by airway epithelial cells. Among airway epithelial cells, MUC5AC and 5B are a major secreted mucin while MUC2 is known as a minor mucin secreted by airway epithelial cells. Although MUC2 expression is increased in the airways with asthma, the localization of MUC2 with Alcian blue/PAS staining is not as clear cut as the localization of MUC5AC. It has been speculated that MUC2 has a high insolubility, making an assay harder. MUC2 also has a characteristic of autocatalytic cleavage at C-terminus at pH 6 or below condition in vitro and possibly in vivo. Here, we used two different, commercially available antibodies related to two different regions of MUC2, tandem repeated (TR) region and C-terminal (CT) region. We utilized fully differentiated normal human bronchial epithelial (NHBE) cells grown on air/liquid interface condition and individual fully differentiated NHBE cells prepared by cytospin. MUC5AC and ChromPure mouse IgG were used as a positive and negative controls respectively. While a staining using a CT antibody showed a rare positive localization of MUC2, a staining using a TR antibody showed higher numbers of positive localization of MUC2. This result suggests that MUC2 staining is dependent of choice of antibody, which might lead to a different conclusion of study.

C12

pH Dependence on DHP-TBP Reaction
Omokuyani Chibuzor Udiani Physics
Mentors and/or Co-Authors: Stefan Franzen Chemistry

Amphitrite is a worm found in shallow coastal waters. The enzyme dehaloperoxidase found in the worm is believed to have both hemoglobin and peroxidase functions. Not only does the enzyme transport oxygen, it also detoxifies compounds such as 2,4,6-tribromophenol as a peroxidase through redox reactions. The enzyme is believed to execute its peroxidase functions at active sites. The different binding locations of substrate 2,4,6-TBP and inhibitor BP determine the fate of these molecules. This research seeks to determine the relationship between the pH of the DHP-TBP reaction and the substrate and inhibitor binding location. Under physiological conditions with a pH of 7.4, 2,4,6-tribromophenol is in its conjugate base form 2,4,6-tribromophenolate. Moreover, 2, 4,6-tribromophenol is barely soluble at a pH below its pKa of 6.4, but is sparingly soluble at a pH of 7.4. This research demonstrates how pH values affect charge and solubility states that in turn affect the binding location of the substrate.
Interactive and Intelligent Media REU

A30
Deep Thought 2.0: Rebuilding a Logic Proof Tutor for a More Effective Learning Environment
Cameren Christopher Dolecheck Computer Science
Mentors and/or Co-Authors: Tiffany Barnes Computer Science

Intelligent Tutoring Systems (ITS) are recognized as being valuable tools for student learning, primarily because of their ability to tailor the learning experience to individual students. In the Game2Learn lab, we have augmented the Deep Thought logic tutor with intelligent, adaptive hints based on prior student work. However, this level of adaptation has not been sufficient to help the wide range of students learning logic with Deep Thought. We have redesigned Deep Thought to be more modular, keep more accurate and complete data logs of student interactions, and to allow for more types of exercises to scaffold learners into being able to do full proofs independently. We hypothesize that the new design will promote higher learning gains and retention when compared with Deep Thought as used in prior classes.

D20
Developing and Testing Interruptible Rendering
Daniel Louis Gross Computer Science
Mentors and/or Co-Authors: Benjamin Watson Computer Science

Despite the great advances made in computer graphics, limits still exist. Even today, the highest detail images cannot be displayed at the highest frame rates. Which should be emphasized, visual detail or frame rate? Interruptible rendering offers a dynamic middle ground. Rather than maintaining either a constant number of frames per second or a fixed level of visual detail, interruptible rendering chooses the best compromise. We have implemented interruptible rendering using Nvidia's OptiX ray tracing engine, as well as a test gaming environment. We plan to compare gameplay with and without interruptible rendering, using measures of gaming performance and player engagement.

C15
Snagem & The Avatar: Mask or Self-Portrait?
Marisa R Guarino Computer Science/Creative Writing
Mentors and/or Co-Authors: Tiffany Barnes Computer Science

Game researchers are often interested in how players use avatars within games to portray themselves in a digital environment, where they are not physically present. Players can choose avatars that reflect their own physical characteristics, or create a new identity — a new avenue toward a person they’d like to be — in the game's world. Snag'em provides a unique virtual experience that is linked to real physical interactions since it is a game that uses missions to meet others to help players become part of a community at a real-world, physical conference. Within Snag'em, players are free to create wild and crazy avatars (called "snaggles"), but to play, they must meet and "snag" others who are playing the game; they cannot play only in virtual space. At the STARS Celebration, the 2013 conference that brings together computing students across the country, the Snag'em social networking game will be used to study how players use avatars when the game exists in both physical and virtual environments (where little research has been done). When players create an avatar, they will receive small in-game incentives to come to the Snag'em booth at the conference and have their photo taken. Comparisons will then be made between the person’s features and their avatar's. In particular, we will investigate whether or not the avatar is seen as a costume (a silly extension of the player where ideas are free to be expressed) or a digital representation of the user (a literal online transcription of a person’s physical appearance). This may help better understand why avatars are important — whether they are expressive masks or detailed self-portraits in the digital world.

A4
Using Student Data to Evaluate Problem Difficulty within an Intelligent Tutoring System
Taryn Leigh Hampton Computer Science
Mentors and/or Co-Authors: Tiffany Barnes Computer Science

Intelligent tutoring systems (ITS) improve student learning by tailoring learning experiences to individual students. This customization is often built using paths through learning materials crafted to lead students from easier to more difficult problem-solving. In
Spring 2013, the Deep Thought logic tutor was modified to allow for more customized paths through the learning material, where students were directed to solve particular problems based on their performance on prior problems. A study was conducted within a philosophy course using this new version of Deep Thought, and data collected from this study revealed a high dropout rate within the tutor. We hypothesize that the cause of the high dropout rate was due to inaccurate problem difficulty classifications. We are measuring the difficulty of each problem based on the time spent, the number of steps each problem took, and the number of errors students made on each problem. We hypothesize that some of the earlier problems classified as "easy" may in fact be more difficult that expected. We will use our findings to create recommendations for problem creation and selection for the Deep Thought logic tutor.

B.O.T.S.: Seeking to Improve an Educational Game's Layout and Design
David William Harris Editing and Sound Design
Mentors and/or Co-Authors: Tiffany Barnes Computer Science

B.O.T.S. is an educational game that seeks to harness user-generated content in a syntax-free environment to teach concepts and develop skills necessary for success in computer science curricula. It is similar in many ways to a game called Lighthbot, but gives players the added function of being able to create their own levels. The current layout of the B.O.T.S. game features a 5x4 grid “program area” into which players can drag commands, controls (loops) and functions in order to move and control a robot character to solve levels using the fewest possible number of commands. This study seeks to determine how small changes to the B.O.T.S. interface and layout affects players' transfer of programming knowledge from the game world to a real-world applied scenario. I hypothesize that a top-down list layout better resembles the experience of working with programming languages such as Python or Javascript and will therefore improve transfer of learning from B.O.T.S. to these and similar languages. We will have two groups of middle-school aged students play two versions of the game and complete three tests (pre test, mid-test and post-test.) One version features the current grid layout, the other uses the revised top-down list layout in the program area. The tests will include questions that evaluate students' understanding of when and how to best use loops and functions within programming and will be administered before and after the students have a chance to play each version of the game.

Who Has Set Us Up The Bomb: A Method for Extracting Game States from Incomplete Game Replays
Thomas Alexander Hege Computer Science
Mentors and/or Co-Authors: David Roberts Computer Science

When working with game data collected from a third-party, researchers don't always get access to the complete data that is needed to answer their research questions. Sometimes the interesting questions involve general or team strategy questions and the only data available are vague position data. These general questions require knowledge about game states that simple telemetry data does not easily explain. Our work interprets player actions, which were given with timestamps and activation positions, into basic game state information which includes game win/loss states, team identification, individual player personality, and character roles. Our approach involved the creation of a data visualization tool which we used to get first impressions of data provided to us for the game Heroes Of Newerth. Heroes of Newerth is a free to play MOBA (Multiplayer Online Battle Arena) game where two teams of five control heroes to destroy the base of the opposing team. The games we were given data for lasted approximately 30 minutes, which is the average length of a match in Heroes Of Newerth. From the visualization we analyzed the given data with simple logistic and linear regression models at early, main, and end game phases to identify a basic game state representation. This provides developers with a tool to interpret general game replays into more meaningful representations and reduces the amount of effort by researchers to begin answering (potentially more complex) research questions.

BOTS: Tutorial Presentation Style Comparisons For Educational Games
Enrique Wanchese Kinsey Software Engineering
Mentors and/or Co-Authors: Tiffany Barnes Computer Science

The attrition rate of students in science, technology, engineering, and math (STEM) related fields is twice that of all other majors combined. It is our goal to attract and retain more students in STEM related fields by engaging students in fun STEM-learning games.
starting in middle school. BOTS is a social multiplayer online game designed to teach students about introductory computer science concepts such as loops and functions in a fun and engaging way. The purpose of this project is to determine the game tutorial presentation method that is most likely to keep new players engaged with our game, while simultaneously providing the maximum amount of learning possible. To test this, we propose a study that will engage three different groups of middle school age children, each interacting with a unique method of tutorial presentation. I hope to prove that the adaptive version of the tutorial which is designed to tailor the amount of information offered to each individual student will be the most effective method. This study should help educational game designers create more effective and efficient tutorials that minimize tutorial time while maximizing learning time within the game.

A49
Engaging Middle School Children with a Game-Based Learning Environment for “Big Data”
Allison Grisell Martinez-Arocho Computer Science
Mentors and/or Co-Authors: Kristy Boyer Computer Science

Living in an increasingly technological world, it is of great importance that students learn about computing during their K-12 years. A particularly important concept is Big Data, which is a continuously growing phenomenon spanning many disciplines. This concept is emphasized within new computing curricula for high school, but how to adapt it for middle grades is an open question. This undergraduate research project has focused on a game-based learning environment called ENGAGE, which aims to translate the new CS Principles curriculum to middle school students, including Big Data. In order to better understand how to teach middle school students about Big Data, this research project conducted a workshop with three middle school teachers who validated the proposed activities and inspired new activities that align with the Common Core State Standards in Math, Science, and Language Arts. This poster presents analysis of these educator recommendations. Future work will conduct a study that will look at how different application domains affect learning the intended material, in the hopes of identifying a way to present Big Data by associating it with concepts that students can relate to. The findings will inform the ENGAGE Project by tailoring the content of the game so that it maximizes students’ interest in computer science.

B22
Increase motivation in Bots, an educational game, by adding a StoryMode
Gabriel Eduardo Perez computer science
Mentors and/or Co-Authors: Tiffany Barnes Computer Science

Bots is a game created to help middle schoolers learn computational thinking skills by solving puzzles. Bots allows students to make and share their own puzzles, which are three dimensional grids that players must navigate with a robot. While making and solving puzzles can be fun, Bots does not provide any direction for players. I hypothesize that a version of Bots that includes a series of challenges in a story progression will engage players, providing them structure that will make them play the game longer and learn more. To evaluate my new story-based version of Bots, I will perform a user study where one half of the students will play the original game and one half will play the story mode. I will compare learning gains between the pre and post tests across the two groups and also the survey results measuring engagement. I expect students in the story mode to learn more, and to be more likely to respond that they would play the game again and would recommend it to their friends.

C8
Intuitive Narrative Generation and Mixed-Initiative Planning
Christian Harrison Stith Computer Science
Mentors and/or Co-Authors: Michael Young Computer Science-Engineering

As computer simulation technology has improved, the benefits and applications of 3D simulation have increased greatly. Of particular interest is the field of virtual narrative generation, in which computer programs are used to create, edit, and view simulated sequences of actions that form a story. Virtual narratives have immediate practical benefits - crime scene investigators, for example, might want to reconstruct the flow of events in an unsolved crime. However, authors of these virtual narratives are typically experts in their own field of study, and are unfamiliar with the programs and techniques used in virtual narrative generation. In addition, these human authors may find the details and small actions associated with maintaining a sound narrative to be tedious. While an automatic narrative generator (such as a planning algorithm) would not have these problems, it lacks the creativity and domain-specific knowledge of a human user. To fully exploit the
strengths of both the human user and the computer, a virtual narrative generation system must be easy to learn and use, while allowing the user to interact with the computer system via a mixed-initiative process. We present Frosty, a user-friendly narrative generation interface modeled after mainstream beginner film editors. We plan to enhance our interface with an automatic planning algorithm that will assist the users in developing narratives. It is our belief that such an interface would allow non-experts to create sound and realistic virtual narratives with minimal effort.

C47  
**Improving The Mobile Experience Through Pre-attentive Processing**  
Christopher Lee Stroud  
Computer Science  
*Mentors and/or Co-Authors: Benjamin Watson  
Computer Science*

While mobile operating systems have grown to support multitudes of third-party applications in recent years, the visual organization paradigm of user app libraries have mostly remained static. This research focuses on how pre-attentive processing may assist users in more easily locating the apps on their smartphone that are most important to them. Pre-attentive processing can be easily visualized by considering an image filled with blue circles, then adding a red circle. When tasked to find the red circle, it is not a challenge for the user, whereas finding a blue square would be quite difficult.

We have implemented a technique for Apple's iOS that allows us to apply preconfigured effects to app icons in a dynamic fashion, as part of our encompassing experimental design. We manipulate various attributes of the icons such as brightness, displacement, rotation, drop shadow, size and shape. Some effects, such as drop shadow, are enhanced with a three-dimensional parallax effect to augment a sense of depth, further separating the highlighted icons from their surroundings by elevating them to a perceptual plane that appears closer to the user.

We aim to test this approach by applying different highlights to icons and timing users to see which, if any, highlights are more effective in helping them find the app they were tasked to locate.

C48  
**The Relationship Between Task Difficulty and Emotion in Learning Environments**  
Joseph B Wiggins  
Computer Science  
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Computer Science*

Promoting positive emotions during learning is important for students' academic well-being. Positive emotions, such as engagement, can be fostered by tailored help if the task the student is working on becomes more difficult. Recognizing when a student is facing a daunting or complex task may better inform teachers or adaptive learning environments about students' affective, or emotional, states in order to provide individualized instruction. We approach this research goal by analyzing a video corpus of computer-mediated human tutoring sessions in computer programming. The most difficult tasks were identified by comparing frequencies of student and tutor interaction and task-related behaviors, such as attempting to run the program and time taken to complete tasks. Nonverbal behaviors, such as facial movements or posture shifting, were then associated with task difficulty. Tutorial interventions can be informed by student nonverbal behaviors, which may keep the student engaged and foster greater learning gains.
Response of Dissolved Organic Matter Quality to Discharge in Urban Streams

Brittney V Adams Science

Mentors and/or Co-Authors: Christopher Osburn Marine, Earth & Atmospheric Sci

Dissolved organic matter (DOM) is an important property of stream ecosystems, resulting from the decomposition of dead organic matter stored in soils. Colored dissolved organic matter (CDOM), the fraction that absorbs ultraviolet (UV) and visible light, is the controlling factor for the optical properties of surface waters. Measuring the specific ultraviolet absorbance (SUVA) of a water sample at 254 nm by normalizing absorption ($a_{254}$) to dissolved organic carbon (DOC) concentration, SUVA$_{254}$, assists in predicting general chemical characteristics of DOM. The ratio of the slope of CDOM absorption at 275-295 nm to the slope of CDOM absorption at 350-400 nm ($S_R$) is another method of characterizing the quality of OM. In urban streams, it is not well known how DOM changes as a function of discharge during storm events. Urbanization radically changes the hydrology of urban stream catchments and can influence the quality of DOM. I studied five urbanized streams in the Neuse River Basin near Raleigh, NC: Crabtree Creek, Rocky Branch, Marsh Creek, Walnut Creek, and Pigeon House Branch. I used $a_{254}$, SUVA$_{254}$, DOC, and $S_R$ values because these urban stream samples vary in response to changes in discharge during both storm events and periods of base flow. In general, $a_{254}$ and SUVA$_{254}$ increase with higher discharge values while DOC concentration decreases with increasing discharge. However, these overall trends are not consistent for each location. Future work to fully understand the dynamics of these systems should include event-based sampling or in situ monitors.

Entering Data for Predicting Hurricanes

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To predict hurricanes, data needs to be collected and entered into a spreadsheet. The data includes the number of hurricanes and tropical cyclones in a given region. The regions I looked at were the Atlantic Ocean, the Caribbean Sea and the Gulf of Mexico. This data was obtained by looking at maps from http://www.ne-climate.ncsu.edu/climate/hurricanes/search.php. I also was given a time frame of 59 years starting from 1901 and ending with 1960.

The hurricane count for each of the three regions is documented in a spreadsheet, as well as the strength of the hurricanes. The spreadsheet also includes the landfall counts for each country or US state in each region.

Once the data has been entered individually for each year, the data for all 59 years goes into one spreadsheet. This spreadsheet has the data for each region and sub regions for all years in the given time period.

With all of the data input in to the spreadsheet, further calculations can be done to determine the projected number and strengths of hurricanes for each of the three regions.

Six-Year Climatology of Precipitation within Major Storms in Northern California

Nicole A Corbin Meteorology

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The altitude where precipitation falls determines if it falls as rain or snow. In mountainous regions such as northern California, single storms can produce both rain and snow at different mountain elevations. More accurate prediction of where precipitation associated with those storms is likely to occur, in terms of specific watersheds and elevations, will aid flood forecasting and fresh water supply planning. We use weather radar data to analyze the distribution of precipitation with elevation within 12 watershed basins in northern California for 64 major storms that occurred over 6 years. We examine both the wind direction near the coast and the occurrence and height of the Sierra Barrier Jet (SBJ) as potential predictors of precipitation location. The SBJ is an approximately 80 km by 300 km region of strong surface winds directed parallel to the Sierra Nevada mountains. Our findings indicate that a few regions on the windward slope of the Sierra Nevada, such as the Yuba, Feather, and Butte Creek basins, frequently experience heavy precipitation. Other basins in the region experience
more variable precipitation from storm to storm. Overall, both characteristics of the SBJ and wind direction have some skill in predicting precipitation location. Our observations also generally confirm the idealized model of increasing precipitation with increasing height from near sea level to 1 km for portions of the windward slope of the Sierra. However, at elevations above 1 km altitude, observations disagree with the idealized theory and indicate that precipitation tends to decrease with increasing height.

A12
Analysis of Environmental Impacts from Site Development at Wake Technical Community College's North Campus Using GRASS GIS
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Wake Technical Community College's north campus has been developed similarly to many commercial sites, in that parking lots tend to be the predominant feature with building footprints occupying a much smaller space. The addition of impervious surfaces changes the rate and volume at which rainfall runoff enters local waterways, increasing erosion and flash flood potential. Parking lot runoff often carries pollutants into local streams which can negatively impact entire ecosystems.

Comparable environmental impacts will likely be associated with similar regional development, therefore the results of this research could help to quantify the impacts of development on regional watersheds. By identifying and implementing the least invasive methods of development, long term negative effects of urbanization could be minimized.

GRASS GIS software was used to analyze available data, develop and compare features and simulate changes in surface runoff. Project data were made available from Wake County and the U.S. Geological Survey. Research efforts were predominately focused on identifying changes in topography, quantifying increase in impervious surfaces and modeling impacts of those changes on spatial pattern and magnitude of storm water runoff.

Weighted flow routing models were run in GRASS GIS with impervious parking surfaces, porous asphalt and multistory parking structures to compare their runoff performance. Porous asphalt performed very well, producing no surface runoff. Traditional paved parking had the largest impervious surface and produced the most runoff. Economic comparisons of each method proved more difficult, as construction, material and maintenance cost vary greatly.

C41
A Comparison of Pedagogical Beliefs of Geoscience Faculty and Graduate Teaching Assistants
Lori Ann Gould Associate In Arts
Mentors and/or Co-Authors: David McConnell Marine Earth & Atmospheric Sciences
Lori Ann Gould College Transfer
Mentors and/or Co-Authors: David McConnell Marine Earth & Atmospheric Sciences, Katherine Ryker, Michael Pelch

How do the teaching beliefs of geoscience Graduate Teaching Assistants (GTAs) compare with those of geoscience faculty? The influence of a teacher's pedagogical beliefs is reflected in the manner in which they teach their classes. The goals of this study were to characterize the teaching beliefs of geoscience GTAs and faculty, and describe any differences identified. Data was collected from three geoscience faculty and three GTAs. The GTAs each had at least three semesters of laboratory teaching experience. The teaching beliefs of each participant were examined using the Teaching Beliefs Interview (TBI). The TBI is a semi structured interview comprised of seven questions. Each interview was audiotaped then transcribed verbatim without dialect for analysis. Responses to each of the seven questions were coded into five categories of beliefs: traditional, instructive, transitional, responsive, and reform based. Responses coded as traditional represent more teacher-centered beliefs. Responses coded as reform-based are representative of student-centered beliefs. The resultant codes were plotted to highlight the similarities and differences between the responses of geoscience teachers and GTAs. The results of this research provide evidence to science departments providing pedagogical guidance and support to GTAs in order to develop their beliefs in accordance with instructional strategies.

A50
Using Sediment Particle Size To Explore The History of Lake Quinault, Washington
Corey Bernard Moore Geology
Mentors and/or Co-Authors: Lonnie Leithold Marine Earth And Atmospheric Sciences

The location of Lake Quinault at the foot of the Olympic Mountains makes it an ideal site for the study of sediment deposits from past landslides and other
erosion-causing events. By studying the sediment layers that have accumulated at the bottom of the lake, we may be able to date previous large-scale events such as storms and earthquakes that have occurred in the region. Sediment particle size is one potential tool for identifying these events, which in return would have yielded large influxes of sediments. Using a Beckman Coulter Laser Particle Size Analyzer we have looked at the particle size trends in gravity cores recovered from two sites in Lake Quinault. The cores record sediment accumulation on the lake floor over several hundred years. One hypothesis we are testing is that a flood may have followed an earthquake that occurred in the year 1700, when a large amount of sediment may have been introduced into the lake as a result of widespread landsliding in the Olympic Mountains. We are also hoping to compare particle size data to the geophysical measurements that have been made on longer cores (up to 7 m long) that were recovered from the lake. For example, if magnetic susceptibility or density measurements show a strong correlation to mean particle size in the gravity cores, then we can use those measurements to hopefully recognize other “event deposits” buried at greater depths in the lake.

A10
Grain Size Analysis of the Piedmont Region of North Carolina
Melanie Cherese Rodems General Studies
Mentors and/or Co-Authors: Karl Wegmann Marine, Earth & Atmospheric Sci
Nathan Lyons Marine, Earth & Atmospheric Sci

We analyzed sediment samples collected from streams in the piedmont region of North Carolina, in order to evaluate the control of bedrock type upon streambed sediment. Stream reaches were classified as containing fine or coarse sediment based upon the grain size distributions of these samples. Rockfish Creek shows a dominant fine grain size, Little River has a coarse grain size. Our results showed that where headwater area was underlain with sandstone bedrock the main stream had a higher proportion of sand. However, in samples collected downstream of conglomerate, the grains are coarser. Bedrock type was a predictor of sediment grain size in some of the study streams. Exceptions were observed where the type of land use altered the source of sediment.

A22
Observations of Seismicity in the Lau Basin
Eric Donald Szymanski Mechanical Engineering

Mentors and/or Co-Authors: DelWayne Bohnenstiehl Marine, Earth & Atmospheric Sci

From November 2009 to November 2010, data was collected in the Lau Basin using an ocean bottom seismograph array consisting of fifty-two ocean bottom seismographs (OBS). Focusing primarily on September 2010, P phase arrivals were manually reviewed and first motions assigned on approximately 300 events in order to determine whether or not detections were the products of earthquakes. For events determined to be shallow earthquakes (no more than a depth of XX meters), S wave arrivals were then added wherever feasible in order to more precisely locate earthquake hypocenters. After analyzing trends in earthquake locations, relationships can be found between seismic activity and offset sections of the fault, as well as seismic activity and the locations of several seamounts. When compared to cumulative data processed from November 2009 to April 2010, the trends mentioned previously become more apparent.

D50
NMR-compatible bioreactor modification for 3D cell culture scaffolds
Kenny White Biomedical Engineering
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An NMR-compatible fluidized-bed bioreactor was previously developed to investigate the metabolic activity of mammalian cells encapsulated in three-dimensional (3D) alginate beads. While this configuration provides excellent mass transfer of oxygen and nutrients, the percolating effect of a fluidized-bed requires a high cell density to obtain sufficient signal-to-noise (SNR) ratio. The scope of this project was to redesign the bioreactor to utilize existing commercial 3D scaffolds to significantly increase the cell density while decreasing the total number of cells required for maximum SNR. A variety of 3D scaffold technologies were previously characterized with respect their cell culture capabilities. In addition, the fragile and cumbersome gas exchange module was replaced with a coaxial tubing configuration to oxygenate the cell culture media. This new bioreactor perfusion system will utilize breast cancer cell lines and 3D scaffolds, to investigate the proliferation of these cells in a hyperglycemic environment.
A35
Characterizing the role of a cellular microRNA in Porcine Reproductive and Respiratory Syndrome Virus Infections
Mary Helen Austin Animal Science
Mentors and/or Co-Authors: H. C. Liu Animal Science

This research was conducted in order to investigate the possible role(s) of a cellular microRNA termed miR-147. A previous study found that miR-147 is highly down regulated 24 hours post-infection in swine alveolar macrophages (SAMs) infected with Porcine Reproductive and Respiratory Syndrome Virus (PRRSV). PRRSV is the causative agent of Porcine Reproductive and Respiratory Syndrome (PRRS). PRRS is characterized by reproductive problems in pregnant sows, usually in the form of late term abortions and still births and by respiratory problems, particularly in young pigs. In the present study SAMs from two 6-week old piglets were transfected with either a microRNA miR-147 mimic or a negative control mimic. SAMs were then infected with PRRSV (strain VR-2332). Next, total RNA was purified and used for synthesizing cDNA. To confirm efficient transfection of the miR-147 mimic, semi-quantitative Real-Time PCR (RT-PCR) was utilized to assay miR-147 expression levels as well as the expression levels its target genes. The results demonstrate that the transfection of miR-147 mimic showed a significant increase of miR-147 levels and significant reduction in the expression of its targets compared to transfection of the negative control. This indicates that the SAMs were sufficiently transfected with the microRNA mimics. Semi-quantitative RT-PCR also revealed that transfection of the miR-147 mimic resulted in reduced expression of the PRRSV nucleocapsid protein (N). These reduced N levels translated to a small but noticeable decrease in PRRSV titers. This indicates that the reduction of miR-147 upon infection may be beneficial for PRRSV replication.

C17
Antioxidant Retention in Apple and Apple Peel Purees After Pasteurization and Accelerated Cooling
Morgan F. Caudill Bioprocessing Science
Mentors and/or Co-Authors: Josip Simunovic Food Science

Continuous flow thermal processing and aseptic packaging are two growing trends in the food and pharmaceutical industries. Often the micro-nutrients responsible for the health benefits in fruits and vegetables, such as vitamins and antioxidants are susceptible to heat exposure. Thermal degradation is dependent on the type of nutrient, food matrix in which it is contained, presence and activity of enzymes (native and microbial), and duration and temperature level of exposure. Antioxidants are particularly sensitive to degradation by a variety of agents and treatments during processing, storage and distribution. With the recent industrial introduction of advanced thermal processing such as continuous flow ohmic, radio frequency and microwave technologies, the nutrient and antioxidant degradation related to the heating segment of the process has been significantly reduced, leaving the cooling segment as the dominant mode of degradation of thermo-sensitive ingredients.

Our research has been directed at determining the effect which improved cooling processes would have
on preserving nutrients, such as antioxidants. We selected apple purees as one of the product to test the retention of micro-nutrients as affected by the application of different methods of cooling. After testing the antioxidants in each sample, our preliminary results indicated that the differences in retention among the different methods of cooling were not significant.

These results should not be extrapolated to other fruit or vegetable products. Also, benefits of advanced and accelerated cooling extend beyond nutrient retention – like improved energy and particularly water usage, and improved quality retention – fresher flavor, better color and texture.

D43

**Visualizing Dynein Light Chain with Green Fluorescent Protein**

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The hedgehog signaling pathway is involved in cell differentiation and the development of organs during the vertebrate embryonic period, and also for allowing a complex body plan to arise in a given organism. It is a key factor in ensuring that developing tissue reaches the correct size, is in the proper place or places pertaining to the body, and contains an appropriate cellular content. The pathway was first discovered in fruit flies (*Drosophila*) in the 1970’s by Christiane Nüsslein-Volhard and Eric Wieschaus, while attempting to isolate the cause of a particular developmental mutation. Smo (smoothened), a membrane spanning receptor, is normally inhibited by ptch (patched), a transmembrane protein. When the hedgehog ligand binds to ptch, it is vesicularized and no longer acts to repress smo. Smo is subsequently moved into the primary cilium, a structure that is found in all vertebrate cells not undergoing cell division. We hypothesize that dynein, a motor protein that moves cargo towards the minus (-) end of microtubules, is responsible for carrying smo out of the primary cilium when hedgehog signaling is no longer required. In order to test this hypothesis, the dynein light chain, an accessory protein involved in binding dynein’s cargo, can be tagged with green fluorescent protein (GFP) so that it can be visualized as dynein moves along the microtubule. The experiment is still in the process of being completed, but preliminary results look promising.

C51

**Building a Planar Black-body Radiation Source for Calibration of IR Cameras**

Christian D. Chapman  
*Mathematics*  
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A black body is an object whose surface absorbs all electromagnetic waves that hit it. For this reason, any emissions from an ideal black body are dependent wholly on its temperature. If a black body is held at a fixed, known temperature, its emissions can be used to calibrate cameras for non-contact temperature detection in a scene. A microcontroller-based fixed-temperature planar black body can be constructed using thermoelectric cooler plates, thermistors and some basic components. The construction and testing of such a device was performed in my research. The device's temperature control relies on a feedback loop that uses power supplied to TEC plates as a mechanism to vary a signal from temperature-variable resistive transducers (thermistors). It's algorithm is a discrete proportional-integral-derivative (PID) loop calibrated using the Ziegler-Nichols method to stabilize these signals to a mean standard deviation of about 0.005V about 2.5V. Using nominal conversion formulae, this translates to the plate being held at 302.2°C with 0.2°C standard deviation. We expect that in practice it should be able to reduce standard deviation with further calibration.

B47

**Differential effects of anthocyanins and their metabolites on the macrophage inflammatory response**

Amelia Chen  
*Biology*  
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Berries are an excellent source of dietary flavonoids which have several health benefits. Anthocyanins are one class of flavonoid compounds with demonstrated anti-inflammatory potential, however these compounds have a rather low systemic bioavailability and they are metabolized intensively in the intestinal tract. This study was conducted to investigate the anti-inflammatory effects of anthocyanins and their phenolic metabolites in the LPS-activated RAW 264.7 macrophages. When tested in physiologically relevant concentrations (100-1,000 nM), malvidin-3-O-glucoside and its aglycone showed the highest anti-
Inflammatory activity as compared to pelargonidin, cyanidin, and delphinidin. Treatment with anthocyanins and their metabolites resulted in 2 fold decrease in gene expression of two biomarkers of systemic inflammation iNOS and IL-6. This activity could be attributed to the B ring of the anthocyanin molecule, as syringic acid (phenolic metabolite of the B ring of malvidin) showed the highest anti-inflammatory activity. These findings suggest that among the anthocyanins tested, malvidin and its breakdown product syringic acid provide the highest protective effect against inflammation in vitro.

C42
Which Flame Retardants May Disrupt the Endocrine System? The Use of Virtual Screening to Predict Risks to Human Health
Timothy S. Chen

Mentors and/or Co-Authors: Melissa Pasquinelli
Textiles
Bilva Sanaba

The use of flame retardants has improved fire safety, but has also led to risks to human health and the environment. Toxicological studies have revealed that a variety of flame retardants can disrupt the endocrine system by mimicking hormones in the body and binding to protein receptors in the endocrine system. It would benefit industries, health practitioners, and government regulatory agencies to understand if the endocrine system is affected by these flame retardants and to what degree. Thus, the goal of this work is to use virtual screening to predict the toxic potential for the endocrine system of various halogenated flame retardants. The software Open Virtual Toxlab used for the virtual screening to calculate the binding affinity of each halogenated flame retardant with ten different protein receptors from the endocrine system. Based on the calculations, it was predicted that the majority of the studied flame retardants could bind to at least one protein receptor from the endocrine system. Furthermore, several flame retardants were observed to bind to multiple protein receptors, which substantiates that an individual flame retardant could potentially affect more than one pathway of the endocrine system. These results will improve the safety of flame retardants by refining regulations of these materials and by inspiring new ones that are less toxic.

Mentors and/or Co-Authors: H. C. Liu
Animal Science

Incubation temperature is an important factor in chicken embryo development. Optimal values have been established with 37°C as the industry standard. Due to the possibility of climate change and higher temperatures, incubation temperatures for outdoor chickens may alter chick development. Our study focused on the effect of different incubation temperatures on different indicators of chick embryo development. Specifically we investigated weight and size of eggs and embryos as well as the gene expression pattern of insulin-like growth factor 1 (IGF-1) and related proteins. IGF-1 is vital to growth and metabolism in avian species, both during embryonic development and during post-hatch growth. Insulin-like growth factor 1 receptor (IGF-IR), and Insulin-like growth factor binding protein 2 (IGFBP-2) also play a key role in IGF-1 activity. Eggs were incubated at 3 temperatures: 35°C, 37°C, and 39°C, and samples from embryonic eyes were collected at E12 (embryonic day 12). A strong relationship between embryo weight and incubation temperature was observed and confirmed through statistical analysis. No clear relationship between expression levels of IGF-I and IGFBP-2 and incubation temperature was noted, but a possible trend was identified between IGF-IR expression and incubation temperature. A greater sample size is needed to improve the statistical analysis of this potential relationship. Our study reveals phenotypic relationships between incubation temperature and embryo development; however, gene expression patterns of IGF-1 in eyes at E12 did not reveal any significant relationships. Further investigation into the genomic and proteomic basis for phenotypic variations of chick embryos is needed.

D21
Direct Dye Identification From Textile Fibers Using Infrared Matrix-Assisted Laser Desorption Electrospray Ionization (IR-MALDESI) Coupled to FT-ICR-MS
Kristin Harr Cochran

Mentors and/or Co-Authors: David Muddiman
Chemistry
Jeremy Barry
Chemistry

The analysis of trace fiber evidence is a significant portion of forensic cases. The typical analytical tests applied to fiber evidence are qualitative and non-destructive. These qualitative tests are unable to uniquely identify the dye(s) that are present in the fiber. Although not currently widely used in forensic
laboratories, mass spectrometry (MS) is beginning to play an increasing role in fiber analysis. Liquid chromatography-MS is the most common mass spectrometry approach for dye identification, but it requires a lengthy and destructive extraction process prior to MS analysis of the dye(s). Infrared Matrix-Assisted Laser Desorption Electrospray Ionization MS (IR-MALDESI-MS) is a direct analysis approach that has the potential to greatly reduce the overall analysis time and is relatively non-destructive. IR-MALDESI is a hybrid ambient ionization source utilizing a pulsed mid-IR laser tuned to 2.94 µm to resonantly excite an exogenous matrix. This resonant excitation results in the desorption of neutral analyte molecules that partition into an electrospray plume and are ionized through an ESI-like mechanism. The infrared laser tuning allows the use of water or ice as the matrix because it overlaps with water’s OH stretching frequency. Water is an ideal matrix because it does not interfere with the dye signal. The IR-MALDESI source is coupled to a LTQ-FT-ICR mass spectrometer in order to obtain high resolving power and high mass accuracy data on each of the analyzed dyes. The dyes were analyzed directly from a tape lift to simulate a real world sample matrix and imaging was performed on them.

D33
The Identification of the fungal pathogen Colletotrichum on the leaves of Jatropha curcas
Ravi Ajit Dixit Microbiology
Mentors and/or Co-Authors: Barbara Shew Plant Pathology

Two fungal pathogens were identified from a sample of Jatropha leaves and fruits. Symptoms associated with one pathogen were lesions on the end of leaves, and the symptoms associated with another pathogen were leaf spot lesions. The fungal pathogen Alternaria was identified from leaf spot lesions. We attempted to complete Koch’s postulates for the leaf spot samples associated with Colletotrichum. The fungus was isolated in pure culture. Inoculum was prepared from 1.35 X 10^5 spores per ml and was sprayed on uninfected, young leaves of Jatropha. After reinoculation was visible in both macroscopic and microscopic observations, the process was repeated for the solidification of the results.

B31
Understanding the Variability of Low Marine Clouds in Three Oceanic Regions
Jason Lee Endries Meteorology
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Clouds, in essence, serve as a barrier for both incoming energy from the sun and outgoing energy from the Earth. Cloud properties, such as thickness and area, can therefore impact how much the Earth warms by trapping or reflecting heat. For this reason, understanding the life cycle of clouds is important in predicting the future climate of Earth. Marine
stratocumulus is a particular type of low cloud that serves as an especially effective energy barrier. How marine stratocumulus clouds form and evolve is associated with the occurrence of drizzle. In this study, we examine both satellite data and global weather model output for three regions where marine stratocumulus clouds are common: the southeast Pacific, the southeast Atlantic, and the northeast Pacific. Seasonal averages of drizzle frequency and seasonal averages of selected weather model output variables in each of the three oceanic regions are analyzed for correlations. No one variable directly correlates with seasonal drizzle frequency in all three regions. For example, surface temperature is positively correlated with drizzle frequency in the northeast Pacific yet negatively correlated in the southeast Pacific. These preliminary results suggest that the complex interactions between variables that control cloudiness characteristics and drizzle frequency are not identical among the three observed regions, and that the causes of interregional variability need to be further investigated.

C39
A Comparative X-ray Photoelectron Spectroscopy Study of Graphene Grown by Different Methods
Yang Ho Physics, Applied Mathematics, Computer Science

Mentors and/or Co-Authors: Jack Rowe Physics, Daniel Dougherty Physics

Many different methods of growing Graphene have been developed and explored as possible options for making sufficiently large enough samples of Graphene for application. The purpose of this study is to examine Graphene grown using different methods and base substrates using X-ray photoelectron spectroscopy (XPS). The XPS analysis was performed using a Riber XPS machine equipped with a Mg- K α X-ray source. Graphene samples grown using chemical vapor deposition on Cu and Ni and by heating SiC were used. Highly oriented pyrolytic graphite (HOPG) was used as a reference. The C 1s region from the XPS measurements showed that the Graphene on Ni foil was multilayered due to similarities with HOPG’s C 1s peak shape; in addition, there was only a faint signal from the Ni 2p electrons. However, for Graphene on Cu, the C 1s peak shapes was different from HOPG’s and suggest that the Graphene on Cu sample was heavily oxidized; unlike the Ni 2p signal from the Ni foil, the Cu-2p signal was clearly observed. The C 1s peak from the Si face of Graphene on SiC showed evidence for carbon bonds in Graphene, SiC, and the interface layer. For the C face, the C 1s peak had similar characteristics to HOPG’s C 1s peak but also had a satellite C-Si peak. The XPS measurements show that XPS can be used to determine the thickness and interactions of Graphene grown using different methods.

B1
Evaluation of the Cross-Neutralization Potential between Norovirus GI Strains
Taylor April Jones Human Biology

Mentors and/or Co-Authors: Lisa Lindesmith Department of Epidemiology
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Noroviruses (NoVs) are the primary cause of human severe viral gastroenteritis. Although these highly infectious viruses were initially thought to cause mild disease in healthy individuals, the incidence rates and severity of sickness due to NoV infection are extensive and compare to illnesses for which immunization is highly recommended. A divalent norovirus vaccine composed of a single virus-like particle (VLP) representing the two predominant norovirus genogroups is currently being tested in humans. In order for this vaccination to be effective, the two component VLPs must activate a cross-strain protective immune response. To determine if Genogroup I (GI) strains share common antibody epitopes that could provide broad protection, we characterized the cross-reactivity and neutralization potential of serum from GI.1 infected subjects and GI human monoclonal antibodies (humAbs) against a panel of GI VLPs. Norwalk (GI.1) infection induced a >= 4 fold increase in surrogate neutralization titer by day 14 post-challenge. Neutralization extended to the other GI VLPs tested, indicating that GI strains do share common antibody neutralization epitopes. Further, two humAbs recognized multiple GI VLPs by enzyme immunoassay but did not recognize a neutralizing epitope. Two of the humAbs tested bound to and neutralized only individual GI VLPs. These data suggest that the cross-neutralization activity in serum likely results from polyclonal activation of GI-reactive antibody producing cells by GI.1. The potential of GI.1 to provide cross-protection through antibody neutralization supports the inclusion of a single GI VLP in the vaccine cocktail.

D52
3D Printing for Sustainable Manufacturing
Carter Keough Industrial and Systems Engineering

Mentors and/or Co-Authors: Tim Horn Industrial and
Three-dimensional printing is a relatively new manufacturing process by which components are fabricated directly from computer models by selectively curing, depositing or consolidating raw materials in successive layers. We are now beginning to see additive manufacturing used for the fabrication of a range of functional end use components in a variety of materials including plastics, metals and ceramics. From the standpoint of sustainability, additive manufacturing has the potential to profoundly reduce our reliance on fuel, raw materials and, to mitigate our impact on the environment.

**D25**  
**Comparative Study of Efficient Cancellation Algorithms for High Dynamic Range RF Measurement**  
**Ian Matthew Kilgore** Electrical Engineering  
*Mentors and/or Co-Authors: Michael Steer Electrical & Computer Engineering*

The effective measurement of PIM (Passive InterModulation) distortion requires a measurement system with a very high dynamic range. In this context, dynamic range enables researchers to measure a relatively small signal in the presence of a relatively large one. This principle has been applied to the development of a state of the art two-tone measurement system by the SEMIWave MURI at North Carolina State University.

One effective way to physically realize this kind of high dynamic range system is to use signal cancellation. While conceptually this is a simple task, limitations of measurement equipment impose constraints upon the process. This work investigates two algorithmic approaches to signal cancellation, both of which are directly applicable to real problems.

Given a sinusoidal signal with a known frequency and power, and unknown phase, power measurements are used in order to find a corresponding signal with the same frequency and power and opposite phase. An analytical approach with a closed-form solution is characterized. This analytical approach is then compared against a classical iterative parameter search.

Both algorithms are implemented in real hardware using LabVIEW, Marconi IFR2025 signal generators, and an Agilent E4419A power meter. Each algorithm is evaluated experimentally across a range of random initial conditions. Performance is evaluated in terms of cancellation power and time required.

**C21**  
**Performance of LC-MS on adjacent tissue sections for verification of observed metabolite to parent drug abundance ratios from IR-MALDESI MSI**  
**Kristin Marie Klinic** Chemistry/Biochemistry  
*Mentors and/or Co-Authors: David Muddiman Chemistry, Jeremy Barry Chemistry*

In Mass Spectrometry Imaging (MSI), biological tissue, that contains a variety of molecular classes spanning a large dynamic range are directly analyzed to determine the spatial distribution of the molecular ions. Due to this complexity, charge competition and suppression effects could contribute to an adulteration of the true molecular abundances. In liquid chromatography-MS (LC-MS), the influence from these suppression effects could be lessened by the effective reduction in sample complexity that is realized by performing chromatographic separation prior to MS analysis. Liver tissue from a rat dosed with the HIV drug Nevirapine was cryo-sectioned. Adjacent sections are either imaged by IR-MALDESI or are homogenized and analyzed by LC-MS. In IR-MALDESI MSI, a thin layer of ice is frozen over the top of the tissue section. The mid-IR laser pulse is absorbed by the ice matrix enabling the desorption of tissue related material. The desorbed material partitions into an electrospray plume and ions are generated by an ESI-like process that are sampled by a LTQ-FT. Ion maps for the endogenous and exogenous species are generated using the MSIReader. For the LC-MS analysis, the tissue section is homogenized and is loaded onto a chip based nano-LC system coupled to a Q-Exactive or LTQ-FT. This analysis provides a database of accurate masses and tandem MS spectra for both the exogenous species (Nevirapine and the metabolites) and the endogenous species (lipids, small molecules). This additional information will be helpful to identify the species that are observed in the IR-MALDESI MSI analysis.

**A39**  
**Product Quality Improvement of Blister-Fried Peanuts**  
**Elliott Hunter McDowell** Food Science  
*Mentors and/or Co-Authors: Jack Davis Food Science*
Lisa Dean Food Science; Brittany White Food Science

Most peanuts sold commercially are either oil or dry roasted. However, blister-fried peanuts are a unique product characterized by raised, blister-like formations on the surface of the peanut, which results from a soaking step followed by oil roasting. The soaking step causes proteins and sugars to leach into the soak water, thus reducing Maillard browning precursors and producing a light-colored product. The purpose of these experiments was to scientifically document information regarding the quality of blister-fried peanuts and evaluate parameters to improve their quality. Peanuts were soaked in water for various times (10, 30 min), temperatures (23, 100°C), and peanut to water ratios (1:5, 4:3), and with or without glucose or fructose (0.5, 1%). Pressure cooking (15 psi, 4:3 peanut to water ratio, 1 to 3 min) was also evaluated as an energy efficient pre-soak process. After soaking, peanuts were fried at 170°C for 5 minutes. After frying, blisters were quantified by ImageJ software, and color was determined using a Hunter colorimeter. Trained texture and flavor panels also evaluated each treatment. Furthermore, confocal and scanning electron microscopy were used to visualize changes in peanut microstructure during blister frying. Addition of sugars to the soak water resulted in darker colored peanuts (L-values=34.2 to 40.7) compared to a water-only soak (L-value=51.9). Blister-frying resulted in peanuts that were crispier and crunchier than an oil-roasted control. Soaking at 100°C resulted in more blister formations; however these peanuts were significantly less crispy and crunchy than those soaked at 23°C.

A44
Down Regulation of the Hedgehog Signaling Pathway
Dana Elizabeth Moeller Biology: Molecular, Cellular, and Developmental concentration B.S. and Interdisciplinary Studies B.S.

Mentors and/or Co-Authors: Antonio Planchart College of Sciences

The hedgehog genes are found in many species of animals and are expressed both during development and throughout life. When something goes wrong within the hedgehog signaling pathway, deformities and disease, including cyclopia and cancer often result. In zebrafish, Sonic Hedgehog (shh) is arguably the most important of the hedgehog signaling molecules. Work in our lab has uncovered a novel regulator of the hedgehog signaling pathway, which according to our preliminary results is required to downregulate hedgehog signaling. We hypothesize that the misregulation of hedgehog signaling resulting from knocking down expression of the regulator and is responsible for the subsequent deformities seen in affected zebrafish embryos. This hypothesis is being tested by in situ hybridization of specific targets of the hedgehog signaling pathway in zebrafish embryos. Thus far, 

C40
Probing the Bases of Polymer Glass Transitions
Miles Ndukwe

Mentors and/or Co-Authors: Alan Tonelli Textile Engineering Chemistry and Science

In industry and commerce, many of the materials produced are composed of polymers. It would be very beneficial for industries to improve their knowledge of polymer properties. The glass transition temperature, \( T_g \), is the temperature at which amorphous polymers soften, and it determines their processing and use temperatures. Large differences in the glass transition temperatures have been observed for structurally distinct polymers, and the following factors have often been considered to be the leading causes of this wide range in \( T_g \)'s: 1) the inherent conformational flexibilities of polymer chain backbones; 2) the sizes or steric bulk of polymer side chains; and 3) the interactions between polymer chains. Amorphous co-polyamides and co-polysterers, two structurally analogous polymers that only differ in the interactions between polymer chains, were synthesized and analyzed to determine the importance of the third factor by comparing their \( T_g \)'s. Previous procedures, which consisted of melt polymerization and melt-blending, were not successful in synthesizing wholly amorphous samples of both polymers, but by finding a report of the syntheses of amorphous co-polyesters, the structurally analogous co-polyamides were synthesized. The \( T_g \) of a sample co-polyamide was observed to be dramatically higher than that of the analogous co-polyester sample; therefore, the hypothesis was confirmed.

B42
Molecular Analysis of Coffee Rust pathogen

Hemileia vastatrix
Jeremiah Todd Nelson  
*Microbiology*

*Mentors and/or Co-Authors: Margaret Daub Plant Biology*

Hemileia vastatrix is an important plant pathogen affecting coffee plants, causing lower yields in the production of coffee beans and substantial economic hardships for growers. The three main objectives of this project were to develop a method to extract DNA from spores, test PCR primers for amplifying DNA sequences, and develop pathogen-specific DNA primers for use in diagnostic tests. DNA-based diagnostic tests are a challenge as the pathogen is an obligate parasite, and DNA extractions must be performed on spores produced on infected plants. Due to the resistant nature of the fungal urediniospores, previous DNA extraction methods proved to be unreliable. A DNA extraction method was successfully developed utilizing liquid nitrogen coupled with the use of a drill-driven fitted pestle, allowing for molecular analyses. PCR analysis showed successful DNA isolation from some H. vastatrix isolates, and a pathogen-specific primer was identified. Further research will need to be done to determine the utility of the primer in diagnosis and strain identification.

A1  
**Comparison of Geminivirus Infection in Two Tomato Cultivars**

Preslyn Andreal Phillips  
*Bio-Chemistry*

*Mentors and/or Co-Authors: Linda Hanley-Bowdoin Biochemistry*

Mary Dallas  
*Biochemistry*

Tomato is a major vegetable crop that is grown in every country of the world. Although tomatoes are usually produced in outdoor fields, they can also be produced in net and greenhouses. Tomatoes are very rich in vitamins A and C, which accounts for their multimillion dollar contribution to the agriculture industry. Geminiviruses pose a serious threat to tomato production. Geminiviruses are single-stranded DNA viruses, with two genome components designated as A and B. The A component is responsible for replication of the virus and the B component mediates movement of the virus. The geminiviruses used in this experiment are Beet curly top virus (BCTV), Tomato mottle virus (ToMoV), and Tomato yellow leaf curl virus (TYLCV). Our goal was to compare their infection of the tomato cultivars – Micro Tom and FL8000. Micro Tom, which is characterized by its small size, is mainly used for experimental purposes and is viewed as a model cultivar for tomato research.

The FL 8000 tomato is an industrial variety that has been engineered with proprietary technology. We asked if the FL 8000 cultivar is susceptible to TYLCV, ToMoV and BCTV by directly comparing them to susceptible Micro Tom plants. The plants were infected by agroinoculation, and tissue prints were taken to measure viral DNA levels at various time points after infection. Photos were also taken at each time point to document symptoms and disease progression.

B41  
**Selfish Genes**

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*Biochemistry*

Quade Robinson  

Mengmeng Fang  

Madeleine Gonzalez

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There has long been an interest in developing gene-drive systems capable of pushing desirable traits into pest populations, such as propagating an anti-malarial gene through a mosquito population. While researchers have made great progress in the field of insect transgenics (adding new genes to insect chromosomes), and in identifying effector-genes (genes capable of inhibiting pathogen growth), they still lack an effective, broad-spectrum gene-drive system. The purpose of this project is to identify the molecular mechanism that directs the selfish behavior of a naturally-occurring selfish gene known as Medea (short for Maternal-Effect Dominant Embryonic Arrest). Medea is thought to act as a toxin/antidote system where Medea moms put a “toxin” into all of their eggs, and inheritance of the Medea gene is required for “antidote” expression which effectively “rescues” the progeny. This system is considered to be “selfish” because only Medea-bearing offspring can survive. While Medea has only been found in flour beetles thus far, such systems could be far more common than we think. Here we use transposon-mediated mutagenesis in an effort to disrupt the Medea1 gene in the red flour beetle, Tribolium castaneum. In the past decade, researchers have created thousands of transgenic Tribolium strains using a piggyBac transposon. One of these strains, pig-19, has a piggyBac transposon inserted near the Medea1 gene. Moreover, due to the insertion site (within a muscle actin gene) the Green Fluorescent Protein (GFP) marker gene is expressed not only in the insect eye, but also in all the muscles. Remobilization of the pig-19 insertion is accompanied by loss of muscle-specific GFP expression, but retention of eye-
specific GFP expression, this allows for remobilization events to be identified. Importantly, piggyBac has a preference for local reinsertion, thereby increasing the odds of reinserting within the Medea gene. Here we report the overall genetic crossing scheme and our progress to date.

C26
Testing of Blackberry Plants by PCR Method to Identify Viral Pathogens in Southeastern Cultivars
Hannah Nicole Reynolds
Mentors and/or Co-Authors: Zvezdana Pesic-Van Esbroeck Plant Pathology
Steven Lommel Administration-Research Service

Virus diseases are widespread in blackberry plantings throughout the Southeastern US. Virus infections usually lead to a rapid decline of plantings including yield reduction and loss of income to berry producers. Blackberries are often propagated by root cuttings and one infected plant can generate a large number of plants that are infected with one or more viruses. Use of micropropagated and virus tested planting stocks is essential to successfully control virus diseases in nurseries and commercial plantings. Blackberry plants of three cultivars (Kiowa, Navaho and Shawnee) with virus-like symptoms were collected from the research plot at Lower Coastal Plain Tobacco Research Station in Kinston, NC and maintained as potted plants in a greenhouse at NCSU. The Polymerase chain reaction (PCR) assay was used to identify Blackberry yellow vein associated virus (BYVaV), Tobacco ringspot virus (TRSV), and Blackberry virus E (BVE) in symptomatic plants. Leaves from the plants were harvested, and total RNA was extracted. M-MuLV Reverse Transcriptase and random primers were used to convert the RNA into cDNA. Primers used in the testing were developed from conserved genes in each pathogen. A 1% agarose gel was run to confirm the results of the PCR test. A positive result was identified by comparing the DNA bands on the gel from each sample to those of the positive control. In this study we have only detected BYVaV and TRSV in symptomatic plants.

D40
Fermentation of Sweet Potato Juice with Probiotic Cultures
Julie Christine Rice Chemistry
Mentors and/or Co-Authors: Van-Den Truong Food Science
Suzanne Johanningsmeier Food Science

Orange-fleshed sweet potatoes (OFSP) are a good source of β-carotene, dietary fiber, iron, and minerals. This nutritious vegetable has been processed into many food products including juices because of its appealing color and various health benefits. An increase toward healthier diets and the development of functional foods has gained momentum, including the use of probiotic organisms in non-dairy foods and beverages. The objective of this study was to ferment OFSP juice with probiotic organisms and identify the volatile compounds in the resulting juice. Freeze dried cultures of probiotic Lactobacillus plantarum, Lactobacillus casei, Lactobacillus acidophilus, and Bifidobacterium lactis were inoculated into pasteurized OFSP juice at 10^7 cfu/ml and incubated at 28 °C. Fermentations were conducted in triplicate. β-carotene, color, pH, and sugar concentrations were measured after 3 and 10 days to evaluate the quality...
of OFSP juice fermented with probiotic cultures. Two-dimensional gas chromatography-time-of-flight mass spectrometry was used to analyze volatile compounds found in OFSP juice. The most suitable cultures for fermentation were L. plantarum and L. casei, which effectively used glucose and fructose and decreased the pH after 10 days incubation to 3.53 ± 0.04 and 3.39 ± 0.05, respectively. The β-carotene levels remained stable throughout the fermentation. The color of the juice was preserved during fermentation and the L*, a*, b* values remained constant throughout the time points. This study describes the first effort to profile the volatile compounds produced by probiotic organisms in OFSP juice and will serve as the basis for further development of probiotic OFSP beverages.

A43
Stability of Linear Multistep Methods
Jacob Lloyd Robbins Physics and Applied Mathematics
Mentors and/or Co-Authors: Hoon Hong Mathematics

This project has focused on finding a closed form algebraic expression for the maximal magnitude of the eigenvalues (“degree of stability”) for a certain family of discretizations of a certain ordinary differential equation. The stability of a discretization ensures that the model error does not grow. Previously, the degree of stability was found numerically on several discretizations chosen from the family. This project’s approach is unique in that it finds a closed form algebraic expression for the degree of stability for all discretizations in the family. For this, we utilized the elimination theory (in particular resultants) from algebraic geometry. So far we found a closed form for Adams-Bashforth methods. In future work, we plan to look for a closed form for other families.

C19
Functional annotation of the prairie vole (Microtus ochrogaster) seminal vesicle proteome
Gabrielle Marie Schroeder Biological Sciences (Molecular, Cellular, and Developmental)
Mentors and/or Co-Authors: Lisa McGraw College of Sciences

In the socially monogamous prairie vole (Microtus ochrogaster), mating coincides with the formation of a pair bond, an enduring social bond between sexual partners. Although the basic neurocircuitry of the pair bond has been determined, little is known of the molecular mechanisms that mediate this change in behavior. In Drosophila melanogaster, seminal fluid proteins (SFPs) transferred to the female during copulation affect female reproductive behaviors and fitness. However, few studies have examined the potential effects of mammalian SFPs on females, although factors in seminal fluid are known to induce ovulation in llamas and koalas. As a preliminary step...
in determining whether prairie vole SFPs affect female behaviors and fitness, we used proteomics to identify 310 candidate SFPs from the contents of the seminal vesicle, a secretory organ that produces the major constituents of seminal fluid. We then used functional annotation programs to identify and visualize enriched gene ontology terms in the proteome. Many SFPs are associated with protease and protease inhibitor activity, regulation of apoptosis, antioxidant activity, and cellular metabolism, processes that are also characteristic of secreted mouse and Drosophila SFPs. Additionally, the seminal vesicle proteome is enriched in extracellular and secreted proteins, as well as other proteins involved in protein transport and localization, which is consistent with the seminal vesicle’s function as a secretory organ. The identification and functional characterization of prairie vole SFPs will allow us to identify candidate genes for further investigations of their influences on reproductive behaviors and physiology in the prairie vole.

A41
Genetic analysis of Type I-C CRISPR-Cas immune systems in Lactobacillus helveticus.
Madelyn Mallison Shoup Food Science
Mentors and/or Co-Authors: Rodolphe Barrangou Food Science and Nutrition

Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR), together with associated sequences (cas) constitute the CRISPR-Cas system, which provides adaptive immunity against invasive elements in many bacteria. These molecular systems function in three stages: (1) adaptation: novel spacers are acquired from invasive genetic elements to build immunity; (2) biogenesis: small interfering CRISPR RNAs (crRNAs) are generated following transcription of the CRISPR repeat-spacer array; (3) cleavage: crRNA-guided, sequence-specific cleavage of nucleic acids, mediated by cas proteins. The occurrence and diversity of CRISPR-Cas systems was determined in Lactobacillus helveticus genomes, notably H10, R0052 and DPC4571. This species is widely used in starter cultures in the fermentation of milk into cheese. A 32nt CRISPR repeat, 5’-GTCGCACCTCTTGTGAGTGGGTGTTGAAAT-3’ was identified, which showed homology to the stereotypical B. halodurans C-125 Type I-C CRISPR repeat. Seven conserved cas genes were identified in the direct vicinity of these loci, including the universal cas1 and cas2 genes, and cas3, which is the Type I systems signature gene. A comparative analysis of CRISPR spacer content revealed that there are between 22 and 42 unique spacers. Several of these spacers shared high homology with phage sequences. An analysis of sequences immediately flanking the CRISPR spacer matches led to the discovery of a novel putative protospacer adjacent motif (PAM), ATTC, at the 5’ end of the proto-spacers. These findings suggest that Type I-C CRISPR-Cas systems are active in Lb helveticus. Furthermore, genetic diversity may provide a molecular basis for genotyping in this species, and novel insights into the interplay between bacteria and phages.

D17
Grade Tendencies for Students in Organic Chemistry with Various Modes of Supplemental Instruction
Sarah Teague Biological Sciences- Human Biology Concentration; Political Science
John Encarnacion Biological Sciences;
Wesley Sayre Biological Sciences
Mentors and/or Co-Authors: Kay Sandberg Chemistry

Organic Chemistry is a challenging and intimidating course offered at NCSU. Dr. Kay Sandberg utilizes a method of teaching that many students find both practical and approachable. As teaching apprentices (TAs) for Dr. Sandberg, we offered assistance to students through the deployment of various formats of review sessions, including an in-class method, an online method, and a hybridization method. We hypothesized that students would be eager to attend TA-led review sessions and that the grades of these students would depict an overall grade improvement when compared to that of non-attending students. Additionally, we hypothesized that the different review sessions would result in different student outcomes. Of the 250 students who were offered access to review sessions, 175 students registered. Each registered student was assigned to a specific review session. The different review sessions presented the same material, differing only in the delivery method. However, the attendance records of the sessions were dramatically skewed. Nevertheless, at the conclusion of the semester, the students’ grades were analyzed. The average final grade of all of Dr. Sandberg’s sections was a 77.5 and the average final grade of the students enrolled in a review session was a 78.7. However, the limitations of this study led these results to be identified as a slight correlation. Essentially, more research needs be conducted in order to determine whether the correlation of grades and review session attendance demonstrates a causal effect, resulting from the additional resource of a TA-led review session, or was due to other independent variables.
**C25**

**Morphological comparison between island populations of the Hog Island Boa Constrictor**

Nikole Marie Tetreault  
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Island Biogeography Theory predicts that the composition of species on islands changes with island size and distance from the mainland. When organisms move from the mainland to islands, changes in body size and morphology can occur. However, in snakes, it is unclear whether phenotypic plasticity or adaptation is the reason for differences in snake body size and head morphology. Therefore, our objective was to determine if body size and head morphology differences exist between populations of the Hog Island boa constrictor (*Boa constrictor imperator*) on two islands in the Cayos Cochinos, Honduras. To compare morphology, snakes were captured and snout-vent length (SVL), tail length (TL), head length, head width, labial, rostral-ocular, nares-ocular, interocular, ocular, and internares were measured. A total of 72 snakes were captured of which 46 were from Cayo Cochino Menor and 26 were from Cayo Cochino Mayor. Analyses were conducted using ANOVAs to determine if there was an island effect, sex effect, and/or an island*sex effect. Our results indicated that snakes on Cayo Cochino Mayor were significantly larger than snakes on Cayo Cochino Menor for all measurements except ocular and tail length. Also, females had significantly larger body and head morphological measurements than males with the exception of TL and ocular. Females from Cayo Cochino Mayor had significantly larger measurements than all other snakes from both islands. Although the mechanistic pressures between the islands are unclear, we believe that differences in prey availability, prey size, and island area may have an effect on the snake morphology.

**A45**

**Modulation of adipocyte lipid accumulation and insulin resistance by anthocyanins and their metabolites**

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Berries are an excellent source of dietary anthocyanins which have several health benefits, including reduction of adipogenesis and lipid accumulation in the adipose tissue. However, these compounds have a rather low systemic bioavailability and they are metabolized intensively in the intestinal tract. This study was conducted to investigate potency and molecular mechanism of anti-obesity and insulin-sensitizing effects of anthocyanins and their phenolic metabolites in 3T3-L1 adipocytes. When tested in physiologically relevant concentrations (100-1,000 nM), malvidin-3-O-glucoside and delphinidin-3-O-glucoside showed highest decrease of lipid accumulation and increase of leptin, adiponectin, and thyroid stimulating hormone gene expression in vitro. While treatments with syringic and gallic acids (respective phenolic breakdown products of the anthocyanin B ring) resulted in marked decrease of lipid accumulation, these metabolites did not affect production of leptin, adiponectin, or thyroid stimulating hormone, suggesting that intact anthocyanins and their breakdown products affect lipid metabolism in adipose tissue via a different molecular mechanism.

**C46**

**A Better Drosophila melanogaster**

Yin Hong Tsang  
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As the price of DNA sequencing goes down, the number of species with sequenced genomes is rapidly increasing. Over the past decade, RNA interference (RNAi) has become one of the most powerful methods for studying gene function in organisms. RNAi is a naturally occurring, post-transcriptional process that is thought to be a defense mechanism against invading viruses (eg. foreign RNAs). RNAi is triggered by double-stranded RNA (dsRNA) and can be “systemic”, dsRNA can pass from one cell to another, or “non-systemic”, dsRNA cannot pass from cell to cell. In the worm *Caenorhabditis elegans*, a channel protein known as Sid-1 is responsible for the ability of dsRNAs to traverse the cell membrane. Interestingly, one of the most widely-used model organisms, the fruit fly, *Drosophila melanogaster*, lacks systemic RNAi, and no apparent Sid-1 gene can be found in the *Drosophila* genome. However, the red flour beetle, *Tribolium castaneum*, has strong systemic RNAi and there are at least three putative Sid-1 genes in the *Tribolium* genome. The goal of this study is to test the hypothesis that the presence/absence of these putative Sid-1 genes is responsible for the ability, or inability of dsRNAs to move between cells. Interestingly, one of the most widely-used model organisms, the fruit fly, *Drosophila melanogaster*, lacks systemic RNAi, and no apparent Sid-1 gene can be found in the *Drosophila* genome. However, the red flour beetle, *Tribolium castaneum*, has strong systemic RNAi and there are at least three putative Sid-1 genes in the *Tribolium* genome. The goal of this study is to test the hypothesis that the presence/absence of these putative Sid-1 genes is responsible for the ability, or inability of dsRNAs to traverse the cell membrane. We are currently in the process of building a Sid-1 transgene that will be microinjected into Drosophila embryos to create a
A salt-free cucumber fermentation process has been developed to address environmental concerns regarding sodium chloride (NaCl) use in cucumber fermentations. The newly developed NaCl-free technology demands the application of a starter culture of the predominant lactic acid bacteria (LAB) in cucumber fermentation, *Lactobacillus plantarum* and *Lactobacillus brevis*. Ideal candidates would quickly perform a lactic acid fermentation, co-ferment with either *L. brevis* or *L. plantarum*, and possess an antimicrobial activity against spoilage LAB such as *Lactobacillus buchneri*. Two experiments were performed to identify starter cultures that are reliable sources of fast fermentation despite lack of NaCl. 117 strains of *Lactobacillus plantarum* and *Lactobacillus brevis* isolated from a commercial cucumber fermentation located in the midwest were screened. Fermentation efficiency of each isolate was tested using a fractional factorial screening design. pH was measured after 48 hours of incubation across 4 treatments of variable NaCl concentrations (0%, 6%), incubation temperatures (15°C, 30°C), and initial pH values (4.0, 5.4). Temperatures were selected to simulate variable climate. NaCl concentration was tested to isolate strains that would do well in the NaCl-free brine. The 40 isolates with a final fermentation pH below a determined cutoff in at least three of four treatments were tested for antimicrobial activity. An antimicrobial assay with an MRS agar overlay was completed using *Lactobacillus buchneri* 47, *Lactobacillus buchneri* 49, and either *L. plantarum* or *L. brevis* as indicator strains. Fermentation biochemistry of isolates which displayed the most antimicrobial activity was analyzed using high-performance liquid chromatography. Isolates exhibiting rapid fermentation and antimicrobial activity are proposed as potential starter cultures for commercial cucumber fermentation.
Viruses are ssDNA viruses that replicate in the nuclei of infected cells and affect the host in many ways. We are interested in understanding the small RNA pathways that are affected during geminivirus infection and use two model plants for that purpose: *Nicotiana benthamiana* and *Arabidopsis thaliana*. Initially we asked if a silencing signal is transmitted to the progeny through seed. We showed that the silencing is not transmitted even if the silencing vector (a geminivirus silencing vector) is retained in the infected plant. Furthermore we will try to identify differences in microRNA target genes involved in the auxin pathway when plants are infected with two different geminiviruses. Our preliminary results show that Cabbage leaf curl virus induces or represses differentially two of the auxin response genes. We will test if the Beet curly top virus also affects the same genes in the same way and what miRNAs are involved in the changes in expression.

**B40**

**Effect of Pasteurization Temperature on the Shelf-Life of Chocolate Milk**

Julia Zhu Food Science

*Mentors and/or Co-Authors: Clinton Stevenson Food Science*

Previous research on chocolate milk reported shorter shelf-life for chocolate milk compared to unflavored milk. It was recently found that reducing the pasteurization temperature decreased the bacterial counts of unflavored milk, thus increasing its shelf-life. The goal of this study was to determine whether the same effect occurs in chocolate milk. Unflavored milk and chocolate milk were drawn over four production days. Each sample was pasteurized at 79.4°C for the low-temperature treatment and 85°C for the high-temperature treatment. Initial counts were done on Aerobic Plate Count Petrifilms, which were then incubated at 35°C for 48 hours. The remaining milk samples were stored in the 7°C incubator and were sampled again 7, 14, and 21 days after production. The unflavored milk displayed the expected results, but the results for the chocolate milks showed that pasteurization temperature did not have a significant and consistent effect. The chocolate milk consistently had more bacterial counts than the unflavored milk throughout the study. In conclusion, it is not recommended to lower the pasteurization temperature of chocolate milk to increase its shelf-life. Further research is needed to understand the cause of the shorter shelf-life of chocolate milk.

**C27**

**Uncovering the Biodiversity in Lake Raleigh utilizing Deep Sequencing and Bioinformatics**

Melissa Madison Zinter Biological Sciences

*Mentors and/or Co-Authors: Carlos Goller Biotechnology Program*

Metagenomics is the study of environmental samples using deep sequencing and bioinformatics with the goal of elucidating the type of organisms and function of the genes present. Plasmids are self-replicating extra chromosomal genomes that are useful for studying evolution, ecology, horizontal gene transfer, and epidemiology. Using next-generation sequencing technologies, the genes in the plasmids can be studied to better understand the advantage of plasmid-borne genes to a microbial population. Thus, the focus of my research was to establish a process to purify and analyze metagenomic plasmid samples. Bacterial samples were collected from various environments: local lakes, sinks, bathrooms, and even a cow rumen to isolate genomic and plasmid DNA. Nucleic acids were purified and individually sequenced to analyze the function of plasmid-borne genes. As proof of the concept, plasmids and genomic DNA from a microbial community near Lake Raleigh were purified and sequenced with an Illumina MiSeq sequencer at the NCSU Genomic Sciences Laboratory. Geneious bioinformatics software, the iPlant online bioinformatics portal, and public databases were used to analyze the microbial composition of the reconstructed gene fragments and assembled contigs. These studies establish a pipeline for future metagenomics investigations that can be easily implemented in a variety of settings. Furthermore, the analyzed Lake Raleigh sample provides a glimpse into the organisms and plasmids found around us, which often have important health and industrial applications.
The Effects of Photothermal Heating on Semicrystalline Polymers

Adrienne Terese Cage Physics
Mentors and/or Co-Authors: Laura Clarke Physics

Metallic nanoparticles have a property called surface plasmon resonance. This allows the particles to absorb visible light and in turn emit heat, known as the photothermal effect. Knowing this, embedding metallic nanoparticles in semicrystalline polymers allows us to heat samples using methods other than traditional treatments (e.g. heating on a hot plate). Our system, composed of gold nanorods in polyethylene oxide, has been used to show a distinct difference between photothermal heating (heating due to the gold nanorods under low-level laser irradiation) and conventional heating methods. Including gold nanorods in our samples has allowed us to increase the percent crystallinity of our samples to higher values than conventional methods, and does so in a shorter period of time. This information can be used to treat polymers quickly and efficiently, increasing their strength and altering other physical characteristics in a controlled manner.

Investigating Volume Conservation During Gut Morphogenesis

Jillian Claire Hattaway Biological Sciences-Molecular, Cellular, and Developmental
Joshua White Physics;
Samantha Zuber Mathematics;
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Sharon Lubkin Mathematics

Over the course of evolution, the gut has evolved to facilitate adequate nutrient absorption from diverse diets. Consequently, different species have changed the length of their gut tubes in order to adapt to their ecological niches. To begin to understand how gut length variation occurs, our group focused on identifying the mechanisms that control gut elongation during development. We chose to study the guts of two anuran tadpoles: the carnivorous Lepidobatrachus laevis and the omnivorous Xenopus laevis. Previous research suggests that rearrangement, rather than proliferation, of existing gut cells contributes to the elongation of the embryonic gut tube, but it is unknown whether this is the sole process driving elongation. If so, we hypothesized that volume would be conserved as the gut elongates. Therefore, we fixed Xenopus and Lepidobatrachus embryos at four critical developmental stages spanning embryonic gut lengthening and dissected their guts into smaller pieces under a Lunar microscope. Then, we photographed the individual pieces with AxioVision software and measured the split length and cross sectional area of each gut piece using ImageJ software. Using volumetric equations for a cylinder and/or a frustum, we calculated each piece’s volume. We found that both species’ guts maintained their volumes across the measured stages. Thus, our data affirms the hypothesis that volume is conserved during gut elongation and it can be inferred that radial intercalation is the major process driving gut length during development. Variation in embryonic gut cell rearrangements may underlie the evolution of different gut morphologies.

Functional Silicon Network Films as Tissue Engineering Scaffolds

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Kewei Xu Graduate Student;
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This projects seeks to improve the functional properties of different silicon network films to be primarily used for implantation in the body. In tissue engineering, an artificial scaffold is applied to serve as the extracellular matrix (ECM) for optimal cell growth and regeneration. For this purpose, the biomaterials to be used must have appropriate mechanical and biochemical properties according to different tissues in nature. For instance, the spinal cord only has 50 Pa of elastic modulus while the elastic modulus of longus tendon is 1600 MPa. Recently many studies have been conducted to understand the relationship between cellular behaviour and mechanical stimuli from its host scaffold2,3, but the choice of material and extrapolation of findings from one cell/material system to another system has proven difficult. Therefore, a substrate capable of large variation in mechanical properties as well as hydrophilic nature is required to
provide an ideal material platform to thoroughly probe the cell-substrate interactions. In this study, a silicone network system, capable of facile manipulation of mechanical properties, was designed to provide a material platform to support cell adhesion and proliferation mimicking the mechanical microenvironment of its physiological tissues. Specifically, the mechanical properties of silicone network biomaterials were engineered via crosslinking hydride-terminated polydimethylsiloxane (PDMS) with polyvinylmethylsiloxane (PVMS) at different ratios. Subsequent modification with mercaptopropionic acid and a water soluble catalyst rendered the silicon film more receptive to collagen deposition and cellular behavior of human dermal fibroblasts.

C49
Differential binding of groundwater extracts from a land-applied wastewater site to the three estrogen receptor subtypes of the Atlantic croaker, *Micropogonias undulatus*

Kyrie Sierra Hooton Environmental Technology and Management

*Mentors and/or Co-Authors: Beth Hawkins Biology*

Environmental estrogens are chemical compounds that can enter aquatic ecosystems and cause deleterious effects in organisms through binding to estrogen receptors (ERs) and disrupting associated endocrine functions. Teleost fish express three ER subtypes with different ligand binding affinities for some estrogens and estrogenic compounds, but little is known about how the structure of teleost ERs influences their ligand binding affinities to most environmental estrogens. In this study, we characterized the relative binding affinity of groundwater from a wastewater treatment facility to the three ER subtypes of a teleost fish, the Atlantic croaker. Groundwater SPE samples had the highest relative binding affinity (RBA) for ERα and a lower, yet still significant, binding affinity for ER βa. ER βb did not significantly bind to groundwater extracts at any concentration tested. These results for whole water extracts agree with previous findings from competitive binding assays with pure compounds, where ERβa has binding affinities unique from ERα and ERβb. These differences have been attributed in part to the amino acid substitution of a methionine in the ERα ligand binding domain to a phenylalanine in the ER βas. We are creating reciprocal mutant receptors to investigate the role of this position in the differential binding of wastewater extracts to fish ERs. We will compare our results for whole water extracts to those found for individual compounds suspected to be present in this water system. This will help us evaluate the estrogenic potential of contaminated water resources and predict their specific effects on ER-subtype mediated physiological processes.

D26
Loss of Ataxia-Telangiectasia Mutated Increases Intracellular Reactive Oxygen Species and Activates Rac1

Claire Elizabeth Kilmer Chemical Engineering

*Mentors and/or Co-Authors: Melissa Srougi Plant Biology*

Rac1 is a member of the Rho family of small GTPases which regulate cell adhesion, polarity, and cell motility. Rac activation is promoted by guanine nucleotide exchange factors (GEFs) which exchange GDP for GTP. Conversely, GTPase activating proteins (GAPs) inactivate Rac by catalyzing GTP hydrolysis, and Rho guanine nucleotide dissociation inhibitors (GDIs) sequester GTPases in the cytoplasm preventing their activation. Interestingly, Rac1 can also be activated through the direct oxidation of a redox-sensitive cysteine motif which promotes guanine nucleotide dissociation in the absence of GEFs. Ataxia-telangiectasia mutated (ATM) is a protein kinase well-known for its role in the DNA damage response. In addition, ATM regulates oxidative stress through modulation of free radical scavenging enzymes such as superoxide dismutase. In this work, we examined how loss of functional ATM affects cellular redox status and levels of activated Rac1. Immortalized human cell lines deficient and proficient in ATM were used to measure intracellular ROS and activated Rac1. Our results suggest that loss of ATM causes increases in intracellular ROS and Rac1-GTP. Furthermore, elevated Rac1-GTP in ATM deficient cells contributes to an increase in focal adhesion (FA) formation compared to ATM proficient cells. The increase in active Rac1 is ROS-mediated as treatment with the ROS scavenger N-acetyl cysteine (NAC) abrogates ROS generation, Rac1 activation, and FA formation in ATM deficient cells. This work will help to further clarify why patients with ataxia telangiectasia, characterized by a loss of functional ATM protein, have a predisposition to cancer.

A46
Differences in Gene Expression Between Male and Female Zebrafish During the Open Field Test

Melissa Marie McLeod Biology

*Mentors and/or Co-Authors: John Godwin Biology*
Abstract Listing by Program Page 72

Ryan Wong Biology

Virtually all animals, zebras included, display anxiety when confronted with stressful situations such as a novel environment or predator. The Godwin lab has shown that expression of certain genes increases over time during the Open Field Test (OFT) for our selectively bred bold and shy zebras and female zebras spend on average more time stationary than males during the OFT. Although many anxiety disorders are female-biased, female zebras are often neglected from studies due to hormonal fluctuations and housing expenses. We performed this study to see if a disparity exists in expression of genes between males and females that correlates with differences in anxiety behavior within and across our bold and shy zebras. The eight genes that we sampled in this study are GABA receptor 1 alpha and beta, prostaglandin D2 synthase b, pro-melanin-concentrating hormone, cfos, cyp19a1b (brain aromatase), IGF1, and deiodinase, iodothyronine, type II. Individual fish were exposed to a novel environment (OFT, 10 of each sex for each strain) for 5 minutes and immediately afterwards, the entire brain was dissected. We then processed the brains for quantitative real time RT-PCR. We hypothesized that among genes thought to be associated with anxiety in other animals, female zebras will have higher gene expression than males. Comparing basal level gene expression and behavioral stress response in individual males to that of individual females would provide insight into differences in behavior between the sexes and emphasize the need to include and account for sex differences in future studies.

A48
Using Sprinkler Systems to Cool Pasture Based Dairy Cattle
Nathanael Edward Morgan BAE
Mentors and/or Co-Authors: Sanjay Shah Biological And Agricultural Engineering

The objective was to determine the feasibility and effectiveness of using a sprinkler system to cool pasture based dairy cows. Pasture based dairy cows face unique challenges when trying to manage heat stress. We constructed a mobile solar-powered (100-W) sprinkler system from a small K-Line irrigation unit that can be moved from pasture to pasture. The sprinkler unit can be controlled such that if temperature is exceeded, the sprinkler will operate. Water is supplied from the automatic waterers already in place. The system is currently being tested at the Center for Environmental Farming Systems dairy unit. During preliminary testing, most cows were observed to use the cooling system. Different sprinkler heads are being compared to increase the wetted area. The effects of the cooling system are being evaluated by monitoring the behavior of the cows, as well as with infrared photographs.

B7
Mathematical Models of HIV Dynamics: Numerical Simulation and Model Validation
Amy Mou Applied Mathematics
Mentors and/or Co-Authors: Hien Tran Mathematics

AIDS is a disease of the human immune system caused by infection with Human Immunodeficiency Virus (HIV). In 2010, 2.7 million people around the world were newly infected with HIV and 1.8 million people died from it while AIDS remains an incurable disease ("Unaids world aids," 2011). This has led to a great deal of effort in the research community to develop mathematical models to understand the physiologic and immunologic response of the HIV in infected individuals. The objectives of our research are two folds. First, we will consider some mathematical models for the HIV dynamics from the literature and develop MATLAB software package for the numerical simulation and analysis of the models. Second, we will develop computational methodologies to validate the mathematical model to current HIV patients’ data from the University of São Paulo in Brazil. Using data from current HIV patients, we will verify the accuracy of the model as well as understand the pattern of viral actions within HIV patients’ immune system and their relationships to the drug treatment schedule.

D46
Using Micro-controllers to Tackle Inefficiency From Shading in Photovoltaic Panels
Miguel Abrantes Rufino Electrical Engineering
Mentors and/or Co-Authors: Alexander Dean Elec & Comp Engineering

Solar cells provide very little voltage on their own. For that reason, in modern solar panels, many of these cells are wired together in series into modules. These modules are then usually connected in series of strings up until the desired output voltage is achieved. Solar panel performance is proportional to the amount of incident light. When a solar panel is subject to partial shade, the shaded cells cause all the other cells in the module, in series with them, to under-perform. In extreme cases, the shaded cells can draw too much
current and eventually over heat and burn out.

Our proposed solution is to equip the modules with a sensing and a bypass mechanism. The goal being to actively determine which cells are shaded, and route around them, therefore increasing the overall efficiency of the system. The current sensing would be achieved using an low power embedded microcontroller, while the bypass would be provided by having bypass transistors at each cell. The system would be powered by the PV panel.

A26

Solitary Waves in Ferromagnetic Nanowires
Nathaniel Lawrence Sherrill Physics/Mathematics
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Mark Hoefer Mathematics

Nonlinear wave behavior is ubiquitous throughout the sciences and engineering. Within this context, solitary waves, also known as solitons, frequently appear as solutions to nonlinear partial differential equations (PDE) which model certain wave phenomena. For instance, it is known that solitons can exist in ferromagnetic materials. A nonlinear PDE known as the Landau-Lifschitz (LL) equation accurately models magnetic solitons in ferromagnets under a continuum approximation. This work confirms that certain solutions to the LL equation exist for a 1-D ferromagnetic nanowire that imply solitary wave behavior in a periodically oscillating bound state, colloquially known as a "bion." Numerical studies have also aided in visualizing and understanding these solutions to the LL equation via media and other graphic representations. Magnetic systems that include damping and external current flow are also shown to exhibit nonlinear wave effects. Critical parameter values in this regime for the nanowire configuration were found and are discussed in detail. A better understanding of wave phenomena behavior in ferromagnets is crucial to applications in numerous fields including spintronics, nanoelectronics, and optical technologies.

Estrogens are vital hormones that control important body functions such as development, reproduction, and behavior in organisms by binding to estrogen receptors (ERs). Synthetic environmental estrogens such as dioxins and PCBs used in industrial compounds enter water sources and can disrupt the endocrine system in many animal species. Teleost fish differ from mammals in that they possess three ER subtypes with different tissue distributions and ligand binding affinities. These characteristics provide an ideal screening tool for potentially estrogenic substances in aquatic environments. In this study, we used teleost ER competitive binding assays to screen for the presence of estrogenic compounds upstream and downstream of the Atlantic Woods Industry Superfund site at Portsmouth, Va. Water samples collected from the Elizabeth River were filtered prior to solid-phase extraction of estrogenic compounds. Concentrated water extracts were tested for their ability to bind to teleost ER fusion proteins produced in a bacterial expression system. Samples collected downstream of the Superfund site had a much higher binding affinity than upstream samples for both ERba and ERbb fusion proteins. In addition, water samples from both collection sites had a higher binding affinity to ERba than to ERbb. The differential binding affinity of contaminated water samples to the teleost ERs compared to mammalian ERs highlights the need to broaden screening efforts for potential endocrine disrupting compounds to a wider range of species.

C24

A computational study of a porphyrin-perylene array employing an energy-based fragmentation method
Kyle Allan Virgil Chemistry
Mentors and/or Co-Authors: Elena Jakubikova Chemistry

Porphyrin-based pigments are important for the development of artificial light harvesting systems. The photo-excitation and charge transfer processes in these systems are intimately tied to their electronic structure. Consequently, our goal is to investigate ground and excited state properties of a trans-(perylene)porphyrin trimer which serves as a model of porphyrin-based natural light harvesting systems. Initially, the geometries of perylene and porphyrin subunits of the trimer were optimized, and their electronic structures were determined using the density functional theory (DFT). All calculations were carried out employing the B3LYP hybrid functional, 6-31G* basis set for H, C, and N, and the LANL08 basis set for Zn. Large molecular arrays, including the porphyrin-perylene
trimer of interest that contains 287 atoms and 1140 electrons, are difficult to study with *ab initio* or DFT approaches. To circumvent this problem, we employ an energy-based fragmentation with molecular orbitals (EBF-MO) method to determine the electronic structure and other ground state properties of the trimer, thus reducing the computational cost. The research summarized here lays the foundation for future work using EBF-MO on larger perylene-substituted porphyrin arrays.
Characterization of Metal Interfaces in Lead Zirconate Titanate (PZT) Devices

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Mentors and/or Co-Authors: Leda Lunardi Electrical & Computer Engineering
Kanu Sharma Electrical Engineering

Lead zirconate titanate (PZT) is one of the most widely used piezoelectric ceramic materials in sensors and actuators applications such as hearing enhancement, ultrasound, mobile phone cameras, vehicle collision avoidance and oil exploration. Ferroelectric materials produce an electrical field when mechanically stressed and vice versa, suitable for random access memories in the microelectronics industry. The primary objective of this research is to examine electrode metal interfaces for highly efficient integration density demanded in today’s microelectronics industry. For optimum performance, the measured polarization as a function of electric field should be symmetrical with no discontinuities. In addition, symmetrical butterfly shaped capacitance-voltage characteristics are typical in ferroelectric materials. Metal-insulator-metal devices were fabricated with platinum and gold as metal electrodes and PZT as the insulator. The electrical response of the devices were measured and analyzed as a function of the metal used as top electrode and different PZT thickness. Different Schottky barrier heights affect the current conduction and depend upon the metal electrodes being examined. The above study was carried out by measuring capacitance and polarization.

A study of direct-write holography on photo-aligned liquid crystal polymers

Jan Brauburger Physics

Mentors and/or Co-Authors: Michael Escuti Elec & Comp Engineering

The alignment quality of liquid crystal polymers (LCP) depending on varying fluence exposure of linearly photopolymerizable (LPP)-polymers was studied. The optical properties of these samples were used as a measure of the alignment quality of the LCP and a polarizing microscope was used to characterize the different regions of alignment quality. There is a nonlinear relationship between the fluence and the alignment quality of the LCP. By applying this to the intensity profile of the laser beam this can be used to make better holograms and optical devices.

Semitransparent Organic Semiconductors

Alexandria Cruz Material Science Engineering

Mentors and/or Co-Authors: Brendan O'Connor Mechanical & Aerospace Engr

Organic photovoltaic devices have the potential to be high performance, low-cost photodetectors with unique detecting capabilities as compared to their commercially available inorganic counterparts. In our research project, we are interested in developing semitransparent organic photodetectors that measure incident light intensity while letting the majority of light pass through the cell.

A focus of this research is on the development of an “inverted” organic photovoltaic design where the cathode is placed on the transparent substrate and the anode is deposited on top of the active organic layers allowing a simpler path toward semitransparent and stable detectors. More specifically, titanium dioxide and cesium carbonate were each deposited on the high work function indium tin oxide (ITO) allowing for a highly transparent electrode. Titanium dioxide was ultimately chosen because its transparency, resistance to degradation in air, and its hole-blocking nature. To optimize processing conditions, casting method, solution concentrations, and annealing times, were varied and we found that anatase titanium dioxide crystals gave the best efficiency. Titanium isopropoxide was spin coated onto ITO glass and was hydrolyzed to form amorphous titanium oxide. Then, the substrate was annealed at 450 C to form the anatase titanium dioxide crystals. To complete the photodetector, a bulk heterojunction polymer-fullerene active layer was added and a thin layer of gold was thermally evaporated on the organic layer, making the cell semitransparent. After metal deposition, the device was exposed air for two days to dope the P3HT in the bulk heterojunction layer with oxygen and increase its conductivity.

A Pilot Study for Cyclic Voltammetry Experiment of Lithium Ion Battery

Priya Renu D'Amico Mechanical Engineering
Mentors and/or Co-Authors: Hsiao-Ying Shadow Huang Mechanical & Aerospace Engr

Lithium-ion batteries have been a major energy storage system for the past decade. Understanding how the cycles affect the battery capacity is of importance, especially for the applications of EV/PHEVs. A potentiostate/galvanostate (Princeton Applied Research 273a) is used to cycle the commercialized A123 Systems LiFePO4 battery. To better control and visualize the voltage variation during (dis)charging processes at different current rates, the research utilizes LabVIEW to simulate cyclic voltammetry experiment. An RS 232-C cable or a GPIB cable is wired to the back of the potentiostat and a desktop. Troubleshooting communication and acquiring the correct devices for communication are conducted. A data acquisition device (DAQ 6009, National Instruments) is used to aid the implementation of the cyclic voltammetry experiment through LabVIEW. The function of the DAQ is to retrieve voltage signals from the analog outputs of the battery and to allow data to be logged in LabVIEW. The current pilot study facilitates the future measurements of mechanical stresses in the battery; and the established LabVIEW simulation will provide a structured method for conducting these experiments.

B18
Template Directed Self-Assembly of Monodisperse Polystyrene Spheres for Hierarchical Three-Dimensional Phase-shift Lithography
Kathryn M Daly Bioengineering
Mentors and/or Co-Authors: Chih-Hao Chang Mechanical & Aerospace Engr

Template directed self-assembly (TDSA) of colloidal particles has proven to be a versatile and cost effective approach for organizing small particles in useful geometries. In this “bottom-up” process monodispersed nanospheres are driven by centrifugal force across a template to form closely packed hexagonal arrays in specified geometries. These assemblies are frequently used in nanofabrication as physical masks during deposition or etching processes; however, in this method it is difficult to pattern 3D nanostructures.

This work aims to selectively pattern 3D nanostructures via an integrated “top-down” phase-shift lithographic approach. In this approach, template directed self-assembly aids itself to a subsequent lithographic process that allows 3D patterning. This approach eliminates the need for a physical mask and significantly reduces cost and process complexity. This technique builds upon 3D lithography using 2D arrays of colloidal spheres that behave as a phase element casting a 3D intensity pattern on a substrate when illuminated. The intensity distribution is then recorded into photoresist generating a periodic nanostucture on patterned areas of substrate shown. However, the addition of a template enables long-range assembly order and independent design of micro and nanoscale features.

This innovative use of TDSA colloidal arrays may prove to have advantageous properties suitable in microfluidics, or photonic circuits, due to reasonably controlled physical surface patterning. Future work involves evaluating the characteristics of hierarchal 3D nanostructures developed by this method.

D18
Development of an apparatus and method for the testing of the electrical properties of novel thermoelectric textiles
Michael R. Hontz Electrical Engineering
Mentors and/or Co-Authors: Jesse Jur Textiles Mark Losego Chemical & Biomolecular Eng

The development of thermoelectric textiles could be a potentially disruptive platform for the production of low-temperature waste-heat recovery systems. As such, a procedure is necessary to evaluate the electrical properties associated with this novel technology as known methods of testing thermoelectric devices are ill-suited for use on samples of the size and geometry of the proposed thermoelectric textiles. This research examines a robust testing apparatus that enables facile evaluation of the thermal power generation capability of thermoelectric textiles. The apparatus possesses a controllable heat source, a stable heat sink and the capability to produce voltage-current curves and current-power curves for a wide range of temperature gradients and loads.

A15
Zinc Oxide Coated Carbon Nanotube Sheets for Flexible Energy Harvesting Structures
Margaret Elyse Payne Physics
Mentors and/or Co-Authors: Philip Bradford Textile Engineering, Chemistry, and Science

Generating green energy is a key issue in today’s scientific world. Power-generating materials imbedded in clothing, that harvest the mechanical
energy of human motion could be one of the solutions for a world with greener energy. Most current energy harvesting materials are built off of rigid substrates with traditional semi-conductor materials. The concept developed in this work is to make flexible generators that can then be seamlessly integrated onto textile materials. The flexibility of our design is derived from the constituent materials. Thin carbon nanotube (CNT) sheets were used as the electrically conductive base material which was then coated with a 30 nm thick layer of zinc oxide (ZnO) using atomic layer deposition. The ZnO is a piezoelectric material which can generate charge under mechanical strain. As the thin ZnO-coated CNT sheets are stretched or bent the material should produce a current and this current can be collected using a properly designed circuit. The ZnO-coated CNT sheets were characterized using Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM). The crystal structure of the ZnO was determined by X-Ray Diffraction (XRD). Electron Energy-Loss Spectroscopy (EELS) and Energy-Dispersive X-Ray Spectroscopy (EDS) were also performed. The ZnO-coated CNT sheets were integrated onto flexible silicone and stretchable nylon fabrics for testing.

That interconnections can be printed on highly-insulating surfaces with resolution up to 5µm. Therefore, it demonstrates to be a higher-resolution printing technique compared to the ink-jet printing which can print on a micron level (less than 10µm).

B6

Low Defect Density AlGaN/ GaN Structures for High-Power Electronic Applications

Kathryn Clare Valentine Physics

Mentors and/or Co-Authors: Tania Paskova Elec & Comp Engineering

AlGaN/GaN heterostructures have performed notably in high-power, high-frequency devices and are rapidly becoming a commercially viable choice for such devices. However, poor thermal management in current AlGaN/GaN structures causes undesirable heating in devices, thus reducing device performance, lifetime, and reliability. The current challenge in the field is to maximize the thermal conductivity of the materials in order to provide proper thermal management. Additionally, it is vital to produce well-performing structures at a competitive cost.

In our work, we focused on the characterization of AlGaN grown on GaN substrates using HVPE. We used the three omega method to investigate the thermal conductivity of samples with AlGaN films of a variety of compositions and thicknesses.

In agreement with theoretical models, we found that the thermal conductivity was highest for low and high percentages of aluminum content, while the mid-range aluminum content samples had lower thermal conductivity. Additionally, using hydride vapor phase epitaxy (HVPE) with low-temperature or graded interlayer optimizations can yield lower defect density while reducing the cost of production.
Large scale Photovoltaic arrays pose a problem with power quality because of the unpredictability of the weather. On days that have intermittent cloud cover, the PV arrays produce sporadic power which can be cumbersome for grid tied systems. One way to combat this problem is to integrate a hybrid energy storage system. A hybrid energy storage system consists of ultra-capacitors and batteries in combination to store energy. Hybrid energy storage systems help smooth out the power production of the PV array by providing its stored energy when there is a dip in power caused by intermittent cloud cover. My research is focused on sizing a PV array along with a hybrid energy storage system for industrial sized applications. My method for sizing the PV and energy storage system was to use the load profile of the FREEDM Systems center and the existing PV array output from the rooftop mounted PV panels. The methodology used to size a PV and energy storage system for FREEDM Center can be used to size any industrial sized building in any climate using the load profile of said building and the solar insulation of the selected location. My methodology is used for off grid applications but, can be very easily used for grid tied systems.

Electric Vehicles (EVs) and Hybrid Electric Vehicles (HEVs) have the potential to provide efficiency benefits over vehicles with combustion engines. Current vehicle test beds available are not suitable for HEV testing purposes. A HEV test platform can provide automobile manufacturers with accessible performance tests and can also be a helpful tool for researchers to develop automobile software, components and control strategies. The HEV test platform consists of a chassis with a hybrid drive train, a data acquisition system, a chassis dynamometer and a MotoHawk micro controller. In this research, the work mainly focuses on the layout design of the hybrid drive train converted from a pure electric drive, which comes from a Department of Energy project. The conversion research begins with the 3D modeling of the existing chassis components in SolidWorks. Components were first measured, sketched and then modeled to appropriate or representative dimensions. With all parts modeled, different layouts for the chassis can be assembled virtually for further analysis. Four different designs were proposed, whose benefits and difficulties were analyzed respectively. The most appropriate design was chosen after analyzing the trade-offs of all designs. This design research provides an optimal layout of the chassis with the hybrid drive train, which will benefit the future development of the HEV test platform.

Finding patterns in large volumes of power system data is an important problem as these patterns can inform the operator about the system-wide behavior and help in predicting faults. Such patterns are often strongly correlated to notions of ‘effective distance’ between the power substations. Our goal in this project is to develop data analysis methods by which an operator may be able to evaluate how different data sources in a large power grid are correlated with each other and relate them to the inter-station distances. Our variables of analysis are voltage and phase angle measurements gathered using Phasor Measurement Units (PMU) from eight 500-kV power substations in the western coastal United States lasting for a period of 3 minutes. The data streams are passed through a Band-Pass Filter for noise elimination first and the relative phase angles are computed from the filter outputs. Statistical calculations are then made to determine the least squares differences of the relative angles and their relationship to respective distances. Other graphs are plotted using different metrics of ‘distance’ such as the linear distance between substations multiplied by the number of connecting transmission lines. Results thus far have shown that
depending on the fault, linear geographical distance between substations may indeed have a positive correlation to the discrepancies in phase angles. Our future work will, therefore, involve defining new metrics of distances that we can use to tune this correlation to match more accurately.

C20
Implementation of 10kVA multi-terminal and three
phase dual-active bridges dc/dc conversion stage
for solid-state transformer applications.
Hyungsun Mark Hwang electrical engineering
Mentors and/or Co-Authors: Subhashish
Bhattacharya Elec & Comp Engineering

The poster represents the method used for design a high frequency dc/dc conversion stage of solid-state-transformer (SST) applications that can replace conventional 60Hz passive transformers. The goal of the project is to design and build a prototype in order to verify the concept and feasibility of the proposed multi-terminal and three-phase dual-active bridge dc/dc conversion stage of SST applications. The proposed design of the transformer does not only simplify design of the commercial power transformer, but it also makes another positive effects. Understanding system behavior of the isolated dc/dc conversion stage with high frequency isolation transformer is one of the key factors to analyze overall system performance and efficiency. In order to emulate and investigate the system performance of the proposed topology with high frequency transformers, we are building scale-down 10kVA prototype and variety of types of high frequency transformers. 1200V IGBTs has been selected for safe margin and soft-switched to protect the power devices from high electric and thermal stress at frequency above10kHz. Two H-bridges of the three are built and successfully connected to NI Compact Rio platform in the last semester so far. And single-phase dual-active-bridge operation with two H-bridges has been run and tested under soft-switching condition at frequency 20kHz as a transition to the multi-port full-operation. As a result of this project could lead the interface medium voltage grid to the distributed generations (DGs) or customer with functionality and minimum efficiency penalty.

This project will design, build and operate a solar powered electric vehicle charging station coupled with an energy storage system. The integrated Vehicle Energy Storage & Solar Demonstration (VESSD) system is being installed in the parking deck of the Keystone Science Center at North Carolina State University and will be connected to the microgrid in an adjacent smart grid lab. It incorporates 18 photovoltaic Isofoton solar modules, with a capacity of up to 4.5 kW. Half of these are interconnected with micro inverters, and half to a junction block in the FREEDM center’s Low Bay lab. The system requires installation and trenching of 4 underground conduits and wire, one empty conduit for future expansion, one AC, a CAT 6 cable for data collection. It will be electrically tied to the existing 12.4 kV Green Energy Hub (GEH) microgrid at NC State. The charging station includes two electric vehicle charging stations and a 20 kW-hr battery for energy storage system. A 42” LED touch screen monitor will be mounted to the parking structure to monitor the energy generation, real time flow between components as well as provide an educational visual display for visitors to the center. The GEH provides unparalleled facilities to support this type of integrated energy system research and development. This research project aims to provide important information on the on how we can better understand and manage the tie between electric vehicles, charging stations and solar panels.

B16
VESSD Project
Allan S Oduor Electrical Engineering
Mentors and/or Co-Authors: Ewan Pritchard Elec &
Comp Engineering
**A9**

**Characterization of Arabidopsis VIP mutants**

Kalyani Subodh Joshi  *Chemical Engineering-Biomolecular*

*Mentors and/or Co-Authors: Imara Perera  Plant Biology*

Inositol hexakisphosphate (IP6) plays a role in plant signaling and is a major phosphate store in seeds. IP6 can be further phosphorylated by the VIP enzymes to form inositol pyrophosphates. Work in yeast and mammals has shown that inositol pyrophosphates are important for nutrient and stress signaling, however not much is known about their function in plants. In the model organism, *Arabidopsis thaliana*, there are two VIP genes (*AtVIP1* and *AtVIP2*) that are homologs of the yeast VIP kinase. The aim of our project is to investigate the function of inositol pyrophosphates in plants, by studying the mutants of these genes under normal conditions and different stresses. We are currently working with four T-DNA insertional mutants, and a double mutant of both *AtVIP1* and *AtVIP2*. The morphology of these mutants has been characterized by monitoring growth parameters of plants through different stages in their life cycle. Some mutants display distinct phenotypes, seen through comparisons of leaf count, rosette diameter, bolting length, and flowering time. Response to various stresses, including abscisic acid (ABA) and nutrient starvation were also monitored. Seed germination trials reveal that some *AtVIP* mutants show differential sensitivity to ABA. Phenotypic analyses indicate altered response to low sucrose and minimal nutrient conditions. The combined results of these experiments and future work will allow us to understand the role of VIP enzymes in plant signaling.

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**C2**

**Genetic dissection of the interaction between indole-glucosinolate biosynthesis and auxin homeostasis in Arabidopsis**

Michael Thomas Judge  *Cell/Molecular Biology*

*Mentors and/or Co-Authors: Linda Robles  Genetics; Jose Alonso  Genetics; Anna Stepanova  Genetics*

The critical phytohormone auxin plays a vital role in maintaining a constant supply of undifferentiated cells in the root and shoot meristems to allow for continuous growth and response to changing conditions. While the molecular mechanisms of auxin transport, perception, signaling and response have been investigated in *Arabidopsis thaliana* in great detail, auxin (indole-3-acetic acid, IAA) biosynthesis remains only partially characterized. At least four different pathways of IAA production have been postulated; a branch involving indole-3-pyruvic acid is believed to represent the main route of IAA biosynthesis in Arabidopsis. Conversely, a parallel indole-3-acetaldoxime (IAOx) route is largely dedicated to defense compound (indole glucosinolate/IG) production, but is also known to contribute to IAA levels since mutations in SUPERROOT1 (sur1), SUPERROOT2 (sur2), and UDP-GLUCOSE:THIOHYDROXIMATE S-GLUCOSYLTRANSFERASE74B1 (ugt74b1 or ugt) lead to IAA overproduction. Unlike sur mutants, which accumulate IAOx, plants defective in UGT show an intriguing combination of high- and low-auxin phenotypes, suggesting that the different biosynthetic intermediates that accumulate in ugt (thiohydroximates) may have anti-auxin phenotypic effects. Three different alleles of ugt were treated with jasmonic acid (JA), a growth regulator known to stimulate the IAOx pathway and thus expected to induce thiohydroximate overproduction. Phenotypic analyses of seedling root morphology and expression of the auxin-responsive reporter DR5:GUS suggest the resulting accumulation of thiohydroximates in JA-treated plants alters auxin biosynthesis and/or transport, and that this effect is dramatically enhanced as seedlings develop from 3 days to 11 days.

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**C9**

**Investigating the Heat-Stress Response of SOR-Expressing Arabidopsis Plants**

Marlee R. Labroo  *Environmental Science*

*Mentors and/or Co-Authors: Imara Perera  Plant Biology; Wendy Boss  Plant Biology*

It is estimated that 50% of potential crop yields are lost annually to abiotic stress, which includes excessive heat (Boyer, 1982). Given predicted increases in global temperature and food demand, the development of heat-resistant plants is a key priority. Under conditions of heat stress, plants accumulate reactive oxygen species (ROS), which cause oxidative damage and cell death. Plants use superoxide dismutases (SODs) to hold ROS in check, but this too generates O₂. The enzyme superoxide reductase (SOR), discovered in the hyperthermophile *P. furiosus*, reduces ROS without generating O₂. We hypothesize that expressing SOR in plants could improve thermotolerance. Previous work
in our lab by Im et al. found that SOR-expressing Arabidopsis outperformed controls in response to heat stress (2009). Our current project sought to further investigate the heat stress response and fine-tune experimental parameters. Different lines of SOR-expressing Arabidopsis were evaluated for protein expression and survival under various experimental conditions, which manipulated developmental stage, heat duration and intensity, plant density, and acquired versus basal thermotolerance. SOR-expressing plants appear to display higher germination rates and greater hypocotyl elongation in response to heat as compared to controls. While further replication is needed to confirm these results, we anticipate that the experimental design we have developed will provide guidance to future research.

C3
Engineering Cercospora disease-resistant plants using fungal toxin-resistance genes
Natalia Maldonado Biology
Mentors and/or Co-Authors: Margaret Daub Plant Biology

The plant pathogenic fungi Cercospora affect many economically important crops. The fungus produces the toxin cercosporin that aids in pathogenesis of host plants. Cercospora's own resistance to cercosporin has been attributed to a variety of mechanisms, one of which is the exportation of the toxin out of the cell by fungal transporter genes such as ATR1 and CFP. We hypothesize that by integrating these transporter genes into tobacco plants, we may be able to engineer resistance to Cercospora nicotianae infection. Haploid tobacco plants were transformed with ATR1 using Agrobacterium-mediated transformation. Diploid plants were generated from transformed haploid ATR1 plants using a mid-vein culture technique, and ATR1 gene expression was tested with quantitative PCR. In order to examine the response of the ATR1 diploid plants to Cercospora nicotianae, disease trials were conducted by inoculating the plants with fungal conidia and assaying symptoms of the disease. Control treatments included wild type plants as well as plants transformed with the vector lacking ATR1. Results obtained showed that some of the ATR1-transformed tobacco plant lines were more resistant to Cercospora than the wild type plants or vector controls. These results suggest that genetically engineering tobacco plants with the Cercospora transporter gene ATR1 increases resistance to C. nicotianae. Studies are underway to engineer tobacco with the Cercospora CFP transporter gene and testing its effect on disease resistance to C. nicotianae.

C4
Characterization of Iron Deficiency Response Proteins in Arabidopsis thaliana
Ethan Tyler Pierce Environmental Horticulture
Mentors and/or Co-Authors: Terri Long Plant Biology

Understanding iron uptake and distribution in response to iron deficiency is essential for improving the nutritional content of agriculturally important crops. Iron deficiency response proteins POPEYE (PYE) and BRUTUS (BTS) play dynamic roles in controlling iron homeostasis within the root system of the model plant, Arabidopsis thaliana (Long et al. The Plant Cell, 2010). While PYE is a transcription factor, BTS is a putative E3 ligase that interacts with PYE-like proteins, including IAA-Leucine Resistance 3 (ILR3). In response to iron deficiency increased expression of these and other genes cause physiological responses that increase content of iron, as well as other metals, such as Zinc (Zn), Manganese (Mn), and Cobalt (Co) in plants. To ascertain the role of PYE, BTS and ILR3 in response to other metals, root length, shoot chlorophyll content, and root iron reductase activity were measured to compare physiological responses between wild type, bts-1, pye-1, and ilr3 mutants under normal growing conditions and under varying conditions of deficient and excess Fe, Zn, Mn and Co. In addition, changes in gene expression in response to these conditions were detected by confocal analysis of plants expressing GFP transcriptional fusions to PYE and BTS. Finally, recombinant plasmids of two additional BTS interactors, previously identified by Yeast-2-hybrid analysis, were generated for and tested by BiFC analysis. This study provides new insight into the function of BTS interactors, and into how key iron response genes may play a role in homeostasis of other metals.

A3
The Mechanism of Resistance in a Geminivirus Resistant Arabidopsis Ecotype
James Leon Pridgen Pharmaceutical Science
Mentors and/or Co-Authors: Linda Hanley-Bowdoin Biochemistry
Jose Ascencio-Ibanez Biochemistry

Cabbage leaf curl virus (CaLCuV), a bipartite begomovirus (Fam. Geminiviridae) transmitted by white flies, infects members of the Brassicaceae family. The CaLCuV genome is composed of two
components. The A component contains all of the viral genes necessary for replication, and the B component encodes the genes related with movement. In this work, we studied CaLCuV movement during the infection of resistant (R) and sensitive (S) Arabidopsis thaliana ecotypes. Our goal was to determine if CaLCuV is localized to inoculated leaves or can cause a systemic infection in the resistance versus the sensitive ecotypes. Using localized biolistic inoculation, we infected three leaves of each plant with both viral DNA components. At 5, 9, 14 and 21 days after the inoculation, we collected samples of the inoculated leaves and from newly developed leaves and determined the viral load by PCR. Additionally, on day 14 we will use in-situ hybridization, an immunohistochemistry technique, to detect the presence of virus in inoculated and systemically infected leaves and to study leaf morphology during infection. The data obtained in this evaluation provide information about CaLCuV systemic infection and whether endogenous resistance can limit its replication or movement in inoculated plants.

D3
The Role of HOPS in Vacuole Fusion in itt3 Mutation
Eliezer Rovira Biology
Mentors and/or Co-Authors: Marcela Rojas-Pierce Plant Biology

Vacuoles are probably the most conspicuous organelle in the plant cell. Vacuoles are used as storage of proteins, ions, organic molecules, water, maintaining pH within the cell and. The integrity of the vacuole is important to maintain a hydrostatic pressure that helps to support plants structure. We have found a one point mutation named itt3 that codifies for an early stop codon that cause a shorter polipeptide chain resulting in a faulty SNAREs complex. This mutation cause framented vacuoles phenotype. In order to that we want to understand the role of HOPS tethering complex in vacuole fusion behavior in itt3. To uncover HOPS role in vacuole fusion we used vc11, vps41 and vps31 mutants in the HOPS complex, LY294002 treatment (a Phosphatidylinositide 3-kinase inhibitor) and a YFP-FYVE transgene (a Phosphatidylinositol 3-inhibitor). The results showed that HOPS may play a role in regulating vacuole fusion in itt3 in a negative or positive way. However the model of how HOPS complex work on plants vacuole fusion is still unkown.

D8
Generating PVY Resistance in Tobacco

Samantha Marie Sparrow Biochemistry and Molecular Biology
Mentors and/or Co-Authors: Ralph Dewey Crop Science

Tobacco crops in the United Stated had an estimated value of $1.6 billion in 2012 and fields infected with potato virus y (PVY) have a 40% value reduction on average (USDA; Sievert 1977). PVY resistance is important for tobacco farmers to maintain profitability and sustain production. When PVY infects its host, it utilizes the host translation machinery to produce viral components. During translation initiation, PVY must interact with eukaryotic initiation factor 4E (eIF4E) within the host. We hypothesize that disrupting the PVY-eIF4E interaction, PVY will no longer be able to replicate, and thus the plants will show resistance. The focus of this research is to develop transgenic tobacco plants displaying PVY resistance. Two isoforms of eukaryotic initiation factor 4E (eIF4E) were isolated and used to transform three varieties of tobacco. The resulting transformed plants will undergo resistance assays to investigate PVY resistance.
was determined that the N-terminus of the protein was folded into the inside and therefore was not surface accessible to interact with the metal affinity resin. To overcome this problem, a new BrBt SCS expression construct was made with a C-terminal His-tag fusion instead. The C-terminal His-tagged version of BrBt SCS was successfully overexpressed in *E. coli* strain BL21(DE3) and purified using IMAC. The purified BrBT SCS also demonstrated SCS activity and therefore is a candidate for use in the synthetic crTCA cycle.
NSF REU Modeling and Industrial Applied Mathematics

C6
Portfolio Optimization with Conditional Value at Risk (CVaR)
Molly Margaret Cobb Mathematics
Collin Eubanks Mathematics;
Itelhomme Fene Mathematics;
Pamela Badian-Pessot Mathematics and Economics
Mentors and/or Co-Authors: Tao Pang Mathematics
Cagatay Karan Math

In the finance industry, investors search for ways to maximize return while simultaneously controlling the risk of their portfolios. Mean variance optimization (MVO) is a common method in the finance industry for forming portfolios; however, some literature has shown that mean-conditional value at risk (M-CVaR) is emerging as an optimization method that could potentially outperform MVO, as M-CVaR considers higher moments. In our research, we seek to extend the pre-existing research by modeling a moving portfolio, using both MVO and M-CVaR to rebalance periodically. Moreover, we incorporate a brokerage fee into our model to more accurately depict the return of a portfolio. Thus far, our results continue to suggest that M-CVaR is the superior method for both normal and stress market conditions. However, during the transition between a normal to stress market, and vice versa, we have seen results that suggest MVO outperforms M-CVaR.

C18
Modeling and Assessment of Cerebral Autoregulation
Nicholas Harold Guerra Mathematics
Willtresca Heppard Mathematics;
Miranda Henderson Mathematics;
Theresa Searnati Applied Mathematics
Mentors and/or Co-Authors: Adam Mahdi Mathematics

The human brain accounts for only two percent of human body mass, yet over fifteen percent of the body’s blood supply goes to the brain. Cerebral autoregulation (CA) is the brain’s local ability to maintain stable cerebral blood flow during changes in arterial blood pressure. Numerous studies have been dedicated to developing computational models in order to understand the physiological mechanisms associated with CA. However, the majority of previous models only supply us with a qualitative understanding of CA. Here, we aim to create a simple, quantitative, and patient specific CA model. Because of the limited data available and the complex physiological processes involved in CA, we predict cerebral blood flow given only systemic arterial blood pressure. The model is made patient specific by using sensitivity and covariance analyses to obtain a subset of parameters that can be estimated given available, quantitative data.

B14
Numerical Analysis in High Dimensions
Nathan Dean Heavner Mathematical Sciences (B.S.)
Andrew Watson Math;
Ryan Atwater Applied and Industrial Mathematics;
Steven Collins Mathematics & Chemical Engineering;
Andrew Chinn Math
Mentors and/or Co-Authors: Pierre Gremaud Mathematics

Many fields, ranging from finance to biology, involve high-dimensional problems that often contain uncertainties, for example, in system parameters. Such uncertainties result in great computational costs of resolution when solved via ordinary methods. Common problems take the form of systems of ordinary or partial differential equations with random initial conditions or parameters. Most often, these problems are solved numerically with Monte Carlo simulations in which solutions are repeatedly computed with sample values of random inputs for uncertainties. From this large set of solutions, statistical properties of the solution, such as the mean and standard deviation, can be determined. Although theoretically sound, the Monte Carlo approach can prove virtually impossible in practice when millions of realizations are required to guarantee an accurate solution.

Instead, following examples from the engineering literature, we derive partial differential equation (PDE) expressions for probability density functions (PDF) of the solutions of several differential equations with uncertainties. We then solve these PDEs numerically by discretizing variables, such as time and space, and approximating derivatives as finite differences. Specifically, we apply this method to several transport equations, ordinary differential equations, and conservation laws.

Ultimately, we find that our PDF solutions agree with
the PDFs determined by the Monte Carlo approach. Moreover, since the equations for the PDFs are only solved once, we find that our approach requires significantly less computational time than Monte Carlo simulations.

D16
The Effect of Structure on Physiologically Based Pharmacokinetic Modeling
Sarah M Laper Math and Chemistry
Jerrell Mure Mathematics;
Archana Patel Mathematics;
Amy Kern Mathematics
Mentors and/or Co-Authors: Marina Evans Pharmacokinetics
Megan Sawyer Mathematics

In physiologically based pharmacokinetic modeling, the structural setup of the model has the potential to impact the accuracy of the results depending upon the amount of details incorporated. By formulating and testing four different models, we sought to identify how the complexity of a model affects parameter optimization. Two volatile organic compounds, methyl tert-butyl ether (MTBE) and bromochloromethane (BCM), served as the test chemicals for this study. The inhalation data sets available provided a basis for comparison of different model structures. The three structures are: (1) a standard, 5 compartment model; (2) the standard model with isolation of the brain; (3) the standard model with the cardiovascular system isolated; and (4) the standard model with the brain and cardiovascular system isolated. We performed sensitivity analysis within each model and dose to determine appropriate parameters for optimization; results of the optimization were compared across model structures to identify effects of levels of complexity.

D42
Applying Machine Learning Techniques to Baseball Pitch Prediction
Joe Andrew Murray Math
Corey Stafford Mathematics;
Mike Hamilton Mathematics
Mentors and/or Co-Authors: Hien Tran Mathematics

Major League Baseball (MLB), a professional baseball league in the US and Canada, is one of the most popular sports leagues in the world. Partially because of its popularity and the wide availability of data from games, baseball become the subject of significant statistical and mathematical analysis. Pitch analysis is especially useful for helping a team better understand the pitch behavior it may face during a game, allowing the team to develop a corresponding batting strategy to combat the predicted pitch behavior. We apply several common machine learning classification methods to PITCH f/x data to classify pitches by type. We then extend the classification task to prediction by utilizing features only known before a pitch is thrown. By performing significant feature analysis and introducing a novel approach for feature selection, moderate improvement over former results is achieved.

B2
Optimization of Klystron Design
Kelsey James Reppert Physics/Mathematics
Juan Guzman Roca Mathematics/Electrical Engineering;
Kayla Cline Mathematics
Mentors and/or Co-Authors: Hien Tran Mathematics

The klystron, which is a specialized linear-beam tube, is used as the radio frequency energy source for high energy accelerators/medical accelerators in the industry and in research. The design of klystrons for a given application requires defined specifications, such as gain, bandwidth and power output. A typical design process involves iteratively simulating and modifying aspects of the klystron, such as the frequencies of the cavities and the power input, to achieve the desired specifications. Because of the large number of variables, this is often a time consuming and expensive process. This project aims to create a computer optimization process for the klystrons. It uses the Java simulation code AJDISK and MATLAB optimization routines to produce a klystron that satisfies some design specifications. Several klystron design cases from the industry will be used to test the efficiency and fidelity of the computer optimization process.

C1
Modeling Illicit Drug Use- Methamphetamine
Lilyana Louise Staight Pure Mathematics
Danielle Williams Mathematics Secondary Education;
Bernadette Bucher Mathematics and Economics;
Robin Mabe Mathematics Secondary Education
Mentors and/or Co-Authors: Alun Lloyd Mathematics
Jacob Norton Mathematics

While the use of other illicit drugs such as cocaine and heroine is declining, the use of methamphetamine continues to rise, in part due to ineffective current treatment strategies. To date, mathematical models have not been used to explore the dynamics of
methamphetamine use in a population. We propose two mathematical models that can predict, evaluate, and simulate methamphetamine use in urban and rural populations. Characteristically, rural areas are hot spots for home based labs, while in urban areas methamphetamine is mostly bought from dealers who are not part of the urban drug using population. Consequently, we created separate compartmental models for urban and rural areas. Similar to techniques often used in infectious disease modeling, the interaction between susceptible, using and recovered individuals in our drug using population acts as a mechanism for the spread of methamphetamine use. Furthermore, we found optimal control strategies for both models to show how the spread of methamphetamine use reacts to implementations of government controls across a population.

D9
Modeling Cell Rearrangement and Morphogenesis in Epithelia
Kaela Shea Vogel Pure Mathematics
Matt Mohorn Mathematics;
Amy Mou Applied Mathematics;
Michelle Andersen Mathematics
Mentors and/or Co-Authors: Sharon Lubkin Mathematics

We developed an off-lattice, three-dimensional, particle-based model to simulate cell rearrangement in epithelial sheets. This model renders cells that have no inertia, exhibit fluid-like behavior, and form tissues that resist deformation. Our model is novel in that it assigns cells orientation and polarization in addition to position, volume, and shape. Cells are given an orientation when they are polarized, allowing cell-to-cell interactions to be simulated as forces determined by the relationships between the orientations and positions of neighboring cells. Including orientation as a cell attribute also allowed us to calculate and impose curvature on sheets and other surfaces of cells, creating hollow spheres, cylinders, and bent sheets. Controlling the time and location of cell polarization allowed us to transform a solid sphere of cells into a hollow sphere, mimicking a morula developing into a blastula. We also utilized cell polarization to convert a rectangular prism of cells into a hollow cylinder in a process similar to gut formation in the embryonic stages of development. Including orientation and polarization in our model not only allowed us to add another facet of realism to individual cells and to cell-to-cell interactions, but it also allowed us to more realistically simulate important developmental processes in collections of cells.

B11
PBPK Modeling of Hazardous Chemicals through Life-Stages
Camille Elizabeth Zerfas Mathematics
Stephen Jordan Mathematics;
Jasmine Jackson Applied Mathematics;
Ariel Nikas Mathematics
Mentors and/or Co-Authors: Hisham El-Masri Systems Biology Branch, Integrated Systems Toxicology Division (ISTD)
Jason Scott Mathematics

There are a number of toxic chemicals found in the environment that may negatively affect humans and animals. Exposure to these chemicals can occur by inhalation, ingestion, or dermal absorption. Pregnant women and their developing fetuses are specifically vulnerable to various chemical toxicities. Unsafe toxic exposure could potentially lead to birth defects, behavioral abnormalities, and diseases. Through the development of a computational model, e.g. physiological-based pharmacokinetics (PBPK), the levels of these chemicals in both a mother's and child's tissues can be ascertained mathematically.

PBPK is a mathematical description of the process by which a drug is absorbed, distributed, metabolized, and eliminated in specific tissues of the body. A life-stage PBPK model was developed that considered physiological changes in pregnant women, such as the change in body weight, blood flow rates, and volumes of mammary tissue, uterus, placenta, and fat. The PBPK model was extended to consider the transfer of chemical from a mother to a nursing child via lactation.

We used the PBPK life-stage model to study the distribution of bisphenol A (BPA) in maternal, prenatal, and postnatal tissue. BPA is produced during the manufacture of polycarbonate plastics and epoxy resins. People are orally exposed to BPA from the plastic used to package foods and drinks. The majority of U.S. adults have detectable urinary concentration levels of BPA. Studies have suggested that BPA exposure can lead to abnormal birth weights, atypical gestation times, and potential reproductive issues.
C11
Predicting Supernova Neutrino Detector Signals

Tara Jasmin Aida  Math and Physics
Mentors and/or Co-Authors: Jim Kneller  Physics
Tina Lund  Physics

Due to ever improving hydrodynamic simulations, our understanding of how massive stars explode has allowed us to make increasingly confident predictions of the neutrino burst signal from the next supernova in our Galaxy. With this signal, we hope to answer the many outstanding questions about the core dynamics of a supernova and the shockwave that propagates through the star. But first, we must be able to decode these signals, which requires understanding the flavor oscillation that occurs as the neutrinos propagate through the star and towards Earth. We present a computational analysis that uses the density and neutrino information of three 1-D hydrodynamic supernova models to predict the neutrino signals that would be detected in three different types of detectors. Our calculations take into account flavor oscillations caused by collective flavor effects and the evolution of the Mikheyev, Smirnov & Wolfstein (MSW) conversion, and we test both normal and inverted neutrino mass hierarchies. We demonstrate how the presence of the shockwave leaves an imprint in the spectral event rates of these detectors, which might be used to test the delayed explosion paradigm, and how the total neutral current event rates versus time can be used to determine the cooling rate of the proto neutron star.

B10
Clump Accretion in Supergiant Fast X-Ray Transients

Eve Adde Chase  Physics
Mentors and/or Co-Authors: John Blondin  Physics

Supergiant Fast X-Ray Transients (SFXTs) are a subclass of High-Mass X-Ray Binaries (HMXBs) that consist of a neutron star and OB supergiant donor star. These systems display short, bright x-ray flares lasting for a few minutes to a few hours with luminosities reaching $10^{36}$ erg/s, several orders of magnitude larger than the quiescent luminosities of $10^{32}$ erg/s. The clumpy wind hypothesis was proposed as a possible mechanism for these transient flares; in this model, a portion of the stellar wind from the donor star forms into clumps and is accreted onto the neutron star, inducing flares of x-ray luminosity. Thus far, analytic models have relied on the predictions of Hoyle-Lyttleton Accretion, which ignore many idiosyncrasies in the system and limit the models to steady, axisymmetric flow. We test the clumpy wind hypothesis by using the VH-1 hydrodynamics code which models the complex time-varying nature of flow. We are modelling clump accretion in 3D over parameters known to form accretion disks in 2D such as radius, density, and distance from accretion axis. When tracking mass accretion rate and angular momentum accretion rate while simultaneously visualizing the data, we observe a negative mass accretion fraction, contradictory to Hoyle-Lyttleton Accretion theory. The x-ray light curves produced by our simulations will be compared to observational curves in order to locate consistent behavior between the two.

D47
Investigating the Formation of Clumpy Ejecta in Young Type Ia Supernova Remnants

Ashton Edward Dyer  Physics, Applied Mathematics

It is believed that planetesimals and asteroids are created by the accumulation of interstellar dust. However, the processes that govern the collision, agglomeration, and fragmentation of clusters of grains are not well understood. Prior research in the topic has established regimes for the results of conservative collisions of particle clusters held together by contact forces, but neglects gravity, a critical component once particles are no longer touching. We run simulations of clusters of particles modeled as hard frictionless spheres that take into account gravity and dissipation of energy. We obtain outcomes of collisions of two clusters with variable masses, particle counts, velocities, and impact parameters. We then compare our results to other models and simulations, and find that conservative collisions can take place at higher energies than classically predicted.
Mentors and/or Co-Authors: John Blondin Physics
Stephen Reynolds Physics

High resolution radio and X-ray images of young Type Ia supernova remnants (SNRs) Tycho and SN 1006 show unexpected protrusions beyond the mean shock radius. The mechanism for the formation of these knots has been debated in recent years, yielding two major theories: hydrodynamic instabilities and high density ejecta clumps existing in the SNR at early ages. Using VH-1 to run hydrodynamics simulations, we investigate the second theory by determining qualities that allow introduced ejecta clumps to reproduce the observed state of SNRs. 2D simulations have revealed that unrealistic density contrasts in clumps are required to create protrusions comparable to those of Tycho and SN 1006. Moreover, simulations run with sufficient resolution reveal significantly different clump evolution than those described in former works. By determining the cause of knot formation on young Type Ia SNRs, a better model for these SNRs can be created for future works and insight may be gained into the processes occurring at early ages.

C5
3D Simulations of Supernova Remnants from Realistic Type Ia Supernova Models
Heather Tomas Johnson Physics

Mentors and/or Co-Authors: Stephen Reynolds Physics
John Blondin Physics;
Carla Frohlich Physics

Type Ia supernovae (SNe) originate from thermonuclear explosions of white dwarfs. Plenty is still unknown about the explosion mechanisms in white dwarfs, particularly those that result in asymmetric Type Ia SNe and leave behind the corresponding supernova remnant (SNR). A SNR of interest is G1.9+0.3, the youngest galactic SNR, which demonstrates an unusual spatial distribution of its elements. An asymmetric detonation within the white dwarf progenitor would best explain the unusual features of G1.9+0.3. We input Type Ia explosion 1D, 2D, and 3D models at an age of 100 seconds provided by other researchers to study asymmetry, the ignition properties, and the resulting nucleosynthesis from these explosions. Using the VH-1 hydrodynamics code, we advance these models to a few hundred years in age. We compare our results to the observations of G1.9+0.3 and find the abundance and location of stellar elements expelled in the Type Ia SN explosions from our models. From this, we further our understanding of Type Ia SNe evolution and the subsequent nucleosynthetic processes.

A42
Using Numerical Models to Predict the Observational Signature of the Cocoons of Gamma Ray Bursts
Clifton Joseph Masdea Physics

Mentors and/or Co-Authors: Davide Lazzati Physics

Gamma ray bursts are brief flashes of gamma ray photons that are detectable from Earth-orbiting satellites, originating in either massive collapsing stars or from the collision of neutron stars and/or black holes. Many previous studies cite the collapsar model as the origin of gamma ray bursts. Yet, previous studies have not determined the structure of the cocoon, nor how its material affects the creation of the gamma ray burst. The purpose of this study is to not only determine the composition of the cocoon structure in gamma ray burst progenitors, but also to compare the cocoon emissions from different star types. Using data from tracer-particle simulations, this study computes the observational signature of cocoons from different progenitor stars with different metallicity, radius, and mass. Our light curve calculation assumes that the cocoon expands with a constant Lorentz factor and that the radiation interacts with the outflowing matter via elastic scattering.

B49
Nucleosynthesis for Core-Collapse Supernovae Ejecta
Cody Allen Melton Physics

Mentors and/or Co-Authors: Carla Frohlich Physics

Understanding nucleosynthesis of the heavy elements in core-collapse supernovae is an important step in determining the origin of the heavy elements in the universe. Simulations of core-collapse supernovae produce proton-rich ($Y_e > .5$) and slightly neutron-rich ($Y_e < .5$) ejecta. The $Y_e$, which determines the initial abundances in the explosion, is highly sensitive to the details of the simulations. Here we investigate both proton and neutron-rich ejecta. In the neutron-rich ejecta, we find a new nucleosynthesis pathway consisting of neutron captures, and subsequent proton captures between 4 and 3 x10⁹ K. Proton-rich ejecta produces a weak neutrino-proton (nu-p) process, as seen previously. In some cases, we find a sudden increase in the proton abundance between 6.5 and 5.5 x10⁹ K. We investigate its origins.
B5
Modeling the Composition of Gamma-Ray Burst Jet Cocoons
Helen Meskhidze Physics, Philosophy
Mentors and/or Co-Authors: Davide Lazzati Physics

Relativistic jets are characterized by their energy-rich nature and surrounding high-pressure cocoons. Such jets occur in the cores of massive, quickly rotating stars and have been known to produce highly energetic flashes of gamma-rays upon breaking free of their progenitors. Though the literature reveals insight into the general formation and photospheric emissions of the cocoons of these jets, their composition has not yet been understood. Generally, it is assumed that either the cocoon divides into an inner and outer part that experience no mixing or that a complete mixing of jet and stellar material occurs with no distinct division. We investigate the true mixing of material in the cocoon. We are doing so by adding tracer particles to special relativistic hydrodynamic simulations of collapsars to follow the mixing of jet matter in the cocoon as it evolves. We find that previous cocoon models provide a simplistic and unreliable understanding of their morphology. Our simulations are repeated for various initial progenitors, varying in radius, angular momentum, mass, and metallicity. The data from these simulations will be used to predict the cocoons’ corresponding radiation, which can then be compared to observations.

D10
Neutrino Oscillations in Core-Collapse Nucleosynthesis
Shaquann Saddat Seadrow Physics
Mentors and/or Co-Authors: Carla Frohlich Physics

When massive stars die, they become core-collapse supernovae at which point they explode and rapidly produce heavy nuclei. These nuclei are products of nucleosynthesis, a process in which nuclei, nucleons, leptons, and neutrinos interact. Neutrinos set the conditions under which the nucleosynthesis occurs. In addition, neutrinos collectively oscillate their flavors. Recent research has shown that neutrino oscillations are a potential contributor to nucleosynthesis. Here, we explore the effects of neutrino oscillations in the core-collapse nucleosynthesis of an 8.8Msun star. Using a nuclear reaction network, we simulate nucleosynthesis under varying conditions—no oscillations, neutrino oscillations assuming a normal hierarchy, and neutrino oscillations assuming inverted hierarchy—for various hydrodynamic trajectories from the supernova model. For early ejected material, we find differences in the final yields between cases with oscillations and cases without oscillations. However, we do not find any significant differences between normal hierarchy and inverted hierarchy, nor do we find any significant differences in the final yields of trajectories ejected later.
Nuclear Engineering UG Research Program

A23
Ablative Behavior of Structured Amorphous Metals in a Confined Capillary Discharge
Suman Srinivas Dev Nuclear Engineering
Mentors and/or Co-Authors: Mohamed Bourham Nuclear Engineering

Controlled electrothermal plasma discharges result from driving high currents through capillary tubes lined with ablative materials to generate high-density \((10^{24} \text{--} 10^{39}/\text{m}^3)\) plasma jets at kinetic temperatures between 1-5eV. An application of interest is the use of such a plasma discharge as a method of surface coating and implantation. Three species of Iron-based Structured Amorphous Metals (SAMs) were studied as inner ablators to determine their plasma formation characteristics for their potential use in single-shot surface implantation. SAM-1651, SAM-2X5, and SAM-40 are composed chiefly of Iron, Molybdenum, and Chromium; ablation data for these pure metals were also included for comparison. ETFLOW — a 1-D, time dependent code written in FORTRAN and running in a Visual Basic for Applications (VBA) environment — was used to simulate the behavior of ideal electrothermal plasmas for various materials. Simulation data at the capillary exit for the SAMs and pure metals were contrasted through analysis of pressure, ion density, and ablated mass. The data reveal that SAMs are more easily ablated to create plasma discharges at higher pressures and with greater ion densities than those of pure metals. Peak exit pressures were around \(10^9\) Pa for SAMs and \(5 \times 10^8\) Pa for pure metals, ion densities around \(10^{27}/\text{m}^3\) for SAMs and \(10^{26}/\text{m}^3\) for pure metals, and ablated mass between 1300-1600 mg for SAMs and 300-500 mg for pure metals. These results suggest that the ablation of SAMs would make a more effective surface coating process than would the ablation of a typical pure metal.

D14
Comparative Study of Plasma Generation from Carbides, Oxides and Nitrides Using an Electrothermal Plasma Source
Timothy William Kreutzfeldt Physics
Mentors and/or Co-Authors: Mohamed Bourham Nuclear Engineering

Electrothermal plasma sources operate by the discharge of high currents through a capillary lined with material which ablates to generate high-density, high-temperature plasmas with large exit pressures. These sources have applications in thermal spray coatings, pellet injectors in future fusion reactors, thrusters in space shuttles and igniters for propulsion systems. This study contrasts the simulated plasma generation of carbides, oxides and nitrides using titanium and zirconium compounds as the source liners. Simulations were run using the electrothermal plasma code ETFLOW, which models the plasma formation and evolution in a capillary discharge and provides the various parameters of plasma generation. This study focuses on three parameters, namely the exit pressure, the ion number density and the total ablated mass. Results illustrate similar peak exit pressures and peak ion number densities for the carbides, oxides and nitrides. The nitrides have the highest peak exit pressures (~\(10^9\) Pa) while the carbides have the highest peak ion number density (~\(8 \times 10^{26}/\text{m}^3\)). Although the results for the ablated mass do not demonstrate grouping for any of the compounds examined, the total ablated mass of each compound per unit of molar mass shows a similar grouping effect to the exit pressure and ion number density. The nitrides have the highest total ablated mass per unit of molar mass (~14). The results suggest that nitrides and carbides would be the most useful source liners for surface coating hardening applications.
develop and optimize the device, laying down the theoretical framework for optimization and experimentally validating these calculations by constructing a prototype IEC device based on this study. The operating parameters for this IEC system, including pressure, voltage, current, and purveyance will be optimized for confined plasma neutron production. Deuterium-Deuterium fusion in an inertial electrostatic confinement device is possible due to the formation of a virtual potential well that only exists within a range of electrical purveyance (this purveyance can be varied by changing operating parameters of the IEC). Trapping the deuterium nuclei in this potential well helps us achieve the three basic conditions required for nuclear fusion, which are: high temperature to overcome the Coulomb barrier, high ion density, and confinement for enough time to avoid plasma cooling. We will present a theoretical model for device optimization and experimental measurement of purveyance curves for a prototype IEC designed and constructed by our group.
Host Genes are Differentially Expressed Between Lines of Root-Knot Nematode Induced Galls
Laurian Ashley Bashay Forensic Science
Mentors and/or Co-Authors: David Bird Plant Pathology

The microscopic round worm root-knot nematode (RKN; Meloidogyne spp.) is a parasite of virtually all plants, and reduces crop yield. RKN infect host root systems and subvert native cell developmental pathways to form specialized and dedicated feeding sites from plant tissue. Gene expression in these feeding sites is presumably modulated by RKN and understanding the mechanisms by which the nematode corrupts plant tissue may lead to novel control strategies. Previously, 4 genes were shown to be differentially expressed in plant host Medicago truncatula feeding sites between two inbred strains of RKN (VW9 and LM). Complete genome sequences for these nematode lines are available and there are known genomic and phenotypic variability between them, including reproductive capacity, host responses, selection and behavior. Here, we sought to explore the possibility that this differential host gene expression is conserved across host plants. To this end, we identified the orthologs of the 4 differentially expressed M. truncatula genes in Tomato and the expression of these orthologs in LM and VW9 induced feeding sites was quantified by qPCR. These differentially expressed genes are transcription factors that are implicated in cell development and thus RKN feeding site formation. We hypothesize that the genotypic variation observed between the two nematode lines results in the observed differential expression of the transcription factors. The ability to link RKN genotypes with host phenotype across multiple plant species represents a tool to identify targets for nematode control.

Ecological Effects of Fungicides on the Phyllosphere of Creeping Bentgrass
Megan Lyn Botti-Marino Biology
Mentors and/or Co-Authors: David Ritchie Plant Pathology

Creeping Bentgrass (Agrostis stolonifera ‘Penn A-1’) is utilized for putting surfaces on golf courses in NC. This grass grows best between 15 and 26 C, making management during NC summers difficult. To maintain grass health, fungicides are periodically sprayed throughout the summer. The effect of fungicide applications on microbes in the turf phyllosphere has received minimum research. Disruption of the natural microflora on creeping bentgrass leaf blades with periodic fungicide applications could negatively affect the plants. In order to investigate this, a study was established to compare the effects of four fungicide treatments (chlorothalonil, fluazinam, fluxapyroxad, fosetyl-Al) non treated. Three applications of each treatment were applied every 14 d to a 0.9 by 1.3 meter plot. Above ground plant tissue samples were collected 5 d post treatment from four randomized locations within each treatment plot. Samples were pulverized in sterile H2O and 100 microliters of dilutions of 10^-3 and 10^-5 were plated on differential media: Actinomycete, King’s B. Nutrient Agar with 1% sucrose, and Acid Potato Dextrose Agar. Statistical analysis of subsequent microbial counts showed that fluazinam was associated with a greater number of actinomycetes and bacteria compared to other plots. Both fluazinam and fluxapyroxad decreased fungal growth. Fosetyl-AL, fluxapyroxad and fluazinam were associated with diminished growth of fluorescent pseudomonas. Fluxapyroxad and chlorothalonil did not stimulate bacterial growth greatly. Therefore, our results indicate that these four fungicides effect the populations of non-target microbes in the phyllosphere of creeping bentgrass.

Mummy Berry Genetics: The Use of Microsatellite Markers to Determine the Genetic Diversity in the Reproductive Biology of Monilinia vaccinii-corymbosi
Megan Elizabeth Miller Environmental Biology
Mentors and/or Co-Authors: Marc Cubeta Plant Pathology
Kathleen Burchhardt Plant Pathology

The fungus Monilinia vaccinii-corymbosi (Mvc) causes mummy berry, an economically important disease of blueberry. Our study had two main objectives; 1) to determine the genetic diversity within individual sexual fruiting bodies (apothecia) and 2) to determine the genetic diversity within infected blueberries. To accomplish our first objective, blueberries (Vaccinium corymbosum x V. darrowii hybrid, cultivar “Blue Ridge”) with apothecia were sampled from a commercial farm in Ivanhoe, NC. The top of each apothecium was excised and attached to the lid of a
petri dish containing ½ strength Potato Dextrose Agar (PDA) with Vaseline. Sexual spores (ascospores) were ejected onto PDA and individual, germinated ascospores were transferred to fresh PDA to obtain pure cultures. DNA was extracted from 95 pure cultures and amplified with the polymerase chain reaction (PCR) using eight Mvc specific microsatellite markers. Amplified PCR products were analyzed to determine the number of alleles and identify genotypes. Two to seven alleles were found among the eight loci examined and 45 genotypes were identified. The second objective was accomplished by sampling the same cultivar of blueberry from the same farm. Mycelium of Mvc was sampled from individual locules of three infected blueberries per plant. Mycelium from each of the 97 samples was placed on ½ strength PDA plates. DNA was extracted, amplified, and analyzed as previously described to determine the number of alleles and genotypes of Mvc within each blueberry. This is the first study to examine whether different genotypes of Mvc exist within apothecia and individual infected mummy berries.
Triangle MRSEC

A18
Self-Running Liquid Metal Alloy on Thin Silver Films
Nia Imani Christian Mechanical Engineering and Biomedical Engineering (double major)
Mentors and/or Co-Authors: Michael Dickey Chemical & Biomolecular Eng

The goal of this project is to get droplets of liquid metal to move spontaneously in a controlled direction on a flat substrate. The phenomenon of self-running droplets is one that has been intensely studied in the scientific community for the last decade. Previously, researchers have been able to induce water, oils, and other liquids to move autonomously and even against the force of gravity by using chemical or thermal gradients to drive motion of the droplets. EGaIn (eutectic gallium indium) is a metal alloy with many interesting properties, the most notable being that it is liquid at room temperature and, when exposed to oxygen, forms a thin oxide skin that allows it to hold its shape despite its liquid form. Our research focuses on creating a suitable environment for self-running droplets of EGaIn. This self-running EGaIn phenomenon is likely due to the wetting properties of EGaIn on a substrate with an appropriately designed chemical landscape and the surface tension of the metal.

D19
Utilization of siloxane network films as a versatile platform for the assembly of peptides
Julie Christine Fornaciari Materials science and engineering
Mentors and/or Co-Authors: Jan Genzer Chemical and Biomolecular Engineering

Surface-grafted peptide assemblies are useful for many applications, including (but not limited to) biosensors, tissue culture, and drug delivery. This particular project focused on using deformable and biocompatible poly(vinylmethyl siloxane) networks (PVMS-N) as substrates for generating peptide assemblies. Peptides were grafted to PVMS-N by employing a two-step coupling procedure. First a carboxylic acid-terminated thiol was coupled to PVMS-N surface via photoinitiated thiol-ene reaction. In the second step, the amine terminus of the peptide was reacted with the carboxylic acid groups on the surface using standard peptide coupling chemistry. The first objective of the project was to produce an elastic PVMS network by optimizing the ratio of cross linker to polymer, R. Formulations with different values of R were made and the mechanical properties of these networks were tested using Instron and Dynamic Mechanical Thermal Analysis (DMTA) methods. From the mechanical tests, the network with R=0.75 exhibited sufficient hardness without being too brittle. The second objective of the project was to optimize conditions for the thiol-ene reaction using attenuated total reflectance Fourier transform infrared spectroscopy (ATR-FTIR) to monitor the success of the reaction. We gained a better understanding of the reaction conditions required by altering systematically solvent, thiols, UV light dose and intensity. We found that successive short exposures of the PVMS networks to the thiol solution under a lower intensity light with dimethyl sulfoxide as the solvent produced a smooth surface with many carboxylic acid groups available for subsequent peptide deposition.

D32
Controlled Deposition of Porous Nanoparticle Films for Supercapacitor Applications
Zachary Wainwright Iszard Chemistry
Mentors and/or Co-Authors: Orlin Velev Chemical and Biomolecular Engineering

Intrinsically conductive polymers (ICPs) demonstrate enhanced electrochemical properties when their surface area and porosity are increased. We seek to fabricate highly porous ICP films for supercapacitor applications. One method to achieve this is by depositing a solution of ICP into a uniform, ordered nanostructure of spherical particles, followed by infiltration with ICP and removal of the nanostructure template. The focus of this study was the deposition and characterization of uniform films from nanoparticles that can serve as templates for ICP supercapacitor electrodes. We used the convective assembly method developed in the Velev group as means for fabricating films from variety of particle templates. After investigating a number of particles, including latex microspheres, silica microspheres, group I and II carbonate nanoparticles, and a variety of ultrasound contrast agents, we identified commercially available aluminum nanopowder (Al NP) as a usable material for fabricating the films. Films of Al NP showed different thickness, uniformity, visual appearance and morphology depending on the method.
of suspension deposition, and further treatment with water. Surprisingly, while suspensions of Al NP in water showed complete oxidation within 12 hours, their semi-reflective thin films were only slightly reactive at this exposure time. The preparation of monodisperse suspensions was achieved by settling the particles in dilute suspension and then centrifuging. We will discuss the characteristics of the coatings deposited at various conditions and the potential application of the films as electrodes and optical nanocoatings.

**B19**

**Simulations of self-assembly of complex micelles**

**Jeremy L. Loffredo** *Engineering*

*Mentors and/or Co-Authors: Yaroslava Yingling*  
*Material Science Engineering*

This research is focused on understanding the relationship between sequence and aqueous solution phase properties of amphiphilic biopolymers. With this understanding, rules can be developed for the design of components whose phase behaviors can be exploited in micelles. The relationship between chain length and the number of chains on the structure of micelles is investigated. Dissipative Particle Dynamics (DPD) simulations were used to model how varying these parameters affect the micelle’s structure and size. After analyzing the results, it appears that increasing both hydrophobic length and number enlarges micelle aggregation size. The aggregation of micelles is very important in the development of targeted drug delivery. By knowing the effect of length of the hydrophobic end, drugs can be developed more quickly by reducing the necessary variations of the drug in its research phase.

**A25**

**Hierarchical Topography Through Thermal & Electromechanical Thin-film Instabilities**

**Kazi N Sadman** *Materials Science & Engineering*

*Mentors and/or Co-Authors: Michael Dickey*  
*Chemical & Biomolecular Eng*

Although buckling instabilities have been observed and studied for a long time, interest in controlling their morphology is relatively recent due to its prospective applications in flexible electronics and tunable surface properties. In this effort, we studied formation of hierarchical surface topography on a polymer film generated by superimposing thin-film instabilities with two distinct characteristic wavelengths. The instabilities form by two independent sources of stress: thermal stress generated by heating a thin metal-polymer film stack, and electromechanical stress generated by applying an electric field between the metal and the substrate. We explored experimental and theoretical evidence that these combined forces result in hierarchical topographic structures.

**B12**

**Self-assembly of single stranded DNA and gold nanoparticles**

**Tasha Latonya Tucker** *Chemical Engineering*

*Mentors and/or Co-Authors: Yaroslava Yingling*  
*Material Science Engineering*

The research is focused on understanding the relationship between single stranded DNA (ssDNA) sequence and ligands on gold nanoparticles (AuNPs) and using this understanding to develop rules for the design of supramolecular hierarchical assemblies. Gold nanoparticles unique properties are utilized in a range of applications such as sensors, catalysis and drug delivery. Previous work has shown that nanoparticles with ligands have the ability to wrap DNA above a critical charge density. The wrapping of the DNA around AuNPs is dependent on the number of modified ligands and its properties. The AuNPs contains a gold core that is stabilized with ligands with various functionalized end groups. A methyl (CH₃), amine (NH₂) and ammonia (NH₃) end groups were studied because of their polarity and charge that effect the wrapping of DNA suggest that gold nanoparticle may have an effect on the binding affinity of ssDNA. By using molecular dynamics simulations, we study the effect of ligand charge and identity on ssDNA interactions. As a result it was found that ssDNA is more compactly wrapped around the gold nanoparticle with modified ligands with the NH₃ end group than the CH₃ and the NH₂ end groups.
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D13 Xavier Fabian Castaneda  
College of the Sequoias, Mechanical/Automotive Engineering  
Layout Design for Hybrid Electric Vehicle Test Platform  
NSF ERC FREEDM Systems Center

C17 Morgan F. Caudill  
North Carolina State University, Bioprocessing Science  
Antioxidant Retention in Apple and Apple Peel Purees After Pasteurization and Accelerated Cooling  
NC State Independent Researchers

D43 Sterling Gabriel Cave  
North Carolina State University, Biology: Integrative Physiology and Neurobiology B.S. and Psychology B.S.  
Visualizing Dynein Light Chain with Green Fluorescent Protein  
NC State Independent Researchers

C51 Christian D. Chapman  
North Carolina State University, Mathematics  
Building a Planar Black-body Radiation Source for Calibration of IR Cameras  
NC State Independent Researchers

B10 Eve Adde Chase  
College of William & Mary, Physics  
Clump Accretion in Supergiant Fast X-Ray Transients  
NSF Undergraduate Research in Computational Astrophysics

B28 Xinyi Chen  
Enloe High School, Shiaomeng Tse  
Effects of Incubation Temperature on Development at E12 in Chick Embryos  
NC State Independent Researchers

B47 Amelia Chen  
Duke, Biology  
Differential effects of anthocyanins and their metabolites on the macrophage inflammatory response  
NC State Independent Researchers

C42 Timothy S. Chen  
North Carolina State University, none  
Which Flame Retardants May Disrupt the Endocrine System? The Use of Virtual Screening to Predict Risks to Human Health  
NC State Independent Researchers

B29 Lian Chengliang  
Updating Flow Field Visualization  
GEAR - Global Engagement in
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<tr>
<th>A18</th>
<th>Zhejiang University, Computer Science Using FLTK</th>
<th>Academic Research</th>
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<tr>
<td>Nia Imani Christian</td>
<td>Carnegie Mellon University, Mechanical Engineering and Biomedical Engineering (double major)</td>
<td>Self-Running Liquid Metal Alloy on Thin Silver Films</td>
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<td>C6</td>
<td>Molly Margaret Cobb, University of Wisconsin - Stevens Point, Mathematics; Collin Eubanks, Mathematics; Itelhomme Fene, Mathematics; Pamela Badian-Pessot, Mathematics and Economics</td>
<td>Portfolio Optimization with Conditional Value at Risk (CVaR)</td>
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<td>D21</td>
<td>Kristin Harr Cochran, North Carolina State University, Chemistry</td>
<td>Direct Dye Identification From Textile Fibers Using Infrared Matrix-Assisted Laser Desorption Electrospray Ionization (IR-MALDESI) Coupled to FT-ICR-MS</td>
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<td>D4</td>
<td>Taylor Alexandra Jun Cook, North Carolina State University, Biomedical Engineering</td>
<td>Hemostatic properties of tissue engineering scaffolds: the effect of tricalcium phosphate on the porosity of electrospun PLA nanofibers</td>
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<td>D30</td>
<td>Nicole A Corbin, North Carolina State University, Meteorology</td>
<td>Six-Year Climatology of Precipitation within Major Storms in Northern California</td>
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<td>B17</td>
<td>Alexandria Cruz, University of Florida, Material Science Engineering</td>
<td>Semitransparent Organic Semiconductors</td>
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<td>A40</td>
<td>Maria Lourdes Carmela Gaurano Cruz, North Carolina State University, Biomedical Engineering</td>
<td>Characterization of Interdigitated Electrodes to Manipulate hASCs / Maria Lourdes Carmela Cruz, Alison Amos, Gregory McCarty</td>
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<td>D12</td>
<td>Priya Renu D'Amico, Georgia Institute of Technology, Mechanical Engineering</td>
<td>A Pilot Study for Cyclic Voltammetry Experiment of Lithium Ion Battery</td>
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<tr>
<td>B18</td>
<td>Kathryn M Daly, University of Maine, Bioengineering</td>
<td>Template Directed Self-Assembly of Monodisperse Polystyrene Spheres for Hierarchical Three-</td>
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Abstract Listing by Program

**C14**
**Anibal R Davalos Morinigo**
Queens College, *Chemistry*
Dimensional Phase-shift Lithography

**A23**
**Suman Srinivas Dev**
North Carolina State University, *Nuclear Engineering*
Screening of 2-Amino Imidazole Analogues as Anti-Sclerotium Agents of the Plant Pathogenic Soil Fungus Rhizoctonia solani

**C32**
**Jian Ding**
Zhejiang University, *Optical Engineering*
Ablative Behavior of Structured Amorphous Metals in a Confined Capillary Discharge

**D33**
**Ravi Ajit Dixit**
North Carolina State University, *Microbiology*
The Identification of the fungal pathogen Colletotrichum on the leaves of Jatropha curcas

**A30**
**Cameren Christopher Dolecheck**
North Carolina State University, *Computer Science*
Fabrication of Plasmonic Nanosensors Using Laser Interference Lithography

**A29**
**Yilin Du**
Zhejiang University, *Energy and Environmental System Engineering*
Ablative Behavior of Structured Amorphous Metals in a Confined Capillary Discharge

**C43**
**Trisha Lee Dupnock**
Clarkson University, *Environmental Engineering and Chemistry*
Fabrication of Plasmonic Nanosensors Using Laser Interference Lithography

**D47**
**Ashton Edward Dyer**
North Carolina State University, *Physics, Applied Mathematics*
The Probability that Multi-Sensor Precipitation Estimates Reflect Observed Precipitation for the

**A27**
**Kristen Elena Eguren**
North Carolina State University, *Human Biology*
Student-Generated Instructional Videos for the Organic Chemistry Laboratory

**B39**
**Geneva Marie Ely**
North Carolina State University, *Meteorology and
The Probability that Multi-Sensor Precipitation Estimates Reflect Observed Precipitation for the

**IMSD - Initiative for Maximizing Student Diversity**
**Nuclear Engineering UG Research Program**
**GEAR - Global Engagement in Academic Research**
**NC State Independent Researchers**
**Interactive and Intelligent Media REU**
**GEAR - Global Engagement in Academic Research**
**Advanced Materials for Environmental Sustainability**
**NSF Undergraduate Research in Computational Astrophysics**
**Chemistry Summer Intern Program**
**NC State Independent Researchers**
Environmental Sciences

Purpose of Bias Correction

B31 Jason Lee Endries
North Carolina State University, Meteorology
Understanding the Variability of Low Marine Clouds in Three Oceanic Regions
NC State Independent Researchers

A16 Carlos Michael Flores
UC Davis, Electrical Engineering
Correlating Power System Responses with Notions of Electrical Distance: A Statistical Approach
NSF ERC FREEDM Systems Center

D19 Julie Christine Fornaciari
University of Pittsburgh, Materials science and engineering
Utilization of siloxane network films as a versatile platform for the assembly of peptides
Triangle MRSEC

C7 Elizabeth Victoria Fortin
San Diego State University, Mechanical Engineering
Silver Nanowire Based Flexible Impedance Sensor for Hydration Monitoring
ASSIST - NSF ERC Advanced Self-Powered Systems of Integrated Sensors and Technologies REU

D45 Qianjun Gan
Zhejiang University, Electrical Engineering and Automation
The application of PSO in distribution network's optimization
GEAR - Global Engagement in Academic Research

D34 Mingze Gang
Zhejiang University, Electrical Engineering and Automation
PID Control for Path Tracking of Unmanned Vehicle
GEAR - Global Engagement in Academic Research

D15 Kristin Elizabeth Gavin
North Carolina State University, Industrial Engineering
Do You See What I See? The Fly as a Model System to Study Vision Disorders
IMSD - Initiative for Maximizing Student Diversity

A12 R. Aaron Goodykoontz
Wake Technical Community College, College Transfer/ A.S.
Analysis of Environmental Impacts from Site Development at Wake Technical Community College's North Campus Using GRASS GIS
MEAS-Wake Tech Program

C41 Lori Ann Gould
North Carolina State University, Associate In Arts
A Comparison of Pedagogical Beliefs of Geoscience Faculty and Graduate Teaching Assistants
MEAS-Wake Tech Program

B3 Michelle Marie Greenough
Wagner College, Chemistry
Modulation of Optical Properties through In-Situ Functionalization
Advanced Materials for Environmental Sustainability

A33 Mary Catherine Grosholz
Florida International University, Computer Engineering
Developing a Healthcare GUI for Children and Adults: How Color & Shape Psychology and Mobile Interactions Change Perceptions
ASSIST - NSF ERC Advanced Self-Powered Systems of Integrated Sensors and Technologies REU

D20 Daniel Louis Gross
Developing and Testing
Interactive and Intelligent
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<tr>
<td>C15</td>
<td>Marisa R Guarino</td>
<td>Emory University, Computer Science/ Creative Writing</td>
<td>Snagem &amp; The Avatar: Mask or Self-Portrait?</td>
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<td>C18</td>
<td>Nicholas Harold Guerra</td>
<td>Washington State University, Mathematics</td>
<td>Modeling and Assessment of Cerebral Autoregulation</td>
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<td></td>
<td>Willtresca Heppard</td>
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<td>Miranda Henderson</td>
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<td>Theresa Scarnati</td>
<td>Mathematics, Applied Mathematics</td>
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<tr>
<td>A17</td>
<td>Britne Rochele Hackett</td>
<td>North Carolina State University, Animal Science</td>
<td>And Then There Were Four: Population Divergence among Florida ridges in the ant species Dorymyrmex elegans and Dorymyrmex bureni</td>
<td>IMSD - Initiative for Maximizing Student Diversity</td>
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<td>D49</td>
<td>Brian Bennett Haidet</td>
<td>North Carolina State University, Materials Science and Engineering</td>
<td>Determination of optical gain in AlGaN and its heterostructures</td>
<td>Advanced Materials for Environmental Sustainability</td>
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<td>A4</td>
<td>Taryn Leigh Hampton</td>
<td>DePauw University, Computer Science</td>
<td>Using Student Data to Evaluate Problem Difficulty within an Intelligent Tutoring System</td>
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<td>C36</td>
<td>Sha Han</td>
<td>Zhejiang University, Physics</td>
<td>The structure of VO2 with different thickness in VO2/NiO/cYSZ/Si heterostructures</td>
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<tr>
<td>B21</td>
<td>Sasha Harbajan</td>
<td>City University of New York, Biology</td>
<td>Functional Senescence in the Rose Lines of Drosophila melanogaster</td>
<td>IMSD - Initiative for Maximizing Student Diversity</td>
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<tr>
<td>D22</td>
<td>David William Harris</td>
<td>University of North Carolina School of the Arts, Editing and Design Sound Design</td>
<td>B.O.T.S.: Seeking to Improve an Educational Game's Layout and Design</td>
<td>Interactive and Intelligent Media REU</td>
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<tr>
<td>A5</td>
<td>Maurita Tifquwana Harris</td>
<td>North Carolina State University, Psychology</td>
<td>The Relationship Between Variables Among Older African American Adults</td>
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<tr>
<td>A36</td>
<td>Jillian Claire Hattaway</td>
<td>North Carolina State University, Biological Sciences- Molecular, Cellular,</td>
<td>Investigating Volume Conservation During Gut Morphogenesis</td>
<td>NC State Undergraduate Research Grant Awardee</td>
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Abstract Listing by Program
Joshua White Physics; Samantha Zuber Mathematics; Nick Dunn Mathematics; Naga Nunna Biological Sciences - Molecular, Cellular, and Developmental

Nathan Dean Heavner
Clemson University, Mathematical Sciences (B.S.)
Andrew Watson Math;
Ryan Atwater Applied and Industrial Mathematics;
Steven Collins Mathematics & Chemical Engineering;
Andrew Chinn Math

Numerical Analysis in High Dimensions
NSF REU Modeling and Industrial Applied Mathematics

Thomas Alexander Hege
North Carolina State University, Computer Science
Who Has Set Us Up The Bomb: A Method for Extracting Game States from Incomplete Game Replays
Interactive and Intelligent Media REU

Yang Ho
North Carolina State University, Physics, Applied Mathematics, Computer Science
A Comparative X-ray Photoelectron Spectroscopy Study of Graphene Grown by Different Methods
NC State Independent Researchers

Shannyn Ashley Holder
North Carolina State University, Textile Engineering
Functional Silicon Network Films as Tissue Engineering Scaffolds
NC State Undergraduate Research Grant Awardee

Michael R. Hontz
Bucknell University, Electrical Engineering
Development of an apparatus and method for the testing of the electrical properties of novel thermoelectric textiles
NSF Engineering the Grid Program

Kyrie Sierra Hooton
North Carolina State University, Environmental Technology and Management
Differential binding of groundwater extracts from a land-applied wastewater site to the three estrogen receptor subtypes of the atlantic croaker, Micropogonias undulatus
NC State Undergraduate Research Grant Awardee

Hyungsun Mark Hwang
North Carolina State University, electrical engineering
Implementation of 10kVA multi-terminal and three phase dual-active bridges dc/dc conversion stage for solid-state transformer applications.
NSF ERC FREEDM Systems Center

Zachary Wainwright Iszard
Controlled Deposition of Porous Triangle MRSEC
Texas State University, Chemistry

C50 Yuan Jin
Zhejiang University, Optical engineering

Nanoparticle Films for Supercapacitor Applications

The Research about the Telomere-related proteins

GEAR - Global Engagement in Academic Research

Heather Tomas Johnson
University of Texas, Austin, Physics

3D Simulations of Supernova Remnants from Realistic Type Ia Supernova Models

NSF Undergraduate Research in Computational Astrophysics

Taylor April Jones
North Carolina State University, Human Biology

Evaluation of the Cross-Neutralization Potential between Norovirus GI Strains

NC State Independent Researchers

Kalyani Subodh Joshi
North Carolina State University, Chemical Engineering-Biomolecular

Characterization of Arabidopsis VIP mutants

NSF Integrative Molecular Plant Systems REU

Michael Thomas Judge
Appalachian State University, Cell/Molecular Biology

Genetic dissection of the interaction between indole-glucosinolate biosynthesis and auxin homeostasis in Arabidopsis

NSF Integrative Molecular Plant Systems REU

Carter Keough
North Carolina State University, Industrial and Systems Engineering

3D Printing for Sustainable Manufacturing

NC State Independent Researchers

Ian Matthew Kilgore
North Carolina State University, Electrical Engineering

Comparative Study of Efficient Cancellation Algorithms for High Dynamic Range RF Measurement

NC State Independent Researchers

Claire Elizabeth Kilmer
North Carolina State University, Chemical Engineering

Loss of Ataxia-Telangiectasia Mutated Increases Intracellular Reactive Oxygen Species and Activates Rac1

NC State Undergraduate Research Grant Awardee

Enrique Wanchese Kinsey
University of West Florida, Software Engineering

BOTS: Tutorial Presentation Style Comparisons For Educational Games

Interactive and Intelligent Media REU

Kristin Marie Kline
North Carolina State University, Chemistry/Biochemistry

Performance of LC-MS on adjacent tissue sections for verification of observed metabolite to parent drug abundance ratios from IR-MALDESI MSI

NC State Independent Researchers

Timothy William Kreutzfeldt
Wake Forest University, Nuclear Engineering UG Research Program

Comparative Study of Plasma Generation from Carbides, Oxides and Nitriles Using an
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<th>Electrothermal Plasma Source</th>
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<td><strong>C9</strong> Marlee R. Labroo</td>
<td>Investigating the Heat-Stress Response of SOR-Expressing Arabidopsis Plants</td>
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<td>Tulane, Environmental Science</td>
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<td><strong>D16</strong> Sarah M Laper</td>
<td>The Effect of Structure on Physiologically Based Pharmacokinetic Modeling</td>
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<td>College of Wooster, Math and Chemistry</td>
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<td>Jerrell Mure Mathematics; Archana Patel Mathematics; Amy Kern Mathematics</td>
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<td><strong>C10</strong> Neal Peyton Lewis</td>
<td>Atomic Layer Deposition of Vanadium Oxide for Pseudocapacitance Enhancement of Electrochemical Double Layer Capacitors</td>
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<td>The Pennsylvania State University, Materials Science and Engineering</td>
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<td><strong>B35</strong> Yueming Li</td>
<td>Breakup of Liquid Jets under Low Pressure from Non-circular Orifices</td>
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<td><strong>C35</strong> Ting Li</td>
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<td><strong>B33</strong> Feifei Liang</td>
<td>Calibrating VaR Models to Chinese Stock Market</td>
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<td><strong>B34</strong> Steven Lin</td>
<td>The genetic mechanism of heterosis</td>
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<td><strong>A32</strong> Syuan-You Lin</td>
<td>Mapping QTLs for Cold Tolerance in a St. Augustinegrass (Stenotaphrum secundatum var. Raleigh) self-pollinated population.</td>
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<td><strong>B4</strong> Anna Litovskaya</td>
<td>Flexible Sensor Array Using Silver Nanowire Electrode</td>
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<td>New York City College of Technology, Mechanical Engineering</td>
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<td>A11</td>
<td>Eleanor G Meisinger</td>
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<td>B49</td>
<td>Cody Allen Melton</td>
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<td>Julie Christine Rice</td>
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<td>D1</td>
<td>Ashley Rene Richmond</td>
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A43  **Jacob Lloyd Robbins**  
North Carolina State University, *Physics and Applied Mathematics*  
Stability of Linear Multistep Methods  
NC State Independent Researchers

A10  **Melanie Cherese Rodems**  
Wake Technical Community College, *General Studies*  
Grain Size Analysis of the Piedmont Region of North Carolina  
MEAS-Wake Tech Program

C38  **Megan L Rogers**  
North Carolina State University, *Psychology*  
Maren Henry *Psychology*  
Mothers' suppressive and ruminative emotion regulation may have detrimental effects on children's classroom socioemotional competence  
NC State Independent Researchers

D3  **Eliezer Rovira**  
University of Puerto Rico at Cayey, *Biology*  
The Role of HOPS in Vacuole Fusion in itt3 Mutation  
NSF Integrative Molecular Plant Systems REU

D46  **Miguel Abrantes Rufino**  
North Carolina State University, *Electrical Engineering*  
Using Micro-controllers to Tackle Inefficiency From Shading in Photovoltaic Panels  
NC State Undergraduate Research Grant Awardee

D48  **Supriya Sadagopan**  
North Carolina State University, *Biochemistry*  
Experimental and computational Studies of the activity of the native substrate for the two isoforms of Dehalperoxidase  
IMSD - Initiative for Maximizing Student Diversity

A25  **Kazi N Sadman**  
University of Florida, *Materials Science & Engineering*  
Hierarchical Topography Through Thermal & Electromechanical Thin-film Instabilities  
Triangle MRSEC

D24  **Shrey Satpathy**  
North Carolina State University, *Nuclear Engineering*  
Carl Smith *Nuclear Engineering*  
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Nuclear Engineering UG Research Program

C19  **Gabrielle Marie Schroeder**  
North Carolina State University, *Biological Sciences (Molecular, Cellular, and Developmental)*  
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NC State Independent Researchers

D10  **Shaquann Saddat Seadrow**  
Hampden-Sydney College, *Physics*  
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NSF Undergraduate Research in Computational Astrophysics

A26  **Nathaniel Lawrence Sherrill**  
North Carolina State  
Solitary Waves in Ferromagnetic Nanowires  
NC State Undergraduate Research Grant Awardee
| A41 | Madelyn Mallison Shoup  
Michigan State University,  
*Food Science* | Genetic analysis of Type I-C  
CRISPR-Cas immune systems in  
*Lactobacillus helveticus.* | NC State Independent  
Researchers |
|---|---|---|---|
| C30 | Austin Reese Smith  
North Carolina State  
University, *Biochemistry* | MUC2 mucin as a minor mucin in  
the airway respiratory epithelial  
cells? | IMSD - Initiative for  
Maximizing Student Diversity |
| B30 | Lingnan Song  
Zhejiang University, *Optical Engineering* | Stretchable RF antenna with Silver  
Nanowires | GEAR - Global Engagement in  
Academic Research |
| D8  | Samantha Marie Sparrow  
Cornell College, *Biochemistry and Molecular Biology* | Generating PVY Resistance in  
Tobacco | NSF Integrative Molecular  
Plant Systems REU |
| C1  | Lilyana Louise Staight  
California State University,  
Monterey Bay, *Pure Mathematics*  
Danielle Williams  
*Mathematics Secondary Education;*  
Bernadette Bucher  
*Mathematics and Economics;*  
Robin Mabe Mathematics  
*Secondary Education* | Modeling Illicit Drug Use-  
Methamphetamine | NSF REU Modeling and  
Industrial Applied Mathematics |
| C8  | Christian Harrison Stith  
North Carolina State  
University, *Computer Science*  
Mary Beth Kery Computer  
Science and Studio Art | Intuitive Narrative Generation and  
Mixed-Initiative Planning | Interactive and Intelligent  
Media REU |
| C47 | Christopher Lee Stroud  
North Carolina State  
University, *Computer Science* | Improving The Mobile Experience  
Through Pre-attentive Processing | Interactive and Intelligent  
Media REU |
| A22 | Eric Donald Szymanski  
Wake Tech Community  
College, *Mechanical Engineering* | Observations of Seismicity in the  
Lau Basin | MEAS-Wake Tech Program |
| D17 | Sarah Teague  
North Carolina State  
University, *Biological Sciences- Human Biology Concentration; Political Science*  
John Encarnacion Biological | Grade Tendencies for Students in  
Organic Chemistry with Various  
Modes of Supplemental Instruction | NC State Independent  
Researchers |
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<tr>
<th>Program</th>
<th>Title</th>
<th>Authors</th>
<th>Institution</th>
<th>Abstract</th>
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<tbody>
<tr>
<td>B51</td>
<td>Screening for Environmental Estrogens on an Industrial Waterfront</td>
<td>Ian Robert Thompson</td>
<td>North Carolina State University, <em>Environmental Technology and Management</em></td>
<td>NC State Undergraduate Research Grant Awardee</td>
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<tr>
<td>A45</td>
<td>Modulation of adipocyte lipid accumulation and insulin resistance by anthocyanins and their metabolites</td>
<td>Yiwen Thor</td>
<td>North Carolina State University, <em>Food Science</em></td>
<td>NC State Independent Researchers</td>
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<tr>
<td>C46</td>
<td>A Better Drosophila melanogaster</td>
<td>Yin Hong Tsang</td>
<td>North Carolina State University, <em>Human Biology</em></td>
<td>NC State Independent Researchers</td>
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<td>B12</td>
<td>Self-assembly of single stranded DNA and gold nanoparticles</td>
<td>Tasha Latonya Tucker</td>
<td>North Carolina State University, <em>Chemical Engineering</em></td>
<td>Triangle MRSEC</td>
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<td>D36</td>
<td>Three-Dimensional (3D) Super Localization and Tracking of DNA Molecules at Solid-Liquid Interface</td>
<td>Paul Maciej Tyrlik</td>
<td>North Carolina State University, <em>Chemistry</em></td>
<td>Chemistry Summer Intern Program</td>
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<tr>
<td>C12</td>
<td>pH Dependence on DHP-TBP Reaction</td>
<td>Omokuyani Chibuzor Udiani</td>
<td>North Carolina State University, <em>Physics</em></td>
<td>IMSD - Initiative for Maximizing Student Diversity</td>
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<tr>
<td>B23</td>
<td>Identifying Efficient Informal Tutorial Dialogue Techniques through Linguistic Analysis</td>
<td>Alexandria Katarina Vail</td>
<td>North Carolina State University, <em>Mathematics / Computer Science / Physics</em></td>
<td>Interactive and Intelligent Media REU</td>
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<tr>
<td>B6</td>
<td>Low Defect Density AlGaN/ GaN Structures for High-Power Electronic Applications</td>
<td>Kathryn Clare Valentine</td>
<td>Whitman College, <em>Physics</em></td>
<td>NSF Engineering the Grid Program</td>
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<tr>
<td>C34</td>
<td>Inoculation and detection of Impatiens necrotic spot virus in tomato and cucumbers</td>
<td>Kristin DeeAnn Vickers</td>
<td>North Carolina State University, <em>Biology</em></td>
<td>Advanced Materials for Environmental Sustainability</td>
</tr>
</tbody>
</table>
C24  Kyle Allan Virgil  
North Carolina State University, Chemistry  
A computational study of a porphyrin-perylene array employing an energy-based fragmentation method  
NC State Undergraduate Research Grant Awardee

D9  Kaela Shea Vogel  
University of North Carolina Wilmington, Pure Mathematics  
Matt Mohorn Mathematics; Amy Mou Applied Mathematics; Michelle Andersen Mathematics  
Modeling Cell Rearrangement and Morphogenesis in Epithelia  
NSF REU Modeling and Industrial Applied Mathematics

D28  Changhan Wang  
Zhejiang University, Mathematics  
TensorReg: A Matlab Toolbox for Statistical Analysis of Tensor Data  
GEAR - Global Engagement in Academic Research

B43  Ruiqi Wang  
Tsinghua University, Electronic Engineering  
Embedded Battery Management System for PHEV: ARM board Test Bed and LCD Display  
GEAR - Global Engagement in Academic Research

D41  Chunqi Wang  
Zhejiang University, Mechatronics  
Development of a LabView-based interface for PID control demonstrations on a QET hardware platform  
GEAR - Global Engagement in Academic Research

D2  Hannah Leigh Wapshott  
University of South Florida, Microbiology  
Characterization of Recombinant Bradyrhizobium Succinyl-CoA Synthetase for Use in a Novel Synthetic Carbon Fixation Cycle  
NSF Integrative Molecular Plant Systems REU

B27  Paige Catherine Wendland  
North Carolina State University, Food Science  
Michelle Borges Biochemistry, Nutrition Science; Lauren Connelly Food Science; Chloe Bream Food Science  
Selection of Starter Culture(s) for Commercial Cucumber Preservation Using a Screening Design for Fermentation Potential and Antimicrobial Activity  
NC State Independent Researchers

D50  Kenny White  
North Carolina State University, Biomedical Engineering  
NMR-compatible bioreactor modification for 3D cell culture scaffolds  
MEAS-Wake Tech Program

C48  Joseph B Wiggins  
North Carolina State University, Computer Science  
The Relationship Between Task Difficulty and Emotion in Learning Environments  
Interactive and Intelligent Media REU
<table>
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<tr>
<th>ID</th>
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<tr>
<td>A20</td>
<td>Meghan Rebecca Wyatt</td>
<td>North Carolina State University, Molecular, Cellular, and Developmental Biology</td>
<td>Population Genetics of the Causative Agent of Black Sigatoka, Mycosphaerella fijiensis Morelet NC State Independent Researchers</td>
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<tr>
<td>C44</td>
<td>Xiaodan Xi</td>
<td>Zhejiang University, Electronic Information Engineering</td>
<td>Self-Powered Environmental Vapor Concentration Monitoring Wristwatch Based on Microfabricated Tuning Forks GEAR - Global Engagement in Academic Research</td>
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<td>D37</td>
<td>Shenglan Xiao</td>
<td>Zhejiang University, Energy and environment</td>
<td>Soot Temperature and Concentration Measurements using Two-color Pyrometry GEAR - Global Engagement in Academic Research</td>
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<tr>
<td>A38</td>
<td>Tianwei Xing</td>
<td>Zhejiang University, Electronics and Information Engineering</td>
<td>Studying Object Recognition as a Function of Perspective GEAR - Global Engagement in Academic Research</td>
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<tr>
<td>D27</td>
<td>Wesley Yang</td>
<td>North Carolina State University, Biochemistry</td>
<td>Understanding silencing and miRNA target dynamics during geminivirus infection NC State Independent Researchers</td>
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<td>B11</td>
<td>Camille Elizabeth Zerfas</td>
<td>North Dakota State University, Mathematics</td>
<td>PBPK Modeling of Hazardous Chemicals through Life-Stages Mathematics; Stephen Jordan Mathematics; Jasmine Jackson Applied Mathematics; Ariel Nikas Mathematics NSF REU Modeling and Industrial Applied Mathematics</td>
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<td>C31</td>
<td>Yu Zhang</td>
<td>Zhejiang University, Physics</td>
<td>PL Study on ZnO NWs by Tensile Strain GEAR - Global Engagement in Academic Research</td>
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<td>B50</td>
<td>Kuang Zhang</td>
<td>ZHEJIANG UNIVERSITY, AGRONOMY</td>
<td>Research About Telomere-Related Proteins GEAR - Global Engagement in Academic Research</td>
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<tr>
<td>B38</td>
<td>Zhao Zhao</td>
<td>Beijing Institute of Technology, Electronic Science &amp; Technology</td>
<td>PID controlling for Lego Mindstorms Unmannned Vehicle GEAR - Global Engagement in Academic Research</td>
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<td>D29</td>
<td>kun zheng</td>
<td>Zhejiang University, Polymer Engineering</td>
<td>Determination of the Sensitivity of SEC GEAR - Global Engagement in Academic Research</td>
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<td>D35</td>
<td>Jingkui Zheng</td>
<td>Zhejiang University, Optical Engineering</td>
<td>Controlled Growth of Novel Cu3Ge Interconnection Thin Film GEAR - Global Engagement in Academic Research</td>
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<td>B40</td>
<td>Julia Zhu</td>
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<td>Effect of Pasteurization NC State Independent</td>
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Abstract Listing by Program
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<tr>
<td>D44</td>
<td>Temperature on the Shelf-Life of Chocolate Milk</td>
<td>Wenjia Zhu</td>
<td>Nanjing Normal University, <em>Geographic Information System</em></td>
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<tr>
<td>A47</td>
<td>Diary Study of GraphTiles</td>
<td>Wenjia Zhu</td>
<td>Nanjing Normal University, <em>Geographic Information System</em></td>
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<tr>
<td>C27</td>
<td>The improvement of Skimmer</td>
<td>Melissa Madison Zinter</td>
<td>North Carolina State University, <em>Biological Sciences</em></td>
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<tr>
<td>A34</td>
<td>Uncovering the Biodiversity in Lake Raleigh utilizing Deep Sequencing and Bioinformatics</td>
<td>Zhiyuan Zou</td>
<td>Zhejiang University, <em>Electronic and Information Engineering</em></td>
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<td>Rui Hu</td>
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<td>Yi Zhao</td>
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<td>B32</td>
<td>Testbed for the New V/f Control Method of Permanent Magnet Synchronous Motor</td>
<td>Zhengyang Zuo</td>
<td>Tsinghua University, <em>Electronics Engineering</em></td>
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2013 NC State University Summer Symposium Summary

Total Participants = 265 (Lead Student Presenters : 203 / Co-Presenters : 59)
Total Posters = 206

Summary of Posters by Program
- Advanced Materials for Environmental Sustainability = 12
- ASSIST-NSF ERC Advanced Self-Powered Systems of Integrated Sensors and Technologies REU = 4
- Chemistry Summer Intern Program = 6
- GEAR - Global Engagement in Academic Research = 35
- IMSD - Initiative for Maximizing Student Diversity = 21
- Interactive and Intelligent Media REU = 13
- MEAS-Wake Tech Program = 9
- NC State Independent Researchers = 40
- NC State Undergraduate Research Grant Awardee = 12
- NSF Engineering the Grid Program = 9
- NSF ERC FREEDM Systems Center = 5
- NSF Integrative Molecular Plant Systems REU = 9
- NSF REU Modeling and Industrial Applied Mathematics = 9
- NSF Undergraduate Research in Computational Astrophysics = 9
- Nuclear Engineering UG Research Program = 3
- Plant Pathology Kelman Scholars = 3
- Triangle MRSEC = 6

Summary by College (Participant's Main Mentor)
- College of Agriculture and Life Sciences = 40
- College of Veterinary Medicine = 1
- College of Engineering = 85
- College of Humanities and Social Sciences = 4
- College of Management = 1
- College of Natural Resources = 1
- College of Sciences = 67
- College of Textiles = 6
- US EPA = 1

Institutions Represented at the Symposium
- Albany State University - 1
- Appalachian State University - 1
- Beijing Institute of Technology - 4
- Benedictine University - 1
- Brandeis University - 1
- Bucknell University - 1
- California State University - 2
- California State University - Monterey Bay - 1
- Capital University of Economics and Business - 2
Carnegie Mellon University - 1
City University of New York - 1
Clarkson University - 1
Clemson University - 1
College of the Sequoias - 1
College of William and Mary - 2
College of Wooster - 1
Columbia University - 1
Cornell University - 2
Creighton University - 1
Davidson College - 1
DePauw University - 1
Duke University - 2
East Stroudsburg University - 1
Eastern Illinois University - 1
Elon University - 1
Emory University - 1
Enloe High School - 2
Florida International University - 1
Georgia Institute of Technology - 1
Grove City College - 1
Guilford College - 1
Hampden-Sydney College - 1
Harvard University - 1
Hastings College - 1
Indiana University of Pennsylvania - 1
Jackson State University - 1
LaGrange College - 1
Massachusetts Institute of Technology - 1
Meredith College - 2
Michigan State University - 1
Millbrook High School - 1
Morehouse College - 1
Nanjing Normal University - 2
National Chiao Tung University - 1
National Taiwan University - 1
New York City College of Technology - 1
Norfolk State University - 1
North Carolina Agricultural and Technical State University - 1
North Carolina Central University - 1
North Carolina School of Science and Mathematics - 4
North Carolina State University - 116
North Dakota State University - 1
Pennsylvania State University - 1
Queens College - 1
Rutgers University - 1
Saint Augustine's University - 1
San Diego State University - 1
SUNY Brockport - 1
Texas State University - 1
The College of New Jersey - 2
Towson University - 1
Tsinghua University - 2
Tulane University - 1
University of California - Davis - 1
University of Alabama - 1
University of Florida - 5
University of Kansas - 1
University of Louisiana at Lafayette - 1
University of Maine - 1
University of Minnesota Duluth - 1
University of North Carolina - Asheville - 1
University of North Carolina School of the Arts - 1
University of North Carolina Wilmington - 1
University of Pittsburgh - 1
University of Puerto Rico - 1
University of Puerto Rico Arecibo - 1
University of Puerto Rico at Cayey - 1
University of Puerto Rico-Mayagüez - 2
University of South Florida - 1
University of Southern Mississippi - 1
University of Texas - 1
University of Texas - Austin - 1
University of Virginia - 1
University of West Florida - 1
University of Wisconsin - Stevens Point - 1
Wagner College - 1
Wake Forest University - 2
Wake Technical Community College - 6
Washington State University - 1
Wellesley College - 1
Wells College - 1
Westminster College - 1
Whitman College - 1
Worcester State University - 1