Technical Research Exhibition NSBE 43rd National Convention 2017, Kansas City, MO Thursday March 30th, 2017

Dear Students, Colleagues and Guests:

The National Society of Black Engineers (NSBE) serves as a sounding board and resource for minority engineering students around the world, and we are proud that you decided to showcase your research in the 2017 Technical Research Exhibition. With more than 35,000 members globally, our mission is — *to increase the number of culturally responsible Black engineers who excel academically, succeed professionally, and positively impact the community*. Academic excellence is our first priority.

As National Academic Excellence Chair my goal is to promote research and technical excellence, and to understand the academic needs of our students. These proceedings are proof that NSBE is a one-stop-shop for academically gifted and technically savvy students. I invite you to attend the oral presentations and poster session to learn about the research your fellow members are conducting around the world.

Thank you for helping us see our mission realized.

Yours in NSBE,

Wayne Lester

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Wayne Lester
National Society of Black Engineers (NSBE)
National Academic Excellence Chair 2016-17
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Contents

Schedule

Poster Competition
1:00PM- 4:30PM
Kansas City Convention Center, Room L2300

Time	Presenter	Description
1:00PM - 2:40PM:	Judging Session 1	Posters #1-30 will present. Posters #31-60 are encouraged to stay and watch the presentations
3:00PM - 4:20PM:	Judging Session 2	Posters #31-60 will present. Posters #1-30 are encouraged to stay and watch the presentations

Oral Presentations
1:00PM - 4:30PM
Kansas City Convention Center, Room 2209

Time	Presenter	Presentation title
1:10PM -1:25PM	Yevgen Nosyk	A systematic approach to derivation of nuclear forces: Chiral Effective Field Theory
1:25PM -1:40PM	Somtochukwu Dimobi	Validation of a Galectin-8 Reporter as a Measure of Nanocarrier Endosomal Escape and Biologic Drug Intracellular Bioavailability
1:45PM -2:00PM	Michael Adenson	Comparative Slow Pyrolysis Kinetics of Herbaceous Feedstock
2:05PM -2:20PM	Harold J. Rickenbacker	Community Engagement and Engineering Interventions in Communities of Color through Participatory Research
2:20PM -2:40PM	*Break*	-
2:40PM -2:55PM	Derius Galvez	Design and Fabrication of a Bio-inspired Fixed Wing Unmanned Aerial Vehicle with Owl-like characteristics

3:00PM -3:15PM	Denean Kelson	Does more variation in muscle activity while performing repetitive work alleviate muscle fatigue?
3:20PM -3:45PM	Christopher Roper	Comparison of High Bypass Turbofan Engine Cycle Analyses – A Case Study
3:50PM -4:05PM	Chaance Graves	Optical Wireless Communications System for secure information exchange
4:10PM -4:25PM	Bethany Gordon	Bio-Inspired Self-Sensing Composites for Civil Structures

Summary of Abstracts Poster

Presenter Title

1. Abdul-Malik Davies: Synthesis of Yolk-Shell Structured Silicon-Germanium Anodes for Lithium-ion Batteries
2. Abdulafeez Adebiyi: Regimes of Flame Propagation in Obstructed Channels
3. Adegbola Balogun: Catalytic Fast Pyrolysis of Cassava Peel for Producing Bio-oil
4. Aditya Patil: Envelope Tracking Converter for Handset LTE Power Amplifier
5. Anthony Williams Rivera: Advancing Out-of-School Learning in Mathematics and Engineering
6. Antonio Funding: NIMO Mission Commitment Enhancements: Exploring a Web-based integrated Mission Design Platform
7. Anuoluwapo Olubode: Impact of Dexamethasone on the Efficacy of the Glioblastoma Multiforme Treatment Regimen
8. Avery Brown: Structural and Chemical Changes of Hydrothermally Treated Biomass during Synthesis and Activation
9. Ayobami Adegbite: Impacts of Earthworms on the Degradation of Different Herbicide Types in Palouse Soils
10. Bethany Gordon: Bio-Inspired Self-Sensing Composites for Civil Structures
11. Chaance Graves: Optical Wireless Communications System for Secure Information Exchange
12. Chibuike Madumere: Estimating Service Areas for Farmer's Markets in Southeastern North Carolina Using a Spatial Interaction Model
13. Christian Joseph: Photoluminescence Characterization of Perovskite Films deposited by RIR MAPLE
14. Christopher Roper: Comparison of High Bypass Turbofan Engine Cycle Analyses – A Case Study
15. Danielle Holt: Water You Consuming? An analysis of trace metals in fish and water in Bolivia
16. David Kargbo: Blood Bots
17. Denean Kelson: Does More Variation in Muscle Activity While Performing Repetitive Work Alleviate Muscle Fatigue?

18. Derius Galvez: Design and Fabrication of a Bio-inspired Fixed Wing Unmanned Aerial Vehicle with Owl-like characteristics
19. Deshaun Crawford: Terrain Classification for Autonomous Wheelchairs
20. Dontray Dowdell: Surface Effects on Nitrogen Vacancy Centers Neutralization in Diamond
21. Ean Hall: Human Interaction With Drones
22. Emmanuel Ijezie: Co-infection of Respiratory Viruses
23. Erin Edler: No bringing Sustainability to Rapid Prototyping
24. Ezekiel Adekanmbi: Towards the Early Diagnostics of Breast Cancer in an Electrodeless Microfluidic Channel
25. George Boateng: Activity Aware: an App for Real-time Daily Activity Level Monitoring on the Amulet Wrist-worn Device
26. Harold J. Rickenbacker: Community Engagement and Engineering Interventions in Communities of Color Through Participatory Research
27. Janelle Boyd: Utilizing Conversational Turn-taking Through Robotics to Engage Autistic Children in Social Interaction
28. Jasmine Jones: Cancer Diagnosis: The Application of Sers Utilizing Pyrylium Dyes to Detect Nanoprobes
29. Jayvaun Young: Development of Wireless Greenhouse Gas Sensor Networks
30. Jeremy Nortey: 3D Printing of Colloidal Building Blocks for Modular Tissue Engineering
31. Joshua Koepke: Passive Solar Distillation of Acid Rock Drainage
32. Kadeem Morrison: Computational Research to Determine the Large Pim-1 Structures
33. Kevin Bultongez: A New Approach in Separating Salt Water from Oil in Deep-sea Applications
34. Khira Momodu: Bridging the Gap: A Math Application for Girls Of Color
35. Krystal Folkes: Understanding of Cyberbullying Incidents of YouTube Adolescents Creators
36. Malik Oliver: Improving temperatures for subway surface decontamination
37. Marcus Barboza: Simulation of Copper Indium Diselenide (CIS) Nanoclusters for Hybrid Solar Cells Using Density Functional Theory and Time-dependent Density Functional Theory
38. Michael Adenson: Comparative Slow Pyrolysis Kinetics of Herbaceous Feedstock
39. Miracle Rogers: Varying Polyelectrolyte Multilayer Wrinkles for Successful Fibroblast Adhesion
40. Monsuru Abass: Boron-modified Silicon Oxycarbide/graphene Composite Paper Electrode for Electrochemical Energy Storage
41. Myly Fabre: Nitrogen Determination in Organic Soil Treated With Fertilizer Using Kjeldahl Method
42. Natasha Rouse: Enhancement of Thermal Conductance in Silicon Dioxide Nanoparticles as a Replacement Material for Insulators in Mobile Electronic Systems
43. Okechukwu Nwamba: Application of Guitar Electrodes as a Microfluidic Pulse Field Generator in the Bioseparation of Homogeneously Infected Erythrocytes
44. Olakunle Ogunsakin: Green Algae from Coal Bed Methane Ponds as a Source of Fertilizer for Economically Important Plants of Montana
45. Olayinka Obafemi: Application of Demand Response for Sustainable Green Energy

46. Oludamilola Adesiyun: High-Resolution Rock Magnetic and Paleointensity Study of Sediments from IODP Site U1389 (West Iberian Margin of the North Atlantic Ocean)
47. Philip Chrostoski: Modified Lead Titanate Thin Films for Uncooled Infrared Detection
48. Prince Osei Aboagye: Game Theory: An Application to the Prisoner's Dilemma
49. Sam Epeagba: Autonomous RC Car Using Pi Control and Computer Vision Techniques
50. Sarah Nerette: Assessing the Effects of Silver on Mosquito Larvae Growth
51. Sayo Eweje: Utilizing Hybrid Polymer-Protein Nanofibers to Promote Skeletal Muscle Tissue Development on an Instrumented Muscle-On-A-Chip
52. Selisa Rollins: Photocatalytic Conversion of CO2 and H2O to Higher Value Products
53. Sofia Garcia: Two Different Stretching Methods of Carbon Nanotube Sheets (Buckypaper) and Their Relationship in Inducing High Mechanical Properties
54. Somtochukwu Dimobi: Validation of a Galectin-8 Reporter as a Measure of Nanocarrier Endosomal Escape and Biologic Drug Intracellular Bioavailability
55. Stephen Benn: Incorporation of Silver Nanoparticles in Electrospun Fiber Mat to Increase Antimicrobial Activity
56. Susan Okrah: Observations of Three Ringed Networks of BZ Droplets
57. Temitayo Bankole: Exploiting Connectivity Structure for Online Selection of Primary Controlled Variables
58. Violet Sheffey: Synthesis of Degradable Polyester Elastomers
59. Yevgen Nosyk: A systematic approach to derivation of nuclear forces: Chiral Effective Field Theory
60. Zena Getachew: A Closer Look at the Self-Correcting Crowd: Examining Corrections in Online Rumors

Preliminary Poster Competition Abstracts

Synthesis of Yolk-Shell Structured Silicon-Germanium Anodes for Lithium-ion Batteries
By: Abdul-Malik Davies

The move towards a more sustainable world requires more efficient energy storage systems. New materials are needed to improve the storage capacity and other important properties of existing batteries. The lithium-ion (Li-ion) battery is an efficient energy storage system because of its relatively high energy density and low self-discharge rate (good charge retention). Silicon-Germanium (SiGe) alloy nanoparticles can potentially be used to create anodes with a much higher specific capacity than graphite, the most commonly used anode material in Li-ion batteries. However, silicon-based anodes suffer from degradation due to the repeated volume expansions and contractions resulting from the lithiation and delithiation processes that occur when the battery is charged and discharged. To address this challenge, we are preparing carbon coated SiGe anodes with a unique yolk-shell nanostructure that can accommodate the volume changes while maintaining performance. This suggested structure consists of a silicon-germanium core, carbon coated shell and a void space in between them. It is denoted as SiGe void C, with three distinct layers. Starting with SiGe nanoparticles obtained by reacting silane and germane gases in an oxygen free laser reactor, we are adding a sacrificial layer of silicon dioxide (silica) by using a sol-gel process. These nanoparticles are then further coated with carbon particles, followed by a careful etching process to remove the sacrificial silica layer, producing SiGe void C nanoparticles with the desired yolk-shell nanostructure. The void space in

these nanoparticles is anticipated to accommodate the volume changes without compromising the integrity the entire yolk-shell nanostructure. We expect Li-ion batteries that incorporate the SiGe void C nanoparticles as an anode material, will show improvement in key performance metrics, such as the battery cycle life and capacity.

Regimes of Flame Propagation in Obstructed Channels
By: Abdulafeez Adebiyi

It is known that a premixed flame front accelerates extremely fast and may even trigger detonation when propagating in a semi-open obstructed channel (one end of the channel is closed; the flame is ignited at the closed end and moves towards the open one). However, industrial and laboratory conduits often have both ends open, or vented, with a flame ignited at one of these ends. The latter constitute the focus of the present work. Specifically, premixed flame propagation through a comb-shaped array of obstacles, in-built in a channel with both ends open, is studied by solving the fully-compressible hydrodynamic and combustion equations with Arrhenius chemical kinetics. Three various blockage ratios are considered, namely, BR = 1/3, 1/2 and 2/3, with oscillations of the burning rate observed for all of them, which conceptually differs from fast flame acceleration in semi-open channels. Such a difference is devoted to the fact that while the entire flame-generated jet-flow is pushed towards a single exit in a semi-open channel, in an open-open one, it is distributed between the upstream and downstream flows, thereby moderating flame propagation. The flame oscillations are nonlinear in all cases, and the nonlinearity is stronger for larger BR. The oscillation period increases with BR, the oscillation amplitude is almost BR-independent, and the average burning rate reduces with BR. The oscillations are steady for BR=2/3 and 1/2, while they slightly damp for BR=1/3. The results obtained resemble the flame oscillations observed previously in open-open unobstructed channels. The present results also support the recent experiments and modelling of flames in open-open obstructed channels, which yielded steady or quasi-steady flame propagation prior to the onset of flame acceleration. Indeed, the oscillations can be treated as the fluctuations around a quasi-steady solution.

Catalytic Fast Pyrolysis of Cassava Peel for Producing Bio-oil
By: Adegbola Balogun

Biomass is a lignocellulosic organic material derived from plants and animals. Biomass can be converted into a mixture of energy rich molecules via thermo-chemical routes such as pyrolysis. Pyrolysis is the thermal decomposition of organic materials at a high temperature in the absence of oxygen. The products of biomass pyrolysis are bio-char, bio-oil and non-condensable gases, such as CO, H2, CO2, and CH4. The bio-oil produced via pyrolysis generally has high oxygen content. Catalytic upgradation in the presence of a zeolite-based catalyst, such as ZSM-5, has to be performed to increase the energy content so it is suitable for use as a source for fuels and chemicals.

Cassava is one of the most common constituent of diet in west and central Africa. Nigeria has been identified as one of the major producers and consumers of Cassava. A significant amount of Cassava peel is not utilized and is wasted, which could otherwise be used for the production of

bio-oil. An opportunity exists for utilizing this sustainable biomaterial as a feedstock for conversion into value-added products using pyrolysis. Very little data exists on the pyrolysis kinetics of cassava peel so the proposed work would fill a gap in the existing literature.
The objectives of the work are four-fold: (1) determine of the optimum pyrolysis reaction temperature for Cassava peel to obtain the highest yield of bio-oil, (2) quantify the effect of pyrolysis heating rate on bio-oil production; (3) study the effect of the biomass (Cassava peel) to catalyst (HZSM-5) ratio on the yield of aromatics and phenols in the bio-oil; and (4) determine the kinetics of catalytic fast pyrolysis of Cassava peel. The approach will involve both an experimental program as well as modeling work with the overall goal of providing the fundamental kinetic models needed for future research involving process scale-up and design.

Envelope Tracking Converter for Handset LTE Power Amplifier
By: Aditya Patil

Rapid technology changes in the electronic industry have made mobile devices ubiquitous. The user demand on high performance application processor and increased data traffic in wireless communication has resulted in higher power dissipation, leading to faster battery drainage. This work presents design of a linear amplifier and a DC-DC buck converter for an envelope tracking system, used to track the envelope for LTE (Long-Term Evolution) signals. Envelope Tracking techniques are used to improve the efficiency of modern radio frequency transmitters, when compared to RF transmitters with a constant DC supply, thus improving system run time. These techniques are based on varying the supply voltage of the power amplifiers (PAs) according to envelope of the signal being transmitted, thus maximizing their efficiency. To jointly leverage the high efficiency of switch-mode DC-DC converters and the wide bandwidth of linear amplifiers, a hybrid power supply topology is employed. We implement a parallel combination of a hysteretic buck converter and Class-AB linear amplifier. The buck converter provides the average, or steady-state, power required to drive the power amplifier. Conversely, the linear amplifier tracks the fast transient segments of the signal envelope. The proposed hybrid power supply was designed and fabricated in a 0.5-µm CMOS process. The linear amplifier operates with a 3.6 V- 5V power supply, and is designed for a low frequency gain of 48 dB. In order to track a 20 MHz signal envelope, the Class-AB amplifier's unity gain frequency is designed to be 130 MHz. The buck converter is designed to operate with a Li-Ion battery voltage range of 2.8 V – 4.2 V. At a nominal switching frequency of 5 MHz, the buck converter achieves a maximum efficiency of 92.1% at an output power of 1.44 W. The proposed envelope tracking hybrid power supply can successfully track signals from 0.8 V – 4.2 V, while exhibiting a low 6 dB RMS error. While tracking a 5MHz envelope signal, the implemented envelope tracking hybrid power supply system exhibits a peak efficiency of 73.2%.

Advancing Out-of-School Learning in Mathematics and Engineering
By: Anthony Williams Rivera

The Advancing Out-of-School Learning in Mathematics and Engineering (AOLME) project is an interdisciplinary effort -from faculty with areas of expertise in bilingual education, mathematics education (Prof. Sylvia Celedón-Pattichis and Prof. Carlos A. LópezLeiva), and electrical and

computer engineering (Prof. Marios Pattichis and Dr. Daniel Llamocca) - designed to support interactive and visual learning in engineering and mathematics of middle school students, especially from underrepresented groups. Through an integrated curriculum, the AOLME project provides engaging experiences in engineering through the use of digital image and video processing examples. Additionally, this curriculum provides a set of mathematical practices different from but related to school mathematics. The project has two programs:
(i) a mathematics-engineering summer school (ME-S2), which was implemented during the Summers of 2012 and 2013.
(ii) a mathematics-engineering club (MEC) which was implemented during the Springs of 2013 and 2014.
These programs comprise a pilot study in the development and implementation of level one and two of an integrated curriculum. The main goal of this after-school initiative is to explore efficient ways to support the learning and active engagement of middle school students in mathematics and engineering related activities. Additionally, the program attempts to expand its curriculum in a series of levels (applied through the ME-S2 and MEC programs) from middle school through high school with the long-term goal of motivating and supporting a pipeline for these students into STEM (Science, Technology, Engineering, and Mathematics) fields at college levels.

NIMO Mission Commitment Enhancements: Exploring a Web-based integrated Mission Design Platform

By: Antonio Fuondjing

NIMO the Networks Integration Management office provides exceptional customer service to new and existing customers. As part of their job NIMO has a suite of tools to provide Coverage, Loading, and Link Analysis. This project is part of an ongoing effort with NIMO to enhance and expand existing features within the customer tool suite. Specifically, combining the Link Analysis and the Loading Analysis into one tool, expanding the link analysis to include a time component, and automating the priority calculator. The output of this project is a web-based prototype utilizing existing NIMO data to generate an integrated Loading and Link Analysis tool. The presentation will delve into the design of the individual components of the tool, explain some of the primary technical challenges, and display a prototype of the current state of the tool suite.

Impact of Dexamethasone on the Efficacy of the Glioblastoma Multiforme Treatment Regimen

By: Anuoluwapo Olubode

Glioblastoma Multiforme (GBM) is the most common malignant primary brain tumor in adults. GBM is a relatively rare disease however it can cause significant morbidity and mortality. The standard treatment plan follows Stupp's Protocol, which involves aggressive surgery followed by radiotherapy and chemotherapy. Despite this treatment, the long-term survival and non-progression survival rates of GBM patients are very low. While the survival rates indicate that the treatment is ineffective, the procedures also cause a host of side effects. Various medications

are used to counteract these side effects, and in particular to reduce the CINV. Dexamethasone (DEX) a corticosteroid is commonly used in conjunction with anti-CINV medications for better control of nausea and vomiting. While DEX decreases the morbidity of the disease by ameliorating the side effects of treatment, recent research associates increased DEX usage with shortened survival periods for both newly diagnosed patients and those with recurrent tumors. The aim of this study is to translate the GBM therapy regimen to an in-vitro system, in order to perform therapeutic testing and examine the impact of DEX on glioma cells following standard treatment. In this study, a cell culture model was used to simulate the conditions of the brain after surgery to simulate stupp's protocol and examine the effects DEX has on the treatment regime.

Impacts of Earthworms on the Degradation of Different Herbicide Types in Palouse Soils
By: Ayobami Adegbite

Through chemical, physical and biological alteration of soil, earthworms can influence the degradation, leaching and adsorption of herbicides. These interactions may reduce the efficacy of herbicides and potentially impact groundwater quality. The drilosphere created by earthworms is characterized by high nutrient availability and microbial activity which suggests that the drilosphere might be playing important role in the degradation of herbicides such as clopyralid and chlorsulfuron. Clopyralid and chlorsulfuron are susceptible to microbial action in soils. This study used mesocosms with either Aporrectodea trapezoides or Lumbricus terrestris to assess the impacts of earthworm activity on clopyralid and chlorsulfuron in a bioassay type study conducted in the greenhouse. Replicate mesocosms with A. trapezoides L. terrestris or no earthworms were sprayed with clopyralid and chlorsulfuron at different rates. Lentil was seeded into each mesocosm using a fixed grid. Germination was recorded at each point in the grid daily for a four-week period. Differences in germination rates and post emergent herbicide analysis were used to assess the impact of earthworm activity on clopyralid and chlorsulfuron. Results of this study contributes to our understanding of how soil organisms influence degradation, adsorption and leaching of clopyralid and chlorsulfuron in earthworm worked soil.

Bio-Inspired Self-Sensing Composites for Civil Structures
By: Bethany Gordon

Self-sensing concrete is a form of Structural Health Monitoring (SHM) focused on creating a material that can use electrical currents to provide real-time information about the stresses within a structure. While self-sensing concrete using carbon nanotubes (CNTs) has proven successful in application, they are expensive, limiting their applicability. Graphene nanoplatelets (GNPs) are a much cheaper alternative with a lot of potential, but have not yet shown a strong correlation between strain and resistivity comparable to CNTs. A GNP mortar mix was chosen for the sensors and an engineered cementitious composite (ECC) mix was used for the test beams. Four bio-inspired sensor shapes were studied: the honeycomb, fractal fern, spider web, and wave pattern. These shapes are intended to increase sensitivity to get more accurate readings. The honeycomb, fractal, and web patterns were designed to be externally attached to a beam, while the web was designed to be embedded inside of a beam. Then, 3D printed molds created and

used to form the bio-inspired sensors. Once removed from the molds, the external sensors were attached and the four beams were tested with cyclic loads to determine their self-sensing capabilities. The external sensors showed no direct correlation between force or displacement and change in resistivity. The embedded wave showed a promising correlation between displacement and change in resistivity. Potential applications of this technology include integrated traffic sensors and non-destructive testing capabilities for new construction. Future work will include embedding the external sensor design or 3 establishing a better attachment mechanism, altering the frequency of the embedded wave, and employing larger beams during flexural testing.

Optical Wireless Communications System for Secure Information Exchange
By: Chaance Graves

In this project, the development of an optical wireless communication system is conveyed for the incorporation of indoor network applications. Currently in our society, many of the devices we use in our daily lives are connected through the restricted and crowded Radio Frequency (RF) bandwidths. Overcoming this challenge presents a unique opportunity to begin to utilize the free space optical standard further into future technologies such as IoT networks. To further understand the design parameters, comparison of uses of optical communication to current market 2.4 GHz Radio Frequency (RF) solutions is investigated, in particular to the security of the link. An overview of the prototype system describes the design and characterizations of an indoor free space optical transceiver. Additional simulations and experimental results show a proof of concept of system reliability in Wireless Local Area Networks (WLANs) along with benchmarks such as data transmission rate within the Mbps range over the span of free space channel distances.

Photoluminescence Characterization of Perovskite Films deposited by RIR MAPLE
By: Christian Joseph

The popularity of perovskite materials for photovoltaic applications has exploded in the past several years after their ability to surpass quantum dot solar cells was demonstrated in a 2009 paper on Perovskite Dye Sensitized Solar Cells. In order to maximize efficiency of perovskite devices, the effect of advantages and disadvantages of many deposition techniques on device performance have been investigated. This study will aim to see the utility of the RIR-MAPLE deposition technique in the fabrication of perovskite devices. RIR-MAPLE is a deposition technique that utilizes Matrix Assisted Pulsed Laser Evaporation with an infrared laser. The infrared laser is resonant with OH bonds and allows many solvent options in the frozen target. This attribute along with the ability to tailor material composition and create heterostructures qualifies RIR-MAPLE as a worthy candidate for perovskite film manufacture. Good film quality is essential to the production of an optimum device and by collecting spatially organized photoluminescence spectra film quality and uniformity can be investigated. The photoluminescence spectra can in turn become a gauge to determine whether a film will make a satisfactory device.

Does More Variation in Muscle Activity While Performing Repetitive Work Alleviate Muscle Fatigue?
By: Denean Kelson

Repetitive work, involving repeatedly performing the same work tasks again and again, is recognized as a risk factor for developing musculoskeletal disorders in the neck, shoulder and arm regions. More variation in biomechanical exposures (postures, movements, forces and muscle activity) is often suggested as an effective intervention in such settings. However, the neurophysiological benefits of variation have mostly only been verified in laboratory conditions using unrealistic tasks such as isometric force exertions. It is yet to be proven whether variation in movements and muscle activity while performing real repetitive work carries similar benefits to short- and long-term physiological outcomes. The aim of this project is to test the hypothesis that repetitive work involving more variation in muscle activity would be associated with lower fatigue and discomfort than repetitive work involving more stereotypical (i.e. less varying) movement patterns. This study will quantify motor variability in a cyclic pick and place task. Muscle activity in the upper trapezius and posterior deltoid muscles will be monitored using surface electromyography. Twelve healthy participants will perform 20 minutes of repetitive pick and place work on a work-surface placed in front of them and halfway between their elbow and shoulder height in different conditions. While the baseline condition will involve just working repetitively, conditions involving intermittent production of more force, more posture and combinations of more force and posture will be tested in addition, to verify the above hypothesis. There will be 30 minutes rest between the different conditions. The Borg CR-10 scale will be used to assess subjective discomfort and the amplitude and power spectrum of muscle activity data will be used to assess signs of fatigue. Correlations between fatigue and variation of muscle activity will be computed to test the hypothesis that more variation is beneficial for alleviating muscle fatigue in repetitive work.

Design and Fabrication of a Bio-inspired Fixed Wing Unmanned Aerial Vehicle with Owl-like characteristics
By: Derius Galvez

Owls fly silently at low speeds to capture their prey. The silent flight of owls is caused by the leading-edge serrations on the owl's wings. Previous research shows these serrations can possibly increase the aerodynamic efficiency of aircraft when flying at low speeds. The purpose of this research is to create a bio-inspired UAV that mimics the fixed-wing flight of an owl; in hopes increase aerodynamic efficiency at low speeds.

Terrain Classification for Autonomous Wheelchairs
By: Deshaun Crawford

For people who are older, lack of mobility leads to isolation and depression. For younger people, lack of mobility prevents them from engaging in vocational and educational opportunities and reduces dependence on family and caregivers thus increasing self-reliance.
I am contributing to an autonomous wheelchair that will strive to that will address this issue. The

autonomous wheelchair will grant individuals greater independence through increased mobility and will better able them to participate in society. Individuals will be granted the power to perform activities such as attending school and receiving an education, attending community and civic events, participating in entertainment such as sporting events or movies, working, and shopping. Along with granting mobility, the wheelchair will also eliminate the need for using muscle strength to move a joystick on a powered wheelchair or to manually move a regular wheelchair's wheels. The autonomous wheelchair performs low level navigation activities itself enabling the operator to only focus on defining end points such as starting and ending destination.

Furthermore, building upon current navigation algorithms, we will address the problem of transitioning from outdoor to indoor environments. My project concerns the development of a terrain classification system that employs spatial derivatives to compute change in smoothness of the surrounding terrain. My terrain classification system is presented as a client server architecture where the classification component takes the role of client and a 3D camera system takes the role of the server. My algorithm will input streaming 3D range pictures of the terrain in front of the wheelchair from the 3D camera server and the classification component will perform transformations and operations on the picture data to compute navigating decisions relative to what is interpreted and forward those decisions to the navigation algorithm.

Human Interaction with Drones
By: Ean Hall

With the rise in commercial success of technologies such as virtual reality, human interaction with technology is becoming increasingly more intimate. Previously, people would control electronic devices with remote controllers and, if the device had a camera, the video would be viewed on a large screen. Now there is a constant push for smaller and faster devices that must be able to work more efficiently than previous models. Some modifications to these devices involve the way they are controlled. A remote controller has buttons and knobs that must be placed ergonomically for ease of use. A natural controller would be one that a person is born with, such as a human arm, a human voice, or human eyesight. Synchronizing human actions to device functions could create a more refined experience for product interaction.

Co-Infection of Respiratory Viruses
By: Emmanuel Ijezie

Currently, our lab is working to identify the relationships between the biological variables of respiratory viral co-infection and the resulting disease severity. These variables include viral strains, doses, viral timing, genetic variation in the host, immune response (which is critical for viral clearance), and pathology. In order to understand how these complex interactions dictate co-infection outcome, we are establishing a murine model of respiratory viral co-infection and

use it to control, quantify, and model how viruses interact within the respiratory tract at the viral, cellular, and organismal level within the context of the murine host's immune system. Infection of human and murine respiratory viruses in respiratory epithelial cells, performed in parallel with our other experiments, will help determine the generality of our model to human infections. Our ""central hypothesis"" that respiratory co-infections change disease severity compared to single infections both by direct viral interactions and by modulating host responses, resulting in altered clearance of the individual viruses and/or immune-mediated pathology. To test our hypothesis we will rigorously test them through two specific aims.
Aim 1 - Determine how Viral co-infection variable influence viral load, host responses, pathology, and disease severity in mice
Aim 2 - Determine the effects of co-infections on viral growth dynamics and cellular responses in respiratory epithelial cells in vitro.

Bringing Sustainability to Rapid Prototyping
By: Erin Edler

The realm of 3D printing has begun expanding to areas across the globe. The fascination with the technology is steadily increasing as time goes on, creating a norm where owning one such device is a necessity. Due to an influx of popularity over recent years, 3D printers have found themselves situated in most academic settings. The operation procedure of a 3D printer involves the operator drafting a project in a computer software and then uploading the file to a compatible printer, which will produce the design from melting plastic filaments and materials through a nozzle head on the device. What many fail to realize is that while this seemingly helpful and innovative technology is running, detrimental side effects to the ecosystem are taking place.
There are exciting opportunities and avenues for improvement in the 3D printing space, and we are living in a particularly exciting time for this field. As things stand today, a greater demand for 3D printers due to this expected growth would also lead to increased environmental impacts, such as harmful emissions produced in a standard sized room and excessive energy consumption. We intend to create an innovative solution that involves a polylactic acid (PLA) recycling unit with a possible ventilation system attachment that will reduce the negative environmental impact of using a 3D printing before this massive market expansion, and can integrate it into the market. Then, when the market expansion does happen, the negative impacts can be minimized while additive manufacturing proliferation is maximized. In this context, we can make the per-printer environmental impact of 3D printing smaller than it is now which – on the individual user level – means lower energy consumption, less waste, less harmful emissions, and greater efficiency."
Ezekiel Adekanmbi Towards the early diagnostics of breast cancer in an electrodeless microfluidic channel Currently, early stage breast cancer detection is a major challenge faced by developed and developing countries. This work presents an experimental approach to obtaining the electrophysiological properties of associated peripheral blood mononuclear cells (iPBMCs) and a simulation approach to characterize and separate breast cancer infected iPBMCs from the healthy mononuclear cells (PBMCs) using peripheral blood stream via electrodeless dielectrophoresis (eDEP) on a microfluidic platform. COMSOL Multiphysics v5.2a was used to simulate the device geometry consisting of microchannel incorporating semicircular obstacles and bifurcating into two outlet channels with different applied voltages and different inlet concentrations in the range of 1 iPBMC per 10 - 108 healthy PBMCs. Mathematical models were

solved for current conservation along with fluid flow, convection, and diffusion to predict the concentration distribution of the cells. Flux streamlines were used to represent the path followed by iPBMCs and PBMCs. Results indicate an optimal separation at 30 V and a recovery rate of ~ 89% irrespective of the concentration of the iPBMCs fed into the device. A micro well was used to obtain the electrophysiological properties of iPBMCs and PBMCs and these were used in optimizing the device.

Utilizing Conversational Turn-Taking Through Robotics to Engage Autistic Children in Social Interaction

By: Janelle Boyd

Autism Spectrum Disorder (ASD) is a complex neurological developmental disorder that impacts a child's ability to communicate and interact with others. Studies have shown that while all autistic children share core characteristics, their specific deficits in socialization, communication, and behavior present differently depending where they are on the spectrum. With cases ranging from high-functioning to severe autism, ASD children have a harder time in becoming self-sufficient. This not only deprives them from reaching their full potential but also their ability to participate in society.

I am implementing an ASD therapy tool, something I call the Shy-Robot, that reinforces a child's understanding and recognition of social queues through a turn-taking interaction. This form of interaction develops a child's ability to shift attention and engage in a shared process. I employ a humanoid robot platform to implement gesture-based instantiations of proportional emotional responses to help children with ASD label and communicate emotional states. The goal is to utilize perception, behavior selection and motor acts to engage autistic children in social interaction through robotics.

With an understanding of toddler social development and psychology, my research incorporates concepts and philosophies from these diverse perspectives to enable the Shy-Robot to improve social interaction and development amongst autistic children. My design will guide the humanoid robot to follow the child's lead by measuring the child's behavior to employ a parameterization of emotions that allow for the humanoid robot to execute meaningful gesture variations. Thus, this provides a measurable assessment for social development.

Cancer Diagnosis: The Application of SERS Utilizing Pyrylium Dyes to Detect Nanoprobes

By: Jasmine Jones

Using a pyrylium-dye based surface enhanced Raman scattering (SERS) probe, one could detect multiple biomarkers associated with various cancers in a single assay. SERS can be used to locate nanoprobes that localize at tumor sites of concentration as low as 10−15 mol/m3, which surpasses currently available techniques, resulting in the detection of cancerous cells before tumor maturation/metathesis. Unlike PET or fluorescence imaging, SERS is compatible with non-ionizing radiation which would allow for increased safety for patients, deeper tissue penetration, and stronger enhancement of scattered radiation. Current data allows one to

conclude that the nanoprobe system will function and report the Raman scattering properly due to the uniform orientation of reporter molecules on the surface of the metal nanoparticle. The early detection of cancer cells would provide patients with a variety of treatment plans in addition to increasing the survival rate. The synthesis and optimization of NIR-IR absorbing dyes in conjugation with the nanoprobe system will be discussed herein.

Development of Wireless Greenhouse Gas Sensor Networks
By: JayVaun Young

Greenhouse gas emissions and air pollution have significant impacts on local and global climate, and human health. Air quality in the United States is tracked using a network of monitors located across the country. The monitors use established technologies that provide accurate regional data on air-quality for use in implementing the nation's air quality standards, enforcement and research. Accurate detection of several greenhouse gases (e.g., methane, nitrous oxide and carbon dioxide) is challenging due to uncertainties in sources of emissions, and complicated atmospheric chemistry. In this project, we design and develop opto-mechanical prototype and communications protocol for precise sensing of a portable, wireless, and fully automated greenhouse gas sensor. For data communications design, we use a set of single board computers (Raspberry Pi, R-Pi) and microcontroller modules (Arduino) to acquire (in real-time) trace gas concentration and metrological data (temperature, humidity, pressure and GPS) from the laser-based sensor on a wireless protocol. The analog and digital metrological sensor data was synchronized between R-Pi and base computer to process and analyze data from the field. In addition, a field prototype of a GHG sensor was developed using optimized opto-mechanical design. The overall goal is to develop a robust field prototype that can measure precise concentration of important greenhouse gases in real-time and provide fast spatial and temporal sampling of the earth's atmosphere.

3D Printing of Colloidal Building Blocks for Modular Tissue Engineering
By: Jeremy Nortey

Modular tissue engineering aims to create biological materials to repair or replace damaged tissues through the use of modular materials with defined nano-architecture. These building blocks can be combined to form macroscale materials that allow for precise control over cell behavior at multiple length scales. This project aims to use colloidal nanogels with finely controlled mechanical and bioactive properties as building blocks for creating tissue engineered scaffolds. 3D printing is utilized to combine the nanogel bioink building blocks into 3D structures with well-defined nano and microscale features. Nanogel thin films are routinely created through a layer-by-layer (LbL) process and film mechanical properties have been shown to direct cell adhesion and spreading responses. We hypothesize that 3D printing of nanogels will facilitate the creation of films with defined patterns, which is not currently achievable through LbL techniques. In these studies we demonstrate the feasibility of using colloidal nanogels as bio-inks and then investigate the effect of varying bioink concentration on printing outcomes.
Nanogels were synthesized through a precipitation polymerization reaction. Nanogel size

characterization was conducted using nanoparticle tracking analysis (NTA) using a NanoSight. Additionally, nanogels were printed on glass coverslips, and imaging was conducted using a scanning electron microscope (SEM) (Verios) and atomic force microscope (Asylum).
Particles had a swollen diameter of 618.7 ± 74.9 nm for the 4% BIS nanogel solutions. SEM images demonstrate that printing 2 mg/ml, 0.2 mg/ml, and 0.02 mg/ml of 4% BIS nanogel solutions was successful.
These results demonstrate that nanogel film construction is possible through 3D printing of nanogel bioinks. Scanning electron micrographs suggest that printing of nanogel solutions results in film formation. The 3D printing process can be further optimized to generate complex patterns of nanogel films, which will enable the fine control over cell adhesion and cell spreading.

Passive Solar Distillation of Acid Rock Drainage
By: Joshua Koepke

The poster I would be presenting is a passive distillation system that has been developed by my senior design team to purify acidic water from mine sites. The goal of this project was to provide a system that is able to treat up to 10 gallons per minute of acidic water without requiring any utility power just energy from the sun. We have researched the problem and investigated possible solutions including building a bench top unit for testing and developed an economic analysis of the system for real world application. The poster will include the problem, our bench top data, the governmental regulations we follow, a process flow diagram, the economic analysis, and the safety plan for the project.

Computational Research to Determine the Large Pim-1 Structures
By: Kadeem Morrison

In this work, molecular dynamics simulations and Microsoft Excel were used to generate PSD curves. From looking at the curves, the width of the pores in the PIM-1 can be ascertained. The PSD curves could also be utilized to ascertain how adsorptive the PIM-1 Polymer can be. Adsorption happens when gas molecules cling to the surface of a larger molecule, such as the pores generated from when PIM-1 was polymerized. PIM-1 was selected for its unique structure and rigid awkward shape, which inhibits efficient packing leading to the said pores produced. PIM-1 was generated from polymatic, which is a set of codes that was designed to aid in the generation of polymeric structures through UNIX that aids in the creation of polymer structures from atomic building blocks. LAMMPS was used to perform structural optimization and molecular dynamics simulations and Pore Blazer was used to perform structural characterization simulations after. Calculations of surface area, density, pore volume and polydispersity index. This methodology could lead to researchers having more direction in the ascertaining of a suitable polymer system to efficiently adsorb gas molecules to the surface. In this study, the structural properties of PIM-1 is compared against the PSD peaks for ten large polymeric systems.

Bridging the Gap: A Math Application for Girls Of Color
By: Khira Momodu

Research has proven time and time again that girls typically lose interest in mathematics during middle school (11-13 years old) and start to consider other career paths. Female students in this age range often consider pursuing careers such as teaching, sociology, and care giving. What is more, this same demographic sparks just as much interest in STEM as their white counterparts, but often loses that interest due to lack of adult support, lower academic achievement, and greater instances of gender barriers in STEM. The goal of this project is to create an interactive, iOS, learning tool that caters to the specific needs of underrepresented girls within the middle school age range. Since studies show that students are often turned away from topics in STEM due to their [association] with mathematics, the application will focus primarily on both improving their skills in Math, as well as sustaining their motivation for the subject. I plan to utilize different shapes, interviews, and [learning tools] to document behavioral patterns and interests of a sample of middle school girls within the Tempe, Arizona region to then create a functioning application.

Krystal Folkes Understanding of Cyberbullying Incidents of YouTube Adolescents Creators

"With the prevalent use of social media and the internet, adolescent cyberbullying is on the rise. To mitigate these online risks, researchers have attempted to use automated detection techniques and natural language processing (NLP) algorithms to identify instances of cyberbullying. Unfortunately, this approach has a number of limitations. First, studies have shown that machine learning detection has reached accuracy to about 78%. Further, much of the research efforts in cyberbullying detection have not included feedback from actual victims on whether they felt cyberbullying really occurred. Otherwise, these studies fall short in focusing on detection without examining risk mitigation techniques for once cyberbullying has been identified. Thus, we proposed a mixed-method approach to for studying cyberbullying from the dual perspectives of automated risk detection algorithms and from the user's perspective. We will scrape publically posted comments views of videos published by pseudo-celebrity teens (ages 13-17) on YouTube on the topic of fashion & beauty. We will process these comments using three NLP algorithms and Sentiment Analysis Application Program Interfaces (API) to detect instances of cyberbullying. We will then get informed consent from parents of these teens so that we can follow-up to ask them their impressions about the comments they received, whether they felt cyberbullied, and if they have any suggestions for ways to mitigate cyber bullying through design. The purpose of this poster is to introduce a novel approach to tackling social media cyberbullying and stimulate discussion of teen adolescent online safety policies.

Improving Temperatures for Subway Surface Decontamination
By: Malik Oliver

Public transit systems in urbanized areas remain a potential target of chemical and biological terrorism. In the event of a contamination incident, rapid re-occupancy requires effective decontamination of large surface areas. Previous studies support an increase in decontamination efficacy when performed at surface temperatures of at least 70 °F. This can present a significant challenge in a subway environment where temperatures can remain below 50 °F for a large fraction of the year. Thus, a study was conducted in order to investigate the feasibility of heating

concrete surfaces by at least 30°F, and estimating the logistical/power requirements to achieve and maintain these temperatures. Two methods of heat transport were selected for investigation: convection and radiation. The analysis consisted of modeling the time and power required to achieve temperature objectives, lab-scale experiments to prove out modeling concepts, and a subway-scale operational test using commercially available heat sources. Preliminary modeling suggests both methods of heating are operationally feasible. Subsequent lab tests utilized concrete cylinders with 36-in outer-diameter, 35-in length, and 3-in wall thickness, approximately 1/4-scale of a typical subway tunnel, outfitted with k-type thermocouples. A 1500-W quartz heating element for radiant tests and five 250-W heat sinks with controlled airflow for convective tests were used. Results suggest it is feasible to apply both heating methods to a full-scale operational environment; operational tests are currently underway. Specific results in addition to the modeling and experimental methods will be described.

Varying Polyelectrolyte Multilayer Wrinkles for Successful Fibroblast Adhesion
By: Miracle Rogers

Cell attachment and migration on a substrate is often affected by the shape, or topography, or the substrate surface. One method for creating substrate topography is to combine Shape Memory Polymers (SMPs) and Polyelectrolyte Multilayers (PEMs). SMPs are smart materials that can memorize a temporary shape and return to their original shape in the presence of a stimulus, such as heat. PEMs are thin material comprising alternating layers that can be deposited on surfaces, including those of SMPs. When the PEMs are applied to SMPs and then the composite PEM-SMP material heated, the SMP contracts to its original shape, resulting in buckling of the PEM and formation of nano-topographic wrinkles. However, the relationship between magnitude of SMP contraction and resulting strength of cell attachment is not known. The purpose of this study was to determine the cells' ability to attach to the PEM-treated SMPs strained to different extents. To achieve the goal of the study, SMPs were synthesized, strained, spin coated with PEMs, and heated in an isothermal oven. After the SMPs were heated, the SMPs returned to its original shape, buckled the PEM coating, and formed nano-wrinkles within the PEM coating. The contact angle of wrinkled polyelectrolyte topographies, a predictor of cell attachment, on three different compositions of SMP were analyzed. For each composition of SMP, the SMP was strained to 10%, 20% or 40%. Each strained SMP group was spin coated with 10 or 15 PEM bilayers. Our results showed average contact angles of 80 degrees for 10% strain, 74 degrees for 20% strain and 75 degrees for 40% strain. The desired contact angle range for fibroblast adhesion is between 60 to 80 degrees. The results suggest, therefore, that this novel substrate is likely to support fibroblast adhesion for strains between 10% and 40%.

Boron-Modified Silicon Oxycarbide/Graphene Composite Paper Electrode for Electrochemical Energy Storage
By: Monsuru Abass

Boron modification of silicon oxycarbides ceramics is one of the sustainable means of improving electrochemical energy storage properties of electrode materials. In this study, thin film composites comprising of boron nitride nanotube-modified silicon oxycarbides (SiOC-BNNT)

ceramic supported on reduced graphene (rGO) sheets were synthesized via vacuum filtration followed by pyrolysis in a flowing argon gas. This configuration ensures a uniform dispersion of the ceramic on rGO sheets and stabilization against aggregation due to BNNTs that form a continuous network connecting the ceramic particles. In electrochemical energy storage application, boron is believed to improve the electronic conductivity and chemical stability of SiOC by modifying its nanodomain structure. Thin films of graphene-supported SiOC modified with different percentages of BNNTs (SiOC-BNNT/rGO) were synthesized, characterized and tested as a lithium-ion battery (LIB) and supercapacitor electrode. Among the synthesized thin film composite papers, SiOC containing 0.25 wt.% and 0.5 wt.% BNNT supported on rGO displayed the optimum electrochemical properties as a LIB anode and supercapacitor electrode, respectively. As observed in this study, the capacity of SiOC-BNNT/rGO as an electrode material for electrochemical energy storage indicates the existence of an optimum wt.% BNNT required to enhance the desirable properties of SiOC composites.

Nitrogen Determination in Organic Soil Treated with Fertilizer Using Kjeldahl Method
By: Myly Fabre

Nitrogen is one of the various macronutrients in plants that results from both soil and the atmosphere. The nitrogen is released as the mineral decomposes in soils and is a major component of chlorophyll, a vital process in the photosynthesis of the plant's life, in the atmosphere. Though nitrogen serves to aid plants in their growth, weeds and nonnative, plants tend to grow more readily with additional nitrogen supplies. However, too much nitrogen also creates an imbalance of nutrients that causes a depletion of other important minerals such as calcium, phosphorus and magnesium. The present research is an analysis of soil samples from Okinawan Spinach plants collected at the Saint-Thomas University gardens. The key objective is to study the total nitrogen in those soil samples containing an enrichment surplus of nitrogen from three different fertilizers and correlate results for advance improvement to minimize potential losses. Here we present the determination of the total nitrogen using the Kjeldalh method to address these gaps in our understanding. It demonstrated that the potential losses of total nitrogen are time dependent from the forty samples analyzed. Its percentage decreases as its abundance reduces important minerals which are replace as aluminum that proliferate and harm plants.

Application of GUITAR Electrodes as a Microfluidic Pulse Field Generator in the Bioseparation of Homogeneously Infected Erythrocytes
By: Okechukwu Nwamba

GUITAR (Graphitic material from the University of Idaho Thermo Asphalt Reaction) is proposed to be a new carbon allotrope owing to its unique properties such as fast heterogeneous electron transport (HET) with rate transfer constants of both edge and basal planes being about the same unlike classical graphitic materials. At the 200μA.cm-2 extrapolation limit, GUITAR has a potential window of about 3.0V in aqueous electrolyte (1M H2SO4); comparable with those of doped diamond electrodes and way beyond graphite and metals such as platinum and or even metal oxides/metal oxide composite electrodes. Yet, unlike diamond and much like graphite it is almost entirely sp2 - hybridized. This properties are being exploited to replace platinum with

GUITAR electrodes in an insulator-based dielectrophoretic microchannel. Voltage effects which seem to generate the heat that compromise the integrity of biological cells would be averted as GUITAR seems to work well at very low voltage. It is also expected that the pulse field generated within the microchannel will be sufficient for the dielectrophoretic re-orientation of the associated erythrocytes. Biosensors would then be placed at the outlets of the channels to make a complete diagnostic tool for any cellular intra-erythrocytic deformity.

Green Algae from Coal Bed Methane Ponds as a Source of Fertilizer for Economically Important Plants of Montana
By: Olakunle Ogunsakin

Algae from the Coal Bed Methane (CBM) ponds of the Tongue River Basin in southeastern Montana have the potential to be utilized as fertilizer for use on the economically important plants of Montana. Two very important crop plants of Montana (winter wheat - Triticum aestivum and potatoes - Solanum tuberosum) were considered. To explore this fertilization potential, isolates of unicellular green algae (PW95) from the CBM ponds were cultured in the laboratory and the cells were concentrated using gravity sedimentation. The nutrient analysis of PW95 was determined. The concentrated algal slurry was added to seedlings of hard winter wheat, T.aestivum, grown in a greenhouse for three months and harvested.
When compared to control wheat grown with only water, or with water and a commercially available fertilizer, the PW95-fertilized wheat had a higher chlorophyll content, more tillers (side shoots), and a higher ratio of inflorescences (groups of flowers) per stem.
The results of this study suggest that PW95 from the CBM ponds may be a viable source of fertilizer for crops and other economically important plants of Montana and may contribute to the development of an economically important and locally obtainable product from the ponds

Modified Lead Titanate Thin Films for Uncooled Infrared Detection
By: Philip Chrostoski

Uncooled detectors are the class of infrared thermal detectors which do not require external cooling during their operation. Among other advantages uncooled detectors provide low cost thermal imaging and compact size. A pyroelectric detector is a class of uncooled thermal detector for which there is a change in spontaneous polarization. Absorption of infrared radiation in the sensing layer of pyroelectric detector causes a change in temperature and hence changes in spontaneous polarization which finally generates a voltage. This work presents the deposition and characterization of Calcium Lead Titanate thin films for using them as pyroelectric detector material. Capacitors of Calcium Lead Titanate thin films with Au electrodes were designed using Intellisuite software. Capacitors of various sizes were fabricated. The diameter of the electrodes for capacitor was varied between 400 um to 1100 um with 100 um increment. The distances between two electrodes were varied between 400 um to 1100 um with 100 um increment as well. On a 3 inch diameter cleaned silicon wafer, 20 nm thick Ti adhesion layer was deposited followed by a 100 nm thick Au layer. On top of this Au layer, 100 nm Calcium Lead Titanate thin films were deposited. Finally, 100 nm thick Au layer was deposited and lifted off by conventional photolithography to form the electrodes of capacitors. All the layers were deposited

by radio frequency sputtering at room temperature. The thin film samples are going to be annealed at temperatures between 350-700 Celsius with 50 Celsius increment in presence of Oxygen for 10 minutes. Morphology, crystal structure and electro-optical properties for Calcium Lead Titanate thin films are now being investigated in the laboratory and the results will be presented.

Assessing the Effects of Silver on Mosquito Larvae Growth
By: Sarah Nerette

Mosquito-borne diseases are endemic in over 100 developing countries and are the cause of death of nearly one million people every year (Rajakumar & Rahuman, 2011, p. 1). They are vectors of many diseases such as malaria, filariasis and dengue fever. Mosquito control is a serious concern in developing countries, mostly due to socioeconomic reasons and lack of awareness. Control methods that are affordable, effective and environmentally friendly need to be provided to regions lacking them. Silver nanoparticles, currently used in ceramic water purification tablets, are a known larvicide. Banu and Balasubramanian (2014), indicate that the mortality rate of mosquitoes is proportional to the concentration of silver, but is inversely proportional to the developmental stage of the mosquito. Research will determine whether silver ions released by ceramic water purification tablets could be used to destroy mosquito larvae.
The research will be conducted using the larvae of Aedes Aegypti, a carrier of the Zika virus, and Anopheles quadrimaculatus, a carrier of malaria. Various concentrations of silver, will be administered to the larvae. Each iteration of the experiment will alter a variable to observe whether similar results are achieved. Once these variables are stabilized, field conditions will be simulated by introducing ceramic water purification tablets and observing how the mosquitoes react to an increasing dose of silver over time versus the previously constant predetermined concentration. Current research indicates that synthesized nanoparticles have successfully destroyed mosquito larvae, albeit at concentrations higher than the drinking water standard of 0.1 mg/L or 100 ppb (Soni & Prakash, 2011, p. 175). There is currently no available research on the performance of silver nanoparticles as a larvicide at lower concentrations. The desired outcome is that ceramic water purification tablets will prove to be an effective larvacide at concentrations lower than the drinking water standard.

Utilizing Hybrid Polymer-protein Nanofibers to Promote Skeletal Muscle Tissue Development on an Instrumented Muscle-On-A-Chip
By: Sayo Eweje

Muscular thin film (MTF) devices recapitulate key structure-function relationships present in native muscle tissue, allowing for the study of healthy and diseased skeletal, cardiac, and smooth muscle. Recently, an instrumented cardiac microphysiological device that integrates soft strain gauge sensors with contractile cardiac tissue was developed. These sensors allow for high throughput electronic readouts of tissue contractile stresses upon cell stimulation, making the device ideal for extended studies of cellular development and drug response. To modify the instrumented MTF device so that it better recapitulates the native microenvironment of skeletal muscle, we introduced nanofibers to its substrate. We supplemented a superficial micro-molded

layer of polydimethylsiloxane (PDMS) on the device with a layer of polymer-protein nanofibers composed of poly-ε-caprolactone (PCL) and gelatin, which helped to promote cell adhesion and alignment, and ultimately allowed for the device to be used to study skeletal muscle. The fibers provide chemical, mechanical, and spatial cues analogous to those provided by the extracellular matrix (ECM) in vivo. These qualities make the nanofibers a fitting substrate for supporting skeletal muscle tissue development. Furthermore, we demonstrated that the device could be used to study the contractile development of these tissues.

Observations of Three Ringed Networks of BZ Droplets
By: Susan Okrah

Synchronization is a huge part of the cardiovascular system. When a person has a cardiac arrest or a heart murmur, the rhythm of their heart is changed. Because the heart is a complex network to study, we use a simpler network with similar qualities to study these patterns. The Belousov-Zhabotinsky reaction or BZ reaction is a nonlinear chemical oscillator. Just like the heart, BZ has a specific synchronization pattern. Over a period of time, this coupled oscillator continually changes from a red reduced state to a blue oxidized state. For this research, we wanted to observe a ring network of BZ. As a wave traveled in one direction in this network, we wanted to find a way to switch the direction of the wave by inhibiting a single drop. Using a microfluidic drop maker, droplets of a consistent size were then observed in one of two environments: capillaries or silicon chips. For capillaries, precut capillaries filled with these droplets were attached to a glass slide using an epoxy mixture. For silicon chips, the BZ droplets were carefully squeezed onto the desired etching, sealed with a glass slide and placed in a special clamping device. For both methods, observations were recorded using the Programmable Illumination Microscope, or PIM. In the capillaries, we observed two isolated rings spontaneously switch direction after two droplets in the ring simultaneously oscillated. In silicon chips, a new sloshing state was observed. Instead of completing a full cycle through all three droplets, the ring continually switches direction. As a future direction, we want to continue to engineer a method to control the direction of these rings. We also want to find and examine the parameters that cause the sloshing state to occur.

Exploiting Connectivity Structure for Online Selection of Primary Controlled Variables
By: Temitayo Bankole

Optimal selection of the primary controlled variables by considering plant economics as well as controllability is critical for optimal control structure design. Due to large number of candidate variables that lead to significant number of combinatorial possibilities even for small plants, online selection of primary controlled variables is computationally prohibitive. Once controlled variables are selected mostly heuristically, the selection rarely changes. In this work, we propose a novel methodology that exploits the structural connectivity of the plant to decompose the large-scale problem into smaller subsets making the controlled variable selection algorithm amenable to parallelization thus achieving solution within the target execution time.
For determining the changing connectivity among plant sections, we draw from the neuroscience literature where dynamic causal models (DCM) are used to determine connectivity among

cortical/sub-cortical areas using the fMRI responses. At a cortical level, the neuronal populations can be modelled as states that dynamically evoke brain responses as a function of inputs. Thus, by modeling islands of sub processes in a chemical plant as cortical/subcortical areas, the effective connectivity of these islands of sub processes can be extracted using bilinear approximation. These connectivity matrices can then be employed as a basis for controlled variable selection.
In this work, an approach to obtain the DCM for the chemical processes will be developed. The model parameters will embody intrinsic coupling among the states, describe the influence of extrinsic inputs on the states and as well as capture the effect of inputs on coupling. These information will be utilized to divide the plant into multiple sections. Finally the controlled variables will be implemented in the framework of a biomimetic control system for an integrated gasification combined cycle plant.

Synthesis of Degradable Polyester Elastomers
By: Violet Sheffey

Plastic waste contamination has become an increasingly global dilemma. In order to combat the effects of non-degradable plastics on our environment, methods to synthesize degradable cross-linked elastomers have been developed. The objective is for these polyester elastomers to compete with conventional elastomers (e.g. rubber bands) in terms of mechanical performance.
Post polymerization cross-linking was used to afford films of varying molecular weights (approx. 10, 20, and 30 kg/mol). It has been demonstrated that the mechanism for film synthesis does not require a catalyst. Also, the effects of varying the amount of carbonate functional groups from the cross-linking agent to the amount of hydroxyl groups present in the polymer were explored. It was found that varying these stoichiometric ratios had profound effects on the degree of cross-linking of the film samples up until a ratio of 2:1.
Ongoing work with these polyester elastomers includes scaling up the film synthesis to films of larger diameters and obtaining mechanical property data. This data shall then be compared against that of a conventional rubber band. Future work shall also revolve around blending polymers of differing molar masses into a single film and the studying the subsequent effects of the resulting mechanical properties thereof.

Showcase Poster Competition Abstracts

Structural and Chemical Changes of Hydrothermally Treated Biomass During Synthesis and Activation
By: Avery Brown

Hydrothermal chars (hydrochars) are carbonaceous solids made from thermal treatment of biomass, in liquid solutions under pressure at temperatures ranging from 180 to 350°C. Hydrothermal carbonization as a biomass treatment method is a relatively new area of study, with the bulk of research starting over the last decade. Hydrothermal char is being investigated for applications such as soil amendment, catalysis, and as a solid fuel. However its most promising application is as an adsorbent for metal contaminants in water. The availability of

clean water is a pressing concern in developed and developing nations, and activated carbons have often been investigated as a means of clearing contaminants from drinkable water. However the cost involved has prevented activated carbons from being used in municipal water plants as a part of the Safe drinking water act in 1974. I plan investigate the synthesis and activation of hydrothermal char to determine if the reactions and activation methods can be tuned to produce a cost effective metal adsorbent. A Raman fitting method has been developed to characterize changes in the structure of hydrochar, and several physical characterization methods will be employed to quantify changes in the physical and chemical properties of the hydrothermal chars. We seek to explore ball-milling as cost effective activation method, and finally popular activation and char synthesis methods will be compared to determine the most effective method of preparing an activated carbon from hydrothermal char, for the purpose of metal adsorption.

Estimating Service Areas for Farmer's Markets in Southeastern North Carolina Using a Spatial Interaction Model
By: Chibuike Madumere

Food security is the assurance and invulnerability associated with adequate access to healthy, affordable and sufficient food within an area or a population. This certainty averts the consequences of food related health issues but on the contrary, inequitable access to various food sources and the overabundance of health ailments are directly related to obesity and poor diet. The term food desert, which expresses areas far from healthy food sources has gained popularity in research and popular literature. Spatial Interactions Models can help explain the relationship between populations and one cohort of the food environment, Farmers' markets. One form of spatial interaction model, a gravity model, describes the draw between a population and a farmers' market to be a function of weights attached to the population at the block group level (source), the attractiveness of the Farmers' market (destination) and the travel time between them. This can be done within the confines of ArcGIS with the help of reconciling each farmers' market with the service areas that are accrued to it.
In this project, we develop GIS data to locate Farmers' markets within an 11 county region in Southeast North Carolina and later determine weight for each Farmers' market based on the type and/or produce it offers as well as the days per year it is open. In doing this, we can determine which farmers' markets have the most desirability using the specifications that we determine that can be utilized for this piece of the gravity model. Using this model and ground truthing to parameterize this model, this can lead to an increased understanding of the push and pull factors that determine spatial patterns of farmers' market patronage and service areas, just one factor in the assessment and evaluation of food deserts.

Comparison of High Bypass Turbofan Engine Cycle Analyses – A Case Study
By: Christopher Roper

The study includes comparison of high bypass ratio turbofan engine analytical performance and experimental engine test bench results. Variations in variables such as altitude, throttle setting, and freestream velocity are explored and their effect on the engine performance at various stages is analyzed to determine thrust force, thermal efficiency, propulsion efficiency and total

efficiency.
This research involves conducting a comparison of a high-bypass ratio turbofan engine simulated on a test bench and parametric cycle analysis of the same engine. The results from these methods of data collection are meant to analyze correlation between the two methods of performing turbine engine cycle analysis. Test bench data is acquired using the Price Induction® engine test bench and is verified with the analytical parametric cycle analysis to calculate the thrust and efficiency. The purpose of this research is to gather data on gas turbofan engines from the Price Induction test bench (simulation) and compute the corresponding parameters the turbofan engine analytically. The test bench uses varying environmental conditions that can be used to collect engine performance data from the simulator. Some of the data collected from the simulator are thrust, efficiency, and pressures/temperatures at specific components in the turbofan engine. Computer Aided Design (CAD) models are generated using SolidWorks. As part of this on-going research, the team will perform CFD analyses at the component level of the turbofan engine. The analytical aspect of this research includes solving a combination of equations that compute specific parameters for different parts of the engine at different flight conditions with the ultimate goal of computing the overall thrust and efficiency. The gas turbofan engine that is used in the Price Induction Test Bench is the DGEN 380 engine. This engine is designed for small private aircraft.

Water You Consuming? An Analysis of Trace Metals in Fish and Water in Bolivia
By: Danielle Holt

Mining has played a huge role in the economy of Bolivia since its colonization in the 17th century. Smelting, a process used in artisanal small-scale gold mining (ASGM), and mining for other minerals uses mercury (Hg) as a key component of these processes. This often results in Hg being released into the atmosphere or entering waterways where it eventually makes it into the atmosphere by way of volatilization. One way to analyze the Hg levels within a particular environment is to assess the levels of atmospheric inorganic mercury. The primary portion of the study focused on the levels of mercury in fish at local markets in Bolivia and the health risk consuming this fish poses to the native population.

Blood Bots
By: David Kargbo

The future of biotechnological medicine is here! Blood bots is a proposed technology by David Kargbo in aims to improve the lives of billions of people. The goal in sight is to have nano-scale computerized bots in our cells of the body, that can aid to maintain healthy homeostasis. Research fields include MicroElectroMechanical Systems (MEMS), NanoElectroMechanical Systems(NEMS), cancer, blood separation and blood doping, silicate and diamond crystal doping, carbon nanotube aromatics, cell structure, and protein structure. Also in regards to MEMS, mechanical engineering, bioengineering, and electrical engineering.
These proposed robots will include research on their composition, what it will take to build them, how they will enter the body, their functionality, costs on parts, different diseases which they can target, programming capabilities, cell locations for attachment (pericytes, mitochondria, cell

membrane essentially), possible epigenetic functioning, remote control, and excavation out of the body and recycling.

Surface Effects on Nitrogen Vacancy Centers Neutralization in Diamond
By: Dontray Dowdell

The performance of nitrogen vacancy (NV−) based magnetic sensors strongly depends on the stability of nitrogen vacancy centers near the diamond surface. The sensitivity of magnetic field detection is diminished as the NV− turns into the neutralized charge state NV0. We investigate the neutralization of NV− and calculate the ratio of NV0 to total NV (NV−+NV0) caused by a hydrogen terminated diamond with a surface water layer. We find that NV− neutralization exhibits two distinct regions: near the surface, where the NV− is completely neutralized, and in the bulk, where the\ neutralization ratio is inversely proportional to depth following the electrostatic force law. In addition, small changes in concentration can lead to large differences in neutralization behavior. This phenomenon allows one to carefully control the concentration to decrease the NV− neutralization. The presence of nitrogen dopant greatly reduces NV− neutralization as the nitrogen ionizes in preference to NV− neutralization at the same depth. The water layer pH also affects neutralization. If the pH is very low due to cleaning agent residue, then we see a change in the band bending and the reduction of the 2-dimensional hole gas (DHG) region. Finally, we find that dissolved carbon dioxide resulting from direct contact with the atmosphere at room temperature hardly affects the NV− neutralization.

ActivityAware: An App for Real-Time Daily Activity Level Monitoring on the Amulet Wrist-Worn Device
By: George Boateng

Physical activity helps reduce the risk of cardiovascular disease, hypertension and obesity. The ability to monitor a person's daily activity level can inform self-management of physical activity and related interventions. For older adults with obesity, the importance of regular, physical activity is critical to reduce the risk of long-term disability. In this work, we present ActivityAware, an application on the Amulet wrist-worn device that measures daily activity levels (sedentary, moderate and vigorous) of individuals, continuously and in real-time. The app implements an activity-level detection model, continuously collects acceleration data on the Amulet, classifies the current activity level, updates the day's accumulated time spent at that activity level, logs the data for later analysis, and displays the results on the screen. We developed an activity-level detection model using a Support Vector Machine (SVM). We trained our classifiers using data from a user study, where subjects performed the following physical activities: sit, stand, lay down, walk and run. With 10- fold cross validation and leave-one-subject-out (LOSO) cross validation, we obtained preliminary results that suggest accuracies up to 98%, for n=14 subjects. Testing the ActivityAware app revealed a projected battery life of up to 4 weeks before needing to recharge. The results are promising, indicating that the app may be used for activity-level monitoring, and eventually for the development of interventions that could improve the health of individuals.

Community Engagement and Engineering Interventions in Communities of Color through Participatory Research
By: Harold J. Rickenbacker

Exposure to air pollution is the fourth largest human health threat worldwide, contributing to the premature death of 6.5 million people per year (WHO 2016). But while premature deaths often make news headlines, exposure to air pollution also exacerbates upper respiratory ailments in communities that live and work in close proximity to major highways and industrial sites. Moreover, hundreds of studies document a higher burden of ecological contamination from industrial and consumer practices in communities of color, which results in crippling health disparities and economic disinvestment that plague these communities for generations to come (Mohai et al., 2009). The goal of our research is to promote developing areas of air quality research through citizen science and civic engagement strategies in the East End of Pittsburgh, PA. We are developing and enhancing the Environmental Justice Community Alert Matrix (EJCAM) to educate and inform vulnerable populations about environmental risks related to air quality, and to further provide residents with the practical responses to mitigate these risks. For our citizen science component, we have developed and implemented a mobile air monitoring bicycle campaign; Dylos air quality monitors were retrofitted to bicycles and used to produce predictive GIS maps of particulate matter dispersion, identifying potential source points and hotspots that may contribute to declining resident health. For civic engagement and training, we have spearheaded the Urban Transition Cities Movement (UTCM) and Community Action Team (CAT) workshops designed to mobilize residents through pre- and post-education techniques that incorporate the longer-term efficacy of multifaceted engineering approaches. Follow-up assessments determine a statistical significance in the difference of the means ($p < 0.05$), defining quantitative measures of success and growth in green literacy.

A New Approach in Separating Salt Water from Oil in Deep-sea Applications
By: Kevin Bultongez

Oil-water flow regimes were studied in 2.1-mm and 3.7-mm borosilicate glass tubes in order to investigate the effects of surface tension on oil and water flows, as both tubes exhibit Eötvös numbers less than one. A closed-loop, adiabatic experimental apparatus was constructed and validated using water. This study focused on tap water and two mineral oils (i.e., Parol 70 and 100) with a density of 840 kg/m3 but a factor of two difference in viscosity. Experiments included a wide range of oil superficial velocities (e.g., 0.84–6.84 m/s for D=2.1 mm and 0.27–3.30 m/s for D=3.7 mm) and water superficial velocities (e.g., 0.21–7.69 m/s for D=2.1 mm and 0.07–4.96 m/s for D= 3.7 mm). Stratified, annular, intermittent, and dispersed flow regimes were observed in both tubes, although the annular flow regime was more prevalent in the smaller tube. Pressure drops increased with decreasing tube diameter and were flow regime dependent. Flow maps were created for these mini-channels and equations adapted from Brauner and Maron (1999) were used to predict the flow regime transitions. The effects of viscosity were modest, although increased oil viscosity enhanced stability of oil-water flows.

Simulation of Copper Indium Diselenide (CIS) Nanoclusters for Hybrid Solar Cells Using Density Functional Theory and Time-dependent Density Functional Theory
By: Marcus Barboza

In solar cells, copper indium diselenide (CIS) is a versatile material that has been recognized as one of the most efficient photon absorbers. Using computational chemistry, this work will investigate the stability of various CIS nanoclusters as well as examine the effects of cluster size on its physical, electrical, and optical properties. The ultimate goal is to use this information to guide synthesis of these clusters in the laboratory. We seek to simulate CIS nanoclusters using software such as Q-Chem and IQmol. If we succeed in optimizing the nanoclusters using our simulations, this will provide a possible synthesis approach for CIS nanoclusters to be used in the fabrication of hybrid solar cells. This project introduces us to the different software tools that can be used to implement density functional theory (DFT) and time-dependent density functional theory (TDDFT). In our work, DFT is used to calculate the ground state energy that represents the optimized geometric structures of the nanoclusters, while TDDFT is used to examine the optical properties. Since part of the mission of Brookhaven National Laboratories and the Department of Energy is the advancement of nanomaterials science for sustainable energy, this work supports this mission by expanding understanding of nanomaterials used in hybrid solar cells. This project also teaches us quantum chemistry, computational materials science, and general computational theory. Additionally, it promotes our understanding of chemistry, physics, and materials science as strongly interdisciplinary areas of science.

Comparative Slow Pyrolysis Kinetics of Herbaceous Feedstock
By: Michael Adenson

Biomass pyrolysis is one of the renewable and sustainable energy sources that will ensure the world's energy demand is continuously met despite the inevitable dwindling of fossil energy stock and reserve. This work considered the study of thermal decomposition of four herbaceous crops using thermogravimetric analysis. Pyrolysis of alfalfa, sorghum-sudangrass, switchgrass, and tall fescue were performed at heating rates of 5, 10, 30, and 50 K/min in an inert atmosphere of nitrogen from room temperature and 1273 K. To describe the decomposition of whole biomass at high temperatures, global kinetic parameters were estimated using a multi-component model in which three main biomass components, cellulose, hemicellulose and lignin, were modeled as partial processes. Results show that this multi-component model adequately reproduces experimental rate curves, and is flexible enough to describe global mass loss events for a range of biomass feedstock each with unique characteristics. Uniquely, the kinetic parameter search was done using a newly proposed multi-start global optimization strategy which ensures the global or true kinetic parameters were obtained.

Enhancement of Thermal Conductance in Silicon Dioxide Nanoparticles as a Replacement Material for Insulators in Mobile Electronic Systems
By: Natasha Rouse

There is a rising need for thermally smart materials that respond to widely varying heat transfer

requirements within mobile electronic systems. For example, self-regulating materials can replace coatings currently used to thermally and electrically insulate lithium-ion batteries in mobile devices. If insulators are slightly damaged, electrical isolation may be compromised while thermal insulation is maintained, leading to short-circuit heat generation and potentially catastrophic temperature rises. Therefore, a battery insulation material that can change its properties from thermally insulating to strongly conducting at high temperatures will enhance the safety and performance of mobile electronic systems. Our research argues that silicon dioxide nanoparticles could be one of these thermally smart materials. A nanoparticle chain is formed by mounting nanoparticles in an intermediate material which plays a part in the conductance of the nanoparticles. We predict that the thermal conductance of a silicon dioxide nanoparticle chain could be increased by a factor of ten depending on the temperature of the intermediate material. To explain this dramatic increase, we note that thermal radiation dominates heat transfer, and modeled the radiation between the nanoparticles as long-range electric fields that arise due to dipole-dipole interactions. We show that enhancement of the dipole-dipole interactions is caused by small changes in the intermediate material permittivity, and thus the dramatic increase in thermal radiation. Our theoretical modelling shows that the temperature, permittivity and distance between silicon dioxide nanoparticles can also be adjusted to dramatically tune the thermal conductance along a nanoparticle chain. This model holds true for quasi-static cases where the nanoparticle diameter is less than 100nm and where thermal radiation dominates.

Application of Demand Response for Sustainable Green Energy
By: Olayinka Obafemi

The purpose of this paper is to introduce an alternative and more effective way in maximizing the operational planning of the output of power that a PV/Battery system provides. The determination method of charge/discharge amount for the battery of an electric vehicle as a demand response is another great approach. This method focuses on the benefits of selling electrical power by finding the best way of meeting all the customer's demand and at the same time maximizing the consumption of power output. There are various ways to approach this system. This paper will emphasize the operational planning from supplier to distribution to end-user, introducing incentive methods to encourage maximum participation from all involved parties, while the goal is to meet demand with response and also limiting the wastefulness of all resources invested in the system.

High-Resolution Rock Magnetic and Paleointensity Study of Sediments from IODP Site U1389 (West Iberian Margin of the North Atlantic Ocean)
By: Oludamilola Adesiyun

High resolution rock magnetic and paleomagnetic data from a section spanning 36 to 107 meters composite depth of the Integrated Ocean Drilling Program (IODP) Site U1389 are discussed. Site U1389 is located in the North Atlantic Ocean at 36° 25.515'N; 7° 16.683'W in 644 m water depth. The main overall objective is to study the Mediterranean Outflow Water (MOW) and its effects on the short term and long term climate and contourite system of the Iberian margin over the past six million years. The sedimentary section at Site U1389 consists of a thick and

consistent succession of contouritic sediments with sedimentation rates of ~40 cm/kyr. The age model was obtained by tuning planktonic foraminifera oxygen isotope data to the NGRIP ice core record. Through alternating field (AF) demagnetization of the natural remanent magnetization (NRM), the characteristic remanent magnetization is isolated while the low stability component is removed. The average maximum angular deviation, calculated from the principal component analysis ~1.2°, illustrates the excellent quality of the preserved magnetic signal. Consistent behavior of the magnetic samples during AF demagnetization and acquisition curves of the isothermal remanent magnetization suggests magnetite as the main magnetic carrier mineral. By normalizing the NRM by the anhysteretic remanent magnetization, isothermal remanent magnetization, and magnetic susceptibility, the relative paleointensity (RPI) was calculated. RPI records from Site U1389 conforms to the desirable attributes of relative paleointensity criteria (e.g. Tauxe, 1993); hence, Site U1389 may be used for future global relative intensity correlation. Qualitative analysis of the RPI proxies and the RPI normalizers are presented with the aim of determining the driver of environmental change.

Game Theory: An Application to the Prisoner's Dilemma
By: Prince Osei Aboagye

This project looks at what Game theory is, the definition for games in normal-form as well as the matrix representation of two-player finite games. It looks further at the famous Prisoner's Dilemma game and how the conflict between social incentive to cooperate and private incentive to defect can be resolved.

Autonomous RC Car Using Pi Control and Computer Vision Techniques
By: Sam Epeagba

The purpose of this experiment was to control our motor speed performance using feedback from Encoders and PI control. The techniques learned throughout this experiment can be applied to the growing field of motor vehicle autonomy. We developed a way for a motor to vary its rate of rotation based on environmental cues. We used various methods gathered through mechatronics labs to enhance our research. We studied PWM, Arduino C++ functions, transistors, H-bridge schematics and PID controllers under the guidance of our advising professor. Initially, we used an PNP transistor which acted as a switch to provide current to our motors. We then started using H-bridge chips as our primary way of switching the motor polarity through simple Arduino C++ programming. This lead us into finding ways to control our motor based on environmental obstructions. We started with an ultrasonic sensor to detect distance and reduce the motor speed if an object is nearby. Our next step was to use this sensor information along with our output motor operation characteristics to create a PI controller inside of our Arduino code. This controller uses the formula, Verror= Vset - Vsensor, to calculate error. This error is then used to correct our system using both Proportional and integral terms. We next implemented a raspberry

pi and camera module to detect lanes on an artificial road model we created in our lab. We then modified an RC car to include both our pi controller and the camera module to detect and avoid objects. These steps and processes allowed us to produce a system that will reach a set desired speed and avoid obstacles based on sensor values feed back into the system.

Photocatalytic Conversion of CO2 and H2O to Higher Value Products
By: Selisa Rollins

Over the years, the increasing demand for fossil fuels and its contribution to atmospheric carbon dioxide (CO2) emissions has raised concerns about its effect on future energy supply and global climate change. The light initiated conversion of CO2 to higher value products is an attractive and promising solution to addressing these challenges. Ever since the first report of water (H2O) splitting over titania (TiO2) in the presence of ultraviolet (UV) light, heterogeneous photocatalysis using TiO2 has grown to become a widely studied and heavily researched area. Nonetheless, the use of TiO2 for the conversion of CO2 is significantly limited due to its rapid electron–hole pair recombination rate. The incorporation of functionalized reduced graphite oxide (RGO) as a support for TiO2 serves as a practical approach to overcoming this challenge. Herein, we obtained a TiO2/ionic liquid functionalized RGO (TiO2/IL-RGO) nanocomposite employing a facile one-step hydrothermal method. The photocatalytic reduction of CO2 in the presence of H2O vapor was studied in a custom-designed cylindrical photoreactor system using commercial TiO2 and the synthesized TiO2/IL-RGO photocatalyst at room temperature. A gas chromatograph (GC) coupled with a vacuum ultraviolet (VUV) detector was utilized to analyze the formation of gas phase products derived from CO2 photoreduction over these TiO2 materials in the presence of H2O vapor. Illumination of the catalysts with UV light led to a decrease in CO2 and a corresponding increase in carbon monoxide (CO). After two hours of UV illumination, the production of CO over TiO2/IL-RGO was found to be significantly greater than the production of CO over commercial TiO2. The results obtained from this study suggest the TiO2/IL-RGO nanocomposite significantly drives the production rate of products from CO2 photoreduction. For broader scale utilization, the prepared composite has a significant operational advantage over commercial TiO2 for real world applications (coal-fired power plants) that employ CO2 capture and conversion.

Two Different Stretching Methods of Carbon Nanotube Sheets (Buckypaper) and Their Relationship in Inducing High Mechanical Properties
By: Sofia Garcia

Mechanical stretching of random carbon nanotube (CNT) networks within CNT sheets, or Buckypaper (BP), leads to very high alignment of such nanotube networks, substantially enhancing the material's mechanical properties. In order to do so, stretching medias for the dry BP are used in this project, which include an inorganic solution to assist BP stretching, and a resin to assist BP prepreg stretching. The stretch ratios of Buckypaper vary directly with the stretching media used resulting in 40%, 60%, and 80% stretched respectively. Mechanical stretching thus produces a unique phenomenon of strain hardening that corresponds to the alignment degree, and produces a more mechanically developed material. Once the aligned BP composite is produced, the CNT alignment degree was characterized by Raman microscopy and

the mechanical properties and failure modes of stretched BP tapes and its composites were evaluated. It is an affordable, scalable, and efficient method in terms of production capacity and product size.

Validation of a Galectin-8 Reporter as a Measure of Nanocarrier Endosomal Escape and Biologic Drug Intracellular Bioavailability
By: Somtochukwu Dimobi

Introduction: Endosomal escape is a critical step in the delivery of intracellularly active biomacromolecules, such as nucleic acids, peptides, and proteins. Here, we sought to validate a Gal8 recruitment-based assay as a direct measure of endosome escape and predictor of biologic drug intracellular bioactivity (siRNA gene silencing).
Materials and Methods: Two polymer libraries, PEG-(DMAEMA-co-BMA)[PEG-DB] with varying mol%BMA composition and 50mol% BMA PEG-DB with varying molecular weight, were synthesized with RAFT polymerization. Polymers were complexed with siRNA into si-NPs, and analyzed for pH-dependent membrane disruption (hemolysis assay), endosome disruption in living cells (Gal8-YFP recruitment assays), cell viability, and knockdown bioactivity (luciferase assay).

Incorporation of Silver Nanoparticles in Electrospun Fiber Mat to Increase Antimicrobial Activity
By: Stephen Benn

There is a need for functional biomaterials that can significantly improve the repair of critically sized defects in the extremities of warfighters. Shape memory polymers (SMPs) have been attracting increasing attention because they are a class of smart materials that can be manipulated and fixed in a temporary shape and later recover back to their permanent shape on command. Previously, our lab custom-synthesized a thermoplastic polyurethane (TPU) and demonstrated fabrication of an electrospun 3D scaffold that can recover under simulated physiological conditions. This functionality of the shape-memory scaffold is currently being used to produce a biomaterial sleeve that can be triggered to contract for the purpose of stabilizing a bone defect site. In recent efforts toward this goal, implantation of electrospun fiber mats in vivo resulted in bacterial infection around the site of defect in more than 50% of treated mice. With the long-term goal of preventing or curing such infections, the purpose of the present study was to incorporate silver nanoparticles (AgNPs), a well-known antibiotic, to provide antibacterial properties to the SMP device. The approach to achieve this goal is to use an agar diffusion test, an in vitro bacterial assay that measures the dead zone of bacteria by immersing the sleeve treated with AgNPs in a plate filled with bacteria, to assess how effectively the material inhibits bacterial growth and also to investigate the release profile of AgNPs to understand for how long the nanomembrane will be effective in preventing infections.

A Systematic Approach to Derivation of Nuclear Forces: Chiral Effective Field Theory
By: Yevgen Nosyk

There are four known fundamental forces in nature: electromagnetic, strong, weak and gravity. Among other things, strong interactions are vital for holding nucleons (protons and neutrons) together inside the nucleus against repulsive Coulomb's force of electromagnetic nature. We discuss the basic ideas behind the strong interaction and different approaches to deriving this force. In the past few decades, the fundamental theory for strong interaction was developed, which involves quarks and gluons and is known as Quantum Chromodynamics (QCD). It has been successfully applied and verified for high-energy processes. However, for the low energies typical for nuclear physics, QCD defies standard methods of analytical solution. Recent attempts to numerically solve the equations of QCD in the low energy limit are increasingly successful ("lattice QCD"). However, due to the high complexity, only simple systems consisting of very few quarks can be calculated that way. The alternative approach is Chiral Effective Field Theory, which is a low-energy version of QCD. I will present the current status of this approach up to fifth order.

A Closer Look at the Self-Correcting Crowd: Examining Corrections in Online Rumors
By: Zena Getachew

This paper examines how users of social media correct online rumors during crisis events. Focusing on Twitter, we identify different patterns of information correcting behaviors and describe the actions, motivations, rationalizations and experiences of people who exhibited them. To do this, we analyze digital traces across two separate crisis events and interviews of fifteen individuals who generated some of those traces. Salient themes ensuing from this work help us describe: 1) different mechanisms of corrective action with respect to who gets corrected and how; 2) how responsibility is positioned for verifying and correcting information; and 3) how users' imagined audience influences their corrective strategy. We synthesize these three components into a preliminary model and explore the role of imagined audiences—both who those audiences are and how they react to and interact with shared information—in shaping users' decisions about whether and how to correct rumors.

About the Presenters

1. Abdul-Malik Davies is a graduating senior majoring in Chemical Engineering at the University at Buffalo. He is the Chapter Senator of the UB NSBE chapter. Malik is passionate about raising awareness for environmental sustainability and plans to pursue a professional career upon graduation.
2. Abdulafeez Adebiyi is a second year PhD candidate in mechanical engineering at West Virginia University. His PhD research area is on flame propagation of hydrocarbon fuels in both atmospheric and supercritical conditions.
3. Adegbola Balogun is currently pursuing Master's degree in Chemical Engineering at Texas A&M University-Kingsville and he is the president of the NSBE TAMUK Chapter.

4. Aditya Patil is second year graduate student in electrical engineering department at New Mexico State University. Currently he is working on his thesis specializing in power management IC. He also has two years of industrial experience where he worked as R&D engineer.
5. Anthony Williams Rivera is a third year undergraduate in Electrical Engineering. He his currently working on research in Biomedical Engineering and Image/Video Processing.
6. Antonio Funding is a fourth year undergraduate in Information Technology at Delaware State University. He is very active on campus being a Senior Resident Assistant, and working for the Marketing Department at Delaware State University.
7. Anuoluwapo Olubode is a senior at the University of Virginia, originally from Hanover, Maryland. This spring she will receive her B.S in Nanomedicine Engineering.
8. Avery Brown is a Ph.D student in chemical engineering at WPI. Growing up, he was taught that if you wanted to know the answer to a question you should look it up, this fostered in him an intellectual curiosity that has served him very well in life and as a researcher.
9. Ayobami Adegbite is a PhD student in the Environmental Science program at the University of Idaho. He is presently working on the impacts of earthworms on the degradation of different herbicides in the soil.
10. Bethany Gordon is a fourth year undergraduate in the Civil Engineering department at the University of Virginia. Her research interests include Sustainable Design and Structural Health Monitoring in the context of developing countries.
11. Chaance Graves is a Senior at Texas A&M University, majoring in Electrical Engineering with a minor in Mathematics. He is an Undergraduate Research Scholar and serves as president of the TAMU NSBE chapter.
12. Chibuike Madumere has a bachelor's degree in Civil Engineering and over 4 years of demonstrated experience in both engineering and currently, environmental science field. He is currently a masters student in Environmental, Earth and Geospatial Science, with a major in Geography and Informational Science.
13. Christian Joseph is a second year undergraduate student at Columbia University studying Materials Science and Engineering. He is currently working in Owen Chemistry lab preparing precursor materials for Cadmium Selenide Quantum dots.
14. Christopher Roper is a senior engineering and physics student enrolled in a dual-degree bachelors program. Double majoring in physics and mechanical engineering, minoring in aerospace engineering and mathematics. Expertise in performing scientific applications as an intern, researcher, coop, and inventor.
15. Danielle Holt is a sophomore undergraduate at Duke University pursuing a degree in environmental engineering. She hails from Baltimore, MD, and serves as Duke's NSBE chapter secretary. She is interested in pursuing employment in renewable energy, possibly with a focus in international development.
16. David Kargbo is an fourth year student at Temple University. He plans on finding work doing research on biotechnology because he is very interested in the field. He is a biology major and is working towards bridging the science engineering gap.
17. Denean Kelson is a graduate student in Industrial and Systems Engineering at Virginia Tech. With a specialization in Human Factors Engineering and Ergonomics, Denean has research interests in upper extremity ergonomics, muscle variability and neuroergonomics.

18. Derius Galvez is currently seeking a master's in Aerospace Engineering from Mississippi State University. His thesis focus is on the bio-inspired design of unmanned aerial vehicles. Modeling the serrations from an owl wing, Derius plans to create an UAV that mimics the gliding flight of an owl.
19. Deshaun Crawford is a fourth year undergraduate student pursuing a BS in Computer Science and he will graduate in May 2017. He is also a Computer Science teaching assistant at Delaware State University. In addition, Deshaun has gained experience through summer internships at Apple and NASA.
20. Dontray Dowdell is a senior at Delaware State University , pursuing a degree in engineering physics with a minor in mathematics.
21. Ean Hall is currently a Senior at North Carolina A&T State University. He is studying Mechanical Engineering and he has the goal of seeking a Master's degree in Robotics upon graduation. He currently resides as the 2016-2017 President for his Toastmasters chapter.
22. Emmanuel Ijezie is a third year undergraduate studying molecular biology and biotechnology. He currently works in an immunology lab at the University of Idaho as a research assistant. His life goal is to become a clinical virologist.
23. Erin Edler is an fourth year undergraduate in Engineering Science at the University of Virginia, with concentrations in Systems Engineering, Environmental Science, and Technology and the Environment. She plans to continue her education on the graduate level in either Systems Engineering or Marine Science.
24. Ezekiel Adekanmbi is a graduate student at the Department of Chemical and Materials Engineering, University of Idaho. He obtained his Bachelor of Science degree in Chemical Engineering from the University of Lagos, Nigeria. He applies dielectrophoresis for disease diagnostics in human.
25. Gbolahan Idowu is a second year graduate student in Mechanical Engineering at West Virginia University. He grew up in Lagos, Nigeria where he completed his High School education, before moving to the U.S in 2009 to pursue a Bachelor's degree in Petroleum Engineering.
26. George Boateng is a first year graduate student at Dartmouth's Thayer School of Engineering pursuing a Master's degree in Computer Engineering. His research is focused on developing mobile health applications on wearables to improve the health of people.
27. Harold J. Rickenbacker is a third year PhD student in Civil & Environmental Engineering at the University of Pittsburgh. His graduate research focuses on indoor and ambient air quality, working to quantify the impact energy conservation strategies have on regional air quality improvements.
28. Janelle Boyd is a fourth year undergraduate student in Computer Science at Delaware State University. Designer, student, and software engineer, she is a 2015 Google Scholar and after graduation, she plans to obtain her Master's degree in HCI while pursuing a career at Microsoft.
29. Jasmine Jones is a fourth year undergraduate student in Materials Science and Engineering at the Ohio State University. She currently serves as the secretary for the OSU NSBE chapter. Her focus is to design an ideal combination of synthetic and biological materials to increase the quality of life for all.
30. JayVaun Young is a fourth year undergraduate student at Delaware State university in

computer science. He works as a student researcher in the Optic Science Center for Applied Research(OSCAR) under the advisement of Dr. Mohammad Khan. His work is on the development of wireless greenhouse gas sensor networks.

31. Jeremy Nortey is a third year undergraduate student at North Carolina State University. He is studying Biomedical Engineering with plans to attend medical school.
32. Joshua Koepke is a fourth year undergraduate student in Chemical Engineering, with a concentration in Chemical Process, at the University of New Mexico. He plans to attend graduate school as a Mechanical/Material Engineer.
33. Kadeem Morrison is a fifth year undergraduate student in Packaging Engineering, with a minor in Materials Science, at the University of Florida. His interests lie in the polymers' applications to packaging. His research focuses on amorphous polymers adsorption.
34. Kevin Bultongez is a master's student in Mechanical Engineering at Kansas State University. He has a passion for energy and looks forward to use his engineering intellect to benefit society through renewable energy.
35. Khira Momodu is a senior undergraduate student in Industrial Engineering at Arizona State. Her research interests include computer science education and computer-based learning environments. She is currently working on a mobile application for middle school girls of color.
36. Krystal M. Folkes is a senior undergraduate student in Computer Engineering,minoring in Information Technology at the University of Central Florida. She is from Riviera Beach, Florida.
37. Malik Oliver is an undergraduate in Chemistry at Fayetteville State University. He is currently working full time at MIT Lincoln Laboratory as a chemical engineering specialist where he supports research in engineering and analytics for chem/bio defense systems.
38. Marcus Barboza is a senior undergraduate student in Physics, with a minor in Mathematics at The Lincoln University of Pennsylvania. His current focus is towards mechanical engineering and aeronautical concentrations.
39. Michael Adenson is a PhD candidate in Chemical Engineering at Tennessee Technological University. He specializes in renewable energy research including fuel cell and biomass pyrolysis. His works combines the use of experimental and computations at nano, micro and macro-scales.
40. Miracle Rogers is an undergraduate student in Health Exercise Science and Bioengineering, with a minor in Dance, on the Pre-Medical track, at Syracuse University. She conducts research on Skin Cells at the Syracuse Biomaterials Institute. She is the NSBE SU Chapter President Emeritus and Miss NSBE.
41. Monsuru Abass is a graduate student at Kansas State University, KS. His current research focuses on synthesis and characterization of nanomaterials for electrochemical energy storage such as batteries and supercapacitors.
42. Myly Fabre is an undergraduate student in Chemical Engineering with an emphasis in polymer sciences at Miami Dade College. Beside her involvement in science, she is a painter, a passionate of languages and spend tremendous hours design and coding.
43. Natasha Rouse is a third year undergraduate in Mechanical Engineering at Howard University. Since April 2016, she has assisted Dr. James Hammonds in his research on thermal transport in nanostructured systems, particularly modelling this transport in silicon dioxide nanoparticle chains.

44. Okechukwu Nwamba is a graduate student in Chemistry at the University of Idaho. His thesis research is on the use of a new carbon allotrope for water purification.
45. Olakunle Ogunsakin is a graduate student in Environmental Engineering at Montana Tech -Butte. Prior to graduate school, Kunle worked as a Quality and Project engineer and was mobilized on multimillion-dollar engineering design projects for multinational Oil and Gas companies.
46. Oludamilola Adesiyun is a graduate student in Civil Engineering. She obtained her Master's Degree in Geology from The University of Louisiana at Lafayette in December 2016.
47. Olayinka Obafemi is a first year graduate student in Industrial, Manufacturing and Systems Engineering at the University of Texas at El Paso. He received his bachelors in Electrical Engineering in December 2012 at UTEP, and shortly after, he worked for Halliburton.
48. Philip Chrostosk is a first year PhD student in Optics at Delaware State University. He received his Bachelor's Degree in Physics from Southern Illinois University - Edwardsville. He is currently researching modified lead titanate thin films for infrared detectors.
49. Prince Osei Aboagye is a first year graduate student in Applied Mathematics at the University of Texas at El paso (UTEP). Prior to his enrollment at UTEP, he obtained a Bachelor of Arts degree in Economics and Mathematics from the University of Ghana, Legon.
50. Sam Epeagba is a third year undergraduate student in Electrical Engineering. He plans to pursue either biomedical engineering or computer science in graduate school. He currently works at Gatech Research Institute in the Electronic systems laboratory.
51. Sarah Nerette is a fourth year undergraduate student in Civil Engineering, with minors in Engineering Business and Global Sustainability and on the Water and Environmental Resources track, at the University of Virginia. She plans to attend graduate school for a Sustainability degree.
52. Sayo Eweje is a second year undergraduate student in Bioengineering at Harvard College. Sayo is the social chair of the Harvard Society of Black Scientists and Engineers, and he hopes to form a NSBE chapter at the school. His research interests include electrophysiology and biomimetics.
53. Selisa Rollins is a PhD candidate in Chemical Engineering. Her doctoral research entails developing improved photocatalytic materials for environmental applications such as the light initiated recycling of carbon dioxide to value-added products.
54. Sofia Garcia is a senior undergraduate student in Industrial and Manufacturing Engineering at the FAMU-FSU College of Engineering. She conducts research at the High-Performance Materials Institute, where she works in projects that allow her to explore her passion for Materials Science.
55. Somtochukwu Dimobi is a second year undergraduate student in Chemical Engineering at Vanderbilt University. She started doing Biomedical Engineering Research in Winter 2015 and is also the PCI chair her NSBE chapter. She loves meeting new people and is passionate about leadership and problem solving.
56. Stephen Benn is a senior undergraduate student in Biochemistry and Bioengineering at Syracuse University. Research experience within the biomedical engineering field truly made his undergraduate experience rewarding. He plans to pursue an M.D. /Ph.D. after

graduating, bridging the gap between medicine and bioengineering.

57. Susan Okrah is a sophomore undergraduate student in Chemical Engineering at Hampton University from Chandler, Arizona. She is currently researching the layer-by-layer assembly of polyelectrolyte multilayers. In the future, she plans to enter an M.D.- Ph.D. program.
58. Temitayo Bankole is a graduate student in the department of chemical and biomedical engineering at West Virginia University. His research is focused on developing modelling and optimization methods for chemical plants. He enjoys reading science history and mathematics.
59. Violet Sheffey is a senior undergraduate student in Chemical Engineering at the University of New Mexico. Her research interests span many fields within the theme of sustainability, including applications of polymers in water treatment & environmental stability.
60. Yevgen Nosyk is a sixth year PhD student at the University of Idaho, and is working on developing nucleon-nucleon potentials with the team of Professor Ruprecht Machleidt.
61. Zena Getachew is a student at the University of Washington studying Human Centered Design and Engineering and Comparative History of Ideas. Her passions include user experience design, writing, research, and social justice.

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Poster Presentation Rubric

(10 points) Display- Poster is neatly constructed, clear, appealing fonts, pictures and extras.

(10 points) Appearance- Display is eye-catching but retains technical substance and addresses multiple dimensions of the question or problem.

(10 points) Layout/Organization- Clear, appropriate section headings.

(10 points) Creativity - Overall topic is interesting and shows creative thought in problem definition, solution and presentation.

(10 points) Content Knowledge – Purpose of material is clearly conveyed visually and orally by participant.

(10 points) Methodology and Results - Graphs, Tables, Equations, Schematics, etc.

(10 points) Conclusions - Definitive, Follow from Results.

(10 points) Overall Speech- Presentation lead to the conclusion/easy to follow.

(10 points) Q & A - Answers to questions clearly expressed with appropriate technical detail.

Oral Presentation Rubric

(10 points) Is there any novel approach to the subject?

(10 points) To what extent is the subject of interest to a technical audience?

(10 points) How much knowledge of the subject was exhibited?

(10 points) Is there sufficient background information provided in order to introduce the audience to the subject?

(10 points) Are the facts developed in logical and continuous sequence?

(10 points) Are there any distracting mannerisms? Is the manner of delivery (conversation, memorized, read from manuscript) satisfactory?

(10 points) Are the answers indicating knowledge of the subject beyond that disclosed in the original presentation?

(10 points) Is proper English used, and is the vocabulary sufficient?

(10 points) Are the words distinctly pronounced and was proper volume used to be heard by all?

(10 points) How readily and with what self-assurance did the speaker answer the questions?

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