NC STATE UNIVERSITY

Postdoctoral Research Symposium

Talley Student Union
NC State University
Raleigh, NC

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NC State University
Graduate School
Office of Postdoctoral Affairs

This event made possible by private donations to the Graduate Education Enhancement Fund.

Welcome to the 2017 Postdoctoral Research Symposium at North Carolina State University. The Office of Postdoctoral Affairs, the Graduate School, NC State University Postdoc Association, and the Postdoctoral Research Symposium Planning Committee are pleased to sponsor this annual event. The Symposium is an opportunity to promote the contributions of the post-doctoral scholars to research and scholarship, both within our own university and throughout the Research Triangle. Their work helps to push the bound-aries of their fields, improves undergraduate and graduate student learning, and improves our communities.

Our keynote speaker this year is Dara Wilson-Grant, the Associate Director of Postdoctoral Affairs at the University of North Carolina at Chapel Hill and the owner of Careers in Bloom. Dara specializes in helping graduate students and postdocs at a career impasse to navigate their professional pathways. In her keynote address, Dara will share her knowledge about the career opportunities available to postdocs, as well as the professional develop-ment skills postdocs can develop to lead to personal and professional success.

The poster session will feature research from across a range of disciplines, conducted by postdocs from multiple institutions and organizations around the Research Triangle. A list of the names and titles of posters being dis-played at the symposium can be found on this program. For a full list of poster abstracts, please visit our website (go.ncsu.edu/prs). We encourage you to engage with the postdocs exhibiting posters today to learn more about their innovative research.

Thank you for joining us for the 6th Annual Postdoctoral Research Sym-posium and for your support of our postdoctoral scholars.

Dr. Laura Demarse
Assistant Dean for Professional Development

Nicole Ditillo
Program Manager, Office of Postdoctoral Affairs

Improvement Science and Implementation Science in Healthcare: Reducing Maternal and Child Mortality

Dr. Shaghayegh Arangdad
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NC State University

In recent years, leading healthcare providers have come together globally to start major initiatives in implementation science. Improvement Science and Implementation Science must be closely linked. There can be no true im-provement without implementation and no implementation without improve-ment. Quality improvement and implementation are inseparably related and mutually reinforcing. The aim of this research is to create a structured frame-work of what works (where, how and why) in order to improve healthcare and reduce maternal and child mortality. We are exploring several challenges in linking clinical and implementation research and comparing improvement science as practiced in manufacturing industries and healthcare. We are iden-tifying best practices in a number of different contexts. The findings of this research will become a major part of structured improvement and implemen-tation practices that support the United Nations Sustainable Development Goals for health for 2030.

***Poster Number**: 59*

Developmental Programming in Response to Maternal Overnutrition

Dr. Marine Baptissart
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Perinatal environmental exposure can permanently impact offspring health; a process called developmental programming. In particular, maternal high-fat-diet (mHFD) predisposes offspring to adult metabolic disorders including obesity and excess hepatic lipid storage (steatosis). Molecular mechanisms leading to steatosis include enhanced fatty-acid uptake, increased triglyceride synthesis and decreased beta-oxidation. However, how mHFD exposure during prenatal or early postnatal development differentially impacts these path-ways remains unclear. Evidence suggests that epigenetic modifications are likely to be crucial for developmental programming by modulating transcriptional network activity. In this context, our study aims to 1) discriminate the molecular changes induced by prenatal and postnatal mHFD exposure, and; 2) test whether epigenetic mechanisms underlie the relative contributions of these distinct time-windows to steatosis in later life. Using a crossfostering strategy, C57Bl/6 mice were exposed to mHFD (45% fat), or correspond-ing control diet, during prenatal and/or postnatal development. At birth, weaning and adulthood, we performed metabolic tests and characterized his-tological and molecular changes in the liver. At weaning, mice exposed to postnatal but not prenatal mHFD exhibit abnormal white adipose tissue accumulation and hepatic steatosis. This is associated with hepatic tran-scriptional changes including an increase in expression of the transcription factor Zac1. Zac1 controls a coordinately expressed Imprinted Gene Net-work (IGN) shown to regulate lipid storage in vitro. However, the function of Zac1 and the IGN in the liver is unknown. We hypothesize that this net-work contributes to hepatic lipid storage during development, and that Zac1 constitutes an epigenetic mediator between mHFD and steatosis in later life.

***Poster Number**: 45*

Enhanced Efficiency of Perovskite Solar Cell on Corrugated Substrate

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NC State University

Organometallic halide perovskites (OHPs) solar cells are fabricated on nano-scaled corrugated substrates using a sequential deposition method. The corrugated structure is found to accelerate the chemical reaction between the sequentially deposited lead iodide (PbI2) and methyl ammonium iodide (MAI) layers to form stoichiometric perovskite films. As a result, the average power conversion efficiency (PCE) increases from 8.7% for the planar devices to 13% for the corrugated devices.

Poster Number: *23*

Modeling the Lamina-Cribrosa to Study the Development of Glaucoma

Dr. Kidist Bekele-Maxwell
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NC State University

Lamina-Cribrosa (LC) is a thin, porous tissue at the base of the optic nerve head which stabilizes the pressure difference between the inside of the eye and the surrounding tissue. It is believed that the biomechanics of LC plays an important role in the development of Glaucoma. We use a mathematical model to describe the relationship between the mechanical action of the internal pressure and the blood flow in LC. We then perform sensitivity analysis to identify parameters that are most influential in order to prevent the development of glaucoma.

***Poster Number**: 46*

Deformation Mechanisms in Crystalline Ag Nanowires

Guangming Cheng
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Nanowires (NWs) are among the most important building blocks for many applications ranging from nanosensors to energy harvesting/ storage to flex-ible/stretchable electronics, to name a few. The operation and reliability of NW-based devices call for a thorough understanding of the mechanical behaviors of NWs. Here, based on in situ nanomechanical testing and atom-istic modeling, we report deformation mechanisms in crystalline Ag NWs (single-crystalline, bi-twinned and penta-twinned) with or without internal twin boundaries (TBs) running parallel to the NW length direction. Local-ized dislocation slip is dominant in twinned NWs, while coherent twinning propagation in single-crystalline NWs. Recoverable plasticity was observed in twinned NWs governed by dislocation nucleation and retraction. And the size-dependent strain hardening was found in penta-twinned NWs to be caused by the effective obstruction of surface-nucleated dislocations by TBs.

Poster Number: *24*

Gradient Hydrogels for Artificial Implants

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Gradient materials play a significant role in the creation of artificial implants due to their potential to reduce stress concentration when two or more structures with different mechanical properties are joined, e.g., tendon, a fi-brous protein that connects the soft and hard muscle tissues in our body. We employ a random copolymer containing 90% of N-isopropylacrylamide (NIPAAm), 5% UV-active methacrylyloxybenzophenone (MABP) and 5%thermally-active styrenesulfonylazide (SSAz) crosslinkers. The presence of MABP and SSAz facilitates adjusting gel density on a flat support in two orthogonal directions by spatially and independently controlling UV dosage and temperature. A systematic investigation of the network properties such as gel fraction, cross-link density, and swelling ratio reveals that gels with higher UV dose or temperature produce densely cross-linked hydrophobic networks with low or no swelling in an aqueous medium. We study the ad-sorption of proteins and cells on such hydrogel substrates and establish that the amount of adsorbed proteins/cells depends on the degree of cross-linking and the swelling capacity of the networks. Specifically, although proteins (and cells) adsorbs heavily on denser networks, loosely bound gels that swell in aqueous medium repel proteins and cells. We attribute the latter behavior to entropic shielding and size-exclusion factors.

***Poster Number**: 25*

The Good, the Bad and the Lethal: Revealing the Physiological Mechanisms Underlying Chronic Thermal Effects in Mayfly Larvae (Neocloeon triangulifer)

Dr. Hsuan (Tina) Chou
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NC State University

Global climate change and other anthropogenic activities warm freshwater ecosystems and prompt us to better understand the mechanisms by which temperature dictates the performance and distribution of species. In this project, we link life cycle rearing experiments across temperatures with metabolomics and gene expression studies to describe physiological processes associated with fitness costs in a mayfly (Neocloeon triangulifer). Metabolomics data show a general reduction of lipids and acylcarnitines in larvae exposed to chronic thermal stress, suggesting energetic depletion. A negative association between histamine and body size/ fitness may po-tentially result from histamine-altered feeding behavior. While both ther-mal stress and hypoxia can cause an organism to utilize alternative energy sources, we found no evidence of thermally induced hypoxia in mayfly larvae via metabolomics or gene expression. These results help deepen our un-derstanding of the physiological mechanisms underlying long term thermal effects on N. triangulifer development.

Poster Number: *47*

Temperature Dependence of Field-responsive Mechanisms in Lead Zirconate Titanate Ceramics

Ching-Chang Chung
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NC State University

Influence of temperature on the field response mechanisms of PbZr1-xTixO3 (PZT) based materials, a commercially available PZT and a 1% Nb-doped PbZr0.56Ti0.44O3 (PZT 56/44), was investigated using in situ X-ray diffraction measurements. The degree of non-180 domain alignment (η002) of the PZT as a function of temperature was quantified. η002 of the com-mercially available PZT increases exponentially with temperature, and was analyzed as a thermally activated process as described by the Arrhenius law. The activation energy for thermally activated domain wall depinning process in PZT was found to be 0.47 eV. Additionally, a field-induced rhombohedral to tetragonal phase transition was observed 5 °C below the rhombohedral-tetragonal transition in PZT 56/44 ceramic. The field-induced tetragonal phase fraction was increased 41.8% after electrical cycling. A large amount of domain switching (η002 = 0.45 at 1.75kV/mm) was observed in the in-duced tetragonal phase.

***Poster Number**: 26*

Towards Next Generation Maggot Debridement Therapy: Transgenic Lucilia sericata Larvae that Produce and Secrete a Human Growth Factor

Dr. Rebecca J. Davis
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NC State University

Diabetes and its concurrent complications impact a significant propor-tion of the population of the US and create a large financial burden on the American health care system. FDA-approved maggot debridement therapy (MDT), the application of sterile laboratory-reared Lucilia sericata (green bottle fly) larvae to wounds, is a cost-effective and successful treatment for diabetic foot ulcers and other medical conditions. Human platelet derived growth factor-BB (PDGF-BB) is a secreted dimeric peptide growth factor that binds the PDGF receptor. PDGF-BB stimulates cell proliferation and survival, promotes wound healing, and has been investigated as a possible topical treatment for non-healing wounds. Genetic engineering has allowed for expression and secretion of human growth factors and other proteins in transgenic insects. Here, we present a novel concept in MDT technology that combines the established benefits of MDT with the power of genetic engi-neering to promote healing.

Poster Number: *1*

Do Neonicotinoid Seed Treatments Benefit Corn Yield? A Multivariate Analysis Using Decision Trees

Alejandro Del Pozo (Presenter), Dominic Reisig, Consuelo Arellano, and Ron Heiniger
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With increased scrutiny of the neonicotinoid class of chemistry and its negative impact on the pollinator community, ecological cost/benefit analy-ses of agronomic crops that use these insecticides are increasingly important. This study initially sought to address the question of yield benefit due to neonicotinoid seed treatment in corn (Zea mays L.), using North Carolina yield contest data from 2002-2006. We recognized that several agronomical practices, beside seed treatment, could affect the yield of this crop; moreover, the analysis could be skewed by early adopters of this technology. Therefore, we used all available data to compare among a typical approach (T-test) for analyzing the impact of seed treatment on yield and an analytical approach (Decision Tree). Conclusions on how seed treatment affected corn yield were different among valid statistical approaches. The contrast in these results highlights the need for future carefully designed studies that include all avail-able data influential to yield.

***Poster Number**: 2*

Solubilizing Phosphate from Metal Phosphates by Different Levels and Types of AVAIL® Polymers

Sarah Doydora (Presenter) and Dean Hesterberg
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NC State University

While fertilizer additives have been developed to enhance availability of added phosphate, the mechanisms by which these chemicals influence sol-ubilization of phosphate in soils are unclear. We evaluated the release of phosphate from Fe and Ca phosphates reacted with different types and lev-els of polycarboxylic AVAIL® polymers. Dissolved phosphate increased with increasing polymer concentrations reacted with both phosphate materials. In the Fe system, the original, unbranched AVAIL® formulation solubilized up to 36% more phosphate than the control when separately tested against any of various newer AVAIL® polymers. In the Ca-phosphate system, newer polymer formulations designated as VLS 9101-01 and VLS 9102-01 dissolved up to 4% and 11% more P than the original AVAIL®. Our results imply that these polymers could potentially solubilize soil phosphate via ligand-enhanced dissolution, depending on their added levels and the metals binding the phosphate in soil.

Poster Number: *3*

Breaking It Down: Mitigating Foam Stabilization in Cell Culture Bioreactors

Dr. Dane Ashton Girmser
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NC State University

Biologics are therapeutic molecules that address numerous diseases. They are produced using cell culture techniques in large-scale production bioreac-tors to generate material for downstream clarification. Within production bioreactors, foam is created and causes challenges during the cell culture process. Whether impacting gas sparing, clogging exhaust filters, or reduc-ing culture viability via cell entrapment, foam levels need to be controlled. This work investigates the root causes of foam stabilization using bioreac-tor foaming models and microscopy techniques. Evidence is presented for the transition from primarily surfactant-stabilized foams to bioparticle-stabilized foams to protein-stabilized foams. Simple guiding principles are explored for antifoam dosing that minimize long-term negative impacts on the process and maximize foam mitigation.

***Poster Number**: 27*

The CRISPR Revolution: Using Cas9 for Gene Editing in Tribolium castaneum

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NC State University

The CRISPR/Cas9 gene-editing system has been hailed as a revolutionary tool for genetic research because of its ability to target any sequence of interest. As a result, it has been effectively deployed in several species to in-duce mutations in target genes, as well as insert genetic sequences of interest. However, outside Drosophila melanogaster, little has been done to study the efficacy of CRISPR/Cas9 in insects. Understanding how its function may vary from species to species, from gene to gene, and even from sequence to sequence will be important for this tool to be effectively applied in novel ways. Recently, researchers published the successful use of CRISPR/Cas9 for gene editing in Tribolium castaneum, but our efforts to employ it in this model organism encountered several issues that were not described by these researchers. Thus, we have pursued a more detailed look at the efficiency and limitations of gene editing in Tribolium.

***Poster Number**: 4*

Influence of Fiber Coating and Diameter on Fiber Bragg Grating Response to Ballistic Impact

Dr. Drew Alexander Hackney
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NC State University

This research presents the results from an investigation to how fiber diameter and coating type influence the strain response of fiber Bragg gratings (FBGs) when the gratings are subjected to a high velocity, high strain rate, ballistic impact. FBGs were integrated into a KevlarTM sensing layer and the sensing layer was placed between a 30 layer KevlarTM shoot pack and a clay backing material and impacted at high speeds using an 8 g steel ball bearing. Two different optical fiber coatings and two different optical fiber diameters were tested. The FBG full-spectrum response was interrogated throughout the impact event. The difference in FBG strain response for the different coatings and fiber diameters were compared. Additionally, the degradation of the coatings after repeated impacts were visually qualified.

***Poster Number**: 28*

Bad Smell, Good Smell: Tracking Bacterial Odors to Locate Oviposition Sites

Dr. Eduardo Hatano
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NC State University

Insects follow odor plumes to locate resources using especially their antennae. Such odors are composed of several volatile compounds which carry information about the source. What compounds insects sense vary according to species, sex and physiological status. Sand flies (Diptera: Psychodidae) are vectors of human leishmaniases which are found on all continents. They oviposit on soil organic material where larvae feed and develop into adults. However, what cues female sand flies use to select oviposition sites are un-known. My work aims at identifying volatile cues from sites that attract sand flies. Because microorganisms significantly contribute to odorant profiles of decaying organic matter, several bacteria strains were isolated and tested. Chemical analyses revealed that these bacteria strains differed in their odor compositions which triggered different behavioral responses from sand flies. The next step is to identify key volatile compounds that trigger these re-sponses.

***Poster Number**: 5*

Municipal Wastewater Application to Forests: Using Participatory Science to Understand Human Exposure and Risks to Chemical Contaminants of Concern

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NC State University

Forested land application sites (LAS) provide an alternative means of wastewater discharge in which treated wastewater is applied to forest soils via slow-rate irrigation. Studies of such sites have demonstrated that citi-zens often have concerns about their lack of involvement in decision-making processes and health and safety issues regarding wastewater reuse. This project will characterize the presence and potential human health risks of organic chemical contaminants that may be found in municipal wastewater applied to a forested LAS in Jacksonville, NC, and aims to better understand community values/perceptions of alternative wastewater reuse to agricultural lands. To facilitate a participatory approach, the project will be guided by a Participatory Leadership Team (PLT) consisting of multiple stakeholders. Additionally, a Community Involvement Group (CIG) will work with the PLT to understand public perceptions of current/future alternatives for non-traditional wastewater use and associated risks, and appropriate strategies to communicate these findings to the broader public.

***Poster Number**: 17*

Genotyping of Probiotic Bifidobacterium longum Strains Using CRISPR Loci

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NC State University

Bifidobacterium longum strains are amongst the most widely used probiotics for human consumption due to their ability to modulate the host immune response, and withstand passage through the human gastrointestinal tract. CRISPR-Cas systems occur widely in bacteria and provide adaptive immunity via acquisition of DNA sequences from viruses and plasmids that constitute unique genetic records of immunization. We performed bioinfor-matics analyses of 66 B. longum genomes that identified 29 CRISPR loci in 25 strains. Each CRISPR locus was characterized and used for phyloge-netic analyses. The spacer sequences enable high-resolution genotyping of B. longum strains, revealed a common origin for some strains, and reflect divergent evolution under selective pressure from invasive DNA. Altogether, results suggest that these immune systems are likely active in this species, and provide a basis for high-resolution genotyping. Furthermore, this study opens new avenues for the repurposing of the endogenous Cas machinery for genome editing applications to enhance their probiotic effect.

***Poster Number**: 48*

DNA Polymerase Beta Uses It Lyase Domain in a processive search for DNA damage

Michael Howard
NIEHS

DNA polymerase (Pol) β maintains genome fidelity by catalyzing DNA synthesis and removal of a reactive DNA repair intermediate during base excision repair (BER). Situated within the middle of the BER pathway, Pol β must efficiently locate its substrates before damage is exacerbated. The mechanisms of damage search and location by Pol β are largely unknown, but are critical for understanding the fundamental features of the BER pathway. We developed a processive search assay to determine if Pol β has evolved a mechanism for efficient DNA damage location. These assays revealed that Pol β scans DNA using a processive hopping mechanism. Lysines within the lyase domain are required for processive searching, revealing a novel function for the lyase domain of Pol β. Application of our processive search assay into nucleosome core particles revealed that Pol β is not processive this context. These data suggest that the repair footprint of Pol β mainly resides within accessible regions of the genome and that these regions can be scanned for damage by Pol β.

***Poster Number**: 55*

Seeing Single Molecules Interact with "Tiny" Metal Particles: A Route to Improve Optical Imaging Accuracy

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Duke University

Super-resolution microscopy has recently been used to study dynamic interactions at various interfaces of metallic nanomaterials and also to visualize optically and catalytically active sites. However, the interactions between fluorophores and gold nanoparticles have shown to modify fluores-cence emission properties, thereby affecting the accuracy of super-resolution imaging. Herein, we systematically investigate the accuracy of emission loca-tion as a function of the fluorophore-gold nanorod (NR) coupling strength by tuning both spatial and spectral separations between fluorophores and NRs. Reconstructed super-resolution images of NRs are acquired by stochastic in-teraction between fluorophores and NRs by motion-blur point accumulation for imaging in nanoscale topography (mbPAINT). We find that the accuracy of emission location is a synergy of the spatial and spectral separations be-tween NRs and fluorophores. Only under reduced fluorophore-NR coupling, single NRs with improved accuracy can be imaged by mbPAINT. Using mb-PAINT we also revealed dynamic interactions of plasma proteins with NRs.

Poster Number: *44*

Core Microbiome of German Cockroach (Blattella germanica) and the Overlapping Composition of Gut and Fecal Microbiota

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German cockroaches are typically found in kitchens and bathrooms of households, but also are widely reported in restaurants, hospitals and live-stock farms. These omnivorous insects live in close association with humans and move freely between food and wastes. Therefore, they have the capacity to acquire and disperse potentially pathogenic bacteria in their feces. How-ever, the microbial community associated with B. germanica feces and its re-lationship to gut microbial diversity has not been investigated. We examined the microbiome of lab and field-collected German cockroaches by sequencing the 16S rRNA gene. Our results indicate that cockroaches harbor a diverse array of microbes. Although they share core bacterial taxa, we observed a clear distinction between the lab and field populations of cockroaches. The fecal and gut microbiota share more than 90% of the OTUs. This study shows that the fecal microbiome generally represents the gut microbiome of the cockroach.

Poster Number: *6*

Antennal Grooming Enhances Courtship Performance and Prevents Mating Disruption in the German Cockroach

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The antennae of German cockroach males detect a contact sex pheromone on the females body surface which stimulates courtship behavior. In aggrega-tions however, both sexes frequently contact each other with their antennae to maintain group cohesion, and these interactions may cause the exchange of and contamination of cuticular lipids (CL), including pheromones, between the sexes. We hypothesized that males prevent contamination-induced decay in their sensory acuity by maintaining their antennal CL layer by grooming, namely, removing old contaminated-CL and restoring it with new CL. Us-ing freely grooming and grooming-prevented males, we demonstrated that the antennae of grooming-prevented males accumulated female-CL and their courtship performance significantly declined. Moreover, these males stimu-lated courtship in other males because their CL were contaminated with female pheromone. We suggest that frequent refreshing of the CL layer on the antenna through grooming plays an important role in fine-tuning courtship performance and preventing mating disruption in aggregations

***Poster Number**: 7*

Degradation of Unpretreated Plant Biomass by the Extremely Thermophilic Bacterium Caldicellulosiruptor bescii for the Production of Fuels and Chemicals

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The primary feedstock for biofuel production in the U.S is currently glucose from starch. However, to become energy independent and to meet future production demands, lignocellulosic substrates will need to be utilized. One of the challenges facing the fuel and chemical industries is the lack of a robust microbial catalyst capable of efficently and economically degrading lignocel-lulosic feedstocks. Caldicellulosiruptor species are extreme thermophiles with the unique ability to degrade unpretreated plant biomass and co-ferment both C5 (hemicellulose) and C6 (cellulose) sugars. While this makes Caldicellu-losiruptor an excellent candidate for producing second-generation fuels and chemicals using a consolidated bioprocessing (CBP) strategy, overcoming challenges related to high loadings of plant biomass remains to be solved. In this study, we employed a unique bioprocess scheme (fixed-substrate continuous culture) to enhance C. bescii's ability to degrade switchgrass at high loads (50 g/L) and also examined two novel lignocellulosic substrates, genet-ically modified poplar and pine tree biomass.

***Poster Number**: 29*

Implementing Arbitrary Boolean Functions in Hybrid Digital-Analog Systems

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As Moore's Law winds down, we look to do more with less--more computing with fewer components, that is. We call our approach, "Chaos Computing", in which nonlinear dynamics is exploited to create any type of logic gate on the fly, almost instantly, from a single generic setup. Starting from super-stable initial conditions robust to noise, we combine a conventional dig-ital circuit with an analog nonlinear circuit to implement arbitrary Boolean functions exponentially faster than in prior architectures. This improves the reliability of chaos-based computing systems, and expands the scope of their potential applications.

Reference: Vivek Kohar, Behnam Kia, John F. Lindner, and William L. Ditto, "Implementing Boolean Functions in Hybrid Digital-Analog Systems", Phys. Rev. Applied 7, 044006 (2017)

***Poster Number**: 49*

Deposition of Inhaled Droplets and Vapors in Human Whole Lung

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Computer simulations can be quite useful for predicting aerosol transport and deposition in a human respiratory tract. However, the sheer complexity of the human lung prohibits detailed analysis. Hence, a novel whole-lung-airway model (WLAM), covering the entire human lung was developed and physiologically accurate breathing modes were implemented. As a practical application, the fate of inhaled droplets and associated vapors emanating from an inhaler was simulated and analyzed. Specifically, in the upper air-ways the transport of these droplets was modeled with hygroscopic growth during droplet-vapor interaction. In the lower airways, transport and depo-sition of these droplets were simulated neglecting droplet-vapor interactions. The computer simulation results provide critical insight to and quantitative information of deposition in lungs. In summary, WLAM can predict inhaled therapeutic (or toxic) aerosol deposition. It is also useful for establishing inhaler-design guidelines to improve drug-aerosol delivery.

Poster Number: *30*

Towards Molecular Electronics Using DNA Origami

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NC State University

To improve the capabilities of electronic devices, very high numbers of transistors within integrated circuits are required. Photo-lithography has been used for fabrication of electronic circuits, however its resolution limits its use in creating sub-10 nanometer circuitry. DNA origami holds great promise for organization of nanomaterials with below 10-nm resolution and has been used for fabrication of nanoelectronic devices. Here we present a new way to create molecular electronics by controlling the conformation of conductive materials in predesigned patterns using DNA origami. Addition-ally, we demonstrate programmable switching of an individual conductive polymer conformation. Lastly, we present a new method to decorate gold nanorods on 3D DNA origami in a controlled fashion using diblock polypeptides. All of these strategies may bring us closer to the goal of self-assembled molecular electronic circuitry which would revolutionize electronic devices.

***Poster Number**: 31*

Cheminformatics Analysis of WNK-Inhibitor Interactions

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NC State University

The With-No-Lysine (WNK1-4) protein kinase family is involved in blood pressure regulation, body fluid, and electrolyte homeostasis. The first orally bioavailable inhibitor WNK463 is a low-nanomolar orthosteric WNK binder, but has been stopped in preclinical trials due to its unacceptable safety pro-file. Due to the high similarity of the ATP binding site of WNK proteins, it is indeed extremely challenging to develop selective inhibitors. Therefore, the emergence of allosteric WNK inhibitors is likely to boost drug discovery based on this family. In this project, our goal is to advance our under-standing of specific WNK-inhibitor interactions. To do so, we (i) conducted structure-based docking and (ii) molecular dynamics simulations to study the dynamic intermolecular interactions of co-crystalized WNK inhibitors,(iii) identified key interactions being specific to each WNK family member and (iv) extended our analysis on the full dataset of active compounds that we collected (around 250 compounds).

Poster Number: *50*

Correlating Functionalized Gold Nanoparticle Properties with Solvent Properties

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NC State University

Gold nanoparticles (AuNPs) are sought for electronics, medical applications, and sensors. However, several factors complicate solvent selection for surface-functionalized or coated AuNPs. Thus, all-atom molecular dynamics computer simulations were conducted to investigate the influence of coating thickness and solvent on AuNPs. There were 48 systems with two AuNPs in one of eight solvents at 12.9±0.7% (g/mL). Each AuNP included a 1.5-nm-diameter gold core coated with 60 ligands (-S(CH2)nC6H4OH, n = 4 to 24). The AMBER software was used (300 K, 1 atm, 100 ns) with the General Amber Force Field and published solvent models. Linear regression of AuNP and solvent properties shows that AuNP-solvent electrostatic en-ergy is best correlated with dielectric constant; van der Waals energy with dielectric constant and coating thickness; and AuNP size and dispersibility with total Hansen solubility parameter. Factors such as AuNP concentration and ligand chemistry could provide a more complete picture to aid solvent selection.

***Poster Number**: 32*

Inhibition of MALAT1 Expression Has a Broad Impact on Host Response to HIV-1 Infection

Dr. David J. Lemler
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NC State University

Introduction: HIV/AIDS affects nearly 37 million people worldwide. Long noncoding RNAs (lncRNAs), transcripts of greater than 200 nucleotides that do not code for a protein, represent potential novel intervention targets. We and others have shown that expression of the lncRNA, MALAT1, is upregu-lated during HIV infection. To investigate the function of MALAT1 during HIV-1 replication, we infected MALAT1 knockdown CD4+ T cells with HIV-1 and profiled the global changes in host response to HIV-1 infection using transcriptome deep sequencing (RNA-seq).

Results: We observed reduced HIV viral RNA expression upon MALAT1 knockdown, along with widespread changes in host transcriptional response to HIV infection. We will present a preliminary characterization of the af-fected host genes. This analysis may allow us to uncover novel host factors involved in the regulation of HIV-1 infection, thereby, potentially new ther-apeutic targets.

Poster Number: *60*

Fine Root Dynamics and Response to Change in Hydrology in Forested Wetland NC

Dr. Xuefeng Li
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NC State University

Hummock and hollow microtopography is a unique feature of many north-ern and southern wetlands but its effects on belowground carbon cycling are poorly understood. The biomass distribution and dynamics of fine roots in both hummocks and hollows are studied in a freshwater forested wetland of coastal North Carolina. Fine roots are classified into live absorptive (first and second order roots) and transport roots (third up to sixth order roots) and dead absorptive and transport roots. Total mass, biomass and necro-mass of both absorptive and transport roots are generally significantly higher in hummock sites than in hollow sites, and the biomass of absorptive roots showes the great extent of differences between the two types of the sites. The upper horizon (Oe and Oa horizon) has significantly higher fine root densitie than the lower horizon in both hummocks and hollows, but the difference is greater in hummocks than in hollows. The difference in root mass per unit soil volume between the two horizons is greater for the absorptive roots than for other types of roots. Different types of roots exhibits different peak and trough during the study period. These results show that the hummock and hollow microtopography significantly affect fine root biomass and necromass distribution and dynamics and different orders of fine roots have quite dif-ferent responses to the change in microtopography.

Poster Number: *18*

Blacktops to Greenways: How to Build and Maintain Our Roads

Dr. Haritha Malladi
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The USA has the longest road network in the world with over 2.7 million miles of paved roads and highways. Thus, it is imperative that sustainable technologies are at the forefront of mainstream pavement industry. Sustainable road construction is ensured two ways: by using effective green technologies during construction and by timely application of preservation techniques to lengthen the service life of pavements. In my research, I work on characterizing and improving two types of green technologies: Warm Mix Asphalt (WMA) and Recycled Asphalt Pavements (RAP). WMA technolo-gies help produce asphalt mixtures at lower temperatures, thus reducing fuel usage and harmful emissions. RAP comes from old pavements and using the material into new construction reduces the resources needed for new road construction. On the preservation side, I work on guidelines to effectively seal cracks on the road surface in order to slow down further deterioration without affecting pavement ride quality.

***Poster Number**: 34*

Biomonitoring Ambient Air Ozone Pollution Using Wheat Plants: Finding the "Canary of the Coal Mine"

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Spring wheat cultivar "Thatcher" is very sensitive to ambient air ozone (O3) pollution. A near isogenic line (NIL) of Thatcher containing a leaf rust resistance (Lr) gene was identified as O3-tolerant, providing the necessary contrast with the original Thatcher parent for use as a biomonitoring system to estimate the impacts of elevated O3 on plants.

Seedlings of Thatcher and 43 NILs with individual Lr genes in the Thatcher background were screened for O3 response in outdoor plant environment chambers, under four O3 treatments (CF, 50, 70 and 90 ppb; 12hrs daytime average). The study was repeated twice, and O3 injury on all leaves of the main stem were estimated. Out of the 43 NILs tested, ten were consistently more tolerance to O3 than Thatcher. Tc-Lr16 was consistently the most tolerant among the NILs tested. These results suggest that Thatcher and Tc-Lr16 are a suitable pair for biomonitoring O3 air pollution.

***Poster Number**: 8*

Optimizing Ribo-seq Library Preparation

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It is well established that changes in mRNA abundance frequently do not correspond to protein abundance. This discordance can be due to many fac-tors including translation rate. Ribosome footprinting (also called Ribo-seq) seeks to quantify the occupancy of ribosomes on a transcript as a measure of its translation rate. Our group recently used Ribo-seq to show that transla-tional regulation is a key component of the ethylene response in Arabidopsis. This finding suggests that regulation of translation may be involved in a diversity of cellular processes. In order to best test this question, we sought to optimize the currently available Ribo-seq protocols. Ribo-seq library prepa-ration is time-consuming and, because up to 90% of sequenced reads can be unwanted rRNA, it can be costly and inefficient. We optimized our previously published protocol to reduce the time involved and have tested several commercial and homemade methods for the removal of rRNA.

Poster Number: *9*

Temperature and Moisture Effects on Peat-derived CO2 and CH4 Fluxes in a Coastal Freshwater Forested Wetland

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In coastal freshwater forested wetlands (CFFW), temperature and hydrology influence soil microbial processes which release carbon (C) from soils as either CO2 or CH4. Changes in temperature and hydrology occur sea-sonally and are projected to change under future climate change scenarios. While coastal wetlands are recognized as important C storehouses our under-standing of temperature and soil moisture content effects on greenhouse gas fluxes is lacking. Peat soil was collected from a CFFW in North Carolina and incubated in the laboratory under different temperature and moisture condi-tions. Soils incubated at higher temperature and under saturated conditions suppressed CO2 production and stimulated CH4 production. Surface soils also released greater CO2 and CH4 than peat soils collected deeper within the soil profile (20-30cm), but exhibited similar treatment effects. These re-sults indicate that CFFW can be a significant seasonal source of CH4, which may be exacerbated by rising atmospheric temperatures and sea level.

Poster Number: *19*

Epigenetic Response of Human Liver Cells to DEET and Fipronil

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While the synthesis and use of new chemical compounds is at an all-time high, the study of their potential impact on human health is quickly falling behind. We chose to examine the effects of two common environmen-tal chemicals, the insect repellent DEET (N, N-diethyl-m-toluamide) and the phenylpyrazole insecticide fipronil (fluocyanobenpyrazole), on transcript levels of long non-protein coding RNAs (lncRNAs) in primary human hep-atocytes. LncRNAs are transcript longer than 200 nucleotides that do not code for active proteins. While lncRNAs are believed to play a critical role in numerous important biological processes many still remain uncharacterized and their functions and modes of action remain largely unclear. RNA-Seq showed that 100 µM DEET, 10 µM fipronil, and a mixture of 100 µM DEET and 10 µM fipronil significantly affected lncRNA transcript levels in primary liver cells. Differentially expressed lncRNA genes were mapped to chromo-somes, analyzed by proximity to neighboring protein-coding genes, and func-tionally characterized via gene ontology and molecular mapping algorithms. While further testing is required to assess the organismal impact of changes in transcript levels, initial analysis links several of the dysregulated lncRNAs to processes and pathways critical to proper cellular function.

Poster Number: *10*

Designing Fibrin Nanoparticles that Kinetically Enhance Wound Healing

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The inability of blood to quickly coagulate and allow tissue remodeling is a major concern, especially in hemophilia, diabetes and Von Willebrand disease (VWD). The CDC reports that delayed blood clotting is responsible for 18.9% of blood based coagulation deaths in 2010. The focus of this poster is to design fibrin nano particles that can kinetically assist the wound-healing phenomenon by enhancing the rate of tissue hemostatis. Uniformly sized fibrin nano particulates are created in a high throughput two-phase Y-channel microfluidic droplet device. The stability and functionality of the designed fibrin nanoparticles were studied for their ability to enhance clotting and wound closure responses in vitro. Preliminary 2D wound healing cellular assays show enhanced dermal fibroblast migration in the presence of optimal amount of fibrin in the scratched area. These fibrin nanoparticles represent a versatile fibrin-based scaffold for improving coagulation and healing outcomes following injury.

***Poster Number**: 35*

Prevalence and Novel Attributes of Listeria monocytogenes Isolated from Black Bears (Ursus americanus)

Dr. Cameron Parsons
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NC State University

Listeria monocytogenes (LM) is a facultative intracellular pathogen that is found ubiquitously in nature and is primarily transmitted through con-taminated food. LM is the causative agent of the disease listeriosis, which is responsible for numerous hospitalizations and deaths annually. LM is in the food supply and in clinical cases has been extensively studied; however, much of the ecology of this pathogen in the natural environment, including impacts to wildlife, remains poorly understood. This study examined the prevalence and characteristics of LM isolated from wild black bears (Ursus americanus) in Asheville, North Carolina, USA. Listeria spp. were detected in 55% of the animals, of which the majority (78%) yielded LM. Targeted subtyping and whole genome sequencing were applied to bear-derived LM strains, and resistance to a panel of antimicrobials was determined. Our re-sults indicate that wildlife may represent a rich reservoir for novel LM strains with interesting and unexpected genomic attributes.

***Poster Number**: 11*

Biodegradable See Wraps for Sustained Release of Pesticides for Crop Protection in Sub Saharan Africa

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Plant parasitic nematodes are one of the major constraints on yield and production of food crops throughout the world. While abamectin has broad nematicidal activity, its poor mobility in soils compromises its efficiency against nematode infestation. Using abamectin as a model pesticide, we present an innovative and cost effective approach for crop protection from plant parasitic nematodes, using a lignocellulosic matrix "wrap and plant" methodology. In our "wrap and plant" approach, we have used abamectin loaded matrices as wraps for seeds to be planted in the soil. To better understand the effect of various processing parameters and nature of the pulp on final properties of the matrix, we have produced lignocellulose matrices using pulp refined at various time intervals. Resulting hand sheets are char-acterized by the controlled release of abamectin which is incorporated into the matrices through sorption. Pulp refining time as well as various physical and chemical properties of the matrix are found to affect its tendency to let the germinating roots penetrate it and also the release rate of abamectin. We perceive that by varying refining time of the pulp, we can obtain matrices that facilitate in slow and sustained release of abamectin which results in long term nematicide protection to the growing plant roots. We have used these results to develop pilot scale paper rolls which are currently used in field trials in various regions of Africa and initial field trials demonstrate promising results regarding better crop protection in nematode infested soils in Benin and Kenya.

***Poster Number**: 36*

Magnetically Aligned Macrodiscs for Structure-Function Studies of Membrane Proteins by Solid-State NMR

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Solid state NMR of oriented samples is capable of studying and elucidating structure and topology of membrane proteins (MPs) under native-like conditions. Nanodiscs can accommodate a wide variety of saturated or unsaturated phospholipids. Significantly, protein-containing nanodiscs are "detergent-free", which minimizes the possibility that the membrane envi-ronment would cause the distortion or denaturation of the native protein structure.

***Poster Number**: 51*

Expression of Limited Transpiration Trait in Soybean and Peanut Under Vapor Pressure Deficit

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NC State University

Plant water conservation to increase soil water availability for use during late season -drought is a critical physiological factor. Limited transpiration (TRlim) at high vapor pressure deficit (VPD) condition is the only physiological trait that may ameliorate drought. Water holding capacity in soybean[Glycine max (L.)], and peanut [Arachis hypogaea (L.)] are always low and are of serious concern. The aim of present study is to determine Lim-ited transpiration (TRlim.) to VPD response in eleven genotypes of soybean and nineteen genotypes of peanut. Soybean genotypes were derived from the mating of PI 416937 X Benning. Both parents PI 416937 and Benning express break point in transpiration rate with increasing VPD. Low break point was obtained in nine progeny of soybean. Virginia type peanut popu-lation was derived from parent NC 3033 x Tifrunner. There was a variation among peanut genotypes with six genotypes exhibit breakpoint in their VPD response at the range of 2-2.9 kPa. The reaming ten genotype has a linear response in TR over the whole range of tested VPD. So the genotype with lower breakpoint may conserve soil water resulting from the decrease in stom-atal conductance under high VPD condition.

***Poster Number**: 12*

Measuring Canopy Anomaly Influence on Golf Putt Kinematics: Does Annual Bluegrass Influence Ball Roll Behavior?

Dr. Sandeep Singh Rana
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NC State University

Weedy annual bluegrass has long been presumed to impact ball roll direction. No peer-reviewed research till date has substantiated this claim. Researchers at Virginia Tech identified several sources of error that were lim-iting research horizons in this area. By controlling such errors, we generated first-ever, scientifically-proven results showcasing the influence of site-specific surface anomalies on putting-green trueness to help practitioners produce championship-level putting surfaces.

***Poster Number**: 13*

Unencumbered Pol β Lyase Activity in Nucleosome Core Particles

Dr. Yesenia Rodriguez
NIEHS

Packaging of DNA into the nucleosome core particle (NCP) is considered to exert constraints to all DNA-templated processes, including base excision repair where Pol β catalyzes two key enzymatic steps: 5′-gap trimming and template-directed gap filling. Despite its biological significance, knowledge of Pol β activities on NCPs is still lacking. Here, we show that removal of the 5′-dRP block by Pol β is unaffected by NCP constraints at all sites tested and is even enhanced near the DNA ends. In contrast, strong inhibition of DNA synthesis is observed. These results indicate 5′-dRP gap trimming proceeds unperturbed within the NCP; whereas, gap filling is strongly limited. In the absence of additional factors, base excision repair in NCPs will stall at the gap-filling step.

Poster Number: *56*

Water-Repelling Silicon and Urethane Based Coating Formulations

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NC State Unviersity

Tighter environmental regulations urge textile industries to seek and apply environmentally friendly water replants. We designed and synthesized a versatile polymer, that incorporates high strength of urethane and the wa-ter repelling properties of siloxanes. Dip-coated textile fabrics showed water contact angles of up to 165^{o}, that make them super water-disliking (super-hydrophobic). We demonstrated how the coating performance on cotton substrates depends on: i) different molecular weight of the initial building blocks, ii) polymer dispersion average particle size, and iii) added silica parti-cles. Electron microscopy images showed that this superhydrophobic surface coating was formed of individual polymer particles, partially fused together during the curing process, forming a hierarchically rough surface at the micro- and nano-scales. We envisage that the inherent durability, water-repellency, and green synthesis approach of this polymer will make it attractive not only as a textile coating, but also essential to many other industries.

***Poster Number**: 37*

Mathematically Modeling Populations of Daphnia magna

Dr. Erica M. Rutter
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NC State University

Daphnia Magna is a species of water flea extensively studied in ecotoxicology and mathematics. They are often used to assess effects of pesticides and other chemicals on ecosystems. Currently, many experiments are per-formed at the individual level, but more population studies are needed to infer ecosystem adversity. We performed a longitudinal population study of Daphnia magna and propose a mathematical model incorporating both density-dependent and density-independent fecundity and mortality rates. We fit our model using a generalized least-squares framework and estimate parameters and their confidence intervals.

***Poster Number**: 52*

Circumventing Limitations of Small Antennas Using Direct Antenna Modulation

Dr. Kurt Schab
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NC State University

For over half a century, engineers and physicists have asked the question: what is the "best" antenna possible? Of particular interest is the maximum achievable bandwidth by an antenna of a given size. Extensive work in this area has given rise to so-called fundamental performance bounds of antennas. Most relevant is the application of these bounds to small antennas, where parameters such as bandwidth are sharply constrained. This work focuses on circumventing these bounds by breaking assumptions used in their deriva-tion. Specifically, rather than assuming an antenna to be time-invariant, we apply rapid changes to the antenna using switching networks and other controllable components. These alterations, known as direct antenna modu-lation, enable behavior not possible on a conventional, time-invariant, small antenna. Here, we present an overview of the traditional bounds on small antennas, an example of a direct antenna modulation system, and an analysis of the resulting performance improvement.

Poster Number: *38*

Re-evaluation and Expansion of the Brachylophosaurus canadensis Collagen I Sequence and Support for the Preservation of Cretaceous protein

Dr. Elena Schroeter
College of Sciences
NC State University

Despite the retrieval of peptide sequences from Cretaceous dinosaur fos-sils, the hypothesis that proteins can persist for millions of years has re-mained controversial. To address lingering questions about the authentic-ity of ancient peptides, we conducted a new paleoproteomic investigation of Brachylophosaurus canadensis using alternative protein extraction proto-cols, MS instrumentation, and bioinformatics software, more strict statistical validation parameters, and the most rigorous anti-contamination procedures to date. Using this updated and stringent methodology, we recovered eight peptides of collagen I, including two recovered in an earlier 2009 study. In phylogenetic analyses, the partial collagen I sequence from B. canadensis did not match any extant species in the database, and was placed between basal birds and crocodylians-the placement predicted for dinosaurs by previous skeletal studies. These data robustly support that fragments of proteins can preserve over millions of years, and may retain a genetic signal that can be utilized for phylogenetic analyses.

***Poster Number**: 53*

Changes in Cropping Patterns May Cause Long-term Food and Water Insecurity

Dr. Kunwar K. Singh
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NC State University

Evaluating the impact of cropping patterns, such as extent, frequency, and intensity on water resources is critical for long-term food and water sustainability. Surface water resources are usually the easiest to access for irrigation and so may be particularly vulnerable to overexploitation. Understanding how changes in cropping patterns have affected surface water resources requires knowledge of changes in cropping patterns and seasonal availability of surface water. We use a Kalman Filter to fuse multi-source re-motely sensed image for obtaining the high-quality time series data necessary to map cropping extent, frequency, and intensity. We analyze the spatiotem-poral changes in the agricultural landscape with respect to changes in surface water and climate using a coupled ecohydrologic model. Our results improve current knowledge of food production by focusing on seasonal variability in surface water resources and highlighting scenarios in which increased crop-ping extent and frequency may actually lower food production.

***Poster Number**: 21*

Determine the Swelling of Gelatin Methacrylate (GelMA) Varying with Flowrate for Tissue Engineering Applications

Dr. Shilpa Sivashankar
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Improving cellular studies via accurate modeling of cellular microenvironment in vitro can lead to understanding better the complex process of human tissue development, regeneration, and disease progression. Hence, we developed a blood vessel model using a semisynthetic origin cellular matrix, called gelatin methacrylate (GelMA) that combines the biocompatibility of a natural matrix with stability and reproducibility of a synthetic biomaterial. We take advantage of the laminar flow in the channels to form a band of polymerized GelMA. As a pilot study, we determine the swelling size of the GelMA bands to mimic blood vessels. The width of the bands so formed with a change in flow rate was analyzed. The cells seeded on the GelMA could be used as models for applications in tissue engineering.

***Poster Number**: 39*

Covert Articulatory Variation and Possible Phonological Implications

Dr. Bridget Joann Smith
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NC State Unviersity

Covert articulatory variation includes differences in tongue and lip gestures in the pronunciation of speech sounds that may not be detectible to listeners, but which may create coarticulatory effects that listeners with dif-ferent articulatory configurations may interpret differently. The fact that there are multiple ways to produce the same speech sound is a challenge for children acquiring a language and even sometimes for adults in perceiv-ing speech. Using a pilot corpus of lip-video and midsagittal ultrasound of the tongue, we examine variability in tongue and lip shapes in speech, then using the acoustic signal of the resulting coarticulation, we try to predict which talkers in the Raleigh Corpus (Dodsworth & Kohn 2012) will have certain types of covertly variable gestures. This poster presents a prelimi-nary analysis of different gestures involved in making the /r/ sound, and its coarticulation with other sounds.

***Poster Number**: 16*

A Thermal Conductivity-based Thermo-TDR Approach for Measuring Soil Bulk Density

Dr. Zhengchao Tian (Presenter) and Dr. Joshua Heitman
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NC State University

Soil bulk density (ρb) is the ratio of dry soil mass to the total soil volume. Continuous in-situ measurement of ρb is important for characterizing water, heat, and gas exchange in agricultural and environmental applications. Un-fortunately, very few measurement approaches are available. Thermo-TDR probes have been used to measure ρb based on the relationship between ρb and soil heat capacity (C). The C-based approach, however, gave ρb mea-surements with relatively large errors. In this study, we present a soil thermal conductivity (λ)-based approach to determine ρb. Error analysis, and labo-ratory and field experiments were used to evaluate the performance of both C- and λ-based approaches. The λ-based thermo-TDR approach significantly improved the accuracy of ρb measurements and provided accurate in-situ ρb dynamics. We conclude that the λ-based thermo-TDR approach is a promis-ing method for continuously monitoring soil ρb under field conditions and may be useful to improve understanding soil water, heat, and gas exchange.

***Poster Number**: 14*

Enhanced Cancer Immunotherapy by Microneedle Patch-Assisted Delivery of Anti-PD1 Antibody

Dr. Chao Wang
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NC State University

Despite recent advances in melanoma treatment through the use of anti-PD-1 (aPD1) immunotherapy, the efficacy of this method remains to be improved. Here we report an innovative self-degradable microneedle (MN) patch for the sustained delivery of aPD1 in a physiologically controllable manner. We find that a single administration of the MN patch induces robust immune responses in a B16F10 mouse melanoma model Moreover, this administration strategy can integrate with other immunomodulators (such as anti-CTLA-4) to achieve combination therapy for enhancing antitumor efficacy.

***Poster Number**: 40*

Prevalence and novel attributes of Listeria monocytogenes isolated from black bears (Ursus americanus)

Dr. Ping Wang
UNC Chapel Hill

Listeria monocytogenes (LM) is a facultative intracellular pathogen that is found ubiquitously in nature and is primarily transmitted through contaminated food. LM is the causative agent of the disease listeriosis, which is responsible for numerous hospitalizations and deaths annually. LM is in the food supply and in clinical cases has been extensively studied; however, much of the ecology of this pathogen in the natural environment, including impacts to wildlife, remains poorly understood. This study examined the prevalence and characteristics of LM isolated from wild black bears (Ursus americanus) in Asheville, North Carolina, USA. Listeria spp. were detected in 55% of the animals, of which the majority (78%) yielded LM. Targeted subtyping and whole genome sequencing were applied to bear-derived LM strains, and resistance to a panel of antimicrobials was determined. Our results indicate that wildlife may represent a rich reservoir for novel LM strains with interesting and unexpected genomic attributes.

***Poster Number**: 58*

Geoscience Videos and Their Role In Supporting Student Learning In Hybrid Iintroductory Geoscience Courses

Dr. Jennifer Wiggen
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A series of geoscience videos were created to support student learning in Introductory Physical Geology classes at North Carolina State University. Videos are typically 5-7 minutes long and made using a stylus, tablet, microphone and video editing software. Essentially, we narrate a slide, sketch a diagram or explain a figure while describing the concept illustrated by what is projected onto the tablet. A typical video lesson would contain specific parts that can be matched against a similar textbook assignment to allow for comparison of student performance in different learning environments. In the context of this study, students were given a video or text-based resource followed by a multiple choice assessments featuring knowledge and comprehension questions. Overall, our results show that the incorporation of short video-based resources improves student performance and confidence on related assessment questions compared to paper-based resources (text and static images).

Poster Number: *54*

Silver Nanowire Enabled Multifunctional Wearable Sensors

Shanshan Yao
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With the recent progress of robotic systems, prosthetics and wearable medical devices, considerable efforts have been devoted towards realization of highly sensitive and skin-mountable sensors. Multifunctional sensors that can detect strain (up to 50%), pressure (up to ~1 MPa) and finger touch with good sensitivity, fast response time and good pressure mapping func-tion were developed. The sensors were demonstrated for several wearable applications including monitoring thumb movements and knee motions. In addition to mechanical sensors, a wearable skin hydration sensor made of sil-ver nanowires in a polydimethylsiloxane matrix was demonstrated based on skin impedance measurement. The hydration sensors were packaged into a flexible wristband for skin hydration monitoring and a chest patch consisting of a strain sensor, three electrocardiogram electrodes and a skin hydration sensor for multimodal sensing. The wearable wristband and chest patch may be used for low-cost, wireless and continuous sensing of skin hydration and other health parameters.

Poster Number: *41*

Genomic Tools in Turfgrass Breeding

Dr. Xingwang Yu
College of Agricultural and Life Sciences
NC State University

Marker-assisted selection (MAS) has been widely used in plant breed-ing as a critical and effective method for varietal improvement. Using high throughput sequencing technology, the high-density genetic map was con-structed in our research, which offer an ultimate MAS too; to accelerate the turfgrass breeding process.

Poster Number: *15*

Narrative Storytelling in STEM Education: Designing Interactive Metaphors for Biomanufacturing Classes

Dr. Xinyu Zhang
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The use of storytelling and narrative in STEM education makes science meaningful, relevant, and accessible to the public and create stronger mem-ory traces. Many videos teaching STEM concepts focus on the accurate reflections of the concepts. However, accuracy may not help to build long-term memory. Instead, making study materials relevant to students lives and engaging through emotions with the materials will trigger a more effi-cient learning and longer retention of their memory. Therefore, we devel-oped several interactive metaphors in the format of games that humanize the technical concepts using narrative storylines relevant to their lives for a bioprocess-engineering class.

***Poster Number**: 42*

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