NC STATE UNIVERSITY

9th ANNUAL GRADUATE STUDENT RESEARCH SYMPOSIUM

ABSTRACTS

Wednesday, March 26, 2014
1:00 to 5:30 pm
McKimmon Center

Ninth Annual
Graduate Student Research Symposium
North Carolina State University

SYMPOSIUM ORGANIZERS

Graduate School

Dr. David Shafer, Assistant Dean of the Graduate School
Bridget Foy, Administrative Assistant
Todd Marcks, Fellowships and Grants Administrator
Darren White, Webmaster

University Graduate Student Association (2013-2014)

Preston Countryman - Physics (Chair)
Maria Eugenia Arceo - Animal Science
Rangeen Basu Roy Chowdhury - Computer Engineering
Stephanie Mathews - Microbiology
Philip Mzyk - Comparative Biomedical Sciences
Efrain E. Rivera Serrano - Comparative Biomedical Sciences
Parth Shah - Aerospace Engineering
Stephen Smith - Marine, Earth and Atmospheric Sciences
Eli Typhina - Communication, Rhetoric and Digital Media
David Woodley - Nuclear Engineering

AGENDA

12:00 pm - 1:00 pm	Poster Set Up	Area 1
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	Dr. Rebeca C. Rufty, Interim Dean of the Graduate School	
	Dr. David Shafer, Assistant Dean of the Graduate School	
1:30 pm - 4:00 pm	Poster Session and Competition	Area 1
4:15 pm - 5:30 pm	Announcements of Awards and Reception	Rooms 2A & 2B
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	Dr. David Shafer, Assistant Dean of the Graduate School	

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ABSTRACTS

College of Agriculture and Life Sciences

Rachel A. Atwell
Graduate Program: Crop Science
Advisor: Dr. Samuel C. Reberg-Horton
Poster Number: 8

The Effects of Row Spacing and Seeding Rate on Yield and Weed Competition in Organic Canola Production

The demand for organic canola (Brassica napus L.) production is increasing in response to increased demand for both human consumption and the organic livestock industry. Weed competition is a major challenge in organic canola production. Increasing seeding rates and widening row spacing to allow for between row cultivations may serve as mechanisms to reduce weed competition. The objective of this study was to evaluate the interaction of row spacing and seeding rate on yield and weed competition in organic canola production. Canola variety 'Hornet' was planted at five seeding rates (3.4, 6.7, 10.1, 13.4, 16.8 kg/ha) in combination with three row spacing's (17, 34, 68 cm) in Goldsboro, Kinston, and Salisbury, NC in 2011 and 2012. In 2013, all locations received between row cultivations in the 68 cm row spacing. Averaged over locations, seeding rate had little effect at the 17 cm row spacing but was negatively correlated with yield at the 34 and 68 cm row spacings. In locations with highly competitive weeds, weed coverage was lowest in the widest row spacing at the higher seeding rates. At locations with a less competitive weed community composition, increased seeding rates lowered weed coverage and row spacing had no effect. Fall and spring stand count results show that wider row spacing at higher seeding rates led to more plants per linear meter but despite these results lower yields were obtained. At each seeding rate, narrow rows had the highest number of plants ha-1 in both the fall and spring stand counts, showing that thinning of the wider rows occurred rapidly. Increased disease pressure and intraspecific competition are possible causes. Results indicate that producers have flexibility with row spacing options for organic canola production, and seeding rate selections should be made based on desired row spacing.

Weston W. Bussler[1,2], Mary Ann Lila[1,2], Slavko Komarnytsky[1,2]
Graduate Program: Food, Bioprocessing, and Nutrition Sciences, North Carolina State University[1]; Plants for Human Health Institute, North Carolina State University, Kannapolis, NC[2]
Advisor: Dr. Slavko Komarnytsky
Poster Number: 23

Comparative Anti-inflammatory Profiles of Near-isogenic Broccoli Lines

Colorectal cancer (CRC) causes the second most deaths per year of any cancer in humans. The rate of CRC development dramatically increases for those afflicted with irritable bowel diseases that promote inflammation. The consumption of high amounts of cruciferous vegetables has shown links to reducing CRC rates. Broccoli is one of the most widely consumed cruciferous vegetables and is rich in a variety of health promoting bioactive compounds. In this study, we used 128 near-isogenic broccoli lines with quantified metabolite profiles for carotenoids, glucosinolates, and minerals (Zn, Fe, B, S, Cu, Ca, Na, K, Mg, Mn, and P) to study which bioactive constituents and in which combinations are more likely to reduce inflammation. RAW 264.7 macrophage cells were treated with whole broccoli metabolite extracts and the potential to reduce inflammation was measured by the amount of nitric oxide released by cells following stimulation by lipopolysaccharide. Combined with a broccoli genetic inkage map generated as part of the Plant Pathways Elucidation Project (P2EP), this data provides a unique opportunity to investigate differences produced from genetic variation on both metabolite concentrations and anti-inflammatory potential.

Ann L. Carr[1], Robert D. Mitchell III[1], Anirudh Dhammi[1], Brooke Bissinger[2], Daniel E. Sonenshine[3], R. Michael Roe[1]
Graduate Program: Department of Entomology, North Carolina State University, Raleigh, NC, USA[1], TyraTech, Morrisville, NC, USA[2], Department of Biological Sciences, Old Dominion University, Norfolk, VA, U.S.A.[3]
Advisor: R. Michael Roe
Poster Number: 26

Next-generation Sequencing of the Haller's Organ of the American Dog Tick, *Dermacentor Variabilis*

The American dog tick, Dermancentor variabilis (Acari: Ixodidae), is the primary vector for transmitting Rickettsia rickettssii with expanding populations present in the eastern and central portions of the U.S. Pathogen transmission occurs during feeding, allowing for growth, sexual maturation and mating. Olfactory stimuli that induce tick host-seeking and feeding behavior convey information about host species, proximity and directionality. Additionally, physical contact with host dermal secretions and blood confirm host type and identity, allowing for successful feeding. The main external apparatus responsible for olfaction is the Haller's organ. The Haller's organ, located on the first tarsus of the first pair of legs, uses unidentified odorant-binding proteins to bind chemical particles that travel through the porous regions of the sensilla cuticle and transports them to the receptors on the sensillum cell wall. Despite the vital role of the Haller's organ, little is known about the genetic structure, protein construction or exact functioning of stimuli perception. Through next-generation sequencing technology and analyses we have identified transcripts exclusive to the Haller's organ with possible roles in olfaction. The location and function of identified transcripts has been verified through comparative alignments with known olfactory proteins and receptors identified in other insect species and using PCR studies to confirm transcript expression only in the Haller's organ. Identification of putative messages in the Haller's organ will allow for a more complete understanding of the olfactory mechanism in ticks and provide alternative targets for population control.

Huaihai Chen, Nape Mothapo, Wei Shi
Graduate program: Soil Science
Advisor: Wei Shi
Poster Number: 29

Relative Importance and Controlling Factors of Fungal Nitrous Oxide Production in Agro-ecosystems

Fungal ability to produce N2O has been increasingly documented, but its relative importance and controlling factors across diverse ecosystems was still unclear. In this study, laboratory microcosm experiments were conducted to determine how fungal N2O production responds to changing soil factors in different ecosystems. Four treatments, antibiotic-free water, streptomycin, cycloheximide or both were amended in soil to evaluate the relative activity of fungi and bacteria in producing N2O. Among five ecosystems, i.e. conventional (CON), integrated crop-livestock (ICL), organic (ORG), plantation forestry (PF), and successional field (SUCC), fungi contributed more than bacteria in PF, whereas fungi and bacteria made comparable contributions in other four systems. In CON and PF, moisture and pH effects were assessed under water-filled pore space (WFPS) from 65-90% and five pH levels from 4.0-9.0. Regardless of different antibiotic treatments, both fungi and bacteria preferred 85-90% WFPS and pH 7-8 to produce N2O, but fungal contribution was greater under sub-anaerobic and acidic conditions. Effects of C and N availability were evaluated under five levels of glucose and KNO3 with C:N ratio from 1-20 in CON. When C is limiting factor, bacterial N2O production was positively related with glucose input, leading to greater fungal contribution with lower C input, whereas both bacterial and fungal N2O production negatively correlated to KNO3 input when C is sufficient. Four types of organic C, i.e. glucose, cellulose, winter pea, and switchgrass, were added in CON to test the effects of different C sources. On day 4, both bacterial and fungal N2O production was greatest in winter pea and lowest in cellulose, but relative fungal contribution was greater in cellulose than winter pea or glucose. In summary, fungi significantly contributed to N2O production across diverse ecosystems, which can be controlled by soil pH, moisture content, C/N availability, and C sources.

Fu-Chyun Chu, Stephanie Gorski, Yasmin Cardoza and Marcé D. Lorenzen
Graduate Programs: Entomology
Advisor: Dr. Marcé D. Lorenzen
Poster Number: 32

Development of a Germline Transformation System for the Western Corn Rootworm, *Diabrotica Virgifera Virgifera*

The western corn rootworm (WCR) is a major pest of maize and is notorious for rapidly adapting biochemically, behaviorally and developmentally to a variety of control methods. Despite much effort, the genetic basis of WCR adaptation remains a mystery. Transformation-based applications such as transposon tagging and enhancer trapping have facilitated the genetic dissection of model species such as Drosophila melanogaster. Following this model, we are developing a germline transformation system for WCR to gain a greater understanding of how resistance evolves in this economically important insect. We are currently using a piggyBacbased transformation system, known to work in another coleopteran, the red flour beetle, Tribolium castaneum. Unlike Tribolium, WCR lacks eye-color mutants conventionally used to observe transgene expression, therefore our transformation constructs include an alpha-tubulin driven fluorescent marker (EGFP). This Tribolium-derived promoter is expected to drive transgene expression in every cell. Importantly, the construct is functional in Tribolium, and transient expression has already been observed in injected WCR embryos. We are using the same piggyBac helper, phspBac, used to establish transgenic Tribolium. Although this construct uses the D. melanogaster heat-shock protein 70 (Dm-hsp70) promoter to drive transposase expression, Dm-hsp70 is known to be functional in a wide range of insects. Our progress towards developing tools, techniques and protocols for WCR germline transformation will be presented. Establishing transgenic technologies for this beetle is the first step towards bringing a wide-range of transformation–based tools to bear on understanding WCR biology, which can then be extended to other rootworm species.

Adrienne R. Cizek[1], William F. Hunt, III[2], Ryan J. Winston[3], Matthew S. Lauffer[4]
Affiliations: [1]Biological and Agricultural Engineering, NCSU, [2]Professor and Extension Specialist, Biological and Agricultural Engineering, NCSU, [3]Extension Associate, Biological and Agricultural Engineering, NCSU [4]Project Engineer-Stormwater & Preliminary Studies, PE, NC Department of Transportation
Advisor: William F. Hunt, III
Poster Number: 34

Performance of Regenerative Stormwater Conveyance (RSC) as a Nature-base Stormwater Control Measure (SCM)

Regenerative stormwater conveyance (RSC) uses a step-pool ephemeral stream design to convey and treat stormwater runoff, as well as provide critical ecosystem services in urban and suburban areas. Rigorous field evaluation of RSC is necessary to truly understand the ability of such systems to manage stormwater flows, both in terms of hydrology and water quality. Hydrologic and water quality monitoring of two RSC sites located in NC, one in the Coastal Plain and one in the Piedmont eco-regions commenced in Fall 2012. Flow and water quality measurements were also taken using simulated hydrographs at a study site on NCSU's campus. Altogether, the data show that RSC effectively mitigate stormwater runoff, with up to 80% volume and 90% peak flow reductions being observed. 85% reductions in TSS, and some nitrogen and phosphorus reductions have also been observed. Additionally, other ecosystem functions, including carbon sequestration, biodiversity, soil formation, habitat potential, and nutrient cycling, are quantified via a field survey of sites in NC and MD. Overall, RSC systems appear be an attractive stormwater management alternative to manage stormwater runoff in urban and suburban areas.

Adam Dale and Steven D. Frank
Graduate program: Entomology
Advisor: Dr. Steven D. Frank
Poster Number: 38

Urban Warming Trumps Natural Enemy Regulation of Herbivorous Pests

Trees provide ecosystem services that counter negative effects of urban habitats on human and environmental health. Unfortunately, herbivorous arthropod pests are often more abundant on urban than rural trees, reducing tree growth, survival, and ecosystem services. Previous research

where vegetation complexity was reduced has attributed elevated urban pest abundance to decreased regulation by natural enemies. However, reducing vegetation complexity, particularly the density of over story trees, also makes cities hotter than natural habitats. We ask how urban habitat characteristics influence an abiotic factor, temperature, and a biotic factor, natural enemy abundance, in regulating the abundance of an urban forest pest, the gloomy scale, (Melanaspistenebricosa). We used a map of surface temperature to select red maple trees (Acerrubrum) at warmer and cooler sites in Raleigh, NC. We quantified habitat complexity by measuring impervious surface cover, local vegetation structural complexity, and landscape scale vegetation cover around each tree. Using path analysis, we determined that impervious surface (the most important habitat variable) increased scale insect abundance by increasing tree temperature, rather than by reducing natural enemy abundance or percent parasitism. As a mechanism for this response, we found that increasing temperature significantly increases scale insect fecundity and contributes to greater population increase. Specifically, adult female M. tenebricosa egg sets increased by approximately fourteen eggs for every 1° C increase in temperature. Climate change models predict that the global climate will increase by 2-3° C in the next 50-100 years. We found that this same temperature increase resulted in three orders of magnitude more scale insects and trees in significantly worse condition. These results support predictions that urban and natural forests will face greater herbivory in the future, and suggests that a primary cause could be direct, positive effects of warming on herbivore fitness rather than altered trophic interactions.

Diane Ducharme[1], Christopher Gunter[1], Lee-Ann Jaykus[2], Penelope Perkins-Veazie[1], Otto Simmons[3], Eric Brown[4], Jie Zheng[4] and Rebecca Bell[4].
Graduate Program: Horticultural Science, North Carolina State University[1]; Food Bioprocessing and Nutrition Sciences, North Carolina State University[2]; Biological and Agricultural Engineering, North Carolina State University[3]; Center for Food Safety and Applied Nutrition, U.S. Food and Drug Administration[4]
Advisors: Chris Gunter and Penelope Perkins-Veazie
Poster Number: 42

Environmental Sampling of NC Tomato Production Systems for Salmonella spp.

Contamination of tomato (Solanum lycopersicum) by Salmonella spp. is the leading cause of produce-based foodborne illnesses. Despite consistent human disease outbreaks, the ecology of Salmonella in the fresh tomato production environment is poorly understood. Additionally, current methods for on-farm control of human pathogens focus on general practices rather than specific crop-pathogen strategies. The aim of this 3-year study is to identify and characterize Salmonella spp. From environmental reservoirs within commercial tomato production systems located on three agriculturally diverse farms. Environmental samples were collected during the NC tomato production season of 2012 (July – September) and 2013 (June - September). Field (tomato fruit, blossom, leaf, weeds, soil) and water samples (N=1010) were analyzed for the presence of Salmonella by enrichment using a modified FDA BAM method and by real-time PCR. Isolates were genotyped using pulse-field gel electrophoresis. Salmonella was isolated throughout June (10 isolates for 2013 only), July (28 isolates), August (35 isolates) and September (42 isolates) with 59% (68/115) isolates from water, 33% (38/115) from sediment, 4% (5/115) from tomato fruit, and 3% (4/115) from soil. Of the serotypes identified, 28% (32/115) were Paratyphi B (monophasic from water); 12% (14/115) were Newport (water and sediment); 7% (8/115) were Hartford (water and sediment); 4% were Agona (5/15), Montevideo (5/15), and Typhimurium (5/15) (sediment, tomato, and water respectively); with 1% (1/115) from Berta (sediment). These data show that Salmonella enterica serovars of clinical significance are present in specific tomato environmental niches. The majority (92%) of niches for these pathogens across the production season appear to be water sources and sediment. The baseline information provided can assist in the tailored management approach of Salmonella on farm environments. This tailored approach can be used to modify current guidelines for tomato production practices to reduce contamination and protect public health.

Amanda L. Faucette[1], Alexander Krings[1], David Lindbo[2], Jon Stucky[1]
Graduate Programs: Plant and Microbial Biology, North Carolina State University, Raleigh[1]; Soil Science, North Carolina State University, Raleigh[2]
Advisor: Alexander Krings
Poster Session: 49

Guide to the Vascular Flora of Buxton Woods (Dare County, North Carolina)

Buxton Woods Coastal Reserve (“BWCR”) is a 403 ha (995 ac) Significant Natural Heritage Area (R1 C1) located on Hatteras Island in Dare County, North Carolina. Due to the mix of Labrador and Gulf currents off the coast of Cape Hatteras, BWCR contains a rich diversity of subtropical and temperate plant species and comprises the largest tract of maritime evergreen forest (G2) left on the North Carolina coast. In order to effectively manage and preserve the biodiversity of BWCR, a comprehensive floristic inventory and mapping of current plant communities was considered a top priority in its management plan. The objectives of this study were to: 1) to document the vascular flora of each of the natural plant communities with voucher specimens, as well as leaf tissue samples for DNA banking; 2) to map plant communities in relation to soil map units within the site; 3) to develop a taxonomic manual with keys to the vascular flora. To date, 396 specimens have been collected, representing over 200 species. Summary floristic statistics will be presented and discussed. Ultimately, keys will be provided to all reported species and genera, including: habitat, phenology, relative abundance, illustrations,relevant voucher information, and synonymy with published floras.

Sofía Feng, Yunbo Cai, Rini Basyamfar, Jonathan Allen
Graduate Program: Food, Bioprocessing and Nutrition Sciences
Advisor: Jonathan Allen
Poster Number: 51

Sweet Potato-Soy-Mung Noodles: Stability of Nutrients in an Accelerated Shelf Life Study

Disaster relief may require long-term feeding of nutrient-balanced food products. Recipients complain of lack of variety and little autonomy if ingredients are not those produced locally and familiar. The high levels of carbohydrates and β-carotene in most varieties and wide Geographical distribution allow sweet potatoes to be used as a functional ingredient in dehydrated products. The purpose of this study was to develop a new malnutrition-preventing food product using ingredients commonly grown in tropical countries for use by relief agencies in disaster situations. Our solution was a sweet potato, soy, and mung bean flour-based instant noodle. After creating the product, we studied chemical changes in an accelerated shelf life study. The noodles were stored up to 5 weeks at 28, 35, 45 and 55 °C. Statistical analysis showed decreases in protein ($P = 0.0027$), lysine ($P<0.001$), water activity (<0.0001), moisture content ($P<0.001$), compressive load (<0.0001), and β-carotene (<0.0001). The initial protein concentration of 20.7% decreased by 1.2% per week. Initial β-carotene concentration of 12 mg/kg decreased by only 0.4 mg/

kg per week in noodles made with defatted say flour and by 1.0 mg/kg per week in a higher fat formulation. Although these components were not stable over the testing period most of the change occurred between weeks 3 and 5. Fat content, delta energy, compressive extension and measurement of L, A and B color seem to remain stable over time (P>0.05). Because the ingredients for these noodles are produced in many disaster-prone countries, the product can be easily manufactured and distributed within a 3-4 week shelf life. Packaging now used in some feeding programs should be modified to reduce water permeability.

Sean T. Giery and Craig A. Layman
Graduate Program: Applied Ecology
Advisor: Craig A. Layman
Poster Number: 56

Interpopulation Variation in Condition Dependent Signaling: Predation Regime Affects Signal Information

In many models of sexual selection, conspicuous ornaments are preferred by mates because they indicate heritable signaler viability. To function as indicators, ornaments must maintain a proportional relationship between expression and viability. These indicators are called condition dependent signals. To maintain condition dependence, signaling costs must prevent males with low viability from expressing disproportionate conspicuous signals. Given ecological variation in signaling costs, it is likely that the strength of condition dependence varies concomitantly. In this study, we assess the effect of variable signal cost, predation risk, on the strength of condition dependence among 15 wild populations of Bahamas mosquitofish (Gambusia hubbsi) that use colorful dorsal fins in courtship displays. We found that the signal of interest, fin coloration, predicted body condition. However, this relationship was only seen in populations subject to predation from piscivorous fish. In contrast, populations without predators showed no signs of condition dependence suggesting that variation in ecological costs has important effects on communication system evolution. In summary, while our study addresses only one type of sexual signal (coloration), uses only one estimate of viability (condition), and focuses on a single type of signaling cost (predation), we confirm a crucial role for ecological signaling cost in communication.

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Graduate Programs and Affiliations: Soil Science, North Carolina State University[1]; North Carolina Division of Water Resources[2]; North Carolina Geological Survey[3]
Advisor: Matthew L. Polizzotto
Poster Number: 57

Sources and Variability of Manganese in Well Water of the North Carolina Piedmont

Manganese (Mn) is a naturally occurring groundwater contaminant of growing concern in North Carolina. Consumption of high quantities of Mn in well water may lead to severe neurological problems, and approximately 50% of sampled wells in North Carolina have Mn concentrations that exceed the state drinking water standard of 50 µg L-1. Although Mn is naturally derived, the specific sources of Mn to groundwater are generally unknown. Spatial patterns of Concentrations, which range from below detection limits to greater than 2000 µg L-1, are variable, making it difficult to predict public exposure to high concentrations. The primary objective of this research is to identify the environmental factors that regulate dissolved Mn concentrations in groundwater of the NC Piedmont. To accomplish this objective, chemical analyses of Mn in regolith, bedrock, and well water samples from ten NC Division of Water Resources groundwater research stations are being integrated with existing state-wide US Geological Survey well-water data, soil maps, and geology maps. A zone of solid-phase Mn-oxide accumulation persists near the water table (~4.6-9.1 m), but solid-phase speciation is dominated by primary, less-reactive Mn-bearing minerals at deeper depths. Across the Piedmont, dissolved Mn concentrations in wells are generally highest just below the zone of solid-phase accumulation and decrease with depth. High concentrations of dissolved Mn are also predominantly associated with the Carolina Slate Belt and Triassic Basin soil systems. Collectively, these results suggest that Mn accumulating near the water table is being reduced, mobilized, and transported downward to groundwater. Population increase is placing a higher demand on the use of groundwater as drinking water source in North Carolina, and our efforts in understanding the controls on Mn distributions can be utilized as a basis for predicting areas at risk for Mn contamination.

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Adviser: Dr. Julie Grossman
Poster Number: 59

Labile Organic Matter Drivers of Nitrous Oxide Production in Organic and Conventional Cropping Systems

Nitrous oxide (N2O) is a strong greenhouse gas that accounts for the majority of global-warming potential from anthropogenic emissions. Agriculture is the main source of human-induced N2O emissions, produced mainly through a biological soil process called denitrification that reduces NO3- to N2. Denitrifying soil bacteria require organic carbon (C) in the soil for growth, provided by easily accessible labile organic matter (LOM). Soil LOM makes up a small fraction of soil C and is replenished via organic additions. Organic systems are characterized by their reliance on high C inputs, such as manure and cover crops grown solely to increase soil quality, so it is reasonable to suspect that they may fundamentally differ from conventional systems in N2O production. To elucidate the effect of cropping system differences on N2O production, we designed an experiment with 3 organic and 3 conventional cropping system treatments with varying tillage intensities and inputs at the Center for Environmental Farming Systems near Goldsboro, NC. Our major objectives were to 1) quantify inputs to each system, and 2) measure soil LOM pools at five time points. Inputs included cover crops, poultry litter in organic systems, and nitrogen (N) fertilizer in conventional systems. Cover crop biomass and manure were sampled and analyzed for C and N content. Soil samples were analyzed for total organic C and N, potassium permanganate oxidizable C (POX-C), microbial biomass C and N (MB-C, MB-N), and particulate organic matter C and N (POM-C, POM-N). Preliminary results suggest that with low tillage intensity, organic inputs enhance LOM pools. In turn, apparent increases in microbial activity in organic systems relative to conventional treatments suggest LOM pool use by soil microorganisms.

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Graduate Programs: Crop Science, North Carolina State University[1]; Soil Science, North Carolina State University[2]
Advisor: Jean-Marie Luginbuhl
Poster Number: 60

Addition of Clover to Tall Fescue Pastures and Its Effects on Nitrogen Status of Animals, Forages and Soils

Adding legumes including clovers to grass pastures as low cost alternatives to nitrogen (N) fertilizer is not a new concept, but is regaining popularity with producers who want to farm more sustainably and economically. This research demonstrates how legumes affect livestock, forages and soils. Through biological nitrogen fixation (BNF), legumes are able to take N from the atmosphere and convert it into "free" plant available N. Objectives were to i) measure the effects of N source on animal performance, forage yield and quality and soil N and ii) measure the effect of grazing/excreta on BNF and soil N. This study was conducted in the 2012 and 2013 spring and fall seasons. The experimental design was a split block with three field replicates and four main N treatments: tall fescue with white clover (WC), tall fescue with red clover (RC), tall fescue fertilized with N (POS) and tall fescue with no additional N (NEG). Within each main treatment plot, there were grazed and mowed subplots. Boer-cross goats were assigned to one of 12 plots. Goats were weighed and bled every 28 days. Forage samples were taken before each grazing/mowing cycle to determine forage yield and quality. 15N Natural Abundance technique was used to calculate %N of clovers derived from the atmosphere. Soil samples were taken before and after grazing/mowing and weekly thereafter. Animal weight gains per hectare, spring forage biomass yields and annual forage nitrogen yields were similar between clovers and fertilized treatments. WC persisted longer and fixed more N than RC. BNF decreased as soil nitrate-N increased. Soil N values tended to be greater for the clover treatments versus the grass-only treatments. Inclusion of clovers resulted in similar yields and gains as POS and increased N cycling in the system which could reduce the need for N fertilization.

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Graduate Program: Animal Science
Advisor: Dr. Sunny Liu
Poster Number: 62

The Interplay between MDV and HVT Affects Viral miRNa Expression

It is well established that herpesviruses encode numerous microRNAs (miRNAs) and that these virally encoded small RNAs play multiple roles in infection. The present study was undertaken to determine how co-infection of a pathogenic MDV serotype one (MDV1) strain (MD5) and a vaccine strain (herpesvirus of turkeys [HVT]) alters viral miRNA expression in vivo. We first used small RNA deep sequencing to identify MDV1-encoded miRNAs that are expressed in tumorigenic spleens of MDV1-infected birds. The expression patterns of these miRNAs were then further assessed at an early time point (7 days postinfection [dpi]) and a late time point (42 dpi) in birds with and without HVT vaccination using real-time PCR (RT-PCR). Additionally, the effect of MDV1 co-infection on HVT-encoded miRNAs was determined using RT-PCR. A diverse population of miRNAs was expressed in MDV-induced tumorigenic spleens at 42 dpi, with 18 of the 26 known mature miRNAs represented. Of these, both mdv1-miR-M4-5p and mdv1-miR-M2-3p were the most highly expressed miRNAs. RT-PCR analysis further revealed that nine MDV miRNAs were differentially expressed between 7 dpi and 42 dpi infected spleens. At 7 dpi, three miRNAs were differentially expressed between the spleens of birds co-infected with HVT and MD5 compared with birds singly infected with MD5, whereas at 42 dpi, nine miRNAs were differentially expressed. At 7 dpi, the expression of seven HVT-encoded miRNAs was affected in the spleens of co-infected birds compared with birds only receiving the HVT vaccine. At 42 dpi, six HVT-encoded miRNAs were differentially expressed between the two groups. Target prediction analysis suggests that these differentially expressed viral miRNAs are involved in regulating several cellular processes, including cell proliferation and the adaptive immune response.

Yu Gu
Graduate Program: Horticultural Science
Advisor: Dr. Julia Kornegay
Poster Number: 66

Productivity of Direct-seeded vs. Transplanted Plantings of Annual Cut Flower Crops

North Carolina is the second largest producer of cut flower in eastern coast, most of the production is in open ground as field crops, a small amount of them is in unheated high tunnel. In addition, some growers choose to harvest from one planting whereas others will pull out the first planting and start a successional planting. Unfortunately, there is very limited research comparing which practice is better for production. This research will evaluate the productivity between different practices of plantings. Study one will compare direct-seeded and transplanted zinnias in two densities, study two will compare the season-long with successional plantings. Sunflowers and celosia are planted respectively using the same protocol as a control. Data were collected three times a week after flowering. Flowers quality are measured by stem length, flower diameter, yield and plant vigor. Preliminary data analysis showed a better yield in direct-seeded zinnia but reduced in flower quality at the end of growing season.

Ben Jones
Graduate Program: Horticultural Science
Advisor: Anne Spafford, MLA
Poster Number: 84

A Hydrological and Ecological Assessment of a Modular Green Roof System Designed for Slopes ≥ 25%

Extensive green roofs have been proven to provide various ecosystem services and economic benefits dependent upon their ability to protect the roof membrane and capture substantial rainfall. This study focuses on the ability to capture rainfall; specifically as it relates to steeply sloping roofs. The stronger pull of gravity on sloping roofs reduces the water holding capacity of the media's pore spaces. This, along with a greater likelihood of media erosion, makes direct-draining green roofs on slopes far less effective at reducing runoff and supporting the essential

functions of plants. These functions include transpiration, water storage, interception of radiation, and heat reduction. Since a large percentage of the world's roof area contributing excess runoff is steeply sloped, a goal was to counteract the force of gravity and increase the amount of stored water to a level comparable with that of a "flat" (<5°) green roof. A 4"x12"x18" modular shingle design was created that utilizes individual elevated outlets to trap a consistent amount of water evenly across the entire roof. Three test roofs were constructed at slopes of 25,50,and 75%. Each platform had two 30 ft2 independently draining roofs separated in the middle. One is a control roof covered with traditional impervious shingles and the other contains the green roof modular shingles. The results of our runoff analysis show average total runoff reductions of 50% across the trials with the greatest retention at the 25% slope. Three species were planted in the green roof modules; Koerleria glauca, Delosperma cooperii, and Sedum album. They were planted randomly on the infiltration slot grid on the top of the modules. These species will be analyzed for total Leaf Area Index (LAI) as it relates to slope, placement along roof gradient, and proximity to module's internal water storage.

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Advisor: Ratna Sharma-Shivappa
Poster Number: 86

Influence of Lignin Monomer Ratios on Fermentable Sugar Production from Miscanthus x *Giganteus* Pretreated by Sodium Hydroxide

Lignin is a highly recalcitrant aromatic polymer impeding release of fermentable sugars for lignocellulosic feedstocks. Alkaline pretreatment with agents like sodium hydroxide (NaOH) is reported to be effective in lignin degradation and improving fermentable sugar production for conversion to bioproducts. Although many researchers have investigated lignin degradation via alkaline pretreatment, the mechanism of how lignin monomers in the feedstocks change and how the change in lignin monomer content (during pretreatment) impacts subsequent sugar production is little known. Therefore, this study investigated changes in lignin monomers; syringyl (G), guaiacyl (G), and p-hydroxyphenyl (H) propanol, in Miscanthus x giganteus pretreated by NaOH. Treatment of miscanthus at different NaOH concentrations (0.5, 1.0 and 1.5%) and pretreatment times (15, 30 and 60 min) at 121oC/15 psi was performed. Samples were further subjected to cellulolytic enzyme hydrolysis. Fermentable sugars produced and lignin monomers were estimated. Current results indicate that NaOH pretreatment improved fermentable sugar release, with glucose and xylose production being 50 and 700% higher than from raw miscanthus, respectively. Under the conditions tested, 28 - 72% degradation of lignin was observed. Comparison of lignin monomer content in raw (S/Vraw=0.64 and H/Vraw=0.48) and pretreated miscanthus showed that S/G ratio (e.g., S/V0.5% NaOH = 0.75 at 30 min pretreatment time) increased with NaOH pretreatment. However, different NaOH concentrations had no significant impact (p>0.5). Conversely, H/G ratio decreased (e.g, H/V0.5% NaOH =0.37, H/V1.0% NaOH=0.24, and H/V1.5% NaOH=0.15 at 30 min pretreatment time) with increased pretreatment intensity indicating that p-hydroxyphenyl propanol was relatively more susceptible to NaOH pretreatment among the lignin monomers analyzed.

Joshua Kellogg
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Advisor: Dr. Mary Ann Lila
Poster Number: 87

Multi-target Functionality of Alaskan Seaweed in Combating Hyperglycemia and Type 2 Diabetes

Two dominant factors underlying the development of type 2 diabetes is prolonged hyperglycemia due to increased carbohydrate consumption and metabolism and chronic inflammation in adipose tissue and macrophages. Alaska Native populations, who suffer disproportionately high rates of diabetes, have shifted away from traditional dietary foods, like seaweeds, that are a rich source of phytochemicals with potential to counteract diabetes and its complications. In this work, Alaskan seaweeds *Fucus distichus (FD), Saccharina latissima (SL), Saccharina groenlandica (SG), Alaria marginata (AM), Pyropia fallax (PF),* and *Ulva lactuca (UL)* were evaluated for their potential to decrease metabolism of carbohydrates and ameliorate symptoms of hyperglycmic-linked inflammatory pathways. High levels of phenolics were discovered in ethyl acetate and butanol fractions of AM, FD, and SG (326.8 - 557.2 µg phloroglucinol equivalents (PGE)/mg extract). The medium-polarity fractions of AM and FD significantly inhibited the activity of two primary carbolytic enzymes, α-glycosidase and α-amylase, with lower IC_{50} concentrations compared to the known inhibitor acarbose. Fractions of AM, FD, SG, and SL reduced nitric oxide levels in LPS-induced RAW 264.7 macrophages to basal levels, and mRNA expression assays demonstrated that organic fractions of AM, SL, and UL reduced expression levels for the inflammatory cytokines IL-10, MCP-1, iCAM, and TNF-α by 92%, 89%, 82%, and 85%, respectively. These results support the potential of Alaskan algae to provide two activities in reducing hyperglycemia and type 2 diabetes, by lowering inflammation and regulating carbohydrate digestion.

Mary Lewis
Graduate Program: Plant Pathology
Advisors: Dr. Peter Ojiambo and Dr. Ignazio Carbone
Poster Number: 102

Implication of Genetic Structure of *Aspergillus* Section *Flavi* in Soil on Efficacy of Biocontrol of Aflatoxin in Corn

Aflatoxin contamination occurs in maize when toxigenic strains of Aspergillus section Flavi infect developing or insect-damaged kernels at flowering or during the growing season. Biological control, using nonaflatoxigenic strains of Aspergillus flavus, in formulations such as either AF36® or Afla-Guard®, offers the greatest potential for the management of aflatoxin contamination. However, the impact of the genetic structure of native field populations of Aspergillus section Flavi on the effectiveness of these biocontrol products is not fully established. Our working hypothesis is that control of aflatoxin contamination is increased if the applied biocontrol strain is genetically similar to the native soil population of A. flavus. Field experiments were conducted in replicated trials in Alabama, Georgia, and North Carolina in 2012 and 2013. AF36 and Afla-Guard were applied at V8 growth stage and 100g soil samples were collected from georeferenced points in each field before biocontrol application, one week after application, and at harvest. Both A. flavus L-strains and A. parasiticus are recovered from the fields in North Carolina, while A. flavus L-strains, A. parasiticus and A. flavus S-strains were present in Alabama. In North Carolina, the majority of the field isolates shared the same multilocus haplotype as the Afla-Guard biocontrol strain. Further, aflatoxin contamination was lower in plots treated with Afla-Guard than plots treated with AF36. Our results support our hypothesis that using a biological control strain that is genetically similar to the native soil population of A. flavus in a given location can increase the effectiveness of biocontrol in reducing aflatoxin contamination in maize. The use of indigenous strains as biocontrol agents tailors biocontrol to specific geographic localities, potentially increasing the longevity of these strains and improving the long-term sustainability of biological control practices.

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Advisors: Travis W. Gannon and Matthew L. Polizzotto
Poster Number: 109

Fate of Arsenic Following MSMA Applications

In 2006, the Environmental Protection Agency proposed a phase-out of organic arsenical herbicides including monosodium methylarsonate (MSMA), due to concerns that arsenic (As) may contaminate groundwater sources. However, little field research has been conducted to evaluate the fate of MSMA given typical management scenarios. Accordingly, the objective of this study was to compare As distributions following MSMA applications to bareground and turfgrass settings. Analysis of vegetation, soil, and porewater were completed to determine the fate of As following MSMA applications (2 x 2.25 kg ha-1 or 2.07 kg As ha-1). Field lysimeters were installed in a Candor sand (> 90% sand) with porewater samplers installed at 30 or 76 cm depth. Lysimeters were exhumed at various days after treatment (DAT) and divided into unique depths. Arsenic concentration in treated bermudagrass foliage was 14.3, 2.9, and 5.3 mg kg-1 at 30, 60, and 120 DAIT, respectively. Although differences in soil As concentrations were not detected between bareground and turfgrass systems, increased soil As concentrations were observed at 0-2 cm at 30 DAIT and 0-4 cm at 60 and 120 DAIT, when compared to background soil concentrations suggesting typical MSMA application increases As concentrations near the soil surface (≤ 4 cm depth). Arsenic concentrations from 30 cm porewater samples were 84 and 56 µg L-1 for treated bareground and turfgrass lysimeters, respectively. However at 76 cm depth, porewater concentrations from treated turfgrass (0.9 µg L-1) were less than treated bareground porewater (5 µg L-1). Collectively, these data suggest that As from MSMA applications does not readily leach through the soil, particularly in established turfgrass systems, and that under the given experimental conditions, the potential for groundwater As contamination is minimal.

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Advisor: Dr. Paul Hamilton[1]
Poster Number: 113

Development of a Genetic Toolbox for Geobacillus Using Two Novel Thermophilic Bacteriophages

Geobacillus species are gram-positive thermophilic bacteria that can ferment sugars to mixed acids and ethanol and have potential for biofuel production. Some species are also able to produce enzymes of industrial interest. Unfortunately, there is a lack of gene transfer and protein expression vectors that are useful in Geobacillus and there is a pressing need for additional genetic tools for these organisms. Bacteriophages represent a vast set of potential tools that can be developed to exchange, alter and express genes and gene products from an organism of interest. We have characterized two novel bacteriophages isolated from a backyard compost pile in Cary, NC that infect Geobacillus kaustophilus (ATCC #8005) in an effort to develop tools to study and modify Geobacillus species. After assembling and sequencing each genome, we determined that GBK1 is a temperate phage with a linear dsDNA genome containing 45,439 base pairs (bp). 63 Open Reading Frames (ORFs) were identified in GBK1. 20 of these ORFs (31.7%) showed homology to known proteins through a BLAST search (NCBI) while the remaining 43 (68.3%) were proteins with unknown functions. ORF 47 is of particular interest because it has homology to tyrosine integrase/recombinase which we plan to use to develop an integration vector for Geobacillus. We have shown that the integrase in GBK1 is active by isolating GBK1 lysogens inserted into G. kaustophilus. This is the first instance of a lysogen observed in Geobacillus. GBK2 is a lytic phage with a circular dsDNA genome containing 39,078 bp. 62 ORFs were identified. 25 of these ORFs (40.3%) showed homology to known proteins while the remaining 37 ORFs (59.7%) were proteins with unknown functions. In GBK2, we identified a thyA gene with the ability to complement an E. coli thyA deletion mutant, making this gene a potential selectable marker in Geobacillus.

Alsayed Mashaheet
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Poster Number: 115

Climate Change and Wheat Leaf Rust Disease: The Components of the Triangle.

Abstract not available for print

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Advisors: Joel Pawlak, Amy Grunden
Poster Number: 116

Biodegradation and Bioconversion of Pulping Waste by *Paenibacillus Glucanolyticus*

The pulping material black liquor is generated by the kraft process, and this underutilized waste stream has potential for downstream bioconversion. A microorganism was isolated from a black liquor sample collected from the Department of Forest Biomaterials at North Carolina State University. The organism was identified as Paenibacillus glucanolyticus using 16S rDNA sequence analysis and was shown to be capable of growth on black liquor as the sole carbon source based on minimal media growth studies. Minimal media growth curves demonstrated that this facultative anaerobic microorganism can degrade black liquor as well as cellulose, hemicellulose, and lignin. High performance liquid chromatography (HPLC) and gas chromatography-mass spectrometry (GC-MS) were used to identify the products produced by P. glucanolyticus when grown anaerobically on black liquor. Fermentation products which could be converted into high-value chemicals such as succinic, propanoic, lactic, and malonic acids were detected. Vanillic and gallic acids were also produced which suggest that P. glucanolyticus can degrade lignin. GC-MS analysis of P. glucanolyticus culture supernatant when grown on cellulose, hemicellulose, and lignin correlated the production of fermentation products with the components of black liquor. These results suggest that P. glucanolyticus can grow on black liquor by degrading the carbon sources that make up this pulping byproduct and in the process produce high-value chemicals.

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Graduate Programs: Plant Biology[1] and Electrical Engineering[2]
Advisors: Dr. Terri Long and Dr. Cranos Williams
Poster Number: 93

Creating a Dynamic Gene Regulatory Model of the Iron Deficiency Response in *Arabidopsis Thaliana*

Iron is a critical nutrient for plant growth and development. Iron deficiency, therefore, is a significant issue for agriculture and human sustainability. Plants have evolved to respond to iron deficiency by deploying a number of strategies that make iron more available in the soil and maintain necessary levels of iron within the plant without reaching toxicity. This critical balance between optimal iron levels in the plant and fluctuating iron availability in the soil requires precise and complex regulation via gene regulatory networks. We are using a collaborative systems biology approach to unravel the regulatory responses following exposure to iron deficiency. The basis of this project is a microarray dataset of global transcriptional responses in the Arabidopsis thaliana root at specific time points following the shift of seedlings from iron sufficiency to deficiency. Applying engineering methodology, each transcriptional response is modeled as a sampled signal obtained from a particular gene. A variation of the wavelet transformation approach is applied to the signals to highlight major patterns in gene response. Signal processing and pattern recognition routines are applied to these patterns in order to classify genes and predict interactions between them. The set of reaction specific genes and their relationships yields a network of gene interactions active during the transition to a new steady state following exposure to iron deficiency. This technique has identified a number of candidate regulator-target relationships that have been experimentally validated using quantitative real-time PCR. Future efforts will further explore these relationships and the implications thereof with the end goal of constructing a model of early transcriptional response to iron deficiency. The results of this project extend beyond the immediate field of iron nutrition and can inform similar systems biology approaches in a diverse range of models and perturbations.

Basheer Nusairat and J. Brake
Graduate Program: Poultry Science
Advisor: John Brake
Poster Number: 133

Effect of Low Phytate and Normal Phytate Soybean Meal and Corn Particle Size on Male Broiler Performance and Development of the Gizzard and Proventriculus to 21 Days of Age

Phosphorus (P) is one of the most expensive ingredients in poultry diets. Low phytate (LP) soybean meal (SBM) varieties contain more available P than normal phytate (NP) SBM. Feeding coarse corn (CC) has improved digestive efficiency of chicks to 21 d of age. This study aimed to determine the effect of SBM variety and CC on live performance and organ weights at 8, 15, and 21-d of age to delineate the response. There were 512 d-old broiler chicks used. From 1 to 8 d, all birds received one of two diets (50%CC or 0%CC) with the same commercial SBM, which was a NP-type. From 9 to 21 d, either NP-50%CC, NP-0%CC, LP-50%CC, or LP-0%CC diets were fed in a 2 x 2 design. Broiler BW gain, feed intake (FI), feed conversion ratio (FCR), and gizzard and proventriculus weights were measured at 8, 15, and 21 d. The FCR was improved by 0%CC from 1-8 d at similar FI and BW gain. From 9-15 d, BW gain and FCR were improved by 0%CC while from 16-21 d 50%CC improved BW gain. The 50%CC diets produced larger gizzard and smaller proventriculus weights at 8, 15, and 21 d of age. Gizzard weight was reduced by the LP diets at 21 d and there was an interaction of SBM and CC for gizzard weight at 21 d due to NP-SBM producing a larger gizzard than LP-SBM in the presence of 0%CC. There was an interaction for proventriculus weight at 15 d due to a larger proventriculus in the NP-SBM diet only in the presence of 0%CC. These data confirmed that both dietary phytate and CC changed gizzard and proventriculus weights almost immediately and that the beneficial response to 50%CC was beginning to develop between 16 and 21 d of broiler age.

Takshay Patel, SF Krasnyanski, DR Panthee, GC Allen, A Desai, JD Williamson
Graduate Program: Horticultural Science
Advisors: Dr. John D. Williamson and Dr. Dilip R. Panthee
Poster Number: 136

Overexpression of Celery Mannitol Dehydrogenase (MTD) in Tomato Increases Resistance to the Mannitol Secreting Fungal Pathogen *Botrytis cinerea.*

Plants have developed numerous strategies to overcome invading pathogens. Among those strategies the production of Reactive Oxygen Species (ROS) and the resultant signaling of the hypersensitive response has the potential of overcoming a wide range of biotrophic plant pathogens. The production of ROS is a crucial step in many aspects of plant immunity including synthesis of salicylic acid and resultant induction of Pathogenesis-Related (PR) genes. Mannitol is hypothesized to be an ROS scavenging agent that is secreted by pathogens like Alternaria solanae, A. alternata and Botrytis cinerea. When a plant is infected by such a pathogen, mannitol secreted by the fungus suppresses ROS signaling in the plant, thus suppressing a cascade of plant immune activities. Plants like celery that synthesize mannitol as a metabolite have an enzyme Mannitol Dehydrogenase (MTD) that catabolizes mannitol to mannose, a sugar that does not quench ROS. We hypothesize that overexpression of MTD might then provide increased resistance to mannitol secreting pathogens. Here we genetically modified tomato (cv. 'Moneymaker') with celery Mtd cDNA using Agrobacterium-mediated transformation and assessed the amount of MTD expressed in the transformed plants by western blotting. Further we are testing transformed plants for resistance to Botrytis cinerea (grey mold) by detached leaf assay. Preliminary results suggest that MTD overexpressing plants are substantially more resistant to grey mold compared to nontransformed plants. These plants will also be evaluated for early blight (Alternaria solani) resistance. If MTD provides general resistance against mannitol secreting pathogens, then breeding lines resistant to early blight and grey mold might be identified by screening for high MTD expression.

Rasha I. Qudsieh, D. P. Smith, and J. Brake
Graduate Program: Poultry Science
Advisors: D. P. Smith and J. Brake
Poster Number: 142

Dietary Zinc Effect on Broiler Blood Zinc Protoporphyrin to Heme Ratio (ZPP/H), Bone Marrow Color, and Breast Meat Quality

Red or bloody discoloration of poultry meat has been a chronic yet sporadic problem for the poultry industry due to consumer complaints of meat that was perceived to be undercooked. Trace minerals such as zinc (Zn) have been supplemented to broiler chickens at higher levels than required for normal bird growth because Zn has been shown as a primary trace mineral required for growth and important for cell membrane integrity and several enzyme functions. However, high Zn levels accompanied by low iron level in the body could elevate Zn protoporphyrin (ZPP) in blood and meat. The ZPP molecule has been suggested to be a red pigment resistant to cooking denaturation even at endpoint temperatures above 1850F, which would likely result in large yield losses. Therefore, the effect of dietary inorganic Zn on broiler ZPP/H breast meat color, and bone marrow color was studied. A total of 288 d-old male and female Ross 708 chicks were assigned to 0, 120, or 240 mg Zn/kg diets and blood ZPP/H was measured weekly. At 42-d, deboned breast fillets and femur bones were collected. Bone marrow was collected from the interior epiphyseal end-caps of femurs. Color measurements taken were lightness (L*), redness (a*), and yellowness (b*). Dietary Zn had no effect on color of either raw or cooked breast meat (P>0.05). Redness of raw marrow measured 1-h after harvest and cooked marrow increased with Zn level (P<0.01). Cooked color a* was reduced by 2.6 units as Zn level increased and was higher in females than males (12.0 versus 10.9). Dietary Zn had no effect on ZPP/H ratio but females had a higher ratio at 7-d (55.1 versus 43.4 µmol/mol) and 42-d of age (37.2 versus 30.8 µmol/mol) as compared to males. These data indicated that breast color was not affected by Zn, however, marrow redness was increased by Zn.

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Graduate Programs: Plant and Microbial Biology[1], Soil Science[2]
Advisor: Alexander Krings
Poster Number: 144

The Vascular Flora of the Eno River Diabase Sill Plant Preserve (Durham County, North Carolina)

Located in Durham County, North Carolina, the Eno River Diabase Sill Plant Preserve is named for the diabase rock formation over which it occurs. The mafic soils that derive from the underlying diabase are regionally rare, resulting in unique plant assemblages on the preserve. At only 358 acres, the site supports a high species diversity, including eleven state-listed taxa, one of which is Federally Endangered. Given its exceptional geological and botanical features, the site is recognized as a Nationally Significant Natural Heritage Area by the North Carolina Natural Heritage Program. Research on the site has been limited, and no comprehensive floristic inventory has been conducted. The goal of this study is to produce a taxonomic guide, with identification keys and illustrations, to the vascular flora of the preserve. To achieve this goal, weekly site surveys were conducted during the 2013 growing season, and voucher specimens have been collected for each taxon found on the preserve. To date, 674 specimens have been collected and archived in the North Carolina State University Herbarium. Site visits, herbarium research, and plant identification efforts are ongoing. Once completed, the taxonomic guide will facilitate management efforts and future research on the preserve.

Justin Schilling [1], Angelito Nepomuceno [2], Jennifer E. Schaff [3], David C. Muddiman [2], Harry V. Daniels [1] and Benjamin J. Reading [1]
Graduate Program: Department of Applied Ecology[1], College of Agriculture and Life Sciences, North Carolina State University; W.M. Keck FT---ICR Mass Spectrometry Laboratory, Department of Chemistry, North Carolina State University[2]; Genomic Sciences Laboratory, North Carolina State University[3]
Advisor: Harry V. Daniels
Poster Number: 149

Compartment Proteomics Analysis of White Perch (Morone americana) Ovary Using Support Vector Machines

Compartment proteomics enable broad characterization of target tissues. We employed a simple fractionation method and filter assisted sample preparation (FASP) to characterize the cytosolic and membrane fractions of white perch ovary tissues by semi---quantitative tandem mass spectrometry using label---free quantitation based on normalized spectral counts. FASP depletes both low---molecular---weight and high---molecular---weight substances that could interfere with protein digestion and subsequent peptide separation and detection. Membrane proteins are notoriously difficult to characterize due to their amphipathic nature and association with lipids. The simple fractionation we employed effectively revealed an abundance of proteins from mitochondria and other membrane---bounded organelles. We further demonstrate that support vector machines (SVMs) offer categorical classification of proteomics data superior to that of parametric statistical methods such as analysis of variance (ANOVA). Specifically, SVMs were able to perfectly (100% correct) classify samples as either membrane or cytosolic fraction during cross---validation based on the expression of 242 proteins with the highest ANOVA p---values (i.e. those that were not significant for enrichment in either fraction). The white perch ovary cytosolic and membrane proteomes and transcriptome presented in this study can support future investigations into oogenesis and early embryogenesis of white perch and other members of the genus Morone.

Sarah A. Seehaver[1], Julie M. Grossman[1], Daniel Israel[1, 2] and Frank Louws[3]
Graduate Programs: Soil Science, North Carolina State University[1]; USDA ARS[1, 2], Plant Pathology, North Carolina State University[3]
Advisor: Julie M. Grossman
Poster Number: 152

Effect of Inoculation on Cover Crop Legume Nodule Occupation and Associated Rhizobia Diversity

Commercial rhizobia inoculant is often added at planting to increase legume biological nitrogen fixation (BNF) and is of particular importance in organic farming systems where cover crop BNF is a leading fertility source. To maximize nitrogen contribution, a better understanding of inoculation effectiveness in the presence of established soil rhizobia populations is needed. The winter annual legume cover crops Trifolium incarnatum L. (crimson clover), Vicia villosa Roth (hairy vetch and woolypod vetch), and Pisum sativum subsp. Arvense L. (Austrian winter pea)

were planted in a randomized split plot design with and without commercial seed inoculation on three organically managed farms. Legume biomass, biomass nitrogen, nodule number, and nodule dry weight were measured in spring 2011, and Most Probable Number (MPN) assays carried out to determine rhizobia population sizes in sampled field soils. A total of 576 rhizobia strains isolated from surface sterilized nodules of subsampled plants from all treatments were fingerprinted using rep-PCR and sequencing of nodulation gene nodC to determine origin and diversity of nodule rhizobia strains. Across both inoculated and uninoculated treatments, plant biomass nitrogen ranged from 80 to 206 kg ha-1. At three field sites, legume inoculation did not result in an increase in plant biomass, biomass nitrogen, nodule number, or mass. A majority of rhizobia isolates belong to 13 DNA fingerprint clusters whose occupants were over 70% similar, typically not grouping by cover crop host, farm location, or inoculation treatment. As few as 8.5% of strains isolated from inoculated nodules had DNA fingerprints closely related to the commercial inoculant. Fingerprinted strains similar to inoculants had genetically distinct nodC sequences from inoculants, suggesting that applied inoculant strains are not present in host nodules. Complex rhizobia ecology may be present in organic farm soils resulting from high levels of competitive native rhizobia populations established through diverse cultivation histories.

Emily Silverman
Graduate Program: Plant Pathology
Advisor: Frank J Louws
Poster Number: 158

Managing Bacterial Wilt of Tomatoes with Grafting and Host Resistance in North Carolina

Bacterial wilt (BW) is caused by Ralstonia solanacearum a soil-borne bacterium indigenous to the southeast US. Over 200 plant species are susceptible to BW such as eggplant, potato, tobacco, and tomato. Management of BW is difficult requiring an integrated pest management (IPM) program. My research is focused on managing BW with grafting and the development of host resistance strategies to reduce the impact of disease for NC tomato growers. On-Farm trials conducted during 2012-2013 field seasons in Jackson county, NC provided insight on the efficacy of ten BW resistant rootstocks grafted to commercial cultivar 'FL47' compared to non-grafted and self-grafted 'FL47' controls. Rootstock selection had a noticeable effect on disease incidence. In 2012, rootstock varieties 'Cheong gang', BHN1054, DP106, CRA66 and BHN998 exhibited the least number of diseased plants with 25, 33, 35, 43, and 45% respectively. Non-grafted and self-grafted 'FL47' controls reached 100% plant death by 75 days after planting (DAP). The 2013 season demonstrated similar results with rootstocks CRA66, DP106, HI7997 and 'Cheong gang' possessing the lowest BW disease incidence with 4, 8, 9, and 10% wilt respectively. Non-grafted and self-grafted controls reached 70 and 63% disease by 77 DAP suggesting grafting alone is not enough to control BW. Grafting coupled with host resistance rootstocks can be used to manage BW in western NC. Host resistance is a valuable tool that can provide long term benefits when used properly in an IPM program. Quantitative resistance relies on many genes interacting together to combat pathogen attack. An F2 population of tomatoes was developed from a cross between CLN1466ea x NC84173 for segregation of BW resistance. Individuals (140 total) were randomly selected from population NC11212 for phenotypic observation and genotypic selection using single nucleotide polymorphisms (SNPs). Genotypic and phenotypic data will provide breeders a new, reliable screening method for early selection. Grafting and breeding advance the sustainability of the tomato industry in NC.

Soundarya Srirangan, Marie-Laure Sauer, Brian Howard, Mia Dvora, Jacob Dums, Patrick Backman, Heike Sederoff
Graduate Program: Plant and Microbial Biology
Advisor: Dr. Heike Sederoff
Poster Number: 161

Metabolic and Genomic Responses on Oil Accumulation in *Dunaliella Viridis*

Dunaliella viridis is a marine microalgae which accumulates triacylglycerol (oil) and serve as an economically viable source for renewable biofuel production. It has a fast growth rate in salt water and does not compete with food crops for land or fresh water, lacks cell wall allowing economically feasible oil extraction. We identified a fast growing Dunaliella viridis strain that accumulated more oil under elevated temperature and continuous light. Our Goal was to identify the genes and pathways in these microalgae which are responsible for enhanced oil accumulation. In order to achieve this, Dunaliella viridis was cultured either under a 12:12 light: dark or under continuous light at 25°C for 18 hours, followed by maintaining either at 25°C or switched to 35°C until 48 hours. Time course analysis of cell counts, metabolic and genomic responses to changes in light duration and temperature were studied. Elevation of the growth temperature under continuous light had no significant effect on the cell division rate but resulted in significant increases in cell size, chlorophyll, starch and total lipid content. The increase in cell size and chlorophyll content correlated with the increased fatty acids contributing to membrane polar lipids. The elevated temperature doubled the amount of triacylglycerol per cell and tripled the amount of saturated fatty acids in triacylglycerol. Transcriptome analysis showed that, 74 genes were differentially regulated at elevated temperature, out of which 9 were down-regulated and 65 were up-regulated. The thioesterase gene in plastid that releases fatty acids from acyl carrier protein for de novo synthesis of triacylglycerol and genes involved in recycling of membrane lipids for triacylglycerol synthesis were up-regulated correlating transcriptome data with the increased triacylglycerol.

David H Suchoff[1], Frank J. Louws[2,3], Christopher C. Gunter[1], Jonathan R. Schultheis[1]
Graduate Programs: [1]Department of Horticultural Science [2]NSF-Centre for Integrated Pest Management, [3]Department of Plant Pathology, North Carolina State University
Co-advisors: Christopher C. Gunter, Jonathan R. Schultheis
Poster Number: 167

2013 On-farm Grafted Tomato Trial to Manage Bacterial Wilt

Grossing over $37 million in annual sales, North Carolina ranks 4th in the US for the production of tomatoes. However, growers face major challenges due to plant diseases and this research project was designed to solve a serious disease problem common in NC by using grafting as a management tool. Through the process of grafting, marketable tomatoes can be grown on rootstocks that have resistance to soilborne diseases. This graft-imparted resistance reduces the need to fumigate, preventing possible deleterious environmental impacts. A replicated on-farm trial was conducted in Rowan County, NC. The farm is one of the largest tomato producers in NC but loses up to 40% of the crop due to severe Bacterial Wilt(R. solanacearum (race 1)) infestation. In the Spring of 2013, two experimental plots were arranged within 20 acres of tomatoes grafted onto two bacterial wilt resistant rootstocks. The objective of this trial was to evaluate disease susceptibility and production

in fields with Bacterial Wilt (BW) history. In addition, plant spacing and training systems were compared. The two experimental plots, one fumigated and one non-fumigated, were arranged in a randomized complete block design with four replications in a commercial plasticulture system. Fruit were harvested twice and wilt incidence data was collected during and after the harvest. Wilt incidence was significantly lower in the non-fumigated field and no differences in yield between the grafted and nongrafted plants were observed. In the fumigated field, grafting tended to increase yield and trained double leaders significantly increased yield by 35.2% (P=0.015). BW incidence was significantly higher in the nongrafted treatment (29.08%) than the grafted treatments (P<.0001). Single-leader grafted plants had 3.93% more BW incidence than double-leader plants (P=0.0007). We conclude that, in conditions of severe disease infestation, grafted tomatoes offer an environmentally sound means of reducing mortality and bolstering yield.

Katharine A. Swoboda Bhattarai
Graduate Program: Entomology
Advisor: Hannah J. Burrack
Poster Number: 169

Effects of Non-crop Habitat on *Drosophila Suzukii* Infestation in Commercial Blackberry Fields

Drosophila suzukii (Matsumura), the spotted wing drosophila, is a highly invasive vinegar fly that was first detected in the continental United States in 2008. Females use their saw-like ovipositor to lay eggs in soft-skinned fruits and severely threaten the viability of raspberry, blackberry, blueberry, cherry, and strawberry production. Understanding the ecology and population dynamics of D. suzukii is essential for the development of effective management programs. It has been shown that non-crop habitat may provide D. suzukii with a refuge from management treatments and serve as a source of infesting populations. Therefore, the objective of this research was to determine if proximity to non-crop habitat has an effect on fruit infestation levels in crop fields. The hypothesis that infestation levels will decrease as distance from non-crop habitat increases was tested from June-August 2013 at two commercial blackberry farms in western North Carolina. At each farm, infestation levels were measured weekly along transects that ran from 1) a wooded edge into a crop field and 2) a water source into a crop field. Traps with a fermentation-based bait were used to catch adult D. suzukii at 20 m intervals along each transect. Larval infestation was measured in samples of 40 ripe, marketable-looking berries collected near each trap located within a crop field. After infestation was detected, more females were caught in traps located adjacent to crop fields than in traps located within crop fields. There was no obvious pattern to initial infestation and proximity to non-crop habitat did not explain infestation.

Laura Villegas[1], Vincent Smith[2], Joe Atwood[2], Eric Belasco[2]
Graduate Program: Agricultural and Resource Economics, North Carolina State University[1]; Economics and Agricultural Economics, Montana State University[2]
Advisor: Dr. Vincent Smith[2]
Poster Number: 176

Does Participation in Public Works Encourage Fertilizer Use in Rural Ethiopia?

A sixth of the world's population receives inadequate nutrition. The problem is severe in Africa where agricultural sectors are dominated by subsistence farmers. African smallholder farmers could double crop yields by doubling fertilizer use. Yet, in many countries, subsistence farmers do not utilize advanced inputs that are apparently available to them at subsidized prices. Extreme poverty and the lack of effective access to disposable income in the aftermath of shocks are likely to be a partial determinant of the low rates of technology adoption among smallholder farmers in Africa. One strategy to address this situation is the provision of economic assistance through food aid programs.

In this study we evaluate the indirect impact of food aid programs on agricultural productivity via changes in participants' input decisions. We also identify the main determinants of participation in public works programs and fertilizer use and examine whether these decisions affect one another. Our contribution to the literature is twofold: we apply econometric techniques to correctly compute the marginal effects of a system of simultaneous models with binary and censored latent dependent variables; and we use a the most recent data from a cross-sectional sample of households from rural Ethiopia that permits us to examine the effects of a safety net program.

The results show no evidence that participation in public works programs and other income support programs adversely affect adoption. In fact, the results suggest that the programs encourage adoption. Additionally, previous choices of both fertilizer use and participation in public works, educational attainment, household characteristics, income-related variables, and some agro-ecological factors are among the determinants of the participation and usage decisions.

Meng Wang
Graduate Program: Biological and Agricultural Engineering
Advisor: Dr. Wenqiao Yuan*
Poster Number: 180

Microalgal Cell Disruption Using Ultrasonic Nuzzle Spraying System

For the first time, an ultrasonic nuzzle spraying system (UNSS) was applied to disrupt microalgal cells for lipid extraction. The system achieves atomization of a pressurized liquid via a novel concept - application of ultrasonic energy to a specific volume of liquid contained in a capillary chamber immediately before it is passed through an orifice. The objective of this study was to understand the effect of UNSS operating parameters, including ultrasound intensity, nozzle orifice diameter, spraying pressure, and cell concentration on microalgal cell disruption. Two algal strains including Scenedesmus dimorphus and Nannochloropsis oculata were studied. The results demonstrated that the UNSS was effective in the disruption of microalgal cells, indicated by significant changes in cell concentration and Nile red stained lipid fluorescence density between all treatments and the control. It was also found that increasing ultrasound intensity from 15% to 25% improved cell disruption efficiency and lipid fluorescence density of both algal strains. Increasing spraying pressure also increased cell disruption because of higher particle velocities at the nozzle exit. However, the effectiveness was restricted by the less ultrasound energy applied to each cell when flow rate increased. For the same reason, with nozzle orifice diameter increased, higher cell disruption efficiency was observed generally, but the higher flow rate with

bigger nozzle orifice reduced ultrasound energy on every cell. Thus, the optimal cell disruption was not always achieved at the highest spraying pressure or biggest nozzle orifice diameter, instead, they appeared at the medium levels depending on the algal strain and specific setting. Increasing initial algal cell concentration significantly reduced cell disruption efficiency as expected because of lower energy input on each cells. In all UNSS treatments, the effectiveness of cell disruption was found to be dependent on the algal species treated.

Jason M. Whitham[1], Oscar Tirado-Acevedo[1], Mari S. Chinn[2] Joel J. Pawlak[3] and Amy M. Grunden[1]
Graduate Programs: [1]Department of Microbiology, North Carolina State University; [2]Department of Biological and Agricultural Engineering, North Carolina State University; [3]Department of Forest Biomaterials, North Carolina State University
Advisors: Dr. Amy M. Grunden and Dr. Joel J. Pawlak
Poster Number: 184

Metabolic Response of *Clostridium ljungdahlii* to Oxygen Exposure

Clostridium ljungdahlii ATCC# 55383 is an autotrophic acetogenic anaerobe capable of converting synthesis gas (syngas - a mixture of CO, CO2, H2, and N2 generated from partial combustion of carbonaceous materials) into ethanol and acetate. This biocatalyst was originally isolated from chicken waste and is recognized for its potential in a variety of applications in the fuel and chemical industries. The chicken gastrointestinal tract normally contains the previously mentioned syngas components as well as oxygen, which enters with chicken feed. The sugars from grain feed, in addition to CO, CO2 and H2 are fermented to ethanol and acetate by Clostridia and other anaerobes. Though acetate is energetically favored over ethanol because of the additional ATP generated by cells, we report that C. ljungdahlii can produce higher amounts of ethanol when batch cultures are exposed to particular concentrations of O2. Furthermore, this anaerobe can grow in the presence of O2 and remove it from the culture headspace over the course of syngas fermentations. Cell extracts generated from the syngas fermentation cultures exposed to oxygen were shown to have NADH oxidase, superoxide dismutase and peroxidase activity but not catalase activity. RNA sequencing analysis revealed differentially expressed genes that provide insight into the observed fermentation profiles and oxygen/reactive oxygen species detoxification enzyme activities.

Quan Zhou
Graduate Program: Biological and Agricultural Engineering
Advisor: Dr. Wenqiao Yuan
Poster Number: 197

Influence of Weak Acids on Butanol Fermentation by *Clostridium Saccharoperbutylacetonicum*

In traditional butanol fermentation processes using glucose as the carbon source, 1/3 of the carbon is lost as carbon dioxide so the maximum theoretical yield of butanol is only 0.67 C-mol/C-mol of glucose. Butyric acid, which is a four-carbon acid, can reduce the carbon loss in the fermentation process. Theoretically, butanol yield can reach 1 C-mol/C-mol of butyric acid. Moreover, adding butyric acid into the culture medium can trigger the fermentation process into solventogenesis phase, which as a result, can increase butanol production rate. One challenge is that some other weak acids, such as acetic acid and lactic acid also present in the product along with butyric acid during the production of butyric acid from biomass and their effects on butanol fermentation are largely unknown. The objective of this study is to investigate the influence of acetic acid and lactic acid on butanol production by Clostridium Saccharoperbutylacetonicum. A batch culture will be conducted by feeding butyric acid and glucose as co-substrate to C. Saccharoperbutylacetonicum. Small amounts of acetic acid and lactic acid and their mixtures, e.g., from 0 to 5 g/l will be added to the baseline. The concentration of feeding substrate and aqueous products will be regularly measured by an HPLC, and the correlation between butanol yield/productivity/concentration and week acid concentrations will be developed.

College of Design

Reza Amindarbari
Graduate Program: Design
Advisor: Dr. Perver Baran
Poster Number: 5

Rethinking the Disbursement of Land Tax Revenue: A Spatial Model for Distribution of Land Tax Revenue

The way properties are taxed by city governments is known to impact urban form (distribution of density and land use). Property tax is often levied with the same rate on the combined value of land and improvements, while the portion levied on improvements is shown to discourage landowners to develop land for its efficient use of density. An extensive body of literature supports split-rate property tax systems, with more or all weight of tax levied on land value, as a tax on land a) is neutral and efficient as it doesn't distort the market, b) can internalize the positive externalities accumulated in land value which is generated by the public. Since land value is not inherent in the land itself but dependent on location – i.e. accessibility to resources – it has been suggested that a tax levied on land is, in fact, the fair share that landowners should pay to the public in return to the value deposited to their land by the public. The variation in the impact of individual agents (e.g. businesses and institutions) on land value, however, has been out of the scope of previous studies. For an "ideal" internalization of externalities generated by the public, the variation in the impact weight of agents should be considered in the disbursement of land tax revenue. Utilizing existing network-based descriptions of accessibility, specifically gravity, for a detailed (parcel level) hedonic pricing model, the present study provides a conceptual framework for developing a spatial model for explaining the variation in the impact weight of individual resources across a city. Utilizing this model, this study tries to extend Pollock and Shoup's model (1977) in order to explain how the distribution of intensity of development may change if the disbursement of property tax revenue follows the impact weight pattern of land value generators.

Brian Franson
Graduate Program: Industrial Design
Advisor: Dr. Sharon Joines
Poster Number: 52

Light for the Shift Worker

The intention of this study is to investigate the daily routines of night shift workers as it pertains to light and their internal clock. This internal clock, called the Circadian Rhythm, affects the way people sleep, feel and behave and is closely linked to light. Many people worldwide struggle with a desynchronized circadian rhythm due to work schedules and environments, causing productivity and health related problems. It is my intention to gain an understanding of the subjects and the people involved, to inform the design of a lighting solution that will help alleviate some of the problems that come about due to these circumstances. A literature review of the subject will help uncover works done by others surrounding this issue and provide basic information on light and night shift workers. Knowledgeable experts will be sought out to inform issues not covered in the literature review. Then, a human-centered design research approach will allow insights to be gained into the user's behaviors and needs. These insights and user feedback will be incorporated into the design development of a product that gives users a better grasp on their condition. Final solution should provide those with a misaligned circadian rhythm with more awareness and control in their natural daily rhythm.

Wesley Hare
Graduate Program: Industrial Design
Advisor: Dr. Sharon Joines
Poster Number: 69

Sketching the User Experience for Creating Next Generation Graphics Tablets: An Investigation in Humancomputer Interactions with Tangible and Touch Screen Interfaces for Digital Sketching Applications

The issue being addressed is the user interface problems industrial designers face when sketching on graphics tablets. Current graphics tablets could offer a more natural user experience more similar to actions of analog sketching to ease the transition into the methods of digital sketching. To address these problems 10 participant, 5 expert users and 5 novice users, will be interviewed and observed performing drawing exercising on the Wacom Cintiq as well as on paper. To record data, video will capture a first person perspective of the tasks being performed as well as to capture body movements. The focus of this research will be on the division of labor between the hands, eyes, and cognition from switching between commonly used tools and navigating through menus. Insight into these areas and the tasks that are being performed by users will be helpful in developing a more natural user experience for digital sketching on the next generation of graphics tablets.

Kelly Kye
Graduate Program: Art + Design
Advisor: Susan Brandeis
Poster Number: 96

Home, Hand and Heritage

I will communicate my design process, production and marketing of a functional quilt collection in a contemporary marketplace, using the parallels between iconic architecture of textile manufacturing and traditional American quilt patterns as a design reference and conceptual theme. I will compare the water wheel, the sawtooth rooftop and digital architectural designs to patterns and stitching used in traditional American quilts, like the Wheel, Fan, Baptist Fan, Sawtooth, Log Cabin, Courthouse Steps, Stepping Stone and Nine Patch variations. The quilts variations are seemingly limitless and its significance to me personally, and in others, is examined in my research. It is also important that this project is a viable product in the contemporary marketplace. I have consulted with product development, small business, trend and marketing resources to supplement my research in product development. Through research in materiality, technique, historical and contemporary precedent, and design

theory I will make a set of quilts and coordinating quilted pillows that serves the purpose of function while also meeting the demands of thoughtful design and craftsmanship using a small-scale manufacturing process. The project research is significant to help future students understand the relationship between maker and product of a quilted item and product development with the intent of marketing and sale of the products. The products developed in this project will be significant to setting a new precedent for home textiles currently being made by incorporating a clean, contemporary aesthetic with a traditional mode of making, hand quilting, as a complete collection of ready to produce goods.

Dwayne Martin
Graduate Program: Art + Design
Committee Chair: Marc Russo
Advisor: Dr. Sarah Stein
Advisor: Cecilia Mouat
Poster Number: 114

Trypticity: The Evolution of Nonlinear Film for a Connected Generation

In my final project, Trypticity, I want to explore nonlinear storytelling by making three short 3D animated films that show intersecting stories of three separate protagonist. I believe this interlaced type of storytelling is on the verge of becoming popular for our current generation. It is a format that allows for an audience to become immersed into the universe of the story rather than a traditional passive one time experience. It is also something that I feel both studios and entertainment services are already beginning to take advantage of in movies and TV. The Internet has brought a new sense of connectivity among mankind. Before the Internet, movies and TV were largely controlled by time, audiences had to be present at a certain time and on specific days in order to see them. Trypticity will attempt to create a new format for storytelling in movies, more specifically, nonlinear movies. In Elements of Film, author Lee R. Bobker stats that “No art can grow or survive without responding to the society that produces it”. Prior to WWII most films featured linear plots that progressed naturally from beginning to end, however, after WWII many films became nonlinear to reflect the mind state of many veterans. These reflections of society still continue today, and with the Internet becoming a resource that people use often, entertainment services that take advantage of what it has to offer are blossoming. The phenomenon known as binge watching is proving that people will watch a massive amount of TV episodes and movies in a single viewing if it is available at once. Trypticity looks to use that to its advantage by relying on elements of Gestalt theory. I believe audiences will be able to make the necessary connections to get a global view of the plot.

Muntazar Monsur
Graduate Program: Design
Graduate Institution: College of Design
Advisor: Professor Robin C. Moore
Poster Number: 123

Architecture and Learning Motivations: Understanding the Spatial Influence of Indoor-Outdoor Relationships in Early Childhood Institutions

How the architectural design of a school/classroom may influence children’s learning outcome is an emerging issue both in the fields of design and education. Research shows that the built environment influences children’s as well as teachers’ behavior. Previous studies indicate that both the indoor and outdoor environment motivate activities. However, very few, if any empirical studies have investigated how the relationship between the indoor and the outdoor environment influences learning behavior. Visual and physical relationships between the indoor and outdoor are delineated as an important aspect for the wellbeing of children. The purpose of this study is to investigate empirically the behavioral consequences of specific architectural indoor-outdoor features of the classroom environment and use the findings to benefit the design processes of childcare centers for improved learning environment by informing architects, educators, and policy makers. A two-stage, mixed methods, exploratory study is conducted with children and their teachers/caregivers in childcare centers in Wake county, North Carolina. Data were collected from 22 classrooms in 8 different childcare centers with 31 teachers/caregivers and approximately 330 children. Environmental data on indoor-outdoor space relationships was measured with validated rating scales. Children’s motivation towards learning was measured by systematic observation during regular classroom activities. Teachers responded to a semi-structured questionnaire survey intended to collect data concerning their understanding and teaching motivations related to classroom design. Initial findings from preliminary statistical analyses show that improved conditions in indoor-outdoor relationship of environment in a classroom enhance learning and teaching motivation among children and their teachers. Good indoor-outdoor spatial relationship in a classroom affords more teaching innovation and nature based learning while poor conditions restrict such opportunities. Findings of this research are being utilized to develop a design of a model classroom maximizing indoor-outdoor spatial relationship to aid motivation towards learning and teaching.

Christine Van Hoever
Graduate Program: Art + Design
Advisors: Tania Allen, Susan Brandeis, Dr. Cecilia Mouat, and Marc Russo
Poster Number: 174

Demystifying Pattern Design: Teaching Repeat Pattern Principles Through an Animated Interactive Application

People are hard-wired for pattern and symmetry. We use pattern to decorate and communicate ideas, stories, and identity. Through investigating the history and principles of repeat pattern, along with the concepts that pattern is relevant to culture and personal identity, that people find joy in making and sharing, and that the Internet and online communities are redefining the future of craft education, this research project will support the creation of an animated interactive application for tablet computers. This application will be designed to teach repeat pattern principles, instruct users how to create their own, as well as understand the connections between pattern, history, culture, and identity. Digital tutorial design is an area that is ripe for further investigation and experimentation. With new digital media and the Internet, instructional how-to guides for craft techniques can incorporate words, still images, video, interactive tools and more. While it does not replace being instructed by a real person, it takes steps closer to a richer and more educational experience. This tool will be an opportunity to actively, through animation and interactive tools, demystify repeat pattern design, and inspire innovation in this field.

Robin Vuchnich
Graduate Program: Graphic Design
Advisor: Meredith Davis
Poster Number: 177

Designing Experiences with Online News to Mitigate Selective Exposure and Fragmentation

News aggregation interfaces that facilitate personalization through topic filtering and media outlet selection are becoming the norm and this has potential consequences for how a society interprets the news and evaluates the importance of various current events. Users have the ability to select from a range of highly partisan content providers. With the integration of social news — which feeds in from social networks and is largely entertainment oriented, these applications run the risk of becoming echo chambers and facilitators of information cocoons that are highly self-focused. Users may opt out of a broad range of news topics that traditional broadcast media would have considered worthy of public attention — things like scientific discoveries, political news, or world news. If these interfaces exacerbate social fragmentation and a lack of awareness of societal issues belonging to important news domains, a society may find itself struggling to cross rifts in public discourse and to solve problems. As intermediaries of online news and information, the environments and experiences we design should facilitate activities and behaviors that: result in occasional exposure to counter-attitudinal information; maintain the value of weak ties between social groups; encourage expansion of topical interests and serendipitous discoveries; and make visible and available, the crucial information that lies outside of our personal information bubbles in order to maintain for society, some level of shared knowledge of news and information. I am designing and prototyping a digital interface that facilitates these kinds of activities on behalf online news users.

Will Walkington
Graduate Program: Graphic Design
Advisor: Meredith Davis
Poster Number: 179

Designing Digital Map Interactions to Support Long-term Decision Making

Humans have long consulted maps as references for both structuring and building their knowledge about unfamiliar places. Over the past few decades, popular digital mapping and navigation tools (Google Maps, Yelp, Garmin, etc.) have increasingly assisted users with making relatively short-term decisions. These decisions may range from choosing a nearby restaurant for dinner to deciding on the most convenient way to travel there. However, when users look to digital maps for assistance in making long-term decisions, the design of the system must accommodate more complex scenarios over longer periods of time. This study investigates how young adults decide where to live when moving to a new city, and how the design of digital maps could better facilitate this process. The results of semi-structured interviews and surveys on decision-making strategies were analyzed to determine the variety of ways in which young adults develop preferences about where to live, and the extent to which such preferences factor into a formal process for making a decision. Further, existing literature on design revealed that the experience of interacting with tools designed to assist users with making a decision can influence their satisfaction with the results of the overall decision-making process. Additionally, case studies were conducted on existing online mapping websites commonly used while deciding where to move. While these applications are able to successfully aggregate data and information about multiple neighborhoods, there is often little opportunity for users to analyze the information in relation to their developing and evolving preferences throughout the decision-making process. Hence, the thoughtful design of digital mapping and planning tools that allow users to formulate and prioritize their preferences in response to information throughout the process has a good chance of increasing one's engagement with such critical decisions as choosing a place in which to live.

Bing Wu
Graduate Program: Industrial Design
Advisor: Bryan Laffitte, Timothy Buie
Poster Number: 186

Public Bicycle Parking

During the past decade, choosing bicycles as a mean Of transportation has been encouraged globally. On one hand, people enjoy the merits that bicycles offer, however, on the other hand, issues caused by the increased number of bicycles can't be ignored. Parking is one of the biggest of these issues. This problem is a significant concern for people in their daily life in different countries all over the world. In this project thesis proposal, the current issues of bicycle parking under different circumstances will be studied.

Yue Yu
Graduate Program: Industrial Design
Advisor: Bong Il Jin
Poster Number: 192

Improving Airports Security Check Experience

Air travel has become a popular travel approach. According to numbers reported in 2012, 1.8 million travelers pass through security checks every day. After 9/11, the US government began to treat airport security more seriously, which has made security checks more strict and stressful. Research shows that 17% of travelers are dissatisfied with the security check process. Even more concerning, globally, up to 7% of passengers miss their flights as a result of their failure to arrive at security points with sufficient time to get through the complex process. The purpose of this design project is to improve this situation, considering the security check process as an integrated experience, in order to give a better solution which makes the process more transparent and organized; provides information more efficiently to travelers; and makes the facilities more friendly and modern. A multiple human-centered research methodology has been employed. The research data was collected by survey, observation, interview and focus groups. Meanwhile, techniques such as behavior mapping, affinitive diagram etc., have helped organize insights and turn them into design criteria. A design solution was developed and presented by sketching, 3D modeling and prototyping, which were based on those insights and criteria. User tests also helped evaluate and refine the solution, to make right changes in order to create a better security check experience.

Yujia Zhai
Graduate Program: Design
Advisor: Dr. Perver Baran
Poster Number: 195

Does Spatial Characters Matter? Examining Park Pathway Space Syntax Characteristics and Senior's Walking

People experience park environment through walking, and walking is the most popular leisuretime physical activity among US adults (DHHS 1996). Walking is also important means by which users could explore a park. It is through walking that users get access to park sceneries and experience the whole park. Users' movement and route choices can significantly influence spatial sequence they experience, which consequently will impact overall experience and satisfaction. Theory of experiential landscape (Thwaites and Simkins 2007) claims that human experience has spatial dimensions, and that certain spatial configurations are beneficial to human experience of the environment. Theory of space syntax provides valuable tools to examine configurational characteristics of environment, and their potential influences on people's activity and perception. Space syntax has been widely used in examining urban environment and people's movement. Research in this area indicates that configurational measurements are correlated with number of leisure walking trips (Baran, Rodríguez, and Khattak 2008), pedestrian movement rates (Hillier et al. 1993; Zampieri, Rigatti, and Ugalde 2009; Ozer and Kubat 2007) and route choice (Chang 2002). However, use of space syntax theory in examining urban park and walking has been limited. This study responds to such a gap and aims at exploring how pathway configurational attributes are related to senior's walking in two real urban parks in Beijing, China. First, general principles for applying space syntax methodology in interpretation of urban park configuration characteristics are generated, and axial maps as well as convex maps of the two parks are developed. Numbers of senior people who walked on each pathway are conducted in morning, afternoon and evening periods, which lasts for three weeks. Statistical analysis indicates that larger global integration values are significantly linked to more senior usages in both of the parks; pathway control value and senior's usage is positively associated in one of the parks; and negative associations between variable of depth to gate and senior's walking exist in both parks.

College of Education

Hannah Carson Baggett, Crystal G. Simmons
Graduate Program: Curriculum, Instruction, and Counselor Education
Advisors: Heather A. Davis, Patricia L. Marshall
Poster Number: 9

"I feel like teachers really have a bias in their head": A case study of teacher candidates' conceptions of racial profiling

Recent events, such as the death of Trayvon Martin last year, rulings regarding "Stop and Frisk" policies in New York, and Attorney General Holder's discussion of the impact of the War on Drugs on communities of color have all brought racial profiling and discrimination to the forefront of our national discourse once again. There is a growing body of evidence indicating that adolescents of color perceive profiling and discrimination in school (Eccles, Wong, & Peck, 2006; Fisher, Wallace, & Fenton, 2000; Neblett et al., 2006, Powell & Ariolla, 2003) in their relationships with teachers, administrators, and peers. As such, it is important to consider the impact of this discourse around profiling, discrimination, and the experiences of students of color on the dispositions of teacher candidates (Villegas, 2006), and how they respond, react, and contribute to this narrative within the social sphere and in their future classrooms. This qualitative case study focused on two teacher candidates' understanding of racial profiling. By interviewing teacher candidates about their own experiences of profiling (if any) we hoped to prompt reflection and perspective-taking, especially in White teacher candidates who may exhibit dispositions such as 'colorblindness' (Bonilla-Silva & Dietrich, 2011; Milner, 2003; Tatum, 1997) or 'naive egalitarianism' (Woolkfolk-Hoy, Davis, and Pape, 2005). Findings indicated that one participant conceptualized racial profiling as intrinsic to her understanding of the schooling experiences of students of color, and articulated that profiling contributed to her broader understanding of racism; the second participant regarded profiling as an issue that is relevant to school contexts, but did not readily make connections among academic profiling and tracking in schools, the ways in which she profiled others, and her work as a future teacher. Implications for teacher education and further research directions are discussed.

Gina Childers
Graduate Program: Science Education
Advisor: Dr. M. Gail Jones
Poster Number: 31

Ownership of Data: Students' Investigations with Remote Electron Microscopy

Remote access technologies are enabling students to become virtual researchers by using scientific tools, communicating in real-time with scientists, and collecting and sharing scientific data. The effectiveness of remote technologies and students' perceptions of ownership of data during a remote investigation has rarely been investigated. The purpose of this study was to identify factors that contribute to successful remote learning investigations, document students' perceptions of ownership of data, science motivation, science identity, virtual presence, and learning outcomes with high school students (n = 72). A pretest-posttest control group design was used, and students were randomly assigned to one of two treatment groups: students able to collect their own insect to use during the remote investigation (n = 36) and students that did not collect their own insects to view during the remote investigation (n = 36). The results of this study showed that students' perception of ownership of data does not significantly change their perceptions of motivation to do science, science identity, and learning outcomes during a remote investigation. The remote investigation positively influenced students' learning outcomes and students' perception of science identity. Exploratory factor analysis of all identified constructs in the remote learning environment indicated that Science Learning Drive (students' perception of their competence and performance in science and intrinsic motivation to do science), Environmental Presence (students' perception of control of the remote technology, sensory and distraction factors in the learning environment, and relatedness to scientists), and Inner Realism Presence (students' perceptions of how real is the remote program and being recognized as a science-oriented individual) are factors that contribute to a successful remote investigation. This study provided valuable information on students' perceptions of ownership of data, motivation, science identity, and virtual presence during a remote investigation that can offer insight into remote learning environments.

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Graduate Programs: Leadership, Policy, and Adult and Higher Education, North Carolina State University[1], Department of Counseling, Higher Education, and Special Education, University of Maryland[2]
Advisor: Audrey Jaeger
Poster Number: 63

Push and Pull: The Influence of Race/Ethnicity on Agency in Doctoral Student Career Advancement

This study examines and enriches our understanding of career advancement for underrepresented doctoral students in science, technology, engineering, and math (STEM) fields. In addition, it explores the challenges facing all doctoral students in STEM in understanding and making meaning of diversity as it relates to individual perspectives and actions. We use an agency theoretical framework to explore careerrelated decisions of doctoral students. To develop the most comprehensive understanding of agency in the doctoral student experience, we chose an explanatory mixed methods design (Creswell & Plano Clark, 2011). Both quantitative and qualitative data answered our first two research questions: What agentic actions did the doctoral students take? What agentic perspectives (e.g. internal conversations, stances, views) did they assume? Our qualitative data addressed the aforementioned questions and the following: How do STEM doctoral students describe their sense of agency? What is the role of race/ethnicity in the career advancement of STEM doctoral students? How can agency help us understand the career related advancement of underrepresented minorities in STEM doctoral fields? Our final research question integrated the quantitative and qualitative data, asking how do our qualitative findings help explain our quantitative results? Data collection included an online survey and face-to-face interviews. Quantitative data was analyzed using ANOVA. Quantitative analysis revealed that participants were assuming agentic actions and perspectives during their doctoral careers; however, students' responses also indicated feeling stuck and lacking control. Additionally, some differences were found in terms of race and agency based on our survey results. Qualitative data analysis revealed the following themes: conflict of privilege, affirmative action at work, intersectionality, and isolation and a desire to build community.

Marcus A. Green
Graduate Program: Curriculum & Instruction, Educational Psychology
Advisor: Dr. Heather Davis
Poster Number: 65

Effective Teaching of Under-performing Students: Investigating the Beliefs of Four NC Teacher-leaders

Research highlights the inequalities of access to quality teachers for underperforming schools (also known as hard-to-staff schools) (Berry, 2004; Murnane, 2007; Murnane & Steele, 2007; Peske & Haycock, 2007). The efforts of a North Carolina school district in the form of a teacher leadership cohort (which strategically places proven teachers in such schools) sought out to address inequities at the district level. Both the quality of teachers' instruction and the quality of interactions between teachers and students can be shaped by their beliefs (Davis, 2003). Ladson-Billings (1994) discovered that in order to fully understand a teacher's practice, it was necessary to go beyond the surface of simply looking at what they were doing in terms of strategies. Four teachers that belonged to the cohort were interviewed, one-on-one, off campus. Teachers were asked to share their personal experiences in education, their perceptions of the nature of underperformance amongst schools and students, and discuss ways they have been successful serving underperforming students. One unifying characteristic of teacher participants in the study was that they were motivated to make a difference. They could speak about where teachers and schools have fallen short and ways they have taken personal responsibility to improve their own practice and influence that of others. They could speak logically about the strategies they employ. They communicated empathy, and a sense of concern to all students. Three demeanors to consider that emerged were 1. Creativity 2. Optimism , and 3. Having Fun.. In the study I also make reference (based on the interviews) to the use of specific research based instructional strategies mentioned by the participants. The theoretical model that surfaced shows that there could be an association between the beliefs (attitudes and actions) of a teacher and their utilization of certain research based instructional strategies that have proven to be successful. I further hypothesize that certain beliefs result in greater self-efficacy for using certain instructional strategies

Shaun Kellogg
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Advisor: Dr. Kevin Oliver
Poster Number: 88

Patterns of Peer Interaction and Mechanisms Governing Social Network Structure in Two Massively Open Online Courses for Educators

MOOCs, or Massively Open Online Courses, have gained extensive media attention for their vast enrollment numbers and the alliance of prestigious universities collectively offering free courses to learners worldwide. For many, MOOCs are filling the role of continuous education and ongoing professional development, serving to satisfy personal intellectual curiosity or enhance the workplace skills of post-graduates. A recent development in the MOOC space has been courses tailored to educators serving in K-12 settings.

MOOCs, particularly as a form of educator professional development, face a number of challenges. Academics as well as pundits from traditional and new media have raised a number of concerns about MOOCs, including the dominance of behaviorist pedagogies on leading MOOC platform, high rates of student attrition, lack of instructional and social supports, and even the potential to undermine the quality and diversity of post-secondary learning institutions. It is an assumption of this study that many of the challenges facing MOOCs can be addressed by leveraging the massive number of learners to develop robust online learning communities. Despite the potential benefits for educators, however, building and sustaining online communities has generally proved problematic. This study attempts address critical gaps in the literature and address issues of community engagement in MOOCs by examining factors that influence interaction among educators. Specifically, this quantitative case study is framed by the social network perspective and utilizes recent advancements in Social Network Analysis to describe the social networks that evolve through peer interactions and model the mechanisms that govern their structure.

Meghan D. Liebfreund
Graduate Program: Curriculum, Instruction, and Counselor Education
Advisor: Dr. Kristin Conradi
Poster Number: 104

Success with Informational Text Comprehension: An Examination of Underlying Factors

The Common Core State Standards call for students to spend significantly more time engaging with informational texts. Inquiry focused on gaining a better understanding of informational text comprehension, with specific attention to how this comprehension may vary for different types of readers, adds to the field and informs classroom instruction. Given differences in readers' scores on measures of narrative and informational text comprehension, one cannot assume that the same factors that lead to success with one type leads to success with the other. Also, readers are heterogeneous and rely on different component skills to comprehend text. Consequently, it becomes important to understand the component skills essential for informational text comprehension. This study aimed to advance the field towards a clearer understanding of the complex, interrelated factors that lead to informational text comprehension and determine if or how these factors vary for higher and lower comprehenders. Specifically, it used hierarchical linear regression to investigate how decoding efficiency, vocabulary knowledge, prior knowledge, and intrinsic motivation influenced informational text comprehension. The sample included 177 students in grades three through five that were predominately African American (61%) and female (51%). For the whole sample, the complete model with all predictors explained 62.5% of the variance in informational text comprehension, and all reading components explained unique variance, with vocabulary knowledge explaining the most variance in informational text comprehension. For lower comprehenders, decoding efficiency accounted for a significant amount of variance in reading comprehension beyond age and grade, but was not a significant predictor when all variables were included in the model. For higher comprehenders, vocabulary was a consistent predictor of informational text comprehension. The results reveal the importance of investigating informational text comprehension for different groups of readers and the value of multiple factors, especially vocabulary knowledge, for success with informational texts.

Kathryn Marker
Graduate Program: Educational Research and Policy Analysis
Advisor: Dr. Tamara V. Young
Poster Number: 112

School Improvement Strategies in North Carolina: Using Data Tools Effectively

Data-based decision making is key to school improvement, and the central player in that decision making process is the school's leader, the principal. The principal not only facilitates data analysis by the school staff, but also ensures a climate conducive to support effective instruction. Cumbersome data access has historically made monitoring and analyzing data, then applying insights gained, unmanageable for practical purposes (Wayman & Cho, 2009). In North Carolina, this obstacle may soon disappear. With a Race to the Top grant from the federal government, the state is bringing together a number of data applications into an integrated platform, or data dashboard, known as Home Base. To ensure successful statewide implementation of Home Base, professional development that assists principals with interpreting and using the data summarized in the dashboard is imperative. It is therefore important to a) know more about how principals utilize data to inform organizational management of the school as well as planning and evaluation of school-wide programs and b) obtain specific information about principals' perceived needs for improving how they use data to inform decisions. Drawing on interview and survey data from principals, this exploratory study delineates principals' experiences with DBDM within their school milieu and provides detailed, textured knowledge of their needs. The results inform the design of a larger study that focuses on understanding the knowledge, skills, and disposition that contribute to effective principal use of data dashboards for systemic school improvement.

Darris R. Means
Graduate Program: Educational Research and Policy Analysis
Advisor: Dr. Audrey Jaeger
Poster Number: 119

Demonized No More: The Spiritual Journeys and Spaces of Black Gay Male College Students

Spirituality plays a significant role in the lives of college students (Astin, Astin, & Lindholm, 2011; Bryant, Choi, & Yasuno, 2003; Chickering, 2006; Parks, 2000). However, Black gay males are uniquely positioned with regards to spirituality given how race, gender, and sexual orientation are generally perceived and experienced in the U.S. society. Unfortunately, current research has overall excluded the spiritual experiences of Black gay male college students. The purpose of this qualitative study was to explore the spiritual journeys and spaces of Black gay male college students who attend predominantly White institutions. This study used Abes' (2009, 2012) "theoretical borderlands" concept as a framework for this study by employing two theoretical frameworks—constructivism and quare theory—to design the study, collect data, and analyze the data. Data collection involved interviews, field observations, and photovoice. Data were analyzed by first utilizing a constructivism lens, specifically self-authorship. Data were next analyzed by using a quare theory lens. The two theoretical frameworks were then applied to one case study to understand how the two frameworks worked together to inform the spiritual journey and spaces of one Black gay male college student. Major findings included: (a) the students perceived spirituality to be connected with their own religion but also connected to nature, science, and music; (b) the students experienced a spiritual trajectory along epistemological, intrapersonal, and interpersonal dimensions as they became authors of their own spirituality; (c) the students experience homophobia, racism, sexism, and classism during their spiritual journeys and in spiritual spaces; and (d) several students were able to resist the oppression during their spiritual journey by resisting homophobia and racism in dominant spaces and creating spiritual counterspaces. The significance of the findings have implications for practice, policy, theory, and future research.

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Advisor: Dr. Audrey Jaeger
Poster Number: 125

The Engaged Dissertation: Exploring Trends in Doctoral Student Research

This exploratory study investigated the extent to which doctoral students conduct community engaged scholarship, and examined characteristics of their degree-granting institutions. It utilized the most immediate work of doctoral students by analyzing completed dissertations from 2001 to 2011. Findings indicated that 60 percent of the institutions producing community engaged dissertations had received national recognition for their commitment to community engagement, either through the Carnegie Community Engagement Elective Classification or the President's Higher Education Community Service Honor Roll with Distinction award (or both). In addition, there existed a small positive relationship between land grant institutions and the Community Engagement Elective Classification. When dissertations were used as the unit of analysis, findings revealed that West coast institutions produced almost twice as many dissertations as institutions situated in the Northeast. Nearly three quarters of the dissertations studied came from education and public health fields. Finally, nearly 75 percent of dissertations were produced in the last four years of the study, suggesting that interest in community engaged scholarship might be gaining momentum in some doctoral programs. This study makes possible future exploration of best practices by identifying these programs, while also highlighting fields and institution types in which there are opportunities for growth in the area of community engagement.

Lindsay Patterson
Graduate Program: Science Education
Advisor: Dr. Eric Wiebe
Poster Number: 138

How Teacher Beliefs Affect the Integration of Electronic Science Notebooks to Scaffold Student Understanding of Scientific Concepts through Writing

As technology becomes more sophisticated, it offers the ability to not only provide content to the students, but also the capacity to act as a pedagogical agent and scaffold the students' learning. Therefore, integrating technology changes the classroom, and there is a need to better understand the way that teacher beliefs concerning: (1) technology, (2) student learning through writing, and (3) science impact the way technology is implemented. This research looks at the way learning is scaffolded by the teacher and the technology. Of particular interest is the way elementary teachers teach science, with and without the use of Electronic Science Notebooks (ESNs). Six teachers from three school districts participated, and data was collected in the form of interviews and classroom observations. Multiple factors influence the way technology is integrated into the classroom, and those factors can be external (e.g. norms of the school, level of tech-support) or internal (e.g. self-efficacy, prior experience).

Jennifer J. Stanigar
Graduate Program: Leadership, Policy and Adult and Higher Education
Advisor: Dr. Diane D. Chapman
Poster Number: 162

Perspectives of Effective Mentoring: A Q-Method Study of Entrepreneurial Learning and Development

Entrepreneurship is an important topic in Human Resource Development (HRD) because of the promise it holds for economic growth through innovation and harnessing the spirit of the entrepreneur. There are many programs that focus on the learning and development of aspiring entrepreneurs, such as incubators, accelerators, and small business development programs. Most programs offer mentoring from experienced entrepreneurs, but little is known about the process of effective mentoring for entrepreneurs. Scholars have called for more research into developmental relationships such as mentoring, especially in new contexts and with alternative methodologies. The author introduces a conceptual framework for entrepreneurial learning and development that synthesizes literature from management, adult education, human resource development, mentoring and entrepreneurship. The objective of this study is to explore what constitutes effective mentoring for entrepreneurs. The study proposes to examine the perspectives of high-potential entrepreneurs and mentors using Q-Methodology. Q-Methodology is an alternative research approach increasingly being used in social science research to study a participant's subjective point of view. The population for the proposed study includes participants in an entrepreneurial accelerator program in the southeastern United States. Using a set of prepared statements on cards, study participants will sort the cards into a quasi-normal distribution that allows the expression of their perspective by placing the statements to which they most and least agree. Analysis is conducted using factor analysis to reveal the viewpoints, or factors, which are distinguished by how participants sort the cards. In the final phase of the study, participants are brought together and grouped based on their shared viewpoints for the purpose of interpretation through participatory analysis. The findings of this study will fill gaps in the literature on entrepreneurial learning and development as well as inform program stakeholders on how to foster effective mentoring relationships for entrepreneurs.

College of Engineering

Zahra Aghazadeh
Graduate Program: Civil, Construction and Environmental Engineering
Advisor: Dr. M.A.Gabr, Dr. M.S.Rahman
Poster Number: 1

Application of Different Constitutive Models for Estimating Plate Anchors Capacity

Evaluation of the uplift capacity of plate anchors in saturated clay is an important aspect in offshore anchoring of various structures. In most of the literature reviewed, a constitutive model such as Tresca or Mohr-Coulomb has been used in analyses. There exists a need to study the anchors' pull out capacity using other advanced soil models and discern differences in results. This study presents the results of finite element simulation of a rectangular or circular plate anchor in saturated clay. The capacity factors (Nc) of the plate are assessed through the application of displacement control approach.

In this study in addition to Mohr-Coulomb two different constitutive models are used to represent the soil. These are Modified Cam-Clay, and the Soft- Soil Model. Undrained effective stress analyses are conducted using the computer program PLAXIS. A series of analyses using different embedment depths are performed for all three constitutive models. The results are compared to the lower bound solution as well as to data obtained from experimental studies available in the literature.

Nouf Mousa Almousa
Graduate Program: Nuclear Engineering
Advisor: Dr. Mohamed A. Bourham
Poster Number: 2

Investigation of High Heat Flux High Density Capillary Plasma Discharges for Hypervelocity Launches and Fusion Engineering Studies

Capillary plasma discharges, described as electrothermal (ET) plasma sources, are devices that produce high-density plasmas at high pressures and very high velocities and can be used in hypervelocity launches. The plasma jet is of high heat flux and has been used in several material studies related to plasma interaction with surfaces to study the surface response and ablation for application in fusion reactors. A capillary discharge generates an intense electric arc inside a tubular ablating material. The arc heats the wall of the capillary and ablates its material, which forms and heats the plasma. Radiation heat transport to the wall is the dominant ablation mechanism. The parameters of the generated plasma depend on the capillary geometry, the discharge current amplitude and the wall material. The 1-D, time dependent ETFLOW code models capillary plasmas and predicts the time and the axial variation of the plasma parameters. Ideal and nonideal models for electron-ion momentum transport cross section are considered in the code. Simulation results indicate that the geometry of the source plays a significant role in the generated plasma parameters. The narrower and the longer the source, the higher ablated mass and heat flux. Also a set of code runs were conducted at various inputs to explore the effect of the high heat flux on the ablation behavior of plasma facing materials surfaces. The ablation rate and the resulting heat flux are strong functions of the material properties. The ideal model of the plasma resistivity leads to an over prediction of the plasma parameters specifically at higher currents ($I > 40$ kA) which suggest that the plasma tends to be weakly nonideal at higher discharge currents. The comparison with the experimental data obtained from the electrothermal plasma facility PIPE at NCSU has shown reasonable agreement with the code results.

Ahmad Alsabbagh
Graduate Program: Nuclear Engineering
Advisor: Dr. K.L Murty
Poster Number: 3

Effects of Neutron Irradiation on Microstructural and Mechanical Properties of Ultra-Fine Grained Low Carbon Steel

Ultra-fine grain (UFG) metals with a relatively large volume of interfaces are expected to be more radiation resistant than conventional metals. Point and line defects produced by neutron radiation exposure migrate to the interfaces wherein they get absorbed thereby not being available for radiation hardening and embrittlement. Neutron irradiation effects on ultra-fine grain (UFG) low carbon steel prepared by equal channel angular pressing (ECAP) have been examined. Counterpart samples with conventional grain (CG) sizes have been irradiated alongside with the UFG ones for comparison. Samples were irradiated in the Advanced Test Reactor (ATR) at Idaho National Laboratory (INL) to 1.24 dpa. Atom probe tomography revealed manganese and silicon-enriched clusters in both UFG and CG steel after neutron irradiation. Xray quantitative analysis showed that dislocation density in CG increased after irradiation while no significant change was observed in UFG steel, revealing better radiation tolerance. Quantitative correlations between experimental and modeling were demonstrated based on irradiation induced precipitate strengthening and dislocation forest hardening mechanisms.

V. Ajay Annamareddy, Xiaojun Mei and Jacob Eapen
Graduate Program: Nuclear Engineering
Advisor: Dr. Jacob Eapen
Poster Number: 6

Dynamcial Recovery in UO2 Following Radiation Impact

Uranium dioxide (UO2) is the fuel material of choice for most nuclear reactors operating around the world. Inside a reactor, UO2 is subjected to different kinds of radiation, all of which change its structure and dynamics over a timespan that ranges from nanoseconds to several years. Literature shows that complex oxides with a natural atomic disordering tendency exhibit resistance to amorphization in a radiation environment. In a recent MD investigation on gadolinium zirconate and gadolinium titanate, the resistance to amorphization has been shown to be dependent

on how the lattice accommodates disorder; a significant density increase can hasten the amorphization process even for fluorite structures. This research investigates the dynamical and radiation tolerant response following radiation impact in UO2 using molecular dynamics (MD) simulations. Using a rigid-ion interionic potential that has been benchmarked to several properties, our main objective is to understand the dynamical correlations that potentially lead to a resistance to amorphization in UO2. We show that the oxygen ions show a collective behavior that enables a quick relapse, following radiation, to the native dynamics that is characterized by concerted oxygen ion jumps across lattice sites. In comparison, we also observe that silicon, which is easily amorphized, portrays a distinct heterogeneous dynamics involving spatially separated groups of more mobile and less mobile atoms. Thus we demonstrate silicon is amorphized under irradiation because it transforms into a glassy state dynamically, whereas, UO2 resists amorphization because it recovers to the original dynamical state very quickly following radiation.

Josephine C. Bodle[1]; Ramey B. Williams[1]; Leigh J. Atchison[1]; Susan H. Bernacki[1]; Elizabeth Loboa[1,2]
Graduate Programs: Joint Department of Biomedical Engineering, North Carolina State University, and University of North Carolina[1]; Department of Material Science and Engineering, North Carolina State University[2]
Advisor: Elizabeth G. Loboa
Poster Number: 12

Does Primary Cilium Structure Morphology Indicate Adipose Stem Cell Lineage Commitment?

Human adipose-derived stem cells (hASC) are a multipotent cell type capable of differentiation into bone, fat and cartilage cell lineages. Due to their multipotency and relative abundance, they have shown great promise as a candidate cell source for engineering tissue replacement therapies for critical defect injuries, such as those sustained by soldiers in combat. To effectively utilize hASC in the clinic, it is critical to elucidate their underlying mechanisms of differentiation. We propose the primary cilium is one such component of the hASC differentiation process. Non-motile primary cilia have been implicated as critical mechanosensory structures in a variety of mammalian cell types and are thought to modulate a number of cell processes including cell lineage specification. We have identified the presence of primary cilia on hASC in both 2- dimensional (2D) and 3-dimensional (3D) culture. Based on our previous work with hASC and tensile strain, we hypothesize that primary cilia are intimately associated with hASC differentiation mechanisms, and that their conformation is related to their chemoand mechanosensory properties. To categorically evaluate hASC primary cilia conformation in relation to lineage specification, immunofluorescence was used to visualize the cilia structure, cilia-associated proteins and early markers for hASC osteogenic and adipogenic differentiation. siRNA knockdown was used to abrogate ciliaassociated proteins polycystin-1 (PC1), polycystin-2 (PC1) and Polaris (IFT88) and to investigate the role of these cilia-associated proteins in hASC differentiation. Primary cilia were observed on hASC in both 2D and 3D culture with diverse cilia conformations based on the dimensionality of the culture environment as well as chemical and mechanical stimulation. Additionally, hASC exhibited a diminished calcium accretion with PC-1 and PC-2 knockdown and diminished Runx2 gene expression with IFT-88 knockdown, all hallmarks of osteogenesis. Our data has indicated that primary ciliaassociated proteins play in important dynamic role in hASC differentiation, particularly in hASC osteogenesis. The results of this study elucidate the intricacies of primary cilia function in hASC differentiation, which can inform and optimize engineering hASCderived tissue replacements to be applied in a range of clinical applications.

Amir Botros
Graduate Program: Civil, Construction and Environmental Engineering
Advisor: Dr. Sami Rizkalla
Poster Number: 15

Development of Rational Design Methodologies for Dapped Ends of Prestressed Concrete Thin-Stemmed Members

Precast double tees with thin stems are widely used in parking structures and other buildings. Frequently, the end supports for these members are dapped such that the bottom of the double tee is level with the bottom of the ledger beam on which it is supported. The dapped connection detail is especially important in parking structures as the overall structural depth and floor-to-floor height need not be increased where the double tee is supported by the ledger beam. While dapped connection details have generally been successful, the frequency of undesirable cracking at such connections has always been a concern. Extensive repairs are often required to address the cracks. In many cases, the cracking is attributed to poor design and construction practices. The main objectives of this research work are to develop rational design approach for the dapped end members and propose the most efficient reinforcing schemes for the dapped ends based on experimental tests and analysis. The research scope includes both extensive non-linear finite element analysis and full scale experimental tests. The finite element modeling was conducted using a commercially available program. The analytical study included investigating various reinforcement schemes for the dapped ends that are not considered in the PCI Design Handbook such as C shaped, Z shaped, vertical, and inclined looped end hanger steel reinforcement. Furthermore, a parametric study was conducted to investigate the effect of some parameters believed to affect the performance of dapped end beams. The analytical study indicated that the failure of dapped end beams was due to diagonal tension cracking in the full depth section. Reinforcement schemes with inclined hanger steel reinforcement performed better than others in regards of strength and crack control. Several parameters were found to have significant effect on the ultimate strength of dapped end and in controlling cracking.

Michael G. Browne
Graduate Program: Biomedical Engineering
Advisor(s): Andrew J. DiMeo Sr. PhD, Gregory S. Sawicki PhD
Poster Number: 19

Optimization of Clubfooted Walking with a Dynamic Foot Abduction Brace

Children with clubfoot present with abnormal ankle joint posture (i.e. plantarflexed and inverted). Clinical interventions always end with foot abduction bracing prescription. Current bracing approaches do not permit functional mobility and merely lock the wearer's legs in place, a defensive strategy that aims to maintain posture rather than encourage growth. We have obtained an articulating ankle-foot clubfoot brace from private brace developer C-Pro Direct that shows promise for improving functional gait. We plan to determine lower-limb joint mechanics and metabolic energy expenditure (i.e. energetics) of a corrected clubfoot child as compared to typical pediatric gait in addition to the effects of the dynamic, articulating clubfoot brace characteristics (e.g. stiffness) on the mechanics and energetics of walking with treated clubfoot. We will conduct gait analysis on 10 clubfoot patients and paired control subjects. Clubfooted walkers will be analyzed while walking both wearing

the brace compared to typical equivalents. Efficiency will be measured by the degree of shift of the center of pressure towards that of a typical walker. We hypothesize that for each subject there is a predictable ideal setting for the brace to maximize efficacy. Preliminary gait mechanics and energetics were performed for one subject both wearing the dynamic brace and without. Center of pressure of the feet in the frontal plane showed a defined medial shift. Additionally, ankle kinematics while wearing the brace show a vertical shift from a position of relative inversion to a more aligned state of eversion. Because clubfoot is a deformity that causes inversion, the shifted COP and more everted ankle angle would signify that with the brace the walker shifted their center of pressure to the middle of their foot, more consistent with typical, ideal gait patterns. Further analysis will determine if the brace can be optimized to improve individual clubfoot gait abnormalities.

Nancy A. Burns and Saad A. Khan
Graduate Program: Chemical and Biomolecular Engineering
Advisor: Saad A. Khan
Poster Number: 22

Blended Cyclodextrin Nanofibers for Drug Delivery

Drug delivery issues that pertain to low loading and bioavailability can be addressed by incorporating the drug within complexing molecules such as cyclodextrin. The use of cyclodextrin-drug complexes in nanofibrous form offers a powerful method to enhance poorly water soluble drugs solubility while protecting the active material from degrading. However, cyclodextrin nanofibers dissolve instantly, limiting their use to sublingual delivery thus modification are needed extend the mat dissolution duration. Our approach entails blending cyclodextrin with different polymers and chemical crosslinking to expand the mat dissolution duration allowing for the release of poorly water soluble drugs over an extended time period. In this case mat morphology and dissolution duration was altered by blending cyclodextrin with poly(vinyl alcohol) or chitosan and chemical crosslinking with glutaraldehyde. Both blending and crosslinking were found to alter the mat dissolution duration and affect the drug crystallinity and release profiles.

Scott E. Carpenter
Graduate Program: Computer Science
Advisor: Dr. Mihail L. Sichitiu
Poster Number: 25

Improving VANET Routing Using Visibility Regions to Avoid Communication Obstacles

Wireless communications between vehicles enables safety applications, such as accident avoidance, and non-safety applications, such as traffic congestion alerts with the intent of improving safety in driving conditions. While broader information dissemination in vehicular ad hoc networks (VANETs) over two or more transmissions (i.e. multihop) greatly enhances application effectiveness, obstacles, such as buildings, foliage, and other vehicles present serious routing challenges by restricting direct line of sight (LOS) communication, especially in urban settings. Although many VANET-centric routing protocols exist, they differ in their information usage to select the next hop and many reactively enter into a route repair phase after a link fails, leading to costly communications overhead and limited effectiveness. To improve mobile communications by minimizing path recalculations, network optimization goals must achieve a viable connectivity capability while maximizing long-term path reliability. We propose using visibility information in next hop selection mechanisms to improve a VANET routing capability. The overlapping visibility regions of two points represents the unobstructed *zone of mutual visibility* (ZOMV) between them and motivates the following research objective: *The goal of this research is to improve VANET application effectiveness by including visibility region information proactively in the next hop node selection mechanisms of routing protocols.* The *visibility-aware route connectivity route lifetime* metric measures the longevity of a visibility-aware route once it has been successfully established. As traffic density increases, the visibility-aware mechanism selects suitable routes, improving route lifetime with the hop count approaching the optimal value. Proactively establishing viable routes reduces communications in a VANET and increases the possibility of transmission success, thus enhancing network reliability. A more reliable VANET information dissemination system advances application effectiveness and promotes safety, thus supporting one of the primary goals of connected vehicle systems.

Stacy DeCrane
Graduate Program: Biomanufacturing
Advisors: Dr. Gary Gilleskie and Dr. Nathaniel Hentz
Poster Number: 39

Evaluation of Endotoxin Removal in BTEC's Green Fluorescent Protein Purification Process

Endotoxin contamination is of major concern for any biopharmaceutical process involving protein production in gram-negative bacteria, such as the commonly used Escherichia coli. The outer membrane of a typical E. coli cell has approximately two million of these toxins, which cause severe immune reactions including fever if injected into the body. The biological effects of endotoxin have resulted in the United States Food and Drug Administration specifying limitations on the amount allowed in any injectable product. This topic is of interest to the Biomanufacturing Training and Education Center (BTEC) at NC State because E. coli is used in its process to express green fluorescent protein (GFP). The unit operations currently used to purify GFP such as chromatography and filtration are known to remove endotoxin. This project aims to quantify the amount of endotoxin removed in each of the downstream processing steps. To measure endotoxin, a chromogenic kinetic assay was employed in this study after suitability of the method for endotoxin quantification in GFP process streams was determined. To evaluate the appropriateness of the assay for this application, assay parameters such as accuracy, precision, linearity, and matrix effects were studied. This assay was then utilized to track the endotoxin concentration through samples from the anion exchange chromatography step of the GFP process. It was found that endotoxin binds more tightly to the chromatography resin than GFP, allowing for an approximately 10-fold decrease in endotoxin concentration in the product stream. The ratio of endotoxin to GFP in the process stream decreased from 47% prior to chromatography to 0.074% in the product effluent from the column. This result demonstrates the effectiveness of anion exchange chromatography at removing significant amounts of endotoxin from GFP. The assay parameter data as well as the profile of endotoxin concentration throughout chromatography will be detailed in this poster.

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Graduate Program: Biomedical Engineering, North Carolina State University/University of North Carolina, Chapel Hill[1]
Advisor: Dr. Zhen Gu
Poster Number: 41

Dissolvable Polymeric Microneedles for Insulin Delivery

Introduction: Microneedles are needles that are typically less than one millimeter in length. Arrays of microneedles are small enough to be inserted into the body painlessly by because they are only capable of penetrating the superficial dermal layers of the skin; thus leaving the underlying nerve cells unstimulated and undamaged. The reported microneedles are made of polymers which dissolve in situ; and as the polymers dissolve, they release their encapsulated drug payloads into cells or surrounding interstitial fluid. Microneedles may represent an attractive alternative to hypodermic needles for many types of drug administration, as their use is painless and eliminates dangerous needle waste.

People with diabetes must regularly check their blood sugar levels and periodically inject insulin in order to maintain normoglycemia. The damaging health complications associated with hyperglycemia include blurred vision, fatigue, and cardiac damage. Insulin is generally self-administered via subcutaneous injection, which is a routine and painful chore for diabetics.

Objectives: The objective of this research is to develop insulin containing dissolvable polymer microneedles that can replace frequent and painful insulin injections.

Methods: Master arrays of microneedles were initially fabricated via an SU-8 photolithography process, and negative molds of these needle arrays were formed by casting the arrays in silicone rubber (PDMS). The negative PDMS molds were subsequently used to form additional arrays of dissolving polymer microneedles by desiccating a solution of hyaluronic acid and human insulin or glucose-responsive insulin-containing nanoparticles into them. The resulting needles underwent microscopic analysis, and their drug delivery efficacy was assessed via a mouse model.

Key Findings and Conclusions to Date: The needle arrays show suitable geometry and mechanical strength for skin insertion. The needles are also capable of releasing their drug cargo in aqueous environments. Current studies are assessing the insulin delivery efficacy of the needle arrays in STZ-induced type 1 diabetic mice (C57BL/6J).

Jun Fang
Graduate Program: Nuclear Engineering
Advisor: Dr. Igor A. Bolotnov
Poster Number: 47

Development of Advanced Analysis Tools for Interface Tracking Simulations

The understanding of turbulent two-phase bubbly flows is important due to the widespread occurrence of this phenomenon in natural and engineering systems. The development of high-performance computing (HPC) allows for increasingly large simulations to be conducted. Direct numerical simulation (DNS) coupled with interface tracking methods (ITM) stands out as a valuable tool to compliment and expand our ability to understand two-phase flow phenomenon. Advanced data analysis techniques are highly desired for large scale simulations to extract very detailed information regarding the individual bubble behavior and correlate it with bubble parameters, such as shape, location, local liquid flow field. These techniques would allow efficiently processing multiple-thousand bubble simulations in complex geometries, like fully-resolved maxing vanes and spacer grids, to extract more knowledge compared to basic mean velocity profiles and bubble void fraction. As the first step, a new capability of the ITM code used in our research has been developed, which can estimate the drag and lift coefficients of the single bubble in uniform shear flow. Using relatively simple cases we demonstrated the new techniques to evaluate bubble deformability, and the capability of distinguishing and tracking individual bubbles. As an important exercise of ITM in complex geometries, law of the wall study for pressurized water reactor (PWR) subchannel is to be presented as well.

Kai Feng
Graduate Program: Civil, Construction and Environmental Engineering
Advisor: Dr. Brina M. Montoya
Poster Number: 50

Drained Shear Strength of MICP Sand at Varying Cementation Levels

Traditionally, geotechnical engineers strengthen soil properties using chemical grouts, which have potential contamination to groundwater or limited injection distance. Microbial induced calcium carbonate precipitation is a novel ground improvement method to improve the strength and stiffness of sand using natural biogeochemical processes, which cause little change to natural environment. Before engineers applied bio-cementation techniques into in situ construction, sufficient laboratory testing and verification are needed. The improvement in strength of bio-cemented sand is dependent on the level of cementation and confining pressure. The stress-strain behavior is systematically investigated using four cementation levels (untreated, lightly cemented, moderately cemented, and heavily cemented) and three levels of confining pressure (100 kPa, 200 kPa and 400 kPa). The uniformity of treatment is also discussed by disassembling samples to six separate sections. The experimental results indicate that the change in shear strength parameters and post-peak behavior are dependent on the level of cementation. The behavior of MICP cemented sands is also compared to the behavior of naturally cemented sands under similar loading conditions.

Qian Ge
Graduate Program: Electrical and Computer Engineering
Advisor: Dr. Edgar Lobaton
Poster Number: 54

Robust Region Matching under Bounded Deformation

Applications in computer vision such as object recognition and tracking, image registration, 3D reconstruction and motion estimation rely on finding point and region correspondences between images of a common scene. One approach for the correspondences problem is feature-based matching, which extracts feature points in images and computes their descriptors. Feature points between images are considered as corresponding points based on a nearest distance criteria. Finding correspondences between images under rigid deformation is well studied. The most popular approach is Scale-Invariant Feature Transform (SIFT). However, SIFT does not perform well for non-rigid transformations since the deformation is arbitrary. To solve this problem, we consider a bounded deformation model while extracting functional and topological descriptors in a hierarchical way in order to efficiently provide matches with low false-negative rates and high precision under bounded non-rigid deformation. Based on the result of point matching, we present a region in image as a graph and perform region matching by solving a hierarchical graph matching problem with some geometry constraints. Then, homeomorphism between the matching regions is estimated by approximating the deformation using radial basis function. This approach is tested using a dataset of depth images of footprint for registration, and considered in applications to 3D reconstruction for safe autonomous driving.

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Graduate Programs: Civil, Construction and Environmental Engineering
Advisor: M. Pour-Ghaz
Poster Number: 55

Experimental and Numerical Investigation of the Effect of Damage on Unsaturated Moisture Flow in Concrete

The presence of cracks noticeably changes the transport properties of concrete and it reduces the service life of reinforced concrete structures. To investigate the effect of damage in the form of cracking on the transport properties of concrete, an experimental and numerical investigation were performed in which different degrees of damage were introduced into specimens through freeze-thaw loading. Degree of damage was quantified by means of ultrasonic pulse velocity and also damage was monitored using active and passive acoustic emission during freeze-thaw cycles. Crack evolution and crack interconnectivity were examined using scanning electron microscope imaging. The saturated hydraulic conductivity (hydraulic permeability) and desorption isotherm of concrete specimens with different degrees of damage are measured and used in unsaturated flow modelling. Sorption and drying experiments were performed on the concrete specimens. Numerical simulations of wetting and drying cycles are performed and the results are compared with experimental results. Bulk electrical resistivity of the concrete materials with different degrees of damage using electrical impedance spectroscopy and 4point Wenner probe methods is also evaluated. Increasing damage generally results in increasing rate of transport in concrete; however, the severity of the microcracking effect is different depending on the considered transport mechanisms. While the initial rate of water absorption, saturated hydraulic conductivity increases exponentially at the same level of damage. However, the secondary rate of water absorption significantly decreases in low level of damage and it remains constant in higher level of damage. Electrical conductivity also shows a bilinear behavior with an initial higher rate of reduction.

Brandon M. Graver
Graduate Program: Civil, Construction and Environmental Engineering
Advisor: Dr. H. Christopher Frey
Poster Number: 64

Estimation of Light-Duty Gasoline Vehicle Emissions Avoided by Passenger Rail Service in North Carolina

The purpose of this research is to estimate the avoided emissions attributable to the reduction in personal automobile trips for riders of passenger rail, and to compare the avoided emissions to train emissions apportioned to each passenger. The North Carolina Department of Transportation owns six locomotives, including two F59PHIs and four F59PHs, which are operated by AMTRAK to provide passenger rail service between Raleigh and Charlotte. Per passenger-mile locomotive emissions were calculated based on portable emissions measurement system (PEMS) measured exhaust concentrations and locomotive duty cycles observed during revenue generating service of the Piedmont. Five years of ridership data were obtained from AMTRAK. The U.S. Environmental Protection Agency's Motor Vehicle Emissions Simulator (MOVES) was used to estimate the fleet average emission factors for travel with light-duty gasoline vehicles (LDGVs). For both the locomotive and LDGVs, travel between five origin and destination (O/D) pairs were analyzed. Removing a passenger from a LDGV and placing them on the train would lead to a net reduction in CO2 and CO emissions, based on the assumption that that the driver is the only passenger in the vehicle. Reduction in HC emissions depend on the locomotive used. On average, the F59PH locomotive per passenger-mile HC, CO2, and CO emission rates were 28, 43, and 92 percent lower than the LDGV emission rates, respectively. On average, the F59PH per passenger-mile NOx and PM emission rates were 198 and 276 percent higher than the LDGV emission rates, respectively. Potential delays in highway and rail travel were evaluated. Such delays are not uncommon. Highway travel delays tend to make the comparison of the train to avoided highway vehicle travel more favorable for rail travel, and vice versa.

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Advisor: Linyou Cao
Poster Number: 68

Instant Transfer of 2-D MoS2 Films

Molybdenum sulfide (MoS2) has layered structure where each layer is composed of a plane hexagonal array of molybdenum atoms between two sheets of sulfur atoms. MoS2 monolayers, with a direct bandgap of 1.8 eV, offer an unprecedented prospect of miniaturizing semiconductor

science and technology down to a truly atomic scale. Recent studies have indeed demonstrated the promise of 2D MoS2 in fields including field effect transistors, low power switches, optoelectronics, and spintronics. However, device development with 2D MoS2 has been delayed by the lack of capabilities to transfer large-area, uniform, and high-quality MoS2 monolayers. Here we present a transfer method for obtaining high quality and large area monolayer and few-layer MoS2 films on arbitrary substrates.

Amr Helal, Mohammed Gabr
Graduate Program: Civil, Construction and Environmental Engineering
Advisor: Mohammed Gabr
Poster Number: 71

Risk Assessment of Embankment Dams Using Performance-based Failure Probabilities.

Dams acting a main defense line against floods and storms have been tested intensively over the last years. According to the Association of State Dam Safety Officials, approximately one third of the “high hazard” earth dams in the nation are considered deficient in some aspects risking the integrity of such structures. Given the shortage of fund reported by ASCE (2009) as of $7.5 billion needed for rehabilitation of these defected structures, therefore, there is a clear need for accurate evaluation of stability and functionality level of earth dams. The experience of past dam failures proved the use of the “factor of safety” approach is not an effective indicator of the safety level or expected performance of these dams. Deformation-based Limit State (LS) approach is applied in this work together with the establishment of structure’s performance envelopes associated with loading. The limit states are correlated with the level of performance (extent of protection, or flood water storage adequacy) and account for factors such as the variation in hydraulic conductivity of the embankment materials as well as the rate of rising water level in the reservoir. In this study, the Risk Prioritization Tool for Dams by Federal Emergency Management Agency (FEMA) is modified to incorporate the estimated failure probabilities using LS approach as an input to the risk assessment algorithm. A case study of the Howard A. Hanson Dam, located on the Green River about 35 miles southeast of Seattle and 32 miles east of Tacoma, Washington, is presented. A Finite Element program (PLAXIS) is used in the analysis and the Artificial Neural Network (ANN) approach is presented for generalizing the analysis. Work here in aims at assisting the decision makers in decisions regarding budget allocation and investigate the efficiency of remedial measure in minimizing failure damages during future storms.

Syed Hussain
Graduate Program: Computer Engineering
Advisor: Dr. David McAllister
Poster Number: 77

Real-time Photo-realistic Rendering of Natural Phenomena in Stereo using Data Parallelism in Graphics Processor

Natural phenomena such as fog and rain are difficult to simulate and render photo-realistically in real-time and in stereo. Phenomena complexity, motion, and illumination issues create computational complexity problems that are difficult to solve, even with modern hardware. The problem of real-time, photo-realistic rendering of rain in stereo is investigated. Creating a convincing impression of virtual rain can be difficult. The challenges include modeling realistic rain distributions, use of illumination models, and the impact of scene dynamics due to environmental changes. The modern OpenGL Shading Language (GLSL) and Single Instruction Multiple Data (SIMD) architectures are used to take advantage of data parallelism in graphics processor. The raindrop geometry is modeled as a dense spherical mesh. Every vertex of each mesh is processed in parallel, using the SIMD capabilities of the Graphics Processing Unit (GPU). The GLSL and GPU programming language, such as CUDA, are used to implement parallel execution. The affects of physical forces are applied on raindrop geometry. Additionally, the concept of retinal persistence is used to elongate the raindrop so that it appears as rain streak. Dynamic level of detail on rain streaks is implemented so that a streak closer to the viewer has more detailed geometry then a rain streak further away. Illumination models are applied before rendering to give photo-realistic output. The parameters of the stereo view frustum are calculated and the scene is rendered twice for left and right eye views. Complexity is reduced by rendering object shadows only once. The GLSL and CUDA implementation exploited data parallelism of the graphics processor to achieve real-time photo-realistic rendering of natural phenomena in stereo. The GLSL implementation executes on the GPU memory to process each geometry vertex in parallel. The CUDA implementation is used to speedup matrix multiplications and calculations of physical forces acting on raindrop geometry.

Rachel Scognamiglio Ingham
Graduate Program: Civil, Construction, and Environmental Engineering
Advisor: Dr. Detlef Knappe
Poster Number: 79

Henry’s Law and Freundlich Adsorption Constants for Carcinogenic Volatile Organic Compounds

Up to 20 carcinogenic volatile organic compounds (cVOCs) are being considered for a new group regulation under the USEPA’s Drinking Water Strategy. The 20 cVOCs include eight currently regulated cVOCs, eight compounds on the third contaminant candidate list (CCL3), and four additional cVOCs. The principal objectives of this research are to determine the effects of temperature and background water quality on Henry’s Law constants (HLCs, describing cVOC partitioning between air and water) and to determine the effects of temperature, background water quality, and granular activated carbon (GAC) type on Freundlich adsorption constants (FACs, describing the cVOC adsorption capacity of GAC). HLCs and FACs are being compiled by conducting a comprehensive literature survey. Also, the effectiveness of predictive tools for estimating HLCs and FACs is being investigated. HLCs and FACs for the currently regulated cVOCs have been reported in many studies; conversely, experimental data are sparse for many unregulated cVOCs. To fill information gaps, HLCs are being determined experimentally using a variable headspace technique. Van’t Hoff relationships describing the temperature dependence of HLCs are being developed from data collected in this research and, when possible, compared with literature data and model predictions. Research results will help water treatment professionals assess the feasibility of using current best available technologies [packed tower aeration (PTA) and GAC adsorption] to remove candidate cVOCs and predict capital and operational costs for meeting the group cVOC rule. The literature survey yielded sufficient HLC information to develop van’t Hoff plots for three of the CCL3 cVOCs and four of the additional compounds. Preliminary results indicate that while PTA is a viable option for all eight of the currently regulated compounds, only two of the CCL3 compounds and one of the additional cVOCs exhibit HLCs that make them candidates for removal by PTA (HLC10°C >0.025).

Brittany Johnson
Graduate Program: Computer Science
Advisors: Emerson Murphy-Hill and Sarah Heckman
Poster Number: 81

Improving the Usability of Program Analysis Tools

Building high-quality software on a timeline, and a budget, is part of every software developers' job description. Developers can automate difficult and time-consuming tasks involved in building quality software like making program modifications and finding errors by using static analysis tools. These tools work by analyzing developers' code and presenting them with notifications containing information about their code. Research has shown, however, that many developers do not regularly use these tools. My research has had two primary goals: to discover why developers do or do not use static analysis tools, and to find what encourages tool adoption and continued tool use. Results from my interview study with 16 professional developers suggested that developers do not use static analysis tools because many tools do not help developers sort through large numbers of notifications, and do not effectively describe errors. My next two empirical studies with student and professional developers confirmed and built upon the results of these interviews. Participants in my studies found it difficult to sort through and address static analysis tool notifications due to a number of factors, including misleading and conflicting notifications. Based on these findings, I propose research to explore improvements to static analysis tools with the goals of increasing developer productivity when using them and increasing developer adoption of static analysis tools. Such improvements may include grouping of notifications based on their solutions and adaptive systems that change their notifications based on developer feedback.

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Graduate Program: Nuclear Engineering
Advisor: Hany S. Abdel-Khalik
Poster Number: 89

Overview on New Advances in Reduced Order Modeling for Nuclear Engineering Applications

Given the huge level of complexity and heterogeneity employed in modern reactor design calculations and safety analysis, reduced order modeling (ROM) techniques are often used to make predictions of reactor behavior in practical computational times. To alleviate the computational cost, ROM can be used to reduce the computational burden either by lessening the number of degrees of freedom at each model interface (e.g. input, state or response), or by the construction of a surrogate that represents the original model with quantifiable accuracy. The main step in ROM is the identification of a lower dimensional active subspace that represents all model's variations within quantifiable accuracy, a step that usually requires multiple executions of the model of interest which might be computationally taxing. This work introduces two advances into the reduced order modeling (ROM) techniques applied into single and multi-physics phenomena in nuclear engineering applications. First, we introduce an efficient technique for ROM subspace construction for computationally expansive models where the non-converged iterates are used to construct the lower dimensional active subspace instead of the fully converged solutions. As a demonstration, a quarter PWR fuel assembly was modeled and the proposed technique was used to construct the lower dimensional subspace. Further, this subspace was employed to estimate the multiplication factor and neutron flux variations over a range of cross-sections variations. The second advance is a novel algorithm for applying ROM on mutually coupled multi-physics models, for example: nuetronics and thermal-hydraulics, or depletion calculations. The idea is to perform three reductions at each physics-to-physics interface, one based on the upstream physics, another for the downstream physics, and a third for the interaction thereof. to exemplify the application of the proposed algorithm, a quarter PWR fuel assembly was depleted to 32 GWD/MTU by iteratively solving the quasi-static transport-depletion approximation. Active subspaces for the nuclear cross-sections and neutron flux are determined, and compared to the active subspaces obtained without the physics coupling. Results indicated that both advances in ROM provide means to employ ROM algorithms in nuclear engineering applications making the design and safety calculations more efficient.

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Advisor: Ruben G. Carbonell
Poster Number: 90

Peptide-Based Affinity Adsorbents with High Binding Capacity for the Purification of Monoclonal Antibodies

Monoclonal antibody-based biopharmaceuticals (MAbs) have vastly impacted human therapy, and a variety of products are now available for the treatment of various cancers and autoimmune diseases. Unfortunately, these products are very expensive, in large part because of the high cost associated with existing MAb purification processes. The presented work offers a way to decrease manufacturing costs by employing a peptide-based affinity absorbent for MAb purification. High binding capacity and selectivity are key features for the successful application of affinity adsorbents for antibody purification. This study presents the development of affinity resins based on hexapeptide ligand HWRGWV for recovering monoclonal antibodies from cell culture fluids. Methods are presented for the immobilization of the peptide ligand and its variants on polymethacrylate and agarose based chromatographic supports using two main coupling strategies. The reaction conditions of peptide coupling were optimized to maximize the binding capacity of the resulting adsorbents. The peptide resins were characterized by measuring their static IgG binding capacities. The measured static binding capacity ranged from 35 to 64 mg/mL. The dynamic binding capacities (DBC) of five selected adsorbents were also determined, and they ranged from 35 to 57 mg/mL with a 5-minute residence time. All the resins exhibited high selectivity towards the Fc fragment of IgG. The affinity resins were used to purify two MAbs, a chimeric IgG1 and a humanized IgG4, from commercial CHO cell culture fluids. The resulting yields and purities for both MAbs were found to be in the range of 87 – 93% and > 94 % respectively, which compare well with the purity and yield values obtained using commercially available Protein A media.

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Advisor: Korukonda Linga Murty
Poster Number: 92

Creep of Zr-1.5Nb Alloy and Application to Prediction of Spent Fuel Reliability during Dry Storage

Creep induced dimensional changes of spent fuel during dry storage need to be considered in assessing the reliability of nuclear spent fuel during dry storage since the temperature of the fuel rod increases as soon as the assembly is transferred from cooling pool to dry storage cannister. Creep deformation is important to be well characterized to be able to predict the reductions in the wall thickness of Zircaloy tubing. In making these predictions accurately requires a good knowledge of transitions in creep mechanisms exhibited by these materials as lower stresses are approached that are relevant to dry storage conditions. To this end, biaxial creep deformation of HANA 4 alloy (Zr-1.5Nb alloy) was carried out recourse to internal pressurization of closed end tubing with an aim to investigate the transitions in creep mechanisms as stress and temperature change. The creep data from the present work was analyzed together with the creep data of Unirradiated and Irradiated Zirlo (Wikmark et al) and Nb-modified Zircaloy-4 (Zhou et al) for comparison. It was observed that the data exhibit transitions in creep characteristics: Coble creep (n=1) at low stresses, viscous glide of dislocations such as is observed in alloy class of materials due to the solute atom locking of gliding dislocations (n=3) at intermediate stresses and climb of edge dislocations (n=5) at high stresses and power-law breakdown with exponential stress dependence at very high stresses.

Predictions based on time variation of fuel rod temperature during dry storage reveal that the accumulated hoop strain for the unirradiated Zircaloys saturates at around 100 years to be around 1.2% beyond which the increase in strain is relatively insignificant due to reduced fuel rod temperature. However, in the case of Irradiated Zircaloy, the predicted hoop strain saturates at much lower value of 0.20% owing to radiation hardening.

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Advisor: Frank Hunte
Poster Number: 94

Magnetotransport Methods to Probe Conductivity Due to Topological Surface States of Bi2Se3 Thin Films Grown by HPCVD

Topological insulators (TI) are a new class of electronic materials having potential for applications in the fabrication of future generation quantum computing and spintronic devices. TIs are insulators in the bulk material but have electronic states at the surfaces that support robust conductivity. Electrical transport through these topological surface states (TSS) is protected from impurity scattering by spin-momentum locking of the carriers. Bi2Se3 TI has a high n-type carrier concentration and shows metallic behavior due to intrinsic defects and Se vacancies. One of the main challenges encountered in the study of topological insulators such as Bi2Se3 is the growth of materials which are actual insulators in the bulk where conductivity due to the topological surface electronic states can be clearly distinguished from that attributed to defects in the bulk material. In order to address this challenge, we deposited Bi2Se3 thin films on (0001) Al2O3 by the method of hybrid physical chemical vapor deposition (HPCVD) with high Se vapor pressure to reduce Se vacancies in the films. These Bi2Se3 films showed a reduction in the carrier concentration from ~ 1x1019 cm-3 to ~ 7.5x1018 cm-3. XRD and phi-scans confirmed the epitaxial growth of Bi2Se3 on (0001) Al2O3. The high phase-purity of the Bi2Se3 thin films was confirmed by characteristic triangular features in AFM scans. This was supported by XPS analysis which showed single-phase Bi2Se3 thin films without the presence of Bi2O3 or any other impurity phases. Topological surface states (TSS) were clearly observed in angle resolved photoemission spectroscopy (ARPES) measurements and 2D surface transport was confirmed by the presence of a weak anti-localization (WAL) effect in high-field magnetotransport measurements. Our results show promise that careful control of growth conditions by HPCVD can be effective at isolating the conductivity due to the topological surface electronic states in Bi2Se3.

Stephanie Lam[1], Elena Blanco[1], Stoyan K. Smoukov[1], Krassimir P. Velikov[2], Saad A. Khan[1], Anne-Laure Fameau[3], Orlin D. Velev[1]
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Advisor: Orlin D. Velev
Poster Number: 97

Novel Classes of Stimuli Responsive Foams

Soft materials, such as foam and emulsion systems which respond to external stimuli, are on the leading edge of materials research and have recently been of interest to many scientists. We present a novel class of magnetically responsive Pickering foams, which remain stable at ambient conditions but can be quickly destroyed upon exposure to a gradient magnetic field. These foams are stabilized by particles made from hydrophobically modified cellulose with magnetic responsiveness imparted through the incorporation of carbonyl iron particles into the cellulose matrix. We studied the change in foam water fraction and collapse behavior over time, and correlated the evolution of these properties with foam viscoelasticity. We observed differences in the mechanism of foam collapse based on the fraction of water in the foam as well as the age of the foam. By correlating the time-dependence of foam viscoelastic properties with magnetic response, we propose two separate mechanisms of collapse - one for fresh foams and one for aged foams. Since novel materials can be fabricated from foaming or emulsifying particles of a certain chemical nature; we demonstrate how the aqueous magnetic foam can be solidified to form an oil-targeting decontamination system, which can easily be manipulated using a magnetic field. We will also discuss how these systems can be made photo- as well as thermally responsive, and analyze the collapse properties of photoresponsive foams as a function of system composition. Soft responsive materials, such as those presented here, can find application in a wide range of industrial and environmental processes such as defoaming, decontamination, as well as controlled chemical delivery.

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Advisor: Prof. Alper Bozkurt
Poster Number: 98

Terrestrial Insect Biobots for Search and Rescue after Natural Disasters

The use of crawling insects, such as the Madagascar Hissing Cockroach Gromphadorhina portentosa, as instrumented biobots in search and rescue missions after natural disasters can prove to be effective thanks to the ability of these insects to efficiently navigate in unknown and dynamic environments. Our preliminary experiments with such biobots involved line following tasks through antennal stimulation using system-on-chip microcontroller-based neural stimulation backpacks. Line following experiments primarily relied on manual control using a handheld radio transmitter. More recently, we have developed a Kinect-based system for automation of biobotic control. The current automated system uses image processing techniques to detect the position of a biobot and sends appropriate stimulation commands to the stimulation backpack via a radio transmitter to precisely make biobots follow a defined line. This closed feedback loop provides an objective environment to assess our biobotic control capability. Moreover, an on-board tissue-electrode coupling verification system would monitor voltage at the stimulation interface, and prevent irreversible damage to it, if and when needed. Current research involves equipping backpacks with an array of microphones to pinpoint help calls from surviving natural disaster victims, and automatically navigate a biobot to the location. These biobots form the nodes of a Zigbee-based sensor network to efficiently transmit the data to the first responders for monitoring and subsequent analysis as needed.

Rudrodip Majumdar
Graduate Program: Nuclear Engineering
Advisor: Dr. Mohamed A. Bourham
Poster Number: 110

Supersonic Plasma Flow Patterns for Simulated Aerosol Expansion Following a Fusion Disruption

A pulsed capillary discharge source operating in the ablation-controlled arc regime generates electrothermal plasma, which is characterized by its high-density and high flow speed, has been investigated. An ablated sleeve material produces a bulk of particles flowing through the source then into an expansion chamber. This enables simulation of the aerosol transporting into the vacuum vessel of a fusion reactor following a hard disruption event and the subsequent ablation of plasma facing components such as the diverter and the first wall of the reactor. The source is attached to a 150 mm long micro-nozzle extended transition region that has a 3.33 mm converging section with a 2o converging angle, followed by a 146.7 mm diverging section with a 60o diverging angle. The diverging section has an exit diameter of 50.82 cm and it opens into a large volume of the same exit diameter and a length of 1 m. This system simulates flow and expansion of the aerosol particulates into a large volume such as the interior of the vacuum vessel of a fusion reactor, and hence provides an insight on the plasma parameters and the bulk plasma transport. Preliminary computation results indicate a Mach number of about 21 at the diverging exit and drops to about 0.7 Mach number after suffering from multiple shocks in the large uniform expansion chamber.

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Graduate Program: Civil, Construction and Environmental Engineering
Advisor: Dr. Akhtarhusein A. Tayebali
Poster Number: 111

Laboratory Evaluation of Warm Mix Asphalt Technologies for Moisture and Rutting Susceptibility

Technologies that can contribute to a cleaner and greener globe are of key importance in today's world, especially in construction. Warm Mix Asphalt (WMA), since its introduction, has garnered a lot of attention and interest from the pavement industry as one such promising green technology to replace the conventional Hot Mix Asphalt (HMA). Despite its many benefits including reducing emissions and fuel usage, definitive answers on the feasibility of replacing HMA pavements with WMA are yet to be answered. A major concern for WMA is susceptibility to moisture-induced damage. Some WMA technologies are inherently moisture-based and utilize water to improve workability at lower temperatures. Water can also be retained in the aggregate as a result of lower construction temperatures. This increased presence of moisture in the mixtures can adversely affect their performance. In this research study, mixtures prepared using three WMA technologies- viz. Sasobit®, Advera® WMA and "The Foamer" were evaluated for their moisture susceptibility and permanent deformation in comparison with an HMA mixture. Tensile Strength Ratio (TSR) and Asphalt Pavement Analyzer (APA) tests were conducted to characterize these mixtures. Results of these tests indicate that moisture-based WMA technologies (Advera and Foamer) are more susceptible to moisture damage. However, rut depths evaluated using APA, even for moisture-conditioned specimens, indicated WMA performance on par with that of HMA. Even though the TSR values do not meet specification, APA test results indicate good potential for the widespread use of WMA.

Tiffany L. Messer, Michael R. Burchell, II and Francois Birgand
Graduate Programs: Biological and Agricultural Engineering
Advisor: Michael R. Burchell, II
Poster Number: 120

Tracing the Fate of NO3 - through Restored Wetlands: A Mesocosm15N Tracer Study

Wetlands receiving agricultural drainage water have been found to effectively reduce nitrogen loads entering adjacent estuaries in the Albemarle-Pamlico peninsula. However, whole system estimates of nitrogen transformations have been difficult to identify and quantify. The primary objective of the study was to improve our understanding of the fate of nitrogen in two distinct restored wetland systems with advanced analytical techniques that included 15N and Br- tracer evaluations. Two large wetland mesocosms containing two distinct wetland soils excavated from future research sites were constructed and planted in 2011. Mesocosms were loaded with 10% enriched KNO3 -15N simulated drainage water in August, 2013. Sediment and biomass samples were taken at the beginning and end of the experiment to be analyzed for 15N/14N. Nitrate-15N, N2-15N, nitrate-N, nitrous oxide-N, and ammonium-N samples were taken throughout the batch run. Nitrate-N and dissolved organic carbon

concentrations were measured hourly with an automatic field spectrophotometer probe. Temperature, total kjehldahl nitrogen, chloride, pH, dissolved oxygen, soil redox, and water depth were measured throughout the experiment with specialized probes and a stage gage, respectively. Preliminary results exhibited significant reductions in nitrate-N (α=0.05) with up to 91% removal within 7 days. Majority of the reduction is believed to be due to denitrification. Multivariate statistical analyses are being utilized to determine differences between nitrogen fates in the two systems. Variables include carbon availability, dissolved oxygen, and pH. Results should quantify plant uptake and denitrification within these wetland systems during the end of the growing season and clarify the significance of total and temporary nitrogen removal. Findings will provide wetland designers a better understanding of the nitrogen dynamics within these systems and could improve methods for increasing nitrogen reduction based on nitrogen transformations.

Arpan Mukherjee[1], Garrett Wheaton[1], Paul H. Blum[2] and Robert M. Kelly[1]
Graduate programs: (1) Department of Chemical and Biomolecular Engineering, North Carolina State University;(2) Beadle Center for Genetics, University of Nebraska-Lincoln
Advisor: Robert M. Kelly
Poster Number: 127

Life in Hot Acid: Uranium Extremophily in Thermoacidophilic Archaea

Bioleaching microorganisms have been known to oxidize ferrous iron present in pyritic ores to ferric iron, thus facilitating the solubilization of base and precious metals, such as copper and gold, respectively. Also present in certain pyritic ores are forms of uranium, a strategic metal with uses for both nuclear power and national defense. Microorganisms suited for this purpose must have a high resistance to uranium in order to be effective. Metallosphaera sedula, an extremely thermoacidophilic archaeon growing optimally at pH 2 and 73°C, has been studied with respect to its ability to oxidize iron and process chalcopyrite (CuFeS2). Its potential to mobilize U from ores has not been examined. In this study, M. sedula and a related archaeon isolated from a uranium mine, M. prunae, were evaluated for their ability to oxidize solid uranium (U3O8) and to resist soluble uranyl acetate. Genome sequencing results indicated that M. prunae is a spontaneous mutant of M. sedula (99.9% similarity in the genomes). Microbial physiology experiments suggested significant differences in uranium mobilization rates of the two species. It was also observed that M. prunae was more tolerant to uranyl acetate (U(VI)) compared to M. sedula. It is proposed that M. prunae resists uranium by stalling its cellular processes; normal growth is regained when stress is alleviated. Transcriptional response analysis indicated that ribonucleases, known as VapC Toxins, could be responsible for metabolic shutdown in the cell. Comprehensive biochemical characterization was performed for all VapC toxins in M. sedula genome and it was discovered that these proteins could target and degrade cellular RNA (mRNA, rRNA, tRNA). The study points to two important conclusions - firstly, natural growth environments play a major role in dictating metal-microbe interactions for closely related Metallosphaera species, and secondly, stress-activated ribonucleases mediate the survival of these organisms under toxic metal stress.

Magreth Mushi
Graduate Program: Computer Science
Advisor: Dr. Rudra Dutta
Poster Number: 128

Studying Security Impacts of the Complexity of Network Management and Administration in the Evolving Landscape of Software Defined Networking

Network management and administration tasks are integral part of IT operations of very large diverse set of organizations, spanning very small to very large organization sizes, ranging from core network service providers, to organizations that are purely users of ICT such as education. The security of networks is of crucial importance to all such organizations, and network misconfigurations have long been one of the primary sources of security vulnerabilities. Significant effort in the training of network administrators is targeted at reducing mistakes and missteps in their workflow, but the complexity of many commonly executed network management and administration tasks, coupled with their repetitive nature, makes them difficult to eliminate. In this study, we searched the literature for the current network administration and management practices, conduct survey with experts in order to get insight of network administration job and assist in formulating the hypothesis for quantitative study in the near future. This study consists of two phases; Phase I involves literature search and experts interviews, while Phase II involves survey of network administrators. Our main contribution is to introduce a more scientific approach to solving the misconfiguration problem by studying the effect of network administrators' actions and decisions in configuration of network devices, and identify those actions which introduces vulnerabilities and are critical to the security of the network. This work can in turn lead to more informed design of networking practices in the future. In phase I we were able to collect qualitative data which assisted in formulating hypotheses for Phase II survey. We also identified a list of common misconfigurations from the point of view of experts. It was clear from the interviews that the misconfigurations were partly attributed by lack of enough skills, and overwhelming responsibilities. We expect to test our hypotheses in Phase II of this research.

Mohamed Nafadi
Graduate Program: Civil, Construction and Environmental Engineering
Advisor: Dr. Sami Rizkalla
Poster Number: 129

Behavior and Design of Directly-Loaded L-Shaped Beam Ledges

Precast concrete L-shaped beams are commonly used in parking garages to support deck elements, such as double-tee beams. The ledge runs the full length of the L-shaped beam to support the eccentric concentrated loads generated by the stems of the double-tee deck beams, which bear on the top surface of the ledge. Such loads can be sufficiently high to cause local punching shear failures of the ledge under the stems of the double-tee beams. The precast industry has not experienced ledge punching shear failures in practice. Nevertheless, results of previous experimental tests have indicated that the current ledge design procedure, used by the Precast/Prestressed Concrete Institute (PCI), may significantly over-estimate the punching shear capacity of ledge. The primary objective of this research is to gain a better understanding of the ledge punching shear and to develop practical design procedure for PCI Design Handbook. The scope of the research program comprises literature review, non-linear finite element analysis, and full-scale experimental program. Results from the analytical modeling indicate that the current PCI procedure can significantly overestimate the punching shear capacity under a variety of conditions. Furthermore, the results clearly

demonstrate that several parameters, which are not considered by the current PCI procedure, can directly affect the behavior of the ledge. Outputs of the analytical modeling are used to develop a comprehensive experimental program to study selected parameters believed to affect the behavior. Upon completion of the experimental program, both experimental and analytical results will be used to provide a set of practical design guidelines to be implemented in the PCI Design Handbook and to form a basis for possible revisions to ACI code.

Punith Naik, Joel Ducoste
Graduate Program: Civil Construction and Environmental Engineering
Advisor: Dr. Joel Ducoste
Poster Number: 130

A Systems Biology Approach towards Modeling the Monolignol Biosynthetic Pathway in *Populus Trichocharpa*

A Biochemical pathway is characterized by an intricate network of nonlinear interactions between transcription factors, genes, proteins, and metabolites. While, the biochemical pathways governing the cellular functions have been characterized, understanding how such complex interactions can give rise to emergent properties is still challenging. The question underlying cell and molecular biology is, how to bridge the gap between the biochemical interactions and a given cell behavior? This question has led to the emergence of a new discipline known as systems biology. An important technique in systems biology is the use of dynamical systems theory to understand and characterize the steady states of biological systems. Bistable systems i.e., those that exhibit (at least) two stable steady states are particularly interesting in biology because they serve as different modes of operation for the cell when faced with genetic or environmental perturbation pressures. This work focuses on investigating the role of an enzyme complex on the stability of metabolic network of monolignol biosynthesis in *Populus trichocharpa*. We hypothesize that the enzyme complex results in bistable systems, which are more robust to perturbations. In this study, we developed a detailed model explaining the metabolic process using a Boolean kinetic model in which the rate of change of all the metabolites was represented by a system of Ordinary Differential Equations (ODE's). In the Boolean approach, the interactions between the various components in the pathway are expressed in terms of Boolean functions. The main advantage of this method is to allow regulatory interactions to be represented using Boolean relationships that requires minimal information on the detailed kinetics. The steady state metabolite concentrations of the metabolites were calculated and stability analysis was performed by perturbing the steady state concentrations. The results from stability analysis reveal that the enzyme complex does indeed results in bistability as compared to a pathway without an enzyme complex.

Benjamin D. Robertson
Graduate Program: Biomedical Engineering
Advisor: Gregory S. Sawicki
Poster Number: 146

Controlling Compliance: Resonant Behavior in Biological Muscle Tendon Units

Decades of research in the mechanics and energetics of gait (i.e. walking, running, hopping) demonstrate the importance of muscle-tendon architecture in stable and efficient movement. For example, humans 'tune' the interaction of their calf muscles and series Achilles tendon with body inertial dynamics so that active muscle generates high forces, allowing passive (i.e. springlike) tendons stretch and recoil under body weight. When this 'tuned' interaction is disrupted due to brain injury (i.e. stroke, spinal cord injury) or atrophy (i.e. microgravity, aging) it can significantly increase metabolic demands of gait, and limit mobility. While the benefits of properly 'tuned' muscle and tendon mechanics are clear, the role that neural control plays in coordinating observed mechanics is not. One of the canonical concepts of linear systems/control theory is mechanical tuning. This refers to the tendency of a system to increase peak response (i.e. force output) as a function of driving frequency (_____) (i.e. rate of mechanical stimulation). Driving frequency is typically normalized to the natural 'resonant' frequency of the system (__), which is a function of system stiffness, or force per unit length change (_), and mass (_): __ = ____ Peak response in achieved when _____ = __ for linear systems. Our goal was to determine the frequency response of the human neuromechanical system by forcing people (whose __ is unknown) to hop at a range of frequencies (_____) commonly observed in human movement. We compare these results to isolated muscle-tendon experiments with a known __ where contraction is driven via direct nerve interface through a range of frequencies _____ from ±20%__. We hypothesize that, despite biological muscle/tendon components being highly nonlinear, we will observe a characteristically linear response at the system level. If supported, our hypothesis would imply that classical concepts from controls engineering are readily applicable to artificial neural controllers to assist/enhance gait.

Peiman Shahbeigi Roodposhti
Graduate Program: Material Science and Engineering
Advisor: K.L Murty
Poster Number: 147

High Temperature Deformation of Mg Alloys

Magnesium and their alloys due to their extraordinary combination of properties gain a high priority in using in various industries. However, their high temperature time dependent deformation, known as creep, need to be improved to be able to use in various industries like aerospace and transportation. In this study it has been planned to investigate the creep behavior of Mg-Zn-Al and Mg-Mn-Al alloys with a major emphasis on the role of intermetallic phases. Various creep characteristics such as the stress exponent and activation energy along with their resistance to creep are investigated. Transmission Electron Microscope (TEM) has been employed to characterize deformation behaviors of alloys due to grain boundary sliding (GBS) at high temperature and dislocation based deformation at lower temperature. Like many other Mg-Al alloys, Mg17Al12 intermetallic phase, revealed by XRD analysis, plays a critical role in deformation behavior of these kinds of soft alloys by providing many obstacles in the path of dislocation movements.

This research is supported by the National Science Foundation grant 0968825.

Zhuo Tan, Rohan A. Shirwaiker
Graduate Program: Industrial and Systems Engineering
Advisor: Rohan A. Shirwaiker
Poster Number: 171

Antimicrobial Dual-Metal (Ag-Ti) Implant System Activated by Low Intensity Direct Current

Infections associated with the medical implant devices pose serious threats to patients in terms of morbidity, mortality and medical costs. This research focuses on the design and characterization of an antimicrobial dual-metal implant system for orthopaedic applications. The system is configured to induce local administration of silver ions from silver thin film coatings on titanium surfaces via low intensity direct current (<15 μA). We identify the important design metrics for the system based on regulatory guidelines. The scaled system prototypes demonstrate antimicrobial activities against both Gram-negative and Gram-positive bacteria. We also develop a 3D in vitro antimicrobial efficacy testing model that mimics post-operative implant-associated infections. The empirical quantitative analysis indicates a non-linear relationship between the antimicrobial performance of the proposed system and the surface current density of the anode. Preliminary in vitro cytotoxicity tests on human osteosarcoma cell lines (MG-63) suggest the possibility of sustaining silver ion concentration at levels that are detrimental to bacteria without inducing human cellular toxicity. Future scale-up and in vivo characterization will permit further refinement of the existing system.

Maziar Vanouni, Ning Lu
Graduate Program: Electrical and Computer Engineering and Future Renewable Electric Energy Delivery and Management (FREEDM) Systems Center, North Carolina State University
Advisor: Dr. Ning Lu, Associate Professor.
Poster Number: 175

Load Control Algorithms for Providing Different Control Measures in Electric Power Grids

Generation, transmission, distribution, and consumption are the steps involved in electric energy service provided by any electric power grid. To maintain the security, reliability, and sustainability of the provided service, control measures are to be taken in different steps of the service provision. Currently, these control measures are taken the most/less in the generation/consumption step, respectively. Electric loads, as the components involved in the consumption step, can provide a great control potential to address a wide range of the security, reliability, and sustainability problems. However, except from some concentrated large commercial and industrial loads, loads control potential has not been widely utilized because the needed automation/communcation/sensor infrastructure was not cost effective. But recently with considerable advances in those technologies, the needed infrastructures are economically more established making it possible to extend load control even in small commercial and residential level. Therefore, large amount of geographically dispersed electric loads can be aggregated/controlled which in turn increases the amount and impact of load control comparable to the other control alternatives and makes load control a more effective alternative than before. This research aims at exploring/proposing robust load control algorithms to centrally control and monitor geographically dispersed (even small residential and commercial) electric loads. The purpose is to regulate the aggregated power consumption of a group of controlled electric loads to perform control actions like load balancing, peak shaving and load shifting which specifically facilitates the integration of intermittent renewable energy based generators and in general more secure, reliable, and sustainable operation of the grid. The coordination of local and central control signals is studied to ensure the consumers comfort settings (like water or indoor temperature) is not (or minimally) compromised while the grid requirements are met. The performance of the control algorithms and their economic benefits are evaluated and studied.

Stephen E. White
Graduate Program: Biomanufacturing
Advisor: Dr. Gary Gilleskie
Poster Number: 182

Characterization of the Freeze/Thaw and Refrigeration Stability of a Cell Culture-Derived Influenza A/PR/8/34 (H1N1) Virus Stock and the Production Impact Thereof

In this study, the stability of live Influenza A/Puerto Rico/8/34 viral stocks for model cell culture influenza vaccine production is studied as a function of freeze/thaw cycling, thawing conditions after freezing, and length of time left under refrigeration conditions (2-8°C). Stability of the virus was determined through plate-based hemagglutination and TCID50 infectivity assays. The impact of freeze/thaw cycles on virus propagation was also studied through a series of cell culture infections.

Ping Xiang
Graduate Program: Computer Engineering
Advisor: Huiyang Zhou
Poster Number: 188

Warp-Level Divergence in GPUs: Characterization, Impact, and Mitigation

High throughput architectures rely on high thread-level parallelism (TLP) to hide execution latencies. In state-of-art graphics processing units (GPUs), threads are organized in a grid of thread blocks (TBs) and each TB contains tens to hundreds of threads. It is shown from research literature, microarchitectural simulators, and our experimental results on both Nvidia GTX480 and GTX680 GPUs that critical GPU resources, such as register files, are managed at the TB granularity. All the resource required by a TB is allocated/released when it is dispatched to / finished in a streaming multiprocessor (SM). In this talk, we show that such TB-level resource management can severely affect the TLP that may be achieved in the hardware. First, different warps in a TB may finish at different times, which we refer to as 'warp-level divergence'. Due to TB-level resource management, the resources allocated to early finished warps are essentially wasted as they need to wait for the longest running warp in the same TB to finish. Second, TB-level management can lead to resource fragmentation. For example, the maximum number of threads to run on an SM in an NVIDIA GTX 480 GPU is 1536. For an application with a TB containing 1024 threads, only 1 TB can run on the SM even though

it has sufficient resource for a few hundreds more threads. To overcome these inefficiencies, we propose to allocate and release resources at the warp level. Warps are dispatched to an SM as long as it has sufficient resource for a warp rather than a TB. Furthermore, whenever a warp is completed, its resource is released and can accommodate a new warp. This way, we effectively increase the number of active warps without actually increasing the size of critical resources.

Nima Yousefpoor
Graduate Program: Electrical Engineering
Advisor: Dr. Subhashish Bhattacharya
Poster Number: 191

Modular Transformer Converter Based Convertible Static Transmission Controller for Transmission Grid Management

This research investigates the concept of Convertible Static Transmission Controller (CSTC) using Modular Transformer Converter (MTC) as the building block. The MTC is a bidirectional back-to-back AC/AC power conversion unit and the CSTC is a versatile transmission controller asset for dynamic power flow control and contingency management of the transmission grid. The proposed CSTC with new functions has several advantages compared to existing FACTS controllers. System modularity for manufacturers and utilities/system operators using standard high power electronic systems is one of the advantages of this structure. In this presentation, algebraic models of the CSTC are derived in three different operation modes (series-shunt, series-series, and shunt-shunt connecting configurations). The proposed algebraic models are used to define the reference values for the CSTC converters based on the desired operating points for the meshed power system, the power transformers in particular. The dynamic performance of the CSTC with the proposed control structures and algebraic models will be investigated based on the PSCAD simulation. To prove the CSTC as a transmission asset and to verify the control structure and algorithm, ultra-high fidelity Controller Hardware-in-the-Loop (CHIL) testing has been conducted and comparative results will be presented. Finally, lab-scale experimental results are reported on the dynamic performance of the MTC-based CSTC.

Vahraz Zamani Farahani
Graduate Program: Electrical and Computer Engineering
Advisor: Dr. Mesut E. Baran
Poster Number: 193

State Estimation for Advanced Volt/Var Control on Distribution Power Systems

Volt/Var control is the main means of keeping voltages within desired limits along the distribution systems. Recent efforts towards improving system efficiency involves reducing the demand during especially heavy loading conditions by lowering the voltage along the feeder while keeping the voltage profile within acceptable limits. This practical application, Conservation Voltage Reduction (CVR), demands advanced Volt/VAR Control on a feeder as well as quite accurate monitoring of voltage levels along the distribution feeder. Here, this is achieved by adopting a state estimator (SE). The main issues related to the real-time monitoring of a distribution system for VVC: 1- Data, 2- System, and 3-VVC.

To address these issues, a three-phase branch current based SE (BCSE) has been adopted. For estimating the voltages along a given feeder, we need a limited number of real-time measurements. To determine this measurement set, a meter placement method has been proposed. The meter placement problem is an integer programming problem. Finding the exact solution for this problem requires an exhaustive search. To facilitate the search, a set of rules has been developed that will help us to determine an initial set of measurements. Then, in the second stage, a search scheme is implemented to find the measurements that can be eliminated. To eliminate the extra meters, we use a “sorting procedure” to find the final meter set. Main findings of this research include: 1- Real-time monitoring needs for advanced Volt/Var control has been identified and incorporated in the proposed metering scheme. 2- A set of guidelines is developed to determine a set of initial measurements. 3- The search scheme is computationally very efficient and quite effective in identifying the minimal set of the meters. 4- The search scheme is flexible in that it allows incorporation of different metering options and robustness measures.

College of Humanities and Social Sciences

Stephanie Mae Batchelor
Graduate Program: Social Work
Advisor: Dr. David Fitzpatrick
Poster Number:10

A Phenomenological Needs Assessment of Intensive Alternative Family Treatment Youth with Multiple Traumas, Adoption Interruption, and Adoption Disruption

Throughout the United States, youth in therapeutic foster care experience high rates of trauma that interferes with psychosocial development. These youths often also experience disturbances in family reunification and adoption, further inhibiting well-being. Yet little research has been conducted with this population. In North Carolina, treatment providers serve this subset of youth at a high frequency. Multiple traumas are defined as a sequence of distressing events that occur over a period of time and invoke feelings of physical or emotional threat such as physical abuse, sexual abuse, neglect, witnessing or involvement in a violent act, and separation from family. Adoption interruption is when an adopted child is living in out-of-home care and their adoptive parent(s) are ambivalent or reluctant to be reunified with the child. Adoption disruption is when a child is preparing for adoption and the prospective adoptive parent(s) end the process before it is legally finalized. This study seeks to understand the needs of youth with a history of multiple traumas, adoption interruption, and adoption disruption living in out-of-home placements. It uses a phenomenological approach for an evaluative needs assessment, examining youth in Intensive Alternative Family Treatment programs at KidsPeace, North Carolina. Data were gathered through semi-structured, qualitative interviews with youths, caregivers, and community stakeholders, providing a comprehensive view of youth needs. Interviews captured knowledge through dialogue and experience sharing. Data were analyzed using a domain analysis to create themes on needs among respondents. Youth were grouped in cohorts by multiple traumas, adoption interruption, and adoption disruption criteria. This study’s findings generate insight and awareness on the needs of affected youth and support future programming initiatives, staff training, and curriculum improvement to promote youth outcomes in this unique population.

Brian Blackmon, Ben Huggins, and Jeffrey Diebold
Graduate Program: Public Administration
Advisor: Jeffrey Diebold
Poster Number: 11

The Impact of Greenways on Property Values: Evidence from Cary, North Carolina

Over the past three decades, a growing number of localities have initiated publically-provided greenway projects in an effort to enhance community quality of life and attract new residents and businesses to the area. In this study, we perform a cost-benefit analysis of a 2004 extension in the White Oak Creek Greenway between Davis Drive and NC Highway 55 in Cary, North Carolina. We used a hedonic pricing model to estimate the benefit of the greenway extension.Our model assumes that the benefits of greenways are capitalized into the price of nearby homes.

Homes surrounding this segment of the greenway were divided into adjacent and near categories to examine the effects of differences in proximate location and their impact on property values. Adjacent homes are categorized as being 0-199 feet from the trail (n=121), and near homes are categorized as between 200-500 feet from the greenway (n=124). Furthremore, we identified a comparison sample of homes (n=284) in Cary that are greater than 500 feet from any greenway and used an algorithm to match our control homes based on square feet, year built, and acres. We collected home values from 2000 and 2008 Wake County tax assessments for all homes

Our analyses indicate that homes directly adjacent to the White Oak Creek Greenway have a $3,255 increase in property values when controlling for square feet, year built, and acres (p= 0.091). Homes that are near the greenway had a $1,824 when controlling for the same covariates (p= 0.258). As support for greenways increases and city budgets decrease, it is important that city managers, planners, and economist make good decisions about capital investments. This study only focused on one of the many proposed benefits of greenways, but it has significant implications for the Town of Cary and other advocates of greenway systems.

Nancy H. Brinson, Haven Hottel and Shatarupa Chakraborty
Graduate Program: Communication
Advisor: Ryan J. Hurley
Poster Number: 16

The Effects of Visual versus Textual Fear Appeals on Intent to Text while Driving

While fear appeals research is extensive within the context of road safety, consideration of visual versus text-based fear appeals is less developed. This study examined responses to high and low fear-based message manipulations involving visual and textual components on young adult drivers' intentions to text while driving. Using the framework of the extended parallel processing model (EPPM), this 2x2 factorial experiment (low or high visual fear with low or high textual fear) measured the impact of four hypothetical fear-based public service advertisements on participants' intentions to text while driving. Respondents' ratings of message fear and their self-reported actual fear in each condition were also examined. Results of this online experiment (n = 141) suggest that high-fear appeals in any combination (textual, visual or both) were effective in producing personal fear; however, an ANOVA analysis of the four conditions identified no significant difference in reported behavioral intention ($M = .37$, $F = .34$, $p > .05$). These results suggest that while the use of high-fear messages may induce perceived threat susceptibility and severity, it does not necessarily cause a change in behavioral intent in this context.

Santiago Nicolas Canete
Graduate Program: Communication
Advisor: Dr. Andrew R. Binder
Poster Number: 24

What Influences Scientists Participation in Public Engagement: A Qualitative Perspective of Museum Researchers

The goal of closing the gap between science and society depends largely on the extent to which the scientific community is involved in meaningful interactions with society. There have been many calls for the mobilization of scientists to do public engagement (PE), but research measuring actual participation and attitudes towards science communication is still developing. This project used a qualitative approach to examine factors that influence researchers' view of and participation in PE activities, such as giving public talks, writing popular science articles or talking to students in schools. In depth interviews were conducted with scientists working at a science museum in North Carolina, which allowed the analysis of the perspectives of active engagers. Using thematic analysis fifteen categories emerged as factors affecting scientists' participation in public engagement, which were organized under three themes: motivations for PE (6), barriers for PE (5), and other factors affecting researchers' involvement in PE (4). Results confirmed findings from prior research but also shed light on new elements that scientists consider regarding their participation in PE. For instance, the study found more extrinsic factors influencing scientists' willingness to participate in PE than intrinsic factors. Moreover, barriers to PE were predominantly extrinsic, while motivations showed a balance between internal and external factors. Implications for the promotion of PE at the institutional and personal levels are discussed.

Kristen Rae Chew
Graduate Program: Anthropology
Advisor: Dr. Ann Helen Ross
Poster Number: 30

The Use of Osteometric Sorting Techniques to Aid in the Resolution of a Large Scale Commingling

The purpose of this study was to illustrate the practicality of utilizing gross and osteometric sorting techniques as a first approach in the sorting of commingled human remains. The Piggot archaeological ossuary site (31CR14), curated at the Forensic Analysis Laboratory at North Carolina State University was employed to represent a large scale commingling. The sample used in this study consists of 114 skeletal elements. Each individual element was assigned an identification number. All bones were measured according to standard and non-standard measurements

and recorded in a Microsoft Excel spreadsheet. In cases of fragmentation, only available measurements were taken. All t-distributions were performed in Excel; regression equations were derived in SPSS Statistics 19.0.0.

Visual pair matching, the association of left and right elements based on parallels in morphology, was conducted on all complete or nearly complete elements. Several elements were successfully pair matched and later confirmed with osteometric sorting. The basic principle of osteometric sorting is that the two bones being considered are of a similar size and shape to have originated from a single individual. Osteometric sorting depends on the ability to distinguish anatomically normal size and shape relationships among skeletal elements. This is done by utilizing a reference sample to calculate means and standard deviations. For this study, the JPAC-CIL database was provided by the Joint POW/MIA Accounting Command in Honolulu, Hawai'i.

Three models were used in the osteometric sorting process. Model one compares left and right sides, which accounts for shape differences. Model two compares articulation surfaces of bone elements based on the size of articulating surfaces. Model three compares bones of different sizes. The t-values calculated for each model are compared using a two-tailed t-distribution (α=0.10). A significant p-value indicates that the two elements are significantly different and could not have originated from one individual.

May F. Chung
Graduate Program: English
Advisor: Walt Wolfram
Poster Number: 33

"The Hmong Among Many":A Descriptive Analysis of a Southern Interlanguage Variety

Even though Asian Americans are perceived as a distinct racial group, their speech has not been categorized as an individualized ethnolect (Wolfram & Shilling-Estes, 2005). However, Ito (2010) looked at bilingual Hmong Americans in Wisconsin, and whether they accommodated to the local norm. Although some accommodation to the matrix dialect was found, other features like the low-back vowel merger did not seem to play a noticeable role in Hmong English. However, Southern Hmong American speakers have very little exploration, perhaps out of consequence of recent tides of migration (late 1990s). For Southern Hmong American speakers in Hickory, North Carolina (n=20), speakers exhibited some past tense absent tokens, unmarking for a cluster morpheme, and invariably before a bilabial.This hints at transference from the Asian language. While some morphological elements were distinct, there may be some typified of integration into the community dialect. A look at prosodic variation among Hmong individuals in Wisconsin and North Carolina reveal speakers have similar speech rhythms, regardless of the matrix dialect. A closer look at their vowels will elucidate if a dialect shift is occurring. In the meantime, it may be that the ethnolect will need time to fossilize before becoming comparable to forms such as Hispanic English. To determine whether speakers within the Asian American speech adopt European American phonological variances in their speech, I acoustically analyze young second-generation bilingual Hmong-Americans from a rural Southern city. I acoustically measure the vowels of Hmong Americans to see if they ascribe to that of their European American counterparts. My research will add to discussions of what particular similarities and distinction constitute ethnolinguistic varieties. This study lends cultural implications of Asian American identity inherent in speech.

Meghan Deanna Cooper
Graduate Program: English
Advisor: Robin Dodsworth
Poster Number: 36

Southern Phonetic Features in Winston-Salem, NC

It is been proven that Southern dialects are becoming less pronounced in large Southern cities such as Raleigh. However, less is known about what happens in average, medium-sized Southern cities that experience less immigration from other parts of the country and world. This project examines and documents the status, change, and trajectory of prototypical Southern linguistic features in a corpus of speakers from Winston-Salem, North Carolina and surrounding communities within Forsyth County. The corpus consists of more than fifty sociolinguistic interviews of speakers raised the area and spanning several generations. Tokens from word lists and reading passages were acoustically measured and statistically analyzed. Features examined include vowel mergers and components of the Southern Vowel shift, particularly in the high front vowels (Labov 1991).

Previous linguistic survey data shows that speakers in all of North Carolina exhibit Southern dialect features, but note that age and rurality are predicting factors in the degree to which a speaker exhibits them (Labov et al. 2006). Specifically, younger speakers and those living in more urban areas are less likely to have Southern features. Linguistic research on Southern metropolises such as Houston, Memphis and, more relevantly, Raleigh, where many non-Southern outsiders have swamped the area has shown that the Southern Shift is steadily retreating or never reached completion (Thomas 1997, Fridland 2001, Dodsworth and Kohn 2012). Preliminary analysis from this corpus shows that, much like Raleigh, younger speakers do not exhibit some Southern features to the degree that their older cohorts do, particularly in regard to pre-lateral merging and the front components of the Southern Vowel Shift.

Georgina Crepps
Graduate Program: International Studies
Advisor: Dr. Mark Nance
Poster Number: 37

The Intellectual Property and Biodiversity Regime: An Analysis of Actors in the Negotiations over the Role of Traditional Knowledge

Intellectual property is a significant part of global trade. Biological resources and traditional knowledge, predominantly from developing countries, have become more widely used in research and innovations. This has increased pressure to settle the rules of their use, particularly because most patents using these resources are filed in developed countries. However, there is no singular international institution that completely regulates this. I therefore apply the framework of regime complexes to analyze how these rules are being set by the various institutions

and agreements that cover this area. Regime complexes are loose, nonhierarchical collections of institutions in the international realm that address overlapping issue-areas. This structure often results in conflicting governance patterns. Within the intellectual property and biodiversity regime complex, the U.N.'s Convention on Biodiversity and Nagoya Protocol, the WTO, and the World Intellectual Property Organization are all attempting to establish the relationship between traditional knowledge, biodiversity, and intellectual property. The overlapping approaches introduce tensions, made more difficult by the varying interests and power levels of actors and the differing levels of enforceability of the regimes. This raises the question of how convergence plays out in a regime complex with such a variety in both the status of the international agreements and the power levels of the actors involved. The norms of the intellectual property regime are the most influential and enforceable through the WTO. However, through analyzing statements and documents made by the institutions and actors involved, I have found that weaker actors (indigenous peoples, developing countries) are taking advantage of the overlap in the regimes to force their interests, represented in regimes that lack enforcement, to be addressed in institutions with more enforcement power. While far from settled, the results of clarifying the rules for using traditional knowledge may significantly affect the recognition and benefits indigenous people receive.

Emily K. Dew and Dr. Ann H. Ross
Graduate Program: Anthropology
Advisor: Dr. Ann H. Ross
Poster Number: 40

A Comparison of Craniometric and Molecular Genetic Variation in a Population of Cotton-top Tamarins (*Saguinus Oedipus*)

Non-human primate skeletal collections are often used as a proxy for humans in anthropological research as lab-raised populations allow for control of environmental factors and have lineage information for numerous generations, which is not possible with human collections. The goals of this study are to examine heritability estimates generated from craniometric measurements to those generated through genetic data, and to test these to the metric results derived by Cheverud and Buikstra (1982) using another population of non-human primates (cotton-top tamarins, N = 157).

Two sets of traditional craniometric measurements were collected: 1. Measurements used in Cheverud and Buikstra (1982) and 2. the standard forensic set (Moore-Jansen et al. 1994). In order to compare the data to genetic data from previously published research, the craniometric measurements were sorted by families and run through RMET with heritability = 0.450, which was derived from previously published research on cotton-top tamarins using 3D craniometric landmarks. RMET produced R matrices from which Fst values and within-group phenotypic variance were calculated.

Results for the standard forensic measurements produced an among-group variance of ~2% (Fst = 0.249, mean within-group variance = 0.977). Cheverud and Buikstra's measurements produced an among-group variance of ~15% (Fst = 0.341, mean within-group variance = 0.847). The values derived from the standard forensic measurements more closely resembles the genetic data, which estimates average heterozygosity <1%. However, Cheverud and Buikstra's measurements account for 34.1% of variance in this population, more than the standard measurements (24.9%), which are often used in humans to estimate ancestry.

Anna Erb
Graduate Program: Social Work
Advisor: Jiyoung Tabone, PhD, MSW
Poster Number: 45

Bridging Human and Animal-related Services During a Crisis: A Community Needs-assessment to Identify Barriers Associated with Seeking Services

Each year people face unforeseen situations, such as domestic violence and homelessness that place them in the midst of a crisis. An estimated 71.4 million U.S. households own a pet, and studies revealed that people who have pets delayed entering a shelter during a crisis due to safety concerns for their pets. There are services available to the families, but are those services extended to include pets? Although, the concern or safety of a pet is a critical factor when considering seeking services for people, it is largely unknown how community agencies address this issue while people are navigating their own safety and needs. The current study attempts to identify gaps in social services and associated barriers that people with pets may face when seeking assistance during a crisis. This study uses a mixed method approach- a survey distributed among community agencies providing crisis services and in-depth interviews with expert community stakeholders across Wake County, North Carolina. This study has significant implications for eliminating the barriers for people to receive necessary services during a crisis while not forcing them to abandon their pets by bridging human and animal-related services. With partnered support, the community can begin to address immediate human and animal welfare concerns while preserving the family system and human-animal bond through collective action.

Alena G. Esposito
Graduate Program: Psychology
Advisor: Dr. Lynne Baker-Ward
Poster Number: 46

Interference Suppression vs. Response Inhibition: An Explanation for the Absence of a Bilingual Advantage in Preschoolers' Stroop Task Performance

The "bilingual advantage" refers to the superior performance of bilingual or multilingual speakers compared to monolingual speakers on tasks involving controlled attention. However, the robustness of this advantage is in question due to several reports of null findings. For example, adult bilingual speakers out-perform monolingual individuals on a variety of tasks involving attentional control, including the Color/Word Stroop task and its variations. Preschoolers, however, have not shown an advantage in Stroop task variations designed for use with preliterate children. Specific task elements that differentiate when a bilingual performance advantage can and cannot be found over monolingual speakers may be responsible for the discrepant findings. We examined the role of task demands in explaining these results. Whereas the Color/Word Stroop used with older participants requires interference suppression (ability to ignore salient but incorrect information such as disregarding a "tricky" multiple

choice option), the Stroop task typically used with young children requires only response inhibition (ability to stop a programmed response such as raising your hand to speak rather than shouting an answer in a school environment). We developed a conflict task that measures interference suppression and is appropriate for use with pre-literate monolingual and bilingual children. Fifty-one preschool children (28 female) across four pre-schools performed both the new Bivalent Shape Task and the Day/Night task used in previous research, as well as a brief vocabulary measure, in a quiet room in their child care center. Bilingual preschool children (n = 26) showed an advantage in performance compared to their monolingual peers (n = 25) on incongruent trials of the Bivalent Shape Task only. The results indicate that the discrepancy in performance on Stroop task variations is a result of elements of the task and provide evidence that the bilingual advantage arises in part from interference suppression rather than response inhibition.

Joshua A. Hendrix
Graduate Program: Sociology
Advisors: Dr. Toby Parcel and Dr. Charles Tittle
Poster Number: 72

Do Atypical Physical Characteristics Discourage or Promote Delinquency among Adolescents?

Although much is known about the effects of adverse emotional and psychological characteristics on youths' engagement in delinquency, criminologists have paid relatively little attention to the relationship between atypical physical characteristics (i.e., disability, overweight or underweight body composition, early or late pubertal development, etc.) and criminal behavior during adolescence. Two theoretical perspectives offer important insights concerning the nature of this relationship, yet offer hypotheses that are contradictory to one another regarding how physical characteristics affect delinquency. Moffitt's "abstention thesis" suggests that adolescents who possess atypical personal traits are more likely to abstain from all criminal behavior, given that these characteristics can lead to their exclusion from normative peer groups in which criminogenic ideas and opportunities are most available. Contrarily, Agnew's general strain theory views atypical traits and processes of peer rejection as types of "noxious stimuli" that promote negative emotions (i.e., anger, depression, anxiety) among adolescents and that in turn encourage criminal behaviors and make abstention less likely. I test these competing hypotheses using a large and nationally representative sample of adolescents from the National Longitudinal Study of Youth 1979 (n=4,559). Results from a series of multinomial logistic regression models indicate some support for both perspectives and suggest that the relationship between physical characteristics and delinquency is complex, as criminal or non-criminal adaptations depend on the type of physical characteristic and other individual-level traits.

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Advisor: Douglas Gillan
Poster Number: 75

An Exploration of Robot Builders' Attachment to Their LEGO® Robots

This research explored the emotional attachment that students might develop towards robots that they built in a 2-month period, as well as the factors that contributed to their emotions towards the robots. Attachment is a long-term feeling of closeness toward another person (Kalat, 2011). The research studied 16 students enrolled in the robotics class in the fall 2012 semester who completed a specially-designed questionnaire. Theresults showed that students had strong positive emotions towards their robots. However, the students differed from typical attachment in that they did not avoid the loss of their robots and had lowanxiety aboutlosingtheirrobot. In open-ended responses on the questionnaire students indicated that they would feel sad dismantling their robots, but they rationally reportedthe robots could be rebuilt. Reflective journal data showed that they enjoyed the building process greatly, especially when they solved challenging problems. The data suggested that students'affection for their robots was not attachment as is typically defined in human-human orhuman-pet relations. Limitations and further research directions were included.As a follow-up, the study also collected data in the spring and fall 2013. The updated results will be included in the full poster.

Keywords: human robot relationship, attachment, robotics, college students, LEGO®.

Kiersten L. Johnson[1], Sarah L. Desmarais[1], Richard A. Van Dorn[2], and Marvin S. Swartz[3]
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Advisor: Sarah L. Desmarais, PhD
Poster Number: 82

A Latent Class Analysis of Agreement between Drug Use Indicators among Adults with Schizophrenia

The co-occurrence of schizophrenia and drug use is associated with heightened risk of adverse outcomes such as violence, homelessness, treatment noncompliance, and increased psychotic symptoms. Accordingly, clinicians and researchers frequently conduct drug use assessments among adults with schizophrenia to identify drug use and inform treatment decisions. In an effort to increase detection rates, results of multiple assessment methods are often used in combination; however, discordance among measures may result. Furthermore, prior research suggests that results of drug use assessments may be affected by variables unrelated to drug use, including demographic characteristics. This research explores discordance among self-report, collateral report, clinician ratings, hair radioimmunoassay (RIA), and drug urinalysis in a large sample of adults with schizophrenia (N=1,460). Latent class and multivariable analyses were conducted to 1) identify classes of concordance/discordance among measures, and 2) examine participant sex, age, and race/ethnicity as correlates of these classes. Results of the latent class analysis identified four classes of concordant and discordant test results. Classes 1 and 2 were concordant, with high agreement among measures in their classification of drug non-use or use, respectively. Classes 3 and 4, in contrast, were discordant. Specifically, Class 3 included cases where biological tests and collateral report indicated non-use while self-report and clinician ratings indicated use. Class 4 included cases which were classified as non-use by all measures except for hair RIA, which indicated use. Multivariable analyses showed that discordance among results is, in part, a function of participant age and race/ethnicity. Specifically, compared to individuals in Class 1, those in Class 3 were significantly younger in age, while those grouped in Class 4 were significantly more likely to be Black than White. These findings may assist in developing population-specific guidelines for drug use assessments to limit discordance and, ultimately, improve detection of drug use in adults with schizophrenia.

Lauren B. Jones
Graduate Program: Anthropology
Advisors: Dr. D. Troy Case, Dr. Ann Ross
Poster Number: 85

Assessing Cranial Trends of Medieval London: A Preliminary Study

The degree of population variation in medieval London (1066-1500) is one usually discussed with reference to linguistic and historical sources. The influx of French influence during this period readily changed the culture of London, but the amount of biological change remains largely unknown. Utilizing a multivariate statistical approach, this preliminary study explores the biological variation among individuals from five cemeteries (Merton Priory, Guildhall Yard, Bermondsey Abbey, St. Mary Graces, and Spital Square) of medieval London. Eight traditional craniofacial landmarks were used to assess patterns of cranial morphological relatedness from a sample of 55 individuals. These data were analyzed in Relethford's RMET R-matrix environment, which calculated both Mahalanobis squared distances and principal component analyses (PCA) of the samples. Results from the D2 matrix illustrate that the samples from Guildhall Yard and St. Mary Graces are the most similar. The sample from Bermondsey Abbey, which is partially comprised of individuals from a religious order originating in France, is the most disparate. The eigenvalues also illustrate this variation with over 90% of the variation accounted for in the first two eigenvalues, which may indicate a morphologically distinct French presence unobserved in the other cemeteries. If so, these results support previous unpublished findings that suggest that the morphological variation observed in Bermondsey Abbey could represent a possible source of the heterogeneity of modern British populations.

Anne-Lise Knox Velez and **Katherine Ngaruiya**
Graduate Programs: Public Administration
Advisor: Dr. Richard M. Clerkin
Poster Number: 91

Reflections on Service Learning: Teacher, Student and Nonprofit Leader Perspectives

Service learning is an instructional technique that combines academic learning with community-based work. Despite a number of case studies focusing on the benefits of service learning for students and studies establishing the necessity of strong partnerships between faculty and community partners in facilitating service learning, it is unclear how service learning is perceived by and benefits the community partners participating.

Service learning courses are structured to allow students to apply lessons learned in the classroom to community service activities. Service learning provides students opportunities to reflect on their experiences and engage in problem-based learning that encourages critical thinking, with the goal of increasing student motivation, knowledge, efficacy, and applied skills (Weigert 1998 in Murawski et al. 1999; Hilosky et al. 1999; Murawski et al. 1999; Clayton 2000; Swick and Rowls 2000; Kirtman 2008). While some scholars cite ethical concerns including time constraints for class and community work (Eby 1998; Murawski et al. 1999; Eastmond and Thomas 2012), potential personality clashes (Burton and Reynolds 2009), and the possibility that students will use the experience for personal gain (Eby 1998), there is general agreement that service learning offers many benefits to students, faculty and the broader community.

This exploratory study uses interviews with students and educators in service learning courses to ascertain their experiences, percieved benefits in and beyond the classroom, and components of service learning courses they feel are particularly beneficial as well as non-beneficial. Nonprofit executive directors were interviewed about their experience with service learning projects and asked whether they feel employees, volunteers, and student interns with service learning experience are more beneficial to their organization, as well as whether there are any aspects of service learning from a nonprofit viewpoint that educators should be aware of prior to engaging in a service learning project.

Kelsey Lawler-Childress
Graduate Program: Foreign Languages and Literatures
Advisor: Dr. Jim Michnowicz
Poster Number: 99

/s/ Weakening in Veracruz Speakers in Central North Carolina

The present study investigates /s/ weakening in the coda in Spanish of native speakers from Playa Vicente, Veracruz, Mexico who currently reside in central North Carolina. The study examines the variation between the sibilant /s/ and the weakened /s/ in various contexts, focusing on both linguistic and extra-linguistic factors. There are lamentably few quantitative studies on Spanish from Veracruz (Orozco & Nemogá, 2012). The majority of Mexico is linguistically classified as a highland dialect zone, although Veracruz and other regions near the Gulf of Mexico are noted as exceptions to this broad category, and are recognized as lowland dialectal zones (Lipski, 1994). /s/ aspiration is a feature that distinguishes Veracruz Spanish from the rest of Mexico (Dominguez, 2006, p. 3). More importantly to this study, the Hispanic community in North Carolina has expanded greatly over the past decade, with the majority of Spanish speaking immigrants coming from Mexico (NCDHHS, 2011). Therefore, speakers from the lowland Playa Vicente, Veracruz are likely to have increased contact with speakers from other highland Mexican states. The present study examines 10 speakers, balanced for gender, from Playa Vicente, Veracruz who currently reside in central North Carolina in order to analyze /s/ reduction in the coda of their speech. The interviews are followed by two reading tasks designed to elicit the token /s/. A total of 100 tokens of /s/ in the coda will be extracted from each interview and will then be analyzed acoustically in Praat, including measures such as centroid and duration (File-Muriel & Brown, 2010). Current statistical analysis in Rbrul has found similar rates of /s/ weakening to those in Veracruz, Mexico. It appears there are no effects of linguistic leveling in the speakers living in North Carolina. Linguistic factors that resulted significant in the analyses are tonicity, position in word, and following segment.

Arina Loghin
Graduate Program: Cultural Anthropology
Advisor: Dr. Nora Haenn
Poster Number: 106

Applying Actor Network Theory: Insights from the Interactions between Scientists and their Tools in the *Drosophila* Laboratory

Actor Network Theory is both popular and contested in the Humanities and Social Sciences. This study contributes to the conversation by bringing insights from the ways in which scientists interact with the material and biological tools in the genetics laboratory. Qualitative data was obtained through participant observation and interviews in a Drosophila melanogaster (fruit fly) laboratory of North Carolina State University. Two major points of interest of this research are the aspects about which researchers are constantly mindful when performing laboratory tasks, and the kinds of difficulties they encounter when using tools. The study follows Drosophila's transformation in the lab from living model organism to DNA/RNA sample to a series of data points. This transformation occurs in the course of three stages. These stages are not consecutive. In the fly work stage, scientists conduct assays on fruit flies to test their behavior or measure physical traits. In the molecular stage, scientists conduct molecular protocols using flies' DNA or RNA. In the data analysis stage, researchers conduct statistical analyses, and use GWAS Pipeline to make correlations between the phenotype and genotype of fruit flies.

This study emphasizes the ambivalence that the scientists in the lab have towards their tools having agency, thus, illustrating that Latour's framework imposes an idea of symmetry that discounts humans' role in interpreting their interactions with their tools. Moreover, Latour's idea of network between humans, other organisms and objects is vague. Rheinberger's concept of instrument-experimental object interface is useful to illustrate how a network can be conceptualized within the lab. Moreover, Knorr-Cetina's concept of indeterminacy helps frame the contextual character of the interactions described.

Brandy Parker
Graduate Program: Psychology
Advisor: Dr. Adam W. Meade
Poster Number: 135

Smartphones in Selection: Exploring Measurement Invariance using Item Response Theory

The use of smartphones by job applicants to complete assessments is a growing phenomenon in the area of selection. According to research conducted by the Pew Research Center's Internet and American Life project, 56% of American adults own a smartphone (Smith, 2013). Organizations have started tracking the operating system and browser types used by online applicants and they have found that anywhere from 1% to 14% of applicants are using a mobile device (i.e., any portable device with a limited operating system and internet connectivity, such as a smartphone or tablet) to apply for jobs. Some organizations have updated their online application process in order to accommodate these mobile applicants by having "mobile-friendly" websites (i.e., website looks identical across devices, but content is shrunken to fit the screen) or "mobile-optimized" websites (i.e., website auto-detects smartphones and reformats to fit the screen). Research is needed in order to understand whether the statistical properties (e.g., difficulty) of tests are the same across device types and website formats. The aim of this research is to examine the equivalence of statistical properties of tests administered via smartphones and non-mobile devices (e.g., laptop computers). This study employs an experimental design and, using item response theory likelihood ratio tests, explores whether equivalence holds for both a cognitive ability test and a personality test across three formats: non-mobile, mobile-friendly, and mobile-optimized. Data have been collected from 693 participants and analysis is underway.

Elizabeth A. Pitts
Graduate Program: Communication, Rhetoric & Digital Media
Advisor: William J. Kinsella
Poster Number: 139

Participatory Documentation: A Case Study & Rationale

This poster focuses on how consumers learn to use marketing automation software, what types of documentation they prefer, and why. Interviews with U.S. and U.K. marketers demonstrate that implementing marketing automation software requires users to re-learn their jobs, and requires companies to reconfigure organizational structures and workflows. Accordingly, users are interested in knowing how counterparts apply the software, despite raising concerns about privacy. Based on these findings, the poster illustrates the advantages that software companies—especially those operating on a Waterfall development model—can gain by allowing users to participate in creating and refining documentation. In addition to reducing the learning curve for users, participatory documentation enables companies to gather feedback that is critical to making documentation and software more usable.

Gwendolynne Reid
Graduate Program: Communication, Rhetoric, & Digital Media
Advisor: Jason Swarts
Poster Number: 145

Using Wikipedia to Teach Critical Information Literacy in the First-Year Writing Classroom

First-year writing (FYW) classrooms are often the main sites of information literacy (IL) instruction in colleges and universities. While long considered important, our changing media landscape has intensified debates on how to define IL, what types of IL outcomes are desirable, and how best to teach it in context of students' writing. Common approaches include integrating library sessions into FYW courses, as well as integrating IL-related skills into the semester's writing instruction. This study explores how Wikipedia might be used to foster information literacy, and more specifically critical information literacy, which moves from practicing skills associated with finding and using information to developing more critical awareness of the processes and contexts of knowledge construction. Toward this goal, Wikipedia offers potential in the first-year

classroom both because its taboo nature engages students, and because its interface affords a more visible view of the process of knowledge construction and of connections between sources of information. To test this potential, 37 students in two FYW classrooms were assigned a formal writing assignment asking them to analyze and evaluate a Wikipedia entry. Students' work from the beginning and end of the unit were then coded for the criteria students were using to evaluate Wikipedia as a potential source. Results suggest that critical analysis of Wikipedia encourages students to consider a wider range of evaluation criteria, and to pay closer attention to both the process behind the source's writing and research, and the students' own context for writing. Students also reduced the importance they placed on convenience in their evaluations. In short, rather than forbidding the site outright, instructors and librarians might consider Wikipedia as an opportunity to help students develop greater critical thinking and meta-awareness about potential sources.

Caroline Sferruzzo
Graduate Program: Foreign Languages and Literatures
Advisor: Dr. Jim Michnowicz
Poster Number: 154

The Realization of Intervocalic /bdg/: A Comparative Study of Immigrant and Heritage Speech in North Carolina

Recent acoustic studies suggest that the traditional understanding of the phonological distribution of Spanish /b d g/ is subject to a variable process. Conventionalists affirm that the voiced plosives [b d g] are found after a pause, nasals, and in the case of /d/, after a lateral; in all other contexts, these consonants are produced as their complementary approximant allophones [β d ɣ] .The current study is an acoustic comparative analysis of the intervocalic realizations of /b d g/ in the speech of Mexican immigrant and heritage speakers living in Raleigh, North Carolina. The goal of the present investigation is to add to the developing body of research regarding Spanish heritage speech in the United States by analyzing the productions of the aforementioned consonants of both groups of speakers.

Utilizing data collected from sociolinguistic interviews, the intensity ratio was calculated by dividing the minimum intensity of the consonant in intervocalic position with the maximum intensity calculated of the following vowel; the closer the value to 1, the more lenited the consonant. In order to analyze the effects of linguistic factors, the following were considered in a one level analysis conducted with the statistical program Rbrul: stress, variable, following vowel and position in word. Final results will include data from 14 speakers with a more balanced proportion of immigrant and heritage speakers. Preliminary results indicated a significant interaction for the factors of stress, variable and following vowel for all of the consonants /b d g/. In addition individual analysis were conducted of each consonant which suggested that heritage speakers produced significantly more consonant like productions of /d/ and /g/ than immigrant speakers. This finding could be due to the possibility of language contact with English. Additional social and linguistic factors will be addressed in the presentation of the final results.

Molly Hartzog Storment
Graduate Program: Communication, Rhetoric, and Digital Media
Advisor: Dr. Huiling Ding
Poster Number: 164

The Rhetoric of Invasion: CrossCultural Analysis of Dengue Fever and Aedes Aegypti in World News

As a growing neglected tropical disease endemic in many tropical areas of Latin America and Asia, dengue fever has recently aroused increased concern within scientific and medical research communities. These communities are currently working towards developing and implementing new technologies for control and treatment of the disease, including vaccines and transgenic mosquitoes. As the number of cases continues to increase, and research in control methods continues, mass media have likewise devoted attention to this global health issue. To facilitate effective risk communication and technical communication of new control techniques, it is crucial to understand how this disease is rhetorically constructed within these culturally distinct areas of the world. That is, how is the illness recognized as a disease? How is Aedes aegypti constructed as a human health threat? Taking a dramatistic approach, this project analyses how this disease and its primary vector, the Aedes aegypti mosquito, are presented in national newspapers in Thailand, a nation currently struggling with endemic dengue, and Australia, a nation under impending threat of dengue. A dramatistic approach allows us to analyze 1) how various actions are constructed; 2) how the disease, mosquito, and patients are constructed as actors; 3) how the locations of their actions are constructed; 4) how these agents act; and 5) why they act. Taken together, these questions provide insight into how the problem of dengue is defined differently across cultures, and how some control strategies (e.g. transgenic mosquitoes and vaccinations) for the disease may be favored over others by policy makers and lay communities.

Jeffery Strange
Graduate Program: English
Advisor: Dr. Huiling Ding
Poster Number: 165

Researching Content-Delivery Usability: Narrative versus Diagram for Delivering Content in a Trade Discipline

Printed technical books governing the construction industry remain a popular medium for content delivery. Good interaction between user and source material increases the likelihood that users will appropriately apply regulatory edicts. But usability studies in trade practice along these lines are virtually nonexistent. Ideas about usability of technical codes in general seem to begin and end with commonplace rhetorical assumptions about clarity and brevity. Furthermore, usability in this context entails considerably more factors than how clear and how brief content may appear on a page. This study argues that (a) usability is a valuable component in technical communication, (b) this usability can be measured, and (c) delivery mode becomes a primary factor when determining the usability of a content delivery instrument. I wanted to know how equivalent content delivered via distinct modes would compare and interact for the purpose of tutorials. This study examined usability across two delivery modes: narrative and diagram. Users tried to learn from tutorials and then applied this knowledge in solving for problems. Realism was enhanced since content was adapted from the standard regulatory codebook controlling a trade discipline. The subject matter involved determining protection area for fire sprinklers; the problem sets required spatial recognition and basic math skills. Equivalency of content across narrative and diagram modes, a critical component of my research, was verified by a recognized expert in the field. The participant sample exhibited diversity of skillsets useful for comparison. Usability measures and techniques for obtaining these measures were adapted from

human-computer usability research. Both observed and reported usability varied significantly. Users preferred diagram delivery to narrative delivery by significant margin. Users who recorded lowest times and exhibited more accuracy preferred diagram delivery by the widest margin. Participants whose job descriptions entail the highest proportion of symbolic-analytic duties judged narrative usability to be poorest.

Martha Summerlin
Graduate Program: English
Advisor: Dr. Erik Thomas
Poster Number: 168

Voice Onset Timing in L1 and L2 Speakers in North Carolina and Texas

This project compares the Voice Onset Timing (VOT) of native Spanish speakers to those of native English speakers. Voiceless stops are aspirated at the beginning of syllables in English but not in Spanish; VOT is the acoustic measure of aspiration. Aspiration is supposedly something that is gradually acquired rather than acquired all at once (Nathan et al 1987). Jia, Aaronson, and Wu (2002) also observe that how much a learner uses their L1 and L2 is important in the development of their L2. In my previous research I have therefore looked at speakers whose L1 is Spanish but have been using English on a regular basis after moving to the United States to see what sort of effect English has had on their voiceless stop aspiration.

About 60 tokens were taken from each speaker, 20 tokens per environment. The tokens were measured in milliseconds from the stop burst to the onset of voicing using mean VOT values statistically analyzed. Thus far I have found VOT to be easily acquirable and I have not found much difference between the VOT of several native English and native Spanish speakers. However, current results indicate differences between the established Latino community in North Town, Texas, and the much newer community in Durham, North Carolina. While statistically significant results in regards to the aspiration of [p] have arisen in Pearsall, nothing is statistically significant in Durham. The VOT of the Texas speakers appears to vary much more than that of the North Carolina speakers. The Texas speakers appear to have developed their own unique dialect, while that in North Carolina is still in the process of developing and acquiring its own unique identity. Future results will show how the VOT of both communities compares to that of a Spanish-only community in Mexico.

Eli Typhina
Graduate Program: Communication, Rhetoric, and Digital Media
Advisor: Dr. Jason Swarts
Poster Number: 173

The Tortoise Finds Direction: Mobile Sustainable Technology Best Practices

The purpose of the Mojave Desert Tortoise mobile app is to help threatened tortoises by using photos from users to track their movements and habits. Despite the good intentions of the app's designers, and many eco-app designers like them, eco-apps can do more harm than good or do nothing at all. Based on over 300 articles from three sustainable persuasive technology meta-analyses examined in this study, the author found many missed opportunities for designers to connect to the human and non-human actors they hope to positively impact. These missed opportunities result in sustainable technologies that focus on individualistic, one time environmental behaviors that miss community grounded, long-term sustainability action. Therefore, this study looked to identify best practices for how designers can research and develop environmental mobile apps to positively influence human/nature dynamics in the long run. The best practices proposed are informed by the fields of sustainable persuasive technology, critical mobile technology, and engaged scholarship. To move eco-app developers from a one dimensional understanding of environmental problems, to an engaging and complex understanding of human and nature interactions, the following best practices were proposed: check your assumptions, broaden the definition of user, engage in participatory design,design for exploration, and evaluate.

College of Management

Fritz Gugelmann, Dale Ambrosini, and Brian Geerlings
Graduate Program: Management
Advisor: Professor Srinivasan Krishnamurthy, Poole College of Management, North Carolina State University
Poster Number: 4

Portfolio Design for the Intermediate-Term Investment Pool North Carolina State University – ITF

Modern portfolio theory offers investment strategies that maximize return for a given level of risk. Working with the NC State investment office, we recommended a suitable portfolio for their $125M Intermediate-Term Investment Pool. Our analysis proceeded in three stages. We first conducted a macroeconomic analysis, with the primary objective of assessing the likelihood and impact of a change in Federal Reserve policies (e.g., a tapering of the bond purchases under the quantitative easing (QE) program) on interest rates. We followed this up with a portfolio optimization program, which involved (a) an estimation of the efficient frontier of assets that would generate the maximum expected return for a given level of risk, and (b) the identification of asset classes and their proportional weights in the recommended optimal portfolio (chosen as the one with the highest Sharpe ratio). Finally (c), for each of the asset classes in the optimal portfolio, we identified the top-ranked fund managers. The rankings were based on a universe of 100,000 narrowed down to 13,000 funds and included an analysis of their returns, investment policies, and other factors. Our report details the three stages of our analysis and presents our final recommendations on interest rates, portfolio construction and managers.

Daniel Nelson
Graduate Program: Economics
Advisor: Dr. Nora Traum
Poster Number: 131

Regulating Investment Banks Equity Capital Ratios, an Unconventional Monetary Policy Tool

The financial crisis of 2007-2008 engendered a reconsideration of financial regulation and the effect financial crises might have on the real economy. A large body of this work has been devoted to the size of investment banks' equity capital holdings relative to their market risk, with some papers proposing required equity reserve ratios as high as 25%. This 1 paper proposes a Federal Reserve policy to offer interest to investment banks on their capital reserves, and examines the macroeconomic implications of this policy in the context of a monetary DSGE with financial frictions2, financial market participants, and commercial and investment banks. Offering an interest rate on equity capital gives the Fed a tool to fix leverage ratios to a desired level without explicitly changing reserve ratio requirements, and functions as an investment bank specific risk free bond. The costs and the welfare effects of the policy are reported, along with the results from a counterfactual experiment calibrated to show the policy's effect on equity ratios during financial crises.

Marjan Orang
Graduate Program: Economics
Advisor: Prof. Ivan Kandilov
Poster Number: 134

Global Retail Expansion: Determinants and Strategies on Entry in a New Market

Over the past two decades, the global retail market has undergone radical institutional, technological and organizational changes which have fundamentally altered the expansion strategies of multinational firms. The reduction in trade barriers, decrease in transport and communication cost, and development of automated and data oriented operations allow retailers to enter new markets with lower cost of operation and more visibility. The current research uses the sample of top 250 global retailers to study the global expansion criteria in retail market. The data is compiled from several sources in retail business, such as Deloitte, World Bank and Mergent Intellect.

The empirical investigation in this research consists of three parts. First, I identify the retailer's important characteristics using a count regression model. Retailers are characterized by their operational format, size, age and rivalry. Second, the country level investment factors are identified using regression analysis. The input variables on this model include several static and dynamic economical, financial and social factors and the output is the number of retailers operating in the country. The most important factors in investment decision making of retailers are determined to be GDP per capita, GDP growth, Consumption and ease of doing business. In the final part, I use the latest data mining techniques such as decision tree and neural network to verify the order and importance of each factor, to derive a theoretical retail investment framework.

College of Natural Resources

Brian Bulla
Graduate Program: Forestry and Environmental Resources
Advisor: Dr. Toddi Steelman
Poster Number: 21

Using Photovoice to Re-Conceptualize the Vulnerability of Small-Scale Farmers to Climate Change in Chatham County, North Carolina

Vulnerability to climate change means more than damaged buildings, impassable roads and disruptions to utilities or supply chains; livelihoods and food systems are also affected. Farming is big business in North Carolina but not all farming is done on large farms. Climate change poses a significant threat to small-scale farmers. Vulnerability to climate change is commonly communicated through a narrow risk-hazard orientation of computer modeling, scenario building exercises and institutions supporting these probabilistic practices. However, taking an integrated approach to understanding vulnerability would benefit decision-makers by capturing environmental and social vulnerabilities related to climate change normally missed. This research utilizes photovoice, a community-based participatory research (CBPR) method to examine how small-scale farmers in central North Carolina are experiencing vulnerability to climate change. A case study of seven farmers across six farms in Chatham County was conducted. Farming tenure ranged from one year to over 40 years and included part-time and full-time farmers. Farm size ranged from less than one to 200 acres, and included certified and uncertified organic farms. Over a five-month period, farmers were provided digital cameras to photograph issues or events on their farm related to a changing climate. Five focus group meetings were held to discuss the photographs and their significance; farmers mentioned both positive and negative effects on their farms. Preliminary results indicate that developing effective informal social networks, seed saving and sharing programs, and flexible crop plantings may boost the adaptive capacity and place-based resiliency of their farms and reduce vulnerability. Policy-makers and researchers should take an integrated approach to understanding vulnerability that focuses on the problem orientation; otherwise climate change vulnerability may become reified as an impact to infrastructure and sectors of the economy thereby marginalizing policy responses addressing social vulnerabilities.

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Poster Number: 35

Exploring the Relationship between Environmental Conditions and User Behavior on Trails

Trails are the fundamental outdoor recreation infrastructure in most protected areas that support multiple use. To sustain trail conditions and develop effective visitor management strategies, managers must understand the physical attributes of trails and the behavior of recreationists. The aim of this study is to improve our understanding of the relationship between environmental conditions and visitor behavior in a trail setting. The two specific objectives are: (1) to develop an integrated analysis utilizing data from different monitoring methods, and (2) to examine if and how visitor behavior varies in different trail resource and use conditions. This study was conducted in the Uwharrie National Forest, North Carolina. Two methods were used to collect environmental condition variables along the trail: the point sampling method and the trail problem assessment method. Observational data of trail users was collected using the camera trap method in collaboration with the eMammal project, a citizen based project from the Smithsonian Institute and the North Carolina Museum of Natural Sciences. Eight camera locations were used to collect human-use data. There were 2187 people observed for the study and about 51.2% were male with 43.2% female. For the behavior category, 64.8% of users were on the trail. The three camera locations on the trail that captured access to a secondary path captured almost 40% of users taking the secondary route. Data revealed that trails with the lowest muddiness class rating (trail tread surface was dry) the user did not use a secondary trail at all. In addition, trails with a high erosion class had over a third of the users walking along the edge of the trail rather than the center. The results of this study will also inform protect area managers in maintaining a sustainable formal trail network with targeted site and visitor management strategies for problem areas.

Charles Warren Edmunds
Graduate Program: Forest Biomaterials
Advisor: Dr. Perry Peralta and Dr. Ilona Peszlen
Poster Number: 43

Understanding the Relationship between Thermo-mechanical Behavior and Lignin Properties in Genetically Modified *Populus Trichocarpa*

The pulping and biofuels industries process wood under elevated temperatures to remove lignin and open the cellular structure. Under saturated conditions, lignin is believed to dominate the thermo-mechanical behavior of solid wood. Therefore, it is important to study the relationship between lignin content, lignin structure, and thermo-mechanical properties in wood. Genetic engineering of the lignin synthesis pathway in P. trichocarpa allows a unique opportunity to isolate the variable of interest and reduce the variation of other factors by producing clones with modified genes and wood samples exhibiting a wide range of lignin properties in the same tree species. This study utilized wood from genetically modified Populus trichocarpa exhibiting altered lignin content and/or lignin composition. The objective of this study was to probe the relationship between lignin content, lignin monomer composition, and the thermo-mechanical properties of solid wood. Structural carbohydrates (cellulose and hemicelluloses), lignin content, and lignin monomer composition were measured using wet chemistry techniques. Thermo-mechanical properties, including storage and loss moduli, tan delta, and glass transition temperature (Tg) were measured using dynamic mechanic analysis. Wildtype and four genetically altered lines had syringyl/guaiacyl (S/G) lignin monomer ratios ranging from 1.3 to 3.3, and lignin contents ranging from 9.9 % to 22 %. Results showed a good correlation between the Tg and lignin content (R2 = 0.73), a moderate correlation between the tan delta value at the Tg and lignin content (R2 = 0.59), and a low correlation between S/V ratio vs. lignin content. These results demonstrate that lignin content, and not lignin structure, is more influential on the thermo-mechanical properties of wood. These findings have important implications for utilizing genetically modified wood in thermal processing applications.

Timo Leskinen
Graduate Program: Forest Biomaterials
Advisors: Dimitris S. Argyropoulos and Stephen S. Kelley
Poster Number: 101

Determination of Molecular Weight Distributions in Native & Pretreated Wood

Wood and other lignocellulosic feedstocks are a globally abundant source of polymeric raw materials amenable to modification into value added derivatives, or to be processed via degradative treatments for biofuel and chemical production. For the efficient utilization of lignocellulosic feedstocks it is important to characterize their polymeric structure and degree of alteration caused by pretreatments, and understand how these factors affect the subsequent processability of the biomass and its components. The determination of molecular weight of the native components of wood is challenging due to their structural and compositional heterogeneity. Isolation and derivatization of wood polymers is typically required for compatibility with analytical techniques such as size-exclusion chromatography (SEC). The objective of this study was to develop a methodology for the determination of the molecular weight distributions in native and processed woods, without the need for preparatory component isolation steps. Our approach was the use of two distinct derivatization methods in a parallel manner, offering a component selective analytical methodology for the pursued task. Previously developed methods, ionic liquid (1-allyl-3-methylimidazolium chloride, [amim]Cl) assisted benzoylation and acetobromination in acetic acid media, were applied to sawdust type wood preparations, after optimization of several reaction parameters. The developed benzoylationacetobromination methodology was then applied to examine the changes occurring in wood after mechanical and/or chemical degradation, such as ball milling, steam explosion, green liquor pulping, chemical oxidation with 2,3-dichloro-5,6-dicyano-1,4-benzoquinone (DDQ), and biocatalytic hydrolysis by cellulolytic enzymes. Significant differences in the native molecular architecture of lignin, and the response of this moiety to a steam explosion pretreatment were found between the softwood and hardwood species. The developed approach provides valuable information on the molecular weights of the wood components and the role of lignin-carbohydrate linkages during wood component fractionation efforts, tretreatments, and enzymatic saccharification processes, which are indispensable operations for the future wood biorefinery industry.

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Advisor: Dr. Orlando J. Rojas
Poster Number: 103

Oil-in-water Fuel Emulsions Stabilized by Carboxymethylated Lignins (CML)

Lignin, mainly used as a low value solid fuel, can be upgraded by functionalization to render it effective in the stabilization of oil-in-water (O/W) emulsions with high calorific value. We used a bitumen fraction and kerosene (equivalent alkane carbon number of 9-11 and 12, respectively) as the oil phase. Carboxymethylation was employed to modify industrial Kraft lignins, mainly to improve its water solubility at neutral pH and adjust their amphiphilicity. The modified lignins were analyzed by elemental composition, molecular weight (GPC), and degree of carboxymethylation (31P NMR). The salinity and pH of the aqueous phase were varied as formulation variables in different Winsor type of systems. Resultant low solution surface tension (~35 mN/m for minimum) of carboxymethylated lignin was used to emulsify oil-in-water with varying degrees of substitution (from 24% to 30%), pH of the aqueous phase (from 5 to 9) and water-to-oil ratios (from 3:7 to 7:3). The fuel emulsions were characterized for drop size and size distribution, stability, and rheological behavior. Oil droplet sizes in the O/W emulsions were of the order of 2 μm and remained stable for over 30 days. I addition, a shear thinning behavior was observed. The fuel emulsions were tested by combustion analysis: heating value, combustion efficiency, and exhaust gas emissions. It is expected that gaseous emissions, including carbon monoxide (CO), sunburnt hydrocarbon (HC), particulate matter (PM), nitrogen oxides (NOx) and nauseous smokes, will be reduced. The small drop size and high stability of the oil/water (O/W) emulsions stabilized with lignin enables a high surface area that is exposed to oxygen so as to effectively and significantly improve the combustion efficiency. Overall, we propose the use of lignin for the stabilization of O/W fuel emulsions and as an important venue in the utilization of this abundant and inexpensive biomacromolecule.

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Poster Number: 105

SND1 Transcription Factor–Directed Quantitative Functional Hierarchical Genetic Regulatory Network in Wood Formation in Populus Trichocarpa

Wood is an essential renewable raw material for industrial products and energy. However, knowledge of the genetic regulation of wood formation is limited. We developed a genome-wide high-throughput system for the discovery and validation of specific transcription factor (TF)–directed hierarchical gene regulatory networks (hGRNs) in wood formation. This system depends on a new robust procedure for isolation and transfection of Populus trichocarpa stem differentiating xylem protoplasts. We overexpressed Secondary Wall-Associated NAC Domain 1s (Ptr-SND1-B1), a TF gene affecting wood formation, in these protoplasts and identified differentially expressed genes by RNA sequencing. Direct Ptr-SND1-B1–DNA interactions were then inferred by integration of timecourse RNA sequencing data and top-down Graphical Gaussian Modeling–based algorithms. These Ptr-SND1-B1-DNA interactions were verified to function in differentiating xylem by anti-PtrSND1-B1 antibody-based chromatin immunoprecipitation (97% accuracy) and in stable transgenic P. trichocarpa (90% accuracy). In this way, we established a Ptr-SND1-B1–directed quantitative hGRN involving 76 direct targets, including eight TF and 61 enzyme-coding genes previously unidentified as targets. The network can be extended to the third layer from the second-layer TFs by computation or by overexpression of a second-layer TF to identify a new group of direct targets (third layer). This approach would allow the sequential establishment, one two-layered hGRN at a time, of all layers involved in a more comprehensive hGRN. Our approach may be particularly useful to study hGRNs in complex processes in plant species resistant to stable genetic transformation and where mutants are unavailable.

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Advisor: Erin L. Seekamp
Poster Number: 117

Predicting Aquatic Invasive Species Prevention: An Examination of Organismsin-Trade Hobbyists' Behaviors in the Great Lakes Region

The spread of aquatic invasive species (AIS) in the Great Lakes region negatively impacts surrounding environments and has led to costly mitigation efforts. Hobbyists in the organisms-in-trade (OIT) industry, namely aquarium hobbyists, water garden or outdoor pond owners, have been identified as vectors of AIS release. This study collected baseline data to inform an educational outreach campaign, created by Illinois-Indiana Sea Grant, aimed at OIT hobbyists living in the Great Lakes region to encourage adoption of behaviors known to prevent the spread of AIS. This study aims to (1) explore the predictive ability of theoretical constructs related to two behavior change theories (e.g., the Theory of Planned Behavior and the Value-Belief-Norm Theory) using linear regression and (2) use seemingly unrelated regression (SUR) technique to examine the differences between the net effect of theoretical constructs on intention to make future purchase and disposal decisions with preventing the spread of AIS in mind. Focus groups and key-informant interviews conducted in fall 2012 (n=22) informed survey development and the survey instrument was distributed to OIT hobbyists living in the Great Lakes region in 2013 (n= 542). Five components were extracted from a principal component analysis: awareness and concern, ascription of responsibility, personal norm, subjective norm, and perceived behavioral control. Regression analyses reveal that Value-Belief-Norm Theory constructs have direct, positive effects on future purchase and future disposal behaviors. One Theory of Planned Behavior construct also predicted likelihood of making future disposal decisions with preventing the spread of AIS in mind. The SUR results suggest that the effect of these constructs differs among purchase and disposal behaviors. Results indicate the need to modify campaign strategies based on behaviors being targeted. Theoretical and managerial implications will be discussed, including suggestions for future campaign messages and outreach strategies.

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Poster Number: 126

Non-Industrial Private Forest Landowners' Perceptions and Knowledge of Biomass and the Bio-energy Industry

The burning of wood and crop residues for heat energy as well as gasification processes to turn these feedstocks into transportation fuels has been heavily researched for their viability, sustainability, and economic profitability for various stakeholders. The one stakeholder this study focuses on is forest landowners. The availability of these feedstock's has been estimated using sampling techniques throughout the S.E. United States, and researchers have found that the S.E. region of the U.S. is capable of producing approximately 55 million dry tons of wood annually. Although the researchers calculated this amount they did not factor in how much these landowners were willing to supply. The purpose of this study is to identify forest landowner's perceptions on biomass harvesting and the bioenergy industry and determine gaps in information about the industry. In this study we grouped the population of landowners by county and randomly sampled 25 counties in North Carolina to develop a database of forest land owners. Once this was done we sampled 1,500 forest landowners in North Carolina. Once the surveys were ready they were mailed to the subjects using the Tailored Design Method (Dillman 2000). In this study we found that North Carolina forest landowner's perceptions of the bioenergy industry focused on a few key factors. These factors includes details on landowner's need for information, their views on the bioenergy market, government support, support to the biofuels market vs. other forestry markets, perceived profitability, professional outreach, and views on alternative biomass sources. Knowledge gaps were also determined in this study, and the most common gaps landowners expressed were centered on the profitability and the economics of producing biomass for the industry.

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Advisors: Sudipta Dasmohapatrab and Steve Kelley
Poster Number: 143

Consumers' Perception of Biofuels in North Carolina and Tennessee

The US biofuels mandate and the efficient implementation of second generation biofuels industry need the knowledge of public perception. The goal of the study understand consumers' perception, expectations, and knowledge about biofuels via conducted large scale perception survey in North Carolina and Tennessee. Web based survey was performed in 2013. 580 respondents answered 100 questions regarding demographic data, environmental questions, different feed stocks and statements about biofuels. Most of the respondents have worries about environmental issues. Global warming is an issue where the population is divided to those who are worried and those are not worried about global warming. The knowledge about renewables and fossil energy has high variance. Respondents need more and reliable information about biofuels, the impact on vehicles, economics, and environment.

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Poster Number: 148

Too Little, Too Soon? The Relationship between the Breadth of an Adolescent Sporting Repertoire and Adult Physical Activity Levels

According to Iso-Ahola's Leisure Repertoire Theory, adult leisure behavior is built upon childhood experiences. However, current youth sport culture is trending towards an early-specialization structure that limits access to physical activity opportunities through sport. This study sought to determine the relationship between the breadth of an adolescent sporting repertoire and an individual's current physical activity levels. Former collegiate varsity athletes (n=148, response rate=30.3%) who had graduated between 1987 and 1993 were invited to complete a Qualtrics online self-assessment survey that evaluated the breadth of an adolescent sporting repertoire and current adult physical activity levels. Former varsity athletes were chosen because they were guaranteed to have an adolescent sporting repertoire and were likely to display a variety of adolescent repertoire breadths. Adolescent sporting repertoires were measured using the Sports and Fitness Industry Association guidelines for "consistent" sport participation, while current adult physical activity levels were quantified using the International Physical Activity Questionnaire. Results indicate that those individuals who played a greater number of sports as adolescents were significantly more likely to meet or exceed CDC recommended levels of physical activity (≥30 minutes a day) as adults. This finding indicates that there may be a specific recommended number of sports that adolescents should participate in to best ensure an active adult lifestyle. Results also supported Iso-Ahola's Leisure Repertoire Theory because they illustrated that a significant portion of respondents engaged in physical activity through sports which they had first participated in as an adolescent. Accordingly, not only may it be important to involve children with a diversity of sporting opportunities, but the specific sports played during adolescence appear to influence those played during adulthood. Consequently, this study contributes to the body of literature in youth sport and can inform parents and organizations involved in the delivery of youth sport programs.

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Poster Number: 153

Assessing the Impacts of Private Protected Area Governance, Conservation, and Development on Human Wellbeing: Three Cases from Los Ríos, Chile

Stimulated by a global land grab in the name of the environment (i.e., 'green-grabbing') wealthy private investors are using favorable economic and political climates around the world to create private protected areas (PPAs) and ensure long-term protection of and access to natural resources. Global conservationists consider PPAs integral to ensuring the conservation of biodiversity. However, as PPAs are rapidly filling rural areas of

the less industrialized world, they are transforming geographic borders, influencing politics and economies, and creating socio-political tensions within rural poor communities. To date, there are relatively few studies that explore how PPAs impact human wellbeing (HWB; opportunities, security, empowerment). We address this need by interviewing residents nearest to Huilo Huilo Reserve, Valdivian Coastal Reserve, and Oncol Park, three large-scale PPAs (>500ha and intentionally creating development pathways for local communities they impact) in Los Ríos, Chile engaging in in-situ conservation of the threatened Valdivian Forest. We conducted three months of fieldwork in Chile between May and August 2013. We used a controlled comparative case study design to select these three large-scale PPAs, as each operates under a different ownership regime (citizen, non-profit, corporation). We then incorporated a diverse-case strategy to sample 10 local communities impacted by these PPAs. We employed key informant and snowball sampling and completed a total 82 semi-structured interviews. Results suggest PPAs chiefly increase opportunities through tourism employment and entrepreneurship, negatively impact security due to diminished traditional practices and over-dependence on tourism, and largely avoid empowerment outside of achieving economic and environmental education ends. This analysis created a space to ponder how adhering to principles of good PA governance (legitimacy; transparency; accountability; inclusiveness; fairness; connectivity; resilience) might mitigate conflict associated with private conservation-development initiatives and also create socially just and sustainable outcomes for locals. It also helps us begin to understand how green-grabs impact HWB.

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Poster Number: 159

Long-Term Trends of DOC Concentration and Export in a Headwater Stream of Southern Appalachians

Dramatic increases in dissolved organic carbon (DOC) of stream water have been reported for aquatic ecosystems of Europe, Canada and US and have been attributed variously to global warming, recovery from acid rain, or to altered hydrologic connections between watersheds and receiving streams. To date, the majority of examined long-term records of stream DOC have been for northern temperate forested ecosystems where snowmelt dominates the annual hydrograph and peatlands are a dominant habitat type. Here, we analyzed one of the longest continuous records of stream water DOC available for a forested headwater stream of the Coweeta LTER in the Southern Appalachians of the Southeastern US. In contrast to the increasing DOC trends reported for northern temperate watersheds, we observed steep declines in both the volume weighted concentrations of stream DOC (43% decline) and annual watershed DOC export (55% decline) between 1988 and 2005. Mean annual air temperature in the watershed rose by 1.44 °C between 1950 and 2010 but the trend was not significant during the 18 years of data studied. Mean annual discharge declined by 38%, which was mostly attributed to lower base flow observed during the study period. In contrast to many of the northern temperate watersheds reporting rising DOC trends, we observed a sustained increase in soil SO4 2- concentrations from 1993-2001. Together, this trend in soil-water sulfate and an accompanying increase in the ionic strength of soil solution both suggest that Coweeta soils are becoming more acidic over time. Results from Coweeta suggest that the dramatic decline in DOC concentrations and export can be attributed to i) a decline in discharge which reduces the hydrologic connectivity of the watershed together with ii) gradual soil acidification which has reduced the solubility of DOC.

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Poster Number: 163

Interacting Influences of Worldview and Climate Change Knowledge on Perceived Climate Change Risk Among Adolescents

Though climate literacy efforts attempt to communicate climate change as a risk, these strategies may be ineffective because among adults, worldview rather than scientific understanding largely drives climate change risk perceptions. Further, increased science literacy may polarize worldview-driven perceptions, making climate literacy efforts counterproductive among skeptics. Because worldviews are still forming in the teenage years, adolescents may represent a more receptive audience. This study examined how worldview and climate change knowledge related to acceptance of anthropogenic global warming (AGW) and in turn, climate change risk perception among middle school students in North Carolina, USA (n = 387). We found no relationship between hierarchy and climate change risk perceptions among adolescents, but individualistic respondents were 16.1 percentage points less likely to accept AGW than communitarian respondents at median knowledge levels, mirroring findings in similar studies among adults. The interaction between knowledge and worldview, however, was opposite from previous studies among adults, because increased climate change knowledge was positively related to acceptance of AGW among both groups, and had a stronger positive relationship among individualists. Though individualists were 24.1 percentage points less likely to accept AGW than communitarians at low levels (bottom decile) of climate change knowledge, there was no statistical difference in acceptance levels between individualists and communitarians at high levels of knowledge (top decile). Non-whites and females also demonstrated higher levels of AGW acceptance and climate change risk perception, respectively. Thus, education efforts specific to climate change may counteract divisions based on worldviews, versus polarize them as among adults.

Yu Takeuchi
Graduate Program: Forestry and Environmental Resources
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Poster Number: 170

An Integrated Spatial Analytic Framework to Manage Invasive Species in Regulatory Phytosanitary Applications

Non-native pests cause tremendous economic and ecological damage to managed and natural U.S. forests and agricultural landscapes. Many insects and diseases are currently under regulatory control in an effort to prevent outbreaks. However, it is difficult to control and minimize the damage once a non-native pest is established. U.S. Department of Agriculture (USDA) has spent a tremendous amount of money and efforts to control invasive alien species since it was established in 1862.

Quick detection and response are required to mitigate invasive species when they are introduced into the United States. Alternatives to rapid response efforts include port inspection, domestic surveillance and monitoring, shipment treatments and pre-clearance programs; however, the international nature of this approach makes it highly complex, operationally difficult and challenging to coordinate.

To ensure more timely responses to pest threats, there should be a system to identify, describe, monitor and forecast global threats and U.S. high-risk areas. This study addressed the need for such a system. To address pest forecasting needs associated with prevention and exclusion efforts, a framework was developed to allow for integration of critical forecasting elements. The framework includes forecasting models (e.g. phenology models, population dynamics, habitat models) and links to important databases (e.g. climatological data, climate change forecasts, vegetation data, demographic data, transportation data, land use data). Users of the system will be able to factor in as many parameters and variables as appropriate. Importantly, the framework includes mechanisms to standardize input and allow for statistical comparisons of different forecasting models. A critical element of the framework is the central importance of uncertainty management. The system as developed is modifiable for specific pests in a short time without sacrificing critical elements that serve as the foundation for a science-based process, especially consideration of epidemiology, population dynamics, impact and overall risk dynamics.

The purpose of this study was to create and validate an integrated spatial analytic framework to manage alien invasive species in regulatory phytosanitary applications. The integrated spatial framework was developed using the Asian gypsy moth (Lymantria dispar (Linnaeus)) as a test case and was validated with various other pests. The validation case illustrated here uses the Asian longhorned beetle (Anoplophora glabripennis (Motschulsky)).

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Poster Number: 189

High Throughput Technique for the Characterization and Pyrolysis Products Prediction of Various Biomass Feedstocks

Bio-oil produced from fast pyrolysis of lignocellulosic biomass has considerable potential to produce biofuels and platform chemicals. However, the effect of different types of biomass has not been fully understood. Understanding the impact of species on pyrolysis products for the selection of the right feedstock is a must to commercialize this technology. In this task, pyrolysis behavior of biomass was evaluated using a high throughput tool, Pyrolysis Molecular Beam Mass Spectrometry (py-MBMS), which thermally pyrolyzed cell wall constituents into small molecules at 500°C. Hundreds of samples were collected from three focused biomass (169 eucalyptus, 155 switchgrass, and 150 loblolly pine) and the results from py-MBMS were statistically analyzed using Principle Component Analysis (PCA). All samples were separated into three groups depending on the species by PC-1 and PC-2, and Eucalyptus samples showed a much wider distribution than other two species. The major difference is attributed to the amount of syringyl lignin in biomass according to the loading plot. The amount of biochar, which is highly related to carbon efficiency and energy consumption, was evaluated at different temperatures and switchgrass has more char residue than other woody biomass, which may result from high total ash content and the impact of alkaline metal on char formation. These results clearly indicate that softwood is a consistent feedstock that can ensure stable product quality, while hardwood and switchgrass have an opportunity to select a specific type for targeted conversion process.

College of Sciences

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Poster Number: 7

Optical Control of Interactions in Ultra Cold Atomic Gases

Interesting aspects of nature like neutron stars and nuclear matter can be simulated in the lab sing ultra-cold atomic Fermi gases. Lithium (6Li) atoms are used to study fermionic systems in our lab. Fermions of different spin states can interact with each other through collisions. In the past decade, an external magnetic field was used to enhance or weaken the interaction between a pair of fermions, but this method does not offer high spatial resolution and fast temporal control. Also in order to have independent control of collisional parameters, the use of optical field becomes inevitable. However, optical techniques suffer from loss due to optical scattering. We have developed a two-optical field method that not only provides tunability of interactions, but also suppresses the scattering loss by quantum interference. In addition, the two-optical field method will allow us to explore more realistic models of strongly interacting systems and can open the door to investigating non-equilibrium thermodynamics.

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Poster Number: 13

MicroRNAs and Iron Regulatory Proteins have Opposing Roles in Controlling Transferrin Receptor 1 mRNA Stability

Iron is an essential micronutrient, acting as a co-factor in cellular processes such as DNA replication and ATP generation. However, excess intracellular iron can catalyze the formation of reactive oxygen species, resulting in oxidative stress and cellular damage. Consequently, iron homeostasis is tightly regulated through the coordinated expression of genes involved in iron metabolism, such as the iron transporter transferrin receptor 1 (TfR1). Expression of iron metabolism genes is primarily regulated at the post-transcriptional level through the iron sensitive association of iron regulatory proteins (IRPs) with iron responsive elements (IREs) located in the 5'- or 3'-untranslated regions (UTRs) of iron metabolism

mRNAs. 3'IRE-containing mRNAs, including TfR1, have expression patterns inversely correlated with cellular iron status; iron deficiency results in mRNA stabilization and increased expression, while iron excess destabilizes mRNA and subsequently decreases expression. However, the molecular mechanism by which iron mediates expression of 3'IRE-containing mRNAs remains uncharacterized, more than 25 years after IREs were first described.

TfR1 mRNA contains five IREs (termed A-E) in its 3'-UTR. Our sequence analysis of the TfR1 IREs revealed putative microRNA-7 (miR-7) and miR-141/200a target sites in IRE-C and IRE-E, respectively. Transfections with miR-7 and miR-141 mimics enhanced iron-dependent destabilization of TfR1 mRNA, while inhibition of endogenous miR-7 and miR-141 by antagomiR blocked TfR1 mRNA degradation in response to iron. Reporter assays using a luciferase vector containing the five TfR1 3'IREs revealed that mutating the miR-7 and miR-141 target sites in IREs C and E blocked iron-induced decrease of luciferase activity. Collectively, our results show that miR-7 and miR-141 destabilize TfR1 mRNA through IREs C and E upon dissociation of IRPs in response to iron excess, thereby maintaining cellular iron homeostasis by acting in opposition to IRP-mediated TfR1 mRNA stability.

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Poster Number: 14

Analytical Theory for Modulated Magnetic Solitons

In the general theory of waves, when nonlinear and dispersive effects are in perfect balance, special wave structures, known as solitons, can exist. Under highly idealized conditions, a thin ferromagnetic material supports an exponentially localized, timeperiodic wave in the magnetization: the droplet soliton. The symmetry of the idealized model implies the existence not of a unique solution, but rather a parameterized family of droplet solitons. Closely related structures have recently been observed in a nanoscale magnetic device called a nanocontact spin torque oscillator (NC-STO). In the NC-STO, both damping and forcing play a significant role, neither of which are included in the idealized model. However, both effects remain small. In this work, singular perturbation theory was used to derive a general framework for investigating the impact of such small effects. Such perturbations select a single solution from this parameterized family, though those parameters may evolve over a slow time scale. The key result here is the reduction of the full mathematical model to a system of ordinary differential equations describing the slow evolution of the droplet's parameters. Specifically, these equations are applied to the perturbations relevant to the NC-STO and standard analytical techniques reveal conditions under which a droplet may exist despite the inclusion of previously neglected effects. In particular, this analysis illustrates the presence of a restoring force, which serves to center the droplet on the nanocontact. Furthermore, similar physical insight can be obtained by applying this framework to a wide range of other perturbations.

Darrell S. Britt, Jr.
Graduate Program: Mathematics
Advisor: Dr. Semyon V. Tsynkov
Poster Number: 17

Restoring Accuracy to Numerical Methods for the Helmholtz Equation with Discontinuous Boundary Conditions

Solutions to Helmholtz equation become singular at points where the given boundary data are discontinuous. In the presence of such anomalies, standard approximation methods lose accuracy near these points. We introduce a supplemental method for preserving the design rate of convergence in such cases. This is accomplished by subtracting out an asymptotic expansion that matches the singularity with several leading orders, yielding a "regularized" problem that can be solved without deterioration of the design rate. We solve the regularized problem with a compact fourth---order finite difference scheme integrated into the method of difference potentials. This methodology confers a number of benefits. Finite differences require only one variable per grid node, keeping the computational cost low. Because we use a compact scheme, the difference stencil does not extend further in the coordinate directions than that of a low---order method; hence, it requires no more boundary conditions than the underlying equation itself. The use of a high---order scheme not only increases accuracy but also mitigates the "pollution effect" - a restriction on the number of nodes per wavelength that causes reduced accuracy in low---order schemes as the frequency increases. The method of difference potentials eliminates a traditional weakness of finite differences by allowing us to solve problems in which the boundary curve is not aligned with the grid, and this is accomplished without sacrificing the design rate of the scheme. Meanwhile, the overall computational complexity remains comparable to conventional finite difference methods. Finally, the method of difference potentials permits the treatment of a wide variety of boundary conditions (such as mixed Dirichlet/Neumann and Robin Problems with variable or discontinuous coefficients) via a piecewise parameterization of the boundary curve, and this parameterization proves to be a natural segue to solving problems with singularities.

Christine Brown
Graduate Program: Zoology
Advisor: Dr. Nick Haddad
Poster Number: 18

Do Wildlife Corridors Make for Bigger and Better Predators? The Effect of Habitat Connectivity on Spider Body Condition

Wildlife corridors are a primary conservation method to facilitate species movement by increasing connectivity between fragmented habitats. In a successful corridor, reproductive success improves otherwise isolated populations. Without high reproductive success, corridors are destined to create sink habitat for our most vulnerable species. Yet, the main focus of corridor research has resided within the movement of single species and not on the factors that affect reproductive success. Here, we test if corridors improve body condition and increase fecundity of green lynx spiders (Peucetia viridans), a generalist ambush predator whose growth and fecundity are inextricably linked to prey availability. If corridors facilitate prey movement, then spider growth and reproduction should be higher than those found in isolated habitats. We used experimental landscapes at the Savannah River Site in Aiken, SC, designed to isolate the effect of connectivity by controlling for distance, area, and edge effects. We collected green lynx spiders within connected and unconnected patches. We found that patches with the least amount of edge habitat, not connectivity, increased spider mass relative to body size. Spiders collected from corridor-connected patches had similar body condition to those collected in

high edge patches, suggesting that the edge created by the linear shape of the corridor over shadowed the benefits of connectivity. Arthropod prey are generally attracted to high quality habitat away from edges, thus likely providing spiders the highest prey availability. Further research in prey subsidies from connected and unconnected patches is necessary as reproductive success, and therefore the overall benefit of a corridor for conservation, can be influenced by a multitude of factors other than patch shape and connectivity.

Shante S. Bryant
Graduate Program: Genetics
Advisors: David Threadgill and Anthony Blikslager
Poster Number: 20

Development and Genetic Analysis of an Irritable Bowel Syndrome Mouse Model

Irritable bowel syndrome (IBS) is one of the most predominant functional bowel disorders affecting approximately 20% of the population in the developed world and 7- 10% of people worldwide. Quality of life for patients suffering from IBS can be greatly reduced by symptoms such as changes in bowel habits, abdominal pain and bloating, cramping, flatulence, and passage of mucus. The etiology of IBS is likely to be multifactorial; environmental factors, genetics, variation in gut flora, nervous system alterations, dysfunction of the brain-gut axis, and psychosocial stressors have all been examined and are thought to contribute to the development of the disorder. Treatment options vary tremendously and are generally aimed at treating symptoms individually and not at addressing IBS as a physiopathological entity. A major limitation to understanding the development of IBS and creating more effective treatments is the absence of a valid animal model. We plan to develop an appropriate mouse model in which symptoms of human IBS can be replicated and examined collectively by comparing two post-infectious and two post-inflammatory models for their ability to induce two major problematic symptoms that IBS patients experience, intestinal motility dysfunction and visceral hypersensitivity. The organisms and inflammatory agents to be examined are Cryptosporidium parvum, Citrobacter rodentium, mustard oil (MO), and dextran sulfate sodium (DSS). Once a model is selected, additional symptoms such as histopathological changes, alterations in intestinal permeability, variation in the gut microbiome, and inflammatory markers will be quantified. Genetic analysis will be performed by using quantitative trait loci (QTL) mapping and transcriptome analysis of full thickness colons. Validation studies of candidate genes will be conducted using knockdown or overexpression mouse models to check for altered susceptibility. The ultimate goal will be to identify causal genetic links that contribute to the development of IBS symptoms using the Collaborative Cross genetic reference panel.

Jonathan Erb
Graduate Program: Physics
Advisor: Carla Frohlich
Poster Number: 44

Supernovae Nucleosynthesis in Old, Massive Stars

Very old, metal-poor stars are ideal candidates for studying core-collapse supernovae nucleosynthesis. The nuclear abundances observed in the oldest stars are thought to originate from only several core-collapse supernovae of massive stars. The nuclear processes responsible for the production of heavy elements like strontium, yttrium, and zirconium in supernovae are, however, not fully understood. Several candidate processes exist which may explain these abundances. We focus on the elements that are synthesized during the stage of evolution prior to supernova, and then study the effects of supernova shock waves on these elements synthesized in pre-supernova stars. To do this, pre-supernova, or progenitor, models need to be evolved with an extensive nuclear reaction network. Such a network contains hundreds of different isotopes and their associated nuclear reaction rates. Coupling this type of nuclear reaction network to the stellar evolution process, however, is a computational challenge and models cannot always be evolved all the way to core collapse. In this research we work with two types of supernova progenitors: progenitors evolved all the way to core collapse using a small nuclear network of several dozen nuclei, and progenitor models evolved only to the core silicon-burning stage with an extended nuclear network. We use the hydrodynamics code VH-1 and a pressure bomb to simulate the supernova explosions. First we investigate the effects of prematurely exploding progenitor models evolved with the small, limited nuclear network. This is done at various stages in the evolutionary process prior to the natural onset of core collapse. Our results indicate minimal differences in the blast dynamics and shock profiles for the explosions at the different evolutionary stages. Second we quantify the temperature rise caused by the shock wave passage in the star layers containing strontium, yttrium, and zirconium abundances and study its dependence on the explosion strength.

Matthew S Gilmer
Graduate Program: Physics
Advisor: Dr. Carla Frohlich
Poster Number: 58

Simulating Core-Collapse Supernova Explosions in One-Dimension: Progenitor Characteristics and Their Effects

Core-Collapse Supernovae have been a subject of research for astrophysicists for several decades. These events are responsible for much of the elemental enrichment of our galaxy (as well as all other galaxies). These events are highly energetic and are a result of many complex physical processes, so many physicists have tried to simulate them on computers. The explosion is triggered the gravitational collapse of a massive star (> 8 Solar Masses). During the collapse, matter is compressed to unimaginably high densities. This process is aided by an enormous number of electron captures on protons which reduce the electron degeneracy pressure. The collapse is halted when the core reaches nuclear density, this is the time of core bounce. Immediately after, a shockwave is produced, powered by a burst of neutrinos released from the electron captures. Here we present results of hydrodynamic simulations in 1D with neutrino transport physics. It is almost always necessary in 1-D to artificially insert energy to generate an explosion, and to do that we use a novel method called Push, which effectively increases the efficiency of the neutrino energy transfer without altering the star's composition. We compare explosion properties between stellar models of 20 solar masses generated by Woosely and Heger, and Raphael Hirschi. We make comparisons between the different models and make connections between physical properties of the initial models, and physical properties of the explosions.

Eric Goggins
Graduate Program: Chemistry
Advisor: Walter W. Weare
Poster Number: 61

Excited State Lifetime Studies on Inorganic Chromophores with Spatially Forbidden Relaxation Mechanisms

In the future, the world's energy demands will increase to the point where non renewable fuel sources, such as fossil fuels, will no longer be economically or environmentally viable. The use of sunlight and water pose little apparent harm to the environment as potential energy sources and their supply is virtually endless. Solar to fuel devices calls for chromophores with charge-separated excited states with lifetimes long enough for photocatalytic production of fuels. We have found that titanium (IV) based chromophores have long ligand-to-metal charge transfer (LMCT) excited state lifetimes of microseconds in solution and at room temperature. Low temperature excited state lifetimes of these complexes can be up to hours. To better understand the mechanism of this long-lived excited state, the nature of the relaxation mechanism is being explored using various spectroscopic, photomagnetic, and electrochemical techniques. In addition, synthesis and spectroscopy are being used to both finely and coarsely tuning the donor and acceptor potentials of these complexes.

Travis Gulledge
Graduate Program: Immunology
Advisor: Dr. Scott M. Laster
Poster Number: 67

Defining the Mechanism of Cytokine Suppression by Alkylamides from *Echinacea*

Alkylamides are a class of fatty acid-like molecules produced by a variety of different plants. Evidence suggests that the activity of alkylamides likely accounts for the medicinal properties of many natural plant remedies. We are interested in the alkylamides produced by Echinacea, a flowering plant that was used extensively by Native Americans to treat inflammatory conditions. The alkylamides produced by Echinacea generally consist of an isobutylamide head group coupled to a 10-12 carbon fatty acid chain with a variable number and placement of double and triple bonds. Echinacea spp. produces over a dozen different alkylamides, which have the potential for use in the treatment of many inflammatory disorders such as irritable bowel syndrome, inflammatory bowel disease, rheumatoid arthritis, or psoriasis. A key step in evaluating the therapeutic use of these compounds will be defining their mechanism of action. We are addressing mechanism questions by utilizing RAW 264.7 macrophage-like cells, which produce pro-inflammatory cytokines following cellular activation. The results of our studies with the alkylamide dodeca-2(E),4(E)-dienoic acid isobutylamide (alkylamide 15) reveal non-specific inhibition of TNF-a protein production following treatment with LPS or PMA/ionomycin. Production of TNF-a mRNA is also inhibited, and our experiments suggest that translocation of the transcription factor NF-kB is reduced. Future studies will focus on determining the precise mechanism of NF-kB inhibition, whether the activity of other transcription factors is also reduced, and whether this effect is unique to alkylamide 15.

Elizabeth Hassell
Graduate program: Zoology
Advisor: Brian Langerhans
Poster Number: 70

Urbanization and Morphological Divergence in Minnows

One of the most interesting discoveries about evolution since it was first described has been that human activities can alter its course. Although evolution was originally conceived as a slow process, we now realize it can be measured on contemporary timescales of a few generations and can alter ecological dynamics. Freshwater systems are heavily influenced by human changes to the landscape, especially urbanization. We measured how urbanization affects morphological changes in fish. In nature, fish morphology is shaped by gradients in water speed, probably through evolution and plasticity. Rapid human alterations to stream flow could have the same effect, since urbanization creates flashier streams with faster, more frequent high-flow events. This means that fish in urbanized streams should experience selection for more streamlined morphologies than fish in rural streams. Specifically, they should have greater anterior/head depth and shallower caudal peduncles. Using 10 sites in 4 watersheds (10-digit HUCs) and 10 subwatersheds, I photographed 213 individual creek chub (Semotilus atromaculatus) and 136 blacknose dace (Rhinichthys obtusus) and used geometric morphometrics to generate shape variables for each species. I used a mixed model MANCOVA (with partial warps and uniform components as dependent variables, and controlling for log centroid size) to test the effect of urbanization on fish shape. Differences between urban and rural fish matched my predictions for morphological adaptation to anthropogenically altered stream flow, suggesting that human activity may drive divergence in small stream fish.

Kimberly N. Herman, Shannon Toffton, Scott D. McCulloch
Graduate Program: Environmental & Molecular Toxicology
Advisor: Scott D. McCulloch
Poster Number: 73

Exploring the Cytotoxic and Mutagenesis Effects of Oxidative Stress in XP-V Cells

Increased levels of reactive oxygen species (ROS) can be induced by exposure to chemicals or radiation. ROS can produce DNA lesions including 8-oxoguanine (8-oxoG), which has been linked to mutagenesis, cancer and aging. Cells can respond to this damage using translesion synthesis (TLS) carried out by Y family DNA polymerases. These polymerases have open active sites, allowing them to copy past DNA adducts that block replication. DNA polymerase eta (pol η) is known to bypass cyclobutane pyrimidine dimers (CPD), and more recently, 8-oxoG. Intriguingly, while in vitro bypass of 8-oxoG by pol η appears to occur with nearly 50% error rate, in vivo experiments suggest it acts to suppress mutagenesis, similar to CPD.

Since we know pol η can bypass 8-oxoG in vitro, we wanted to explore its cellular effects. We evaluated multiple oxidative treatments for cytotoxicity using CellTiterGlo high-throughput analysis and found our treatments were not overly cytotoxic. We quantified 8-oxoG levels using mass spectrometry analysis and found methylene blue plus light caused the formation of 8-oxoG in total DNA, appearing heavily focused in the mitochondria. We also performed the hypoxanthine-guanine phosphoribosyltransferase (HPRT) assay to evaluate for mutation frequencies. We found that the nuclear mutations within the HPRT gene were very similar to that of the untreated samples; this, combined with the 8-oxoG analysis and low levels of cytotoxicity point to the treatments used here causing a majority of the oxidative damage localized to the mitochondria. Since pol η is not readily involved in the mitochondria we instead switching to the supF mutation assay in which the damage can be focused on a plasmid versus spread throughout the cell. This will allow us to compare our XP-V lines to that of published data as well as analyze effects of inserting pol η mutants into the pol η deficient line.

Chad M. Hunter
Graduate Program: Genetics
Advisor: Dr. Nadia D. Singh
Poster Number: 76

The Genetic Architecture of Recombination Rate Variation in *Drosophila Melanogaster*

Meiotic recombination is an essential biological process, necessary for proper chromosome segregation in many organisms. Despite this importance, rates of recombination are highly variable. The genetic architecture of this variation remains poorly understood, especially in the model organism Drosophila melanogaster. We sought to identify the genetic basis of recombination rate variation using whole genome association mapping. We leveraged the Drosophila Genetic Reference Panel for this purpose and measured rates of meiotic recombination on two chromosomes in 205 fully sequenced inbred lines. Recombination rates were measured using a two-step crossing exploiting recessive morphological markers. We scored over a 500,000 progeny, empowering precise estimation of recombination rate variation among lines. Rates of recombination varied 1.8-3.5 fold among lines on the two chromosomes. Much of this variation is genetic, with estimates of broad-sense heritability exceeding 22% in both cases. We also performed a genome-wide association to identify genetic factors contributing to recombination rate. Our resulting candidate gene list includes a subset of genes possessing multiple C2H2 zinc fingers very similar to PRDM9, which was recently shown to associate with recombination hotspot locations in mice and humans. Other promising candidate genes include genes showing sequence-specific DNA binding transcription factor activity and protein binding functions. Our results thus provide comprehensive insight into the scale and scope of population-level variation in recombination rate in Drosophila. Moreover, our unbiased association mapping approach promises to reveal genes and alleles mediating this variation for the first time. We now stand poised to understand the genetic architecture of an essential biological process in a genetic and genomic model system.

Tam Huynh
Graduate Programs: Statistics, Financial Mathematics
Advisor: Dr. Peter Bloomfield
Poster Number: 78

Recipe for Disaster: The Equation that Destroyed Wall Street

For years the Gaussian copula function was the golden egg in financial technology that allowed hugely complex risks to be modeled with more ease and accuracy than ever before. The method was adopted by everybody, from bond investors and Wall Street banks to rating agencies and regulators. However, before long the model started to fall apart and ruptured the foundation of financial system putting the survival of the global banking system in serious peril. A copula is a flexible way to model the relationship between multiple random variables. The trouble comes when the type of copula is missspecified and the theoretical model is not respected by the data. In this paper I address the question of the selection of garch-copulas models in terms of variance matrix and expected shortfall forecasting accuracy and value-at-risk backtesting. I consider six different copulas, paired with five unique garch models. I consider fifty assets selected by volume from markets across the world and choose every possible pair to be used as bivariate portfolios. I propose an alternative goodness of fit test that is more sensitive to deviations from data in the left tail. Finally, the best fit garch-copula is benchmarked against dynamic condition correlation (DCC) and HAR models.

Bérénice C. Lemercier
Graduate Program: Chemistry
Advisor: Joshua G. Pierce
Poster Number: 100

Novel Approaches to Thiazoline Synthesis

Thiazolines are important heterocycles present in numerous bioactive natural products. There are numerous methods available to synthesize thiazolines; however, all of these methods suffer from drawbacks such as the difficulty of accessing complex, fully substituted thiazolines or the lack of enantiocontrol in the reaction. We sought a new method to access thiazolines from heap, readily available starting materials: thiohydroxamic acids and a,b-unsaturated carbonyls or thiohydroximic acids. To accomplish this, we have optimized a procedure for the preparation of N-unsubstituted thiohydroxamic acids and developed a one-pot preparation of thiohydroximic acid derivatives. A variety of functional groups are well tolerated and products bearing alkene groups and activated N-O bonds are readily prepared. We then turned our attention towards converting these activated thiohydroximic acids into thiazoline products via copper(I)-catalyzed amino-bromination. The optimized reaction allows the synthesis of bromothiazolines bearing a range of functional groups in good yields and diastereoselectivities. These initial studies on thiohydroximic acids demonstrate their potential as building blocks in organic synthesis. Future work will focus on developing an asymmetric method to access complex thiazolines from thiohydroxamic acids and a,b-unsaturated carbonyls.

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Advisor: Karl W. Wegmann
Poster Number: 108

Topographic and Genetic Markers of Landscape Change: Landslides and Isolated Fish Populations Demarcating Basin-wide Erosional Waves Above the Cascadia Subduction Zone

Glacial-interglacial climate cycles modulate the elevation of rivers. Increases of sediment supply or discharge during interglacial periods cause rivers to incise vertically into bedrock. We hypothesize that hillslopes are steepened adjacent to rivers following interglacial incision. Steepening encourages landslides, which drives a wave of accelerated erosion that propagates up to ridgelines. This hypothesis is tested in the Clearwater River basin along the Cascadia Subduction Zone, Washington State.

Prior investigations have revealed mountain range-scale responses to climatic fluctuations and tectonic uplift along the Clearwater River. Well-preserved river terraces provide a record of incision. River terraces are elevated, elongated steps on hillslopes along rivers. These landforms demarcate the elevation of the river prior to interglacial incision. A well-constrained rock uplift gradient causes variations in incision that provides metrics in which to evaluate our model of the erosional wave.

Also within the premise of our hypothesis, waterfalls demarcate the front of the erosional wave, which isolates headwater fish populations. Introduction of alleles—alternative forms of a gene—to fish populations upstream of waterfalls is then limited to mutations, which along with the genetic mutation rate of a species, operates as a "molecular clock". We collected and analyzed DNA from Cutthroat trout (Oncorhynchus clarkii) specimens above waterfalls to measure the genetic distance of populations, estimate the time since waterfalls disconnected populations, and infer when the erosional wave initiated.

Field observations, results of numerical models, and fish genetics analyses indicate that a wave of accelerated erosion initiated approximately 125,000 years ago and continues to propagate up the Clearwater River basin. Waterfalls on numerous tributaries of this river were formed at approximately this time. Bedrock landslides cluster below these waterfalls. These results have implicates for the resiliency of small isolated fish populations, the transmission of erosion through basins, and the far-reaching effects of climate.

Nikolette L. McCombs and Reza A. Ghiladi
Graduate Program: Chemistry
Advisor: Reza A. Ghiladi
Poster Number: 118

Oxygenase Activity of Dehaloperoxidase-Hemoglobin from *Amphitrite Ornata*

The marine globin dehaloperoxidase (DHP) from the terebellid polychaete Amphitrite ornata was found to catalyze the oxidation of 2,3-dimethylindole, a previously unknown substrate for DHP. Reactivity could be initiated from either the ferric or oxyferrous states with equivalent substrate conversion and product distribution at neutral pH. The major products were found to be the monooxygenated product 3-hydroxy-2,3-dimethylindole and the dioxygenated product o-acetamidoacetaphenone. Anaerobic controls showed the requirement of molecular oxygen for reactivity to occur. Consistent with these results, isotope labeling studies confirmed that the oxygen atom incorporation was derived exclusively from molecular oxygen, indicative of a previously unreported oxygenase-like activity for DHP. Interestingly, horseradish peroxidase, myoglobin, and hemin were also shown to have reactivity with 2,3-dimethylindole, albeit with lower conversion than DHP, suggestive of a radical-based mechanism. When the radical scavengers DMSO and formate were employed, it was found that they hindered reactivity, and as such the initial step of dimethylindole reactivity is proposed to be a reduction of the ferric heme by the substrate to yield a substrate radical that then reacts with molecular oxygen. Our proposed mechanism for the observed radical-based oxygenase activity of DHP is reminiscent of the enzyme lipoxygenase, a non-heme dioxygenase. Overall, our results demonstrate that in addition to the oxygen-transport, peroxidase, and peroxygenase activities of DHP, that this hemoglobin is capable of oxygenase activity, which adds further complexity to understanding the paradigms of structure-function relationships in heme proteins.

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Poster Number: 121

An Adaptive Treatment Strategy for the Management of White-Nose Syndrome

Bats are a primary consumer of agricultural pests and insect vectors of human disease. Consequently, the emergence of White-Nose Syndrome, a rapidly spreading and fatal fungus afflicting bats, poses a serious threat to U.S. agriculture, ecosystem diversity, and human health. We construct a data-driven adaptive sequential treatment strategy for the management of White-Nose Syndrome which combines systems dynamics models and online updating algorithms. The proposed method uses historical data and ecological theory to estimate a systems dynamics model which is used to derive an initial treatment strategy. The initial treatment strategy is then updated as data accumulates over time using a stochastic approximation algorithm. We show the proposed method is consistent under regularity conditions and derive a null distribution for parameters indexing the estimated optimal treatment strategy. The method is illustrated using simulated experiments.

Yasamin Moazami
Graduate Program: Chemistry
Advisor: Dr. Joshua G. Pierce
Poster Number: 122

Progress Towards the Pentacyclic Guanidine Core of the Monanchocidin Family of Apoptosis-Inducing Natural Products

For many years the diverse molecular architectures of natural products have been a major source of inspiration for both novel reaction development and therapeutic lead molecules. The marine environment has become one of the most prolific sources of chemical and biological diversity. One such example is the recently isolated apoptosisinducing pentacyclic guanidine alkaloid, monanchocidin A, isolated from a Far Eastern marine sponge. The intricacy and novelty observed in the structure of the pentacyclic guanidine alkaloids, coupled with the wide range of biological activities exhibited by these molecules, have attracted significant attention from the scientific community. We are developing an approach to the pentacyclic guanidine core of the monanchocidins that relies on the utilization of a disubstituted trans β-lactam building block in order to overcome the stereochemical challenges associated with the previous syntheses of this class of natural products. Our synthetic approach combines asymmetric synthesis with biomimetic cascades to provide greatly increased efficiency and selectivity. Furthermore, our approach should allow for pinpoint modification of the molecules' complex functionality to further optimize its potent biological activity, uncover its mechanism of action and potentially develop simplified lead molecules for chemical probe development. To date, we have successfully prepared the desired β-lactam scaffold and efforts are underway to explore the reminder of the synthetic sequence to the core. Additionally, we are working towards the synthesis of simplified analogues and other less complex pentacyclic guanidine scaffolds in this class of natural products to begin addressing long-standing questions regarding their mechanism of biological activity.

Emily C. Moore, Jonathan Tufts, and Reade B. Roberts
Graduate Program: Genetics
Advisor: Dr. Reade B. Roberts
Poster Number: 124

Behavioral Diversity in African Cichlid Fish

African cichlid fish are an excellent evolutionary model for studying diversity among many phenotypically divergent but closely related species in a natural context. The small evolutionary distance between species allows for the creation of interspecies hybrids in the lab, which can be used for gene mapping of quantitative trait loci (QTL) for speciesspecific traits. Because of this unique feature, laboratory lines of African cichlids can be used to examine the genetic basis of a variety of morphological and ecologically relevant phenotypes, including fundamental differences in how species use and investigate their environment. In order to identify behavioral differences between cichlid species, I modified classical behavior tests to quantify individual responses to novel environments, objects, and individuals in five wild-derived cichlid lines representing two genera. Recorded videos of each assay were analyzed with computer software to generate measures of movement (such as speed) and exploration (such as number of approaches to a novel object). Preliminary findings suggest that both open field speed and novel object investigation differs by species, providing exciting prospects for future QTL mapping. By examining the genetic architecture of these behaviors, we will identify natural genetic variation that leads to behavioral differences between individuals. Since behavioral differences between species can act as barriers that maintain reproductive isolation, our studies should also lead to a better understanding of the speciation process, in addition to adding to our knowledge of how genetic differences lead to patterns of behavior.

Jacob Norton
Graduate Program: Biomathematics
Advisor: Dr. Georgiy Bobashev
Poster Number: 132

An Agent---based Model of Drug Switching Incorporating Ethnographic Data

Drug offenses are the single most common cause of arrest in the United States. Of the 12.2 million estimated arrests in the US, 1.55 million were for drug abuse violations. Though many studies investigate the risk factors associated with drug use, treatment outcomes and effectiveness, differences in use across gender and ethnicity, and individual drug use trajectories, most often, drug use dynamics of single drugs are explored without considering poly---drug use. However, there is mounting evidence that illicit drug markets adapt in ways that simple models do not predict. Missing is a description of a combination of individual choice and drug trajectories and illicit drug market adaptation without "leadership." Agent---based modeling is a useful modeling framework when anticipating emergent behavior and faced with high complexity. Therefore, we developed an agent---based model to identify causal patterns and feedbacks that could predict drug use behavior quantitatively and qualitatively. However, instead of populating the agent---based model with a theoretical drug---using community, ethnographic data gathered from the drug---using population in Summit County, Ohio was used to create agents that correspond to real---world drug---users. Finally, the agent---based model was used to determine emergent behavior from changes in law enforcement policies, population level effects of widespread use of methadone or naltrexone replacement therapy, and the effects of positively and negatively correlated drugs use patterns and their effects on drug switching.

Bhumi Patel
Graduate Program: Immunology
Advisor: Aravinda DeSilva
Poster Number: 137

Dissecting Antibody Responses in People Exposed to Secondary Infections

Dengue Virus (DENV) is an arthropod-borne flavivirus that is spread most commonly by the mosquito, Aedes aegypti. DENV is the causative agent of Dengue fever (DF) and Dengue hemorrhagic fever (DHF) and is most prevalent in tropical and sub-tropical regions of the world. Recent studies estimate the global burden of dengue to be approximately 100 million DF cases and 500,000 DHF cases. The goal of my project is

understand the human antibody response to dengue, with long-term goal using this information to inform vaccine development. As there are 4 serotypes of dengue, people can be infected multiple times, each time with a new serotype. Currently, the dengue field has a clear understanding of the antibody response generated in people exposed to the first for the first time (primary infections) but little is known concerning the response generated during a repeat infection with a new serotype (secondary infection). During primary infections, the individual develops lifelong protective immunity towards the serotype of infection (homologous virus). Primary infections stimulate antibodies that only bind to the serotype of infection (type specific) as well as antibodies that are serotype cross-reactive. However, only the type-specific antibodies contribute to neutralization of the homologous virus. My project investigates the properties of antibodies produced during a secondary infection. Following a secondary infection, the individual generally develop protective immunity to multiple serotypes including serotypes that have not infected the individual. . An antibody depletion technique using beads coated with purified virus was used to measure levels of serotype specific and cross reactive antibodies and their relative contribution to neutralization. Out of a panel of five secondary serum samples, two types of responses were observed: in some sera, dengue virus neutralization was dominated by cross reactive antibodies, whereas in other sera both type-specific and cross-reactive antibodies contributed to neutralization. Unlike primary sera, secondary sera contain a population cross-reactive antibodies that are able to neutralize all four serotypes. Further studies involving DENV E glycoprotein mutants will allow us to shed light on the epitopes these cross-reactive antibodies recognize.

Monica D. Poteat and David B. Buchwalter
Graduate Program: Environmental & Molecular Toxicology
Advisor: David B. Buchwalter
Poster Number: 141

Comparative Analyses of Metal Bioaccumulation Parameters in Aquatic Insects

Aquatic insects are extensively used in biomonitoring and bioassessment programs worldwide due to their predominance in freshwater systems and differential sensitivities to pollutants (e.g., metals). However, we lack a fundamental understanding of how and why these organisms are differentially responsive to dissolved metals. Previous work has shown that for EPT (orders Ephemeroptera, Plecoptera, Trichoptera) taxa, phylogenetic position drives metal bioaccumulation parameters. Here, we analyzed metal bioaccumulation parameters for two species-rich families, Ephemerellidae (order Ephemeroptera) and Hydropsychidae (order Trichoptera), in order to determine what factors (e.g., phylogenetic position, allometric differences) drive metal bioaccumulation at the family and genus level. We measured uptake and efflux rate constants (ku and ke, respectively) of Zn and Cd in 19 total species in an attempt to study physiological variance in closely related species. While highly variable, Zn and Cd kus ($r = 0.95$, $p < 0.0001$) and kes ($r = 0.89$, $p < 0.0001$) were all found to significantly co-vary across all species tested. Additionally, we found body weight to be a large driver of the variance seen in Zn and Cd kus ($r = -0.75$, $p = 0.0002$), but not in kes. The variance observed in metal bioaccumulation parameters within each of these two families was not explained by phylogenetic position. Therefore, while a significant driver at a coarse (e.g. family/order) level of taxonomic resolution, the influence of phylogeny breaks down within families at the genus/species level. By understanding underlying patterns within the data of this study (e.g., co variation of Zn and Cd bioaccumulation traits, the correlation of kus with body weight) we can begin to extrapolate data for untested species.

Andreas C. Schmidt and Leslie A. Sombers
Graduate Program: Chemistry
Advisor: Leslie A. Sombers
Poster Number: 150

Innovative Approaches and Novel Materials for Resolving Neurochemical Events in Real-Time Using Fast-Scan Cyclic Voltammetry

Carbon-fiber ultramicroelectrodes are the preferred sensing substrate for the real-time detection of in vivo neurotransmitter release using fast-scan cyclic voltammetry. The application of this technology to dopaminergic studies of neurological disease states has significantly advanced our understanding of molecular mechanisms underlying these problems; however, far less work has been done to significantly advance the detection capabilities of the technique itself over recent years. This research sought to broaden the abilities of fast-scan cyclic voltammetry through the usage of innovative new materials, such as microelectrodes made purely of carbon nanotube yarns, as well as through the development of analyte specific waveforms that allow for a reliable detection of difficult to detect neuropeptergic fluctuations in real-time. This work has improved the sensitivity, selectivity, reproducibility, and reliability of fast-scan cyclic voltammetry and has been successfully tested in living brain tissue. The advancements to this technology provide the foundation for the expansion of fast-scan cyclic voltammetry detection to new neurotransmitters.

John R. Shorter, Charlene Couch, Robert Anholt, Trudy F. C. Mackay
Graduate Program: Genetics
Advisor: Trudy F. C. Mackay
Poster Number: 157

The Genetic Architecture of Aggression in *Drosophila Melanogaster*

Most animals display aggressive behavior to secure food resources, protect against predators and facilitate access to mating partners. Among social animals, appropriately balanced aggressive behavior gives rise to a stable social organization by creating and maintaining dominance hierarchies. Inappropriate or excessive aggression has detrimental consequences for a society. Aggressive behavior is genetically complex, influenced by many genes as well as interactions with the environment. However, the genetic pathways affecting variation in aggressive behavior are evolutionarily conserved, enabling general inferences to be drawn from genetic analysis using a model system. We investigated the natural genetic variation of aggression using the Drosopihla melanogaster Genetic Reference Panel (DGRP), a collection of 205 inbred lines with fully sequenced genomes. We performed a genome wide association study (GWAS) and identified 244 SNPs associated with variation in aggression. Additionally, we performed an independent experiment to replicate causal candidate SNPs by creating an outbred population from lines representing the extremes of the DGRP. We measured aggressive behavior of 3,000 individuals across 7 generations from this outbred population and performed QTL mapping, which identified several genes in common with the GWAS in the DGRP. We also tested these gene candidates by using RNAi knockdown to reduce gene expression. We identified several previously known genes involved in aggression as well as several more with no previous known associations with aggression.

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Advisor: Karl W. Wegmann
Poster Number: 160

Using Landsat Imagery and GIS to Constrain Late Miocene Paleo-relief and Rates of Erosion in the Hangay Dome, Mongolia

Existing hypotheses maintain that the Hangay Dome of central Mongolia, a broad region of high topography flanked by large strike-slip faults, were formed relatively recently, but ongoing geological investigations of erosion rates, river downcutting, and paleo-topography yield evidence to the contrary. For instance, Landsat Thematic Mapper (TM) imagery provides a unique opportunity to establish a 1st order approximation of local topographic relief at ~10 Ma. This age corresponds to the lowest layer in a thick (>600m) sequence of lava flows capping a 525 km2 area of high topography in the Hangay (47.15°N, 100.05°E). The lava flows filled in and now preserve paleo-valleys with ~700 m of local relief that are exposed along valley walls carved by Quaternary alpine glaciers. We quantify paleo-relief in this remote mountain range by mapping the contact between basalt flows and the underlying granitic basement rock with ArcGIS and Landsat TM imagery. From this contact, a basal surface was interpolated and inferred to represent local topography at the time of the lowermost basalt flow (~10 Ma). Various analyses of this surface indicate that paleo-relief is analogous to that of the present day. A similar GIS technique was applied to calculate the volume of rock removed since 6.13 Ma, which is the age for the uppermost, ridge-top basalt flow. In this experiment, a post-eruptive landscape was constructed by 'filling in' modern valleys that have been formed since the lava flows. This analysis revealed a net valley incision rate of 0.037 mm/yr, which is much lower than published estimates of erosion in actively uplifting areas, thereby suggesting that the Hangay is an old (>10 Myr), slowly eroding mountain range. Current work aims to elucidate the driving mechanisms behind the long-term evolution of the Hangay Dome, including the impact of glacial cycles on erosion and local relief production.

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Poster Number: 178

Exploration and Expansion of an Existing Bioenergetics Compartmental Model of Fuel Homeostasis in Humans*

**This is an abstract of a proposed presentation and does not necessarily reflect EPA policy. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.*

Computational modeling can provide a way to tackle questions that are difficult to address directly by laboratory experiments. The overall goal of this project is to develop a bioenergetics-based computational model of the effects of the environmental contaminant TCDD (dioxin) on energy homeostasis: specifically mitochondrial function, choline metabolism and development of fatty liver. As a starting point, we recreated an existing multi-organ model of energy homeostasis in a human individual. We used a compartmental approach, modeling biochemical reactions within different tissue compartments and the transport of chemical species and metabolites between them. By examining different initial conditions, small nuances in the behavior of the system were examined and compared to biological expectations to confirm the legitimacy of the computational model. In subsequent steps, this human model will be adapted to that of a mouse for better calibration with collaborative laboratory work, and integrated with a physiologically-based pharmacokinetic (PBPK) model describing target tissue dosimetry of TCDD, thereby allowing investigation of the bioenergetic effects of exposure to TCDD on a number of biological processes.

Donald C. Warren III, John M. Blondin
Graduate Program: Physics
Advisor: John Blondin
Poster Number: 181

3-D Modeling of Type Ia Supernova Remnants

In their 2005 paper, Warren et al. noted that several features of Tycho's supernova remnant (SNR) could not be easily explained by purely hydrodynamical models. Our work addresses that claim, using an exponential density profile to model a generic Type Ia SNR. In addition, we have run several simulations with different degrees of compressible fluid, to emulate efficient acceleration of cosmic rays.

We find that many features of both Tycho's SNR and the remnant of SN 1006 can be explained purely by hydrodynamics: the close proximity of the forward and reverse shocks to the contact discontinuity, the appearance of ejecta structures in both remnants, and the protrusion of ejecta knots ahead of the forward shock. We also use these simulations to estimate the dynamical ages of both remnants and to comment on key SNR parameters such as the ambient density and the energy of the explosion.

Kyle R. White, Leonard A. Stefanski, and Yichao Wu
Graduate Program: Statistics
Advisors: Leonard A. Stefanski and Yichao Wu
Poster Number: 183

Variable Selection and Shrinkage in Nonparametric Regression via Measurement Error Attenuation

Variable selection is a common and well-studied statistical technique to obtain sparse and interpretable models. Popular methods, such as the LASSO and elastic net, use penalized likelihoods to shrink regression coefficients and achieve sparsity. Measurement error, caused by imprecise

data collection, is also known to attenuate effect sizes in linear regression. We have shown that there is a strong connection between attenuation and shrinkage/selection (Stefanski, Wu, and White, 2012). We extend this idea to develop a variable selection method for nonparametric models, where penalization is challenging. Our method, the Measurement Error Kernel Regression Operator (MEKRO), assumes that truly error-free data are measured with some controlled, 'false' amount of measurement error. We derive and maximize a pseudolikelihood, based on the Nadaraya-Watson kernel estimator, that estimates the amount of 'false' error in each variable. Variables with more error are less reliable, and their effects are shrunken or completely selected out by increasing the corresponding kernel bandwidths. The MEKRO does not assume that the regression model contains only main effects or first-order interactions, like some other nonparametric variable selectors. Based on simulation evidence, the MEKRO greatly outperforms current methods, in terms of selection error and test set prediction error, when the data generating process has higher order interactions, yet remains competitive with current methods when the underlying model is simpler.

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Advisor: Brian J. Reich
Poster Number: 185

Modeling the Effect of Temperature on Ozone-Related Mortality

Climate change is expected to alter the distribution of ambient ozone levels and temperatures which, in turn, may impact public health. Much research has focused on the effect of short-term ozone exposures on mortality and morbidity while controlling for temperature as a confounder, but less is known about the joint effects of ozone and temperature. The extent of the health effects of changing ozone levels and temperatures will depend on whether these effects are additive or synergistic. In this paper we propose a spatial, semi-parametric model to estimate the joint ozone-temperature risk surfaces in 95 US urban areas. Our methodology restricts the ozone-temperature risk surfaces to be monotone in ozone and allows for both non-additive and non-linear effects of ozone and temperature. We use data from the National Mortality and Morbidity Air Pollution Study (NMMAPS) and show that the proposed model fits the data better than additive linear and non-linear models. We then examine the synergistic effect of ozone and temperature both nationally and locally and find evidence of a non-linear ozone effect and an ozone-temperature interaction at higher temperatures and ozone concentrations.

Guangning Xu and Leonard A. Stefanski
Graduate Program: Statistics
Advisor: Leonard A. Stefanski
Poster Number: 190

Variable Selection When Some Predictors are Measured with Error

A fundamental problem in biomedical research is identifying key risk factors and determining their impact on health outcomes via statistical modeling. However, due to device limitations and within-subject variation, some risk factors are measured with error, e.g., blood pressure. Ignoring measurement error adversely impacts variable selection and model fitting. Thus it is desirable to develop a variable selection method that takes the measurement error into account. We propose a new method for variable selection in measurement error models by transforming the observed noisy data to a new dataset, so that a non-measurement error model analysis of the transformed data gives exactly the same measurement error model estimates of the original data. We use two strategies to transform the data, method of moments and conditional score. After transformation, existing non-measurement error variable selection methods can be applied to the transformed data directly. The key advantage of our new method is that it is conceptually simple and greatly eases computing by using existing algorithms.

Xiangming Zeng, Ruoying He, and Yizhen Li
Graduate Program: Marine, Earth and Atmospheric Sciences
Advisor: Ruoying He
Poster Number: 194

Predictability of Loop Current Eddy Shedding Process in the Gulf of Mexico Using an Artificial Neural Network Modeling Approach

The Loop Current (LC) is a dominant ocean circulation feature in the Gulf of Mexico (GoM). One of its most notable characteristics is that it episodically sheds large warm-core eddies that affect almost every aspect of GoM hydrodynamics and the daily operations of thousands of oil and gas platforms in GoM. The typical cycle of LC eddy shedding consists of highly nonlinear LC expansion, shedding, and retraction processes. It is thus challenging to perform mid- to long range predictions of LC state using dynamical ocean models. Here we applied an Artificial Neural Network (ANN) nonlinear statistical modeling approach to construct Sea Level Anomaly (SLA) fields and based on which to predict the LC shedding process. Our method first applied the Empirical Orthogonal Function (EOF) analysis to decompose existing SLA data into time independent spatial patterns (EOFs) and time-dependent principal component time series (PCs). ANN was then used to predict GoM SLA PCs in the future. Finally, the future GoM SLA fields were reconstructed by multiplying the EOFs and predicted PCs. Sensitivity of results to model parameters was studied by conducting a set of experiments. Comparisons between predicted and observed SLA data were then used to quantify the predictability of LC eddy shedding using the ANN modeling approach.

Jing Zhao
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Advisor: Dr. Stefan Franzen
Poster Number: 196

Perspectives of Probing Internal Binding Substrates in Dehaloperoxidase- Hemoglobin

The multi-functional enzyme dehaloperoxidase-hemoglobin (DHP) from Amphitrite ornata has been shown to be able to accommodate several types of ligands, including halogenated phenols, indoles and L-Tyrosine internally in the distal pocket above the heme, which is a rare scenario

among heme proteins because of their restrained space in the distal pocket. The binding affinity and binding modes of all these potential substrates have been screened and probed by competitive fluoride anion binding experiments. The heme forms a six coordinated high spin fluoride adduct with moderate binding strength. Competitive binding between potential substrate and fluoride anion in the distal pocket can be observed by the variance of the binding affinity of the fluoride complex. The relative effect of a given substrate (or inhibitor) on fluoride binding can be used to study the binding affinity and binding mode of the potential substrate. A pHdependent competitive binding titration experiment also proves that the substrate, for example 2,4,6 trichlorophenol must bind in the protonated form with neutral charge. An alternative perspective on relative binding affinity can be obtained from the reactions of DHP with a competing substrate (hydroquinone) or inhibitor (4-bromophenol), which has been scrutinized by transient kinetics using a stopped-flow UV-vis spectrometer. The time-resolved spectra have been analyzed by using singular value decomposition (SVD) and global-fitting analysis. The spectra of intermediate species have been reconstructed based on the proposed reaction mechanism. In the end, the protein dynamics of DHP have been studied by NMR and MD simulations in terms of backbone dynamics, which provides a dynamical picture of the global motions of the protein backbone of DHP. The dynamic pattern of DHP will also provide critical information about the substrate binding from a dynamic point of view.

College of Textiles

Shelley Cernel
Graduate Program: Textile Technology Management
Advisor: Dr. Kate Carroll, Dr. Marguerite Moore
Poster Number: 27

Identification of Social Tactics to Engage Consumers on Fashion Brands' Social Media Interfaces

Social media marketing is a relatively new concept that is revolutionizing the way brands engage with their consumers. World-wide participation in social media continues to increase, with over a billion people on Facebook alone. The purpose of this study was to identify tactics that selected fashion brands use in their social media strategy to reach and engage consumers online. A qualitative research design was used to conduct a content analysis of Facebook for four types of retail formats, with a representative retailer chosen based on market prominence and social media presence: fast fashion (H&M), mass merchandiser (Target), department store (Macy's), and designer boutique (Tory Burch). Data was collected from each brand's Facebook page for a six-month period (January 1, 2013 to June 30, 2013) with a total of 1,009 posts for all four brands. A social media marketing typology by Constantinos Coursaris, et al., was used as a framework to categorize the top fifteen percent of the most frequent keywords for each format into the following categories: Brand Awareness, Community Building, Corporate Social Responsibility, Customer Service, Emotion, Engagement, Fashion, Product Awareness, Promotional, and Seasonal. Results suggest that fashion brands maintain a brand image in the digital space that is consistent with that of their physical space. All four brands exhibit low usage of social responsibility and customer services tactics on Facebook, perhaps due to use of other media channels for conveying this information. Predictably, dedicated apparel retailers (H&M, Tory Burch) had a higher usage of Fashion engagement tactics in comparison to retailers with mixed product lines (Macy's, Target). Additionally, hedonics emerged as a tactic for brands on social media, as positive emotions can motivate consumers to further engage with a website. In conclusion, multiple social media tactics were found across the brands to engage with consumers.

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Advisor: Ahmed El-Shafei
Poster Number: 28

Carbazole-Based Ancillary Ligands Tethered to Long Alkyl Chains in Amphiphilic Ru (II) Bipyridyl Heteroleptic Complexes for High Efficiency Dye-sensitized Solar Cells

Human society is facing enormous pressure because of rapidly increasing energy demands and depletion of conventional energy resources. Additionally emissions from burning fossil fuels are contributing to the global warming and affecting the ecosystem of our only home (Earth). Therefore, alternative, sustainable and green energy sources are vital to fulfill the increasing global energy demands. It is believed that more solar energy strikes the earth surface in one hour than the energy provided by fossil fuels in one year according to current demands. To exploit the solar energy, silicone-based cells have been used widely because of their steady efficiencies. However manufacturing of such cells is expensive and has environmental issues. Dye-sensitized solar cells (DSSCs) have received immense interest from research community owing to their unique features of transparency, flexibility, low cost, independency of incident light angle, simple manufacturing and high power conversion efficiencies year around, including rainy and cloudy weather and diffused light conditions. Here we report two novel amphiphilic Ru (II) bipyridyl heteroleptic complexes HD-14 and HD-15 for applications in DSSCs. We have combined the strong electron donor characteristics of carbazole-based ancillary ligands (AL) and hydrophobic nature of long alkyl chains tethered to the AL to study its effect on charge separation and recombination and dye regeneration by measuring ground and excited states oxidation potentials, incident-photon-to-current conversion efficiency (IPCE), impedance measurements, TCSPC and ultrafast transient absorption measurements, short-circuit photocurrent density (Jsc), and total solar-to-electric conversion efficiency (η). This strategy resulted in highly efficient sensitizers with photocurrent up to 22% greater than N719, and solar-to-power conversion efficiency (η%) of 9.34 for HD-14 and 9.19 for HD-15 against 9.32 of N719, under the same experimental device conditions.

Nasim Farahbakhsh
Graduate Program: Fiber and polymer Science
Advisors: Dr Jesse S. Jur, Dr Richard A. Venditti
Poster Number: 48

Application of Nano-Sized Biofiller from Waste Cotton T-shirts in Thermoplastic Polymer Films

Replacing petroleum-based materials with biodegradable materials that offer low environmental impact and safety risk is of increasing importance in applications that require increased awareness in sustainable materials processing and materials. The purpose of this work is to examine the range of methods to produce uniform microfibrillated cotton from recycled waste cotton T-shirts and evaluate its use as filler in thermoplastic polymers films and fibers. Microfibrillated cotton was prepared by microgrinding mechanical treatment of pulverized cotton, resulting in an aggregated nano-cellulose network with fibril diameters of 10-100 nm and a corresponding crystallinity of 77%. Film composites of low density polyethylene and cotton before and after microfibrilation were fabricated using melt extrusion to show the effect of filler size on mechanical, thermal and morphology of polymer. Compounding microfibrillated cotton with LDPE resulted in well-dispersed nanocomposites with no discoloration after 10 min of melt extrusion at 170°C. The biocomposites produced with microfibillated cotton showed a 21% increase in strength, owing to the higher crystallinity of the nano-sized cotton-derived filler material.

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Advisor: Xiangwu Zhang
Poster Number: 53

Unexpected Performance of Carbon Fiber-Sulfur Webs as Cathode for Lithium-Sulfur Batteries

In the pursuit of high battery performance, significant efforts have been placed to explore new types of lithium batteries with high energy density, good safety, and low cost for transportation and stationary energy storage systems. Among various forms of secondary lithium batteries, lithium-sulfur battery shows great potential to substitute traditional lithium-ion battery due to its high theoretical capacity and high energy density, maximizing to 1675 mAh g-1 and 2500 Wh kg-1, respectively. In addition, the low-cost, abundant resource, and non-toxicity factor of sulfur make it economically and environmentally affordable in large-scale lithium-sulfur battery applications. In this work, a novel facile-synthesized carbon nanofiber-sulfur (CNF-S) composite with high sulfur content (> 60%) is designed and it exhibits as a promising binder-free and Al-free electrode with high sulfur loading (> 2.5 mg cm-2) for high-energy density lithium-sulfur batteries. This self-supporting porous CNF web can not only allow the loading large amount of solid sulfur but also help localize polysulfide catholyte inside the cathode electrode. In this work, a facile and fast sulfur loading method was introduced and the composite preparation time can be greatly reduced to ~30 min compared to the several hours in the traditional sulfur impregnation method, and this can significantly simplify the battery processing and configuration. The resultant CNF-S cathode can have high discharge capacity (around 1000 mAh g-1), long term cyclability (over 200 cycles), high sulfur loading (~ 2 mg cm-2) and sulfur content (~65%), offering great potential to get further improvement by optimizing the CNF-S composite structure so as to substitute the conventional sulfur electrode and cell configuration for lithium-sulfur batteries in the near future.

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Poster Number: 83

Glass-Transition Temperatures of Nanostructured Amorphous Bulk Polymers and their Blends

Nanostructured amorphous bulk polymer samples were produced by processing them with small molecule hosts. Urea (U) and gamma-cyclodextrin (γ-CD) were utilized to form crystalline inclusion compounds (ICs) with low and high molecular weight as-received (asr-) poly(vinyl acetate) (PVAc), poly (methyl methacrylate) (PMMA), and their blends as included guests. Upon careful removal of the host crystalline U and γ-CD lattices, nanostructured coalesced (γ-) bulk PVAc, PMMA, and PVAc/PMMA blend samples were obtained, and their glass-transition temperatures, Tgs, measured. In addition, nonstoichiometric (n-s)-IC samples of each were formed with γ-CD as the host. The Tgs of the un-threaded, un-included portions of their chains were observed as a function of their degree of inclusion. In all the cases, these nanostructured PVAc and PMMA samples exhibited Tgs elevated above those of their as-received and solution-cast samples. Based on their comparison, several conclusions were reached concerning how their molecular weights, the organization of chains in their coalesced samples, and the degree of constraint experienced by un-included portions of their chains in (n-s)-γ-CD-IC samples with different stoichiometries affect their chain mobilities and resultant Tgs.

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Graduate Program: Textile Technology Management
Advisors: Kristin Thoney-Barletta and William Oxenham
Poster Number: 95

Characterizing the Relationship of Tensile Properties and Pressure Profiles of Compression Bandages and Fabrics

Compression therapy is the cornerstone treatment for venous and lymphatic disorders and is commonly administered through medical compression hosiery, pneumatic pumps, and compression bandages. Research has shown compression therapy to be the most effective technique in alleviating symptoms associated with venous disorders, such as painful swelling and skin ulcerations, but is also implemented in sports therapy and preventing edema that may affect pregnant women and stationary travelers. While the medical community agrees on compression therapy's efficacy, there is no approved testing standard in the US, with manufacturers adopting standards from Europe.

There are various devices used for measuring the pressure applied by a compression textile, and these work either indirectly by gathering force measurements or directly, by observing the pressure profile as it is worn on a patient or leg form. These methods are often associated with compression hosiery and not bandages. This study explored implementing a newly developed indirect testing technique in order to characterize the relationship between tensile properties and pressure profiles for commonly used bandage wrap systems and hosiery samples. Two separate direct testing techniques were also performed – the first using participants' legs to measure interface pressure with the PicoPress Compression Measuring System and the second test used a set of specially designed tubes with a sensor foot built into the surface known as the CRIM Pressure System. Pressure data was collected from all three testing techniques using three different circumferences and analyzed to show the correlation between each measuring system. While the indirect testing approach indicated good correlation between rigidity and pressure profiles, a comparison of the extrapolated data with direct PicoPress pressure readings indicated that some bandage and hosiery samples had good correlation, but others did not. PicoPress and CRIM Pressure System values showed a better correlation between readings, but still varied for some sampling.

Jinzhao Lu
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Advisor: Dr. Yingjiao Xu
Poster Number: 107

The Role of Self-congruity on Chinese Young Consumers' Brand Evaluation and Brand Loyalty for Sportswear Brands

Chinese market for sportswear is by far the second largest market in the world just after United States. However, while international sportswear brands are enjoying the Chinese market, Chinese domestic brands are experiencing collective plummeting in terms of sales and market share. The purposes for this study are two fold: 1) to compare Chinese young consumers' brand evaluation and brand loyalty toward the domestic and global sportswear brands; and, 2) to investigate the role of self-congruity on Chinese young consumers' brand evaluation and brand loyalty toward sportswear brands.

Totally 398 surveys were collected through street intercept interviews in Shanghai, China in summer, 2013. Multiple independent T-tests were conducted to compare consumers' behavior toward global and domestic Chinese sportswear brands. Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) Analysis were conducted to test the proposed hypotheses.

The T-test results suggested a significant difference between Chinese and global brands in consumers' brand association and attitudinal brand loyalty. The SEM results indicated a significant influence of user image self-congruity on consumers' brand evaluation (brand association and perceived quality), which in turn had a significant influence on consumers' attitudinal brand loyalty. The influence of attitudinal loyalty on behavioral loyalty was also confirmed in this study. However, no significant influence of personality self-congruity was found. Therefore, to appeal to the Chinese young consumers, brands need to focus on developing and communicating a desirable image to their target market. A descriptive analysis indicated that the sample had a very high level of public selfconsciousness. Therefore, the generalization of the results of this study may be limited due to the high public self-conscious sample employed in this study.

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Advisor: Dr. Abdel-Fattah M. Seyam
Poster Number: 155

Investigation of the Spinnability and Antimicrobial Activity of Soy Protein Isolates/Polyvinyl Alcohol Blend

Biomaterials have been preferred choices for fabricating medical textiles and scaffolds owing to their biocompatibility, intrinsic antimicrobial nature and low immunogenicity, more so proteins. The objective of our work was to investigate whether soy protein isolate (SPI) has antimicrobial properties in the prospect of incorporating them in wound-dressing materials. To make a fiberforming polymeric solution, SPI was blended into polyvinyl alcohol (PVA) at an optimum weight ratio and subjected to electrospinning at various combinations of electric field, solution flow rate and drum speed. The SPI-PVA solution showed two distinct morphologies at a lower viscosity and a higher viscosity. Antimicrobial evaluation of SPI solution alone showed a trend of decreasing bacterial population with increasing amount of SPI. But, contrary to this, the same evaluation with SPI/PVA electrospun fibers had the opposite effect. This led to the hypothesis that blending SPI and PVA may have caused a change in antimicrobial behavior due to structural change in SPI as a result of combining with PVA. The SPI/PVA fibre-webs were also characterized by beads with formation of unusual 'spikes' on fused fibre bunches. Elemental Analysis revealed that these 'spikes' contained more SPI than any other part of the sample. Beginning with formation of spinnable SPI with the help of a stronger polymer such as PVA, to the antimicrobial analysis of SPI, there have been many interesting and unexpected observations that serve as strong springboards for future research in this area. The inferences made in this work may give birth to several investigative paths such as Chitosan-Soy blend and deeper understanding of the chemical interaction between SPI and bacteria.

Jialong Shen
Graduate Program: Fiber and Polymer Science
Advisor: Dr. Alan E. Tonelli
Poster Number: 156

Evaluating the Relative Importance of Three Structural Factors Commonly Suggested to Contribute to the Softening/glass Transition Temperatures of Polymers

Glass-transition temperatures (Tgs) are temperatures at which polymer materials soften and therefore are critical to their processing, use, and behaviors. However, the molecular structural bases for the wide range of glass-transition temperatures (several hundred K) observed for chemically distinct polymers are largely unknown. Three factors are often cited as being pivotal in the literature: 1.The inherent conformational flexibilities of their individual chain backbones; 2.The sizes or steric bulk of their side-chains; and 3.The interactions (steric, dipolar, hydrogen-

bonding, van der Waals, etc.) between polymer chains. But because these three factors are usually structurally interdependent, it can be difficult to evaluate their relative importance to the Tgs of chemically different polymers. Our approach to this problem is synthesizing and comparing the Tgs of structurally analogous copolymer pairs which differ in only a single structural or conformational factor. With the irregularity introduced by the inherent expected randomness of step-growth copolymerization, the crystallinities of copolymers can be significantly reduced to near or wholly amorphous, leaving their Tgs unaffected by crystallinity. A nylon tetrapolymer with very little discernible crystallinity and a Tg ~ 47 °C was produced by melt transamidation from Nylon 6, 66, 610, and 11. While the melt polymerization of 66 and 610 salts with various ratios did not yield amorphous copolyamides. Addition of α,ω- aminoundecanoic acid as the third component largely impeded the crystallization during the subsequent cooling scan from its melt, and manifested a cold crystallization upon heating which is a sign of their diminishing crystallizability. Amorphous linear aliphatic polyesters were made by following a recent report on copolymerization of succinic acid with ethylene glycol and 1,3-propanediol. Corresponding polyamide-34, though not amorphous, showed a Tg over 240K higher than polytrimethylenesuccinate, which indicated Tgs are highly sensitive to factor 3, the interactions between polymer chains; i.e., dipolar vs. H-bonding in this case.

Keywords: Polymer, Glass-transition temperature, Amorphous, Polyester, Polyamide

Ya-Ting Su
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Poster Number: 166

A Systematic Investigation of the Factors that Trigger Thermal Degradation During the Processing of Industrially-Relevant Polymers

During the formation of polymer products, thermal degradation has been an issue, which is also affected by the presence of oxygen and other impurities as well as the processing conditions. Thermal degradation not only impacts the physical and mechanical properties of the products, but also often leads to the failure of production lines. An understanding of the molecular mechanisms that underlie thermal degradation can thus lead to the production of polymer materials with enhanced properties and can minimize waste during production. The goal of this work is to utilize both experiments and simulations to investigate the effects on polymer thermal degradation of its processing conditions (residence time, temperature, pressure) and the local environment (the presence of oxygen, water, additives, crystal domains, or impurities). We studied two model systems, polypropylene (PP) and polyethylene (PE). From both simulations and experiments, the processing conditions including temperature and the residence time during the melt processing phase of extrusion were identified to be critical factors. Both PP and PE were observed to have has their own mechanisms for thermal degradation. Other interesting observations from both the simulations and the experiments will also be discussed.

Sibei Xia
Graduate Program: Textiles
Advisor: Dr. Cynthia Istook
Poster Number: 187

Sizing Systems Created Using SizeUSA Data for Three Body Shapes

Literature reviews showed that consumers were not satisfied with the fit of garments sold in stores, primarily due to outdated sizing systems and the limited number of sizes being produced. Classifying body shapes has been combined with pattern making to improve the fit of apparel. The purpose of this study was to create a sizing system included sizes designed for different body shapes based on SizeUSA anthropometric data. A total of 6308 subjects in SizedUSA data were studied. The sizing system creation process included natural log transformation, principle component analysis (PCA), multivariate linear regression analysis, size range determination and measurements calculation. A total of 62 key measurements were transformed into their natural log values, went through PCA and determined two principle components (PCs). These Principle Components were used as independent variables in the multivariate linear regression to predict other measurements. Multivariate linear regressions were done on the rectangle body shape, the spoon body shape, the bottom hourglass body shape and the whole data set with no shape specification. Sizes were determined by classifying PCs within ranges set by mean value and standard deviation value (SD). Calculated values were rounded to the nearest 1/8".The created sizing system was then compared with ASTM D5585-11e1. Analysis of the results showed that the method used to create the sizing system was reliable and repeatable. It is necessary to include body shape information in sizing systems. This was an important research effort for apparel manufactures, as it demonstrated the importance of body shape classification, as well as conducted a body sizing system that is flexible and can be altered to fit target consumers.

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Poster Number: 74

Monocyte-derived DCs from FIV+ peripheral blood induce greater CD8+ T cell proliferation than those from uninfected animals

Dendritic cells (DCs) are antigen-presenting cells that have been utilized to enhance CD8+ memory T cell formation in response to pathogen-associated peptides for enhancement of vaccine efficacy. CD8+ T cells are responsible for the elimination of viruses during acute viral infection and control of viremia during chronic viral infection. For lentiviral infections such as HIV and FIV, dendritic cell vaccines may be useful in boosting CD8+ T cell function. We asked if there was a difference in DC capacity to stimulate CD8+ T cell proliferation in uninfected control cats when compared to chronically infected FIV+ cats. In this study, we generated DCs from peripheral blood monocytes in vitro by sorting based on forward versus side scatter and treating cells with IL-4 and GM-CSF over the course of 6 days, adding LPS to stimulate maturation after the first 72 hours. We confirmed the identity and maturation status of cells using Diff-quick staining. We then assessed differences in CD8+ T cell proliferation

in the presence of sorted monocytes, immature dendritic cells (iDCs), and mature dendritic cells (mDCs). We demonstrate that CD8+ T cell proliferation is enhanced in the presence of DCs from FIV+ animals. The average relative proliferative indices for CD8+ T cells co-cultured with monocytes, iDCs, and mDCs were increased by 47.5%, 54.1%, and 50.9% respectively for FIV+ samples over FIV- samples. Additional research is required to ascertain whether this characteristic is related to the hyper-functionality of DCs during chronic immune stimulation or expansion of the FIV-specific CD8+ memory population in culture.

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Poster Number: 80

Lubiprostone Protects Against Murine Colitis Principally in a ClC-2-Dependent Manner

Lubiprostone, a ClC-2 chloride channel activator, induces intestinal secretion and is used in the management of idiopathic chronic constipation. Recent studies have suggested that lubiprostone has multiple targets and mechanisms of action in the intestine. However, we have previously reported that lubiprostone initiates intestinal barrier repair in ischemic-injured intestine via its principal target, the chloride channel ClC-2. Thus, we hypothesized that lubiprostone would have a protective effect in an in vivo colitis model. We administrated lubiprostone in a dextran sulfate sodium (DSS)-induced colitis model in wild type and ClC-2-/- mice. We determined the severity of colitis based on body weight, disease activity index (DAI), histology scores, and levels of cytokine production. Additionally, intestinal permeability was measured in vivo to evaluate barrier function. Administration of DSS in the drinking water initiated symptoms of experimental IBD, including weight loos and elevation in DAI. Oral administration of lubiprostone protected against weight loss and significantly reduced DAI ($P<0.05$) in a dose-dependent manner. In addition, lubiprostone significantly reduced histology scores, colon shortening, and intestinal permeability ($P<0.05$) as compared to DSS-treated wild type mice that were not pre-treated with lubiprostone. When administered to ClC-2-/- mice, lubiprostone treatment had a limited protective effect against DSS colitis. Specifically, loss of body weight, DAI, and intestinal permeability were significantly reduced in the high dose (100 g/kg) lubiprostone treatment group of ClC-2-/- mice, but they showed no difference in colon length and histology score. In conclusion, lubiprostone has a major protective effect in a ClC-2-dependent manner in experimental colitis model, but it also has some alternative protective mechanisms of action at high dosages. Additional investigation is required to determine the detailed mechanisms of action of lubiprostone in experimental colitis.

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Poster Number: 140

Investigation into the Mechanism of Chemotherapeutic Resistance in Canine Oral Melanomas

Canine oral melanoma is an almost uniformly fatal disease of dogs and is typically resistant to a wide range of chemotherapeutics. While drug resistance is partially responsible for low survival rates; studies suggest that some patients do respond to and benefit from chemotherapeutics. Identifying which patients will respond to treatment is essential for both choosing an effective course of treatment and accurate prognosis. In people, it has been well established that the ATP-binding cassette transporters (ABC protein family) are responsible for the majority of chemotherapeutic resistance; however the mechanism of chemotherapeutic resistance has yet to be elucidated in the dog. We hypothesized that tumors which demonstrate resistance to the clinically relevant chemotherapeutics, doxorubicin and mitoxantrone, will highly express efflux pumps in the ABC protein family, specifically ABCB1 and ABCG2. To test our hypothesis, canine oral melanoma cell lines (n=7) were treated with doxorubicin and mitoxantrone for 72hrs then measured for cell viability and metabolic activity via an MTTlike assay. Gene expression of ABCB1 and ABCG2, export pumps specific for doxorubicin and mitoxantrone respectively, was measured using RT-qPCR. Results showed a direct correlation between expression of cellular drug pumps ABCB1 and ABCG2 and resistance to chemotherapeutic agents ($p=0.001$ and $p=0.0005$). Expression of ABCC1, a multi-drug resistance efflux pump, showed no significant difference with either doxorubicin or mitoxantrone resistant cells ($p=0.424$ and $p=0.254$). Our results suggest these drugs are being regulated though their specific drug pumps, and not through a generalized efflux pathway. In conclusion, we have shown that cellular chemoresistance to doxorubicin and mitxantrone can be predicted through monitoring expression of ABCB1 and ABCG2, respectively. These findings suggest a direct clinical application in targeting effective treatments to individual patients most likely to respond, avoiding unnecessary courses of chemotherapy in patients with predicted resistance.

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Poster Number: 151

***Cytauxzoon Felis* Cytochrome *b* Pharmacogenomics: Development of a Rapid Cytochrome *b* Genotyping Assay Using High Resolution Melt Analysis**

Cytauxzoon felis is a virulent tick-transmitted protozoan parasite that infects felines. Without treatment, as few as 3% of infected domestic cats survive. Treatment combining atovaquone and azithromycin (A&A) has increased the survival rate to 60%. Atovaquone treatment targets C. felis cytochrome b (cytb). Recent work done by our lab has identified an association between a C. felis cytb genotype (cytb1) and survival when treated with atovaquone and azithromycin. We hypothesized that by using real-time PCR and high-resolution melt analysis we would be able to distinguish C. felis cytb1 from other cytochrome b genotypes. DNA samples were available from 69 cats with cytauxzoonosis; all samples' C. felis cytb genotypes had been previously characterized by DNA sequencing. PCR assays were designed to identify single-nucleotide polymorphisms (SNPs) in the C. felis cytb gene that distinguish cytb1 from other cytb genotypes. The resulting amplicons were analyzed using high-resolution melt analysis. By assessing high resolution melt clustering at five different SNP sites, 100% of the cytb1 samples were accurately identified. This test can rapidly provide prognostic information for clients considering atovaquone and azithromycin treatment in cats with cytauxzoonosis.

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Zebrafish Larvae Reveal a Novel Mediator of Macrophage Chemotaxis

Tissue infiltration by macrophages and neutrophils is an early and critical step in the innate immune response. Yet excessive infiltration by these leukocytes can result in tissue damage and perpetuate inflammation, contributing to disease pathology. Chemotactic factors and cell surface receptors mediating leukocyte migration have been extensively studied, but the intracellular mediators of this process are less well-defined. Zebrafish (*Danio rerio*) are advantageous for studying innate immunity because during the first weeks of life larvae lack a functional adaptive immune response and are protected against pathogens entirely by innate immunity. Importantly, zebrafish share many defining features of the innate immune response with mammals. We used a RNA microarray strategy to define an innate immune response transcriptome in 3-day-old zebrafish larvae exposed to a bacterial or a viral mimic. Analysis of this transcriptome revealed a gene, tripartite motif containing 9 (*trim9*), that had increased transcript levels in response to both mimics, is highly conserved among vertebrate species and, prior to our studies, had no reported immune function. We found that*Trim9* transcript levels increase in neutrophils and macrophages of zebrafish and humans in response toll-like receptor stimulation. Although a function for Trim9 in the immune response has not been described, its published role in control of axon growth guidance suggests it is important in cell migration. To investigate the role of Trim9 in leukocyte migration, we disrupted Trim9 function in zebrafish macrophages through expression of a dominant negative form of Trim9 (dnTrim9). We demonstrate reduced *in vivo* chemotaxis in zebrafish macrophages expressing dnTrim9, suggesting a novel role for Trim9 in macrophage chemotaxis.

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