NC STATE UNIVERSITY

8 T H A N N U A L

GRADUATE STUDENT RESEARCH SYMPOSIUM

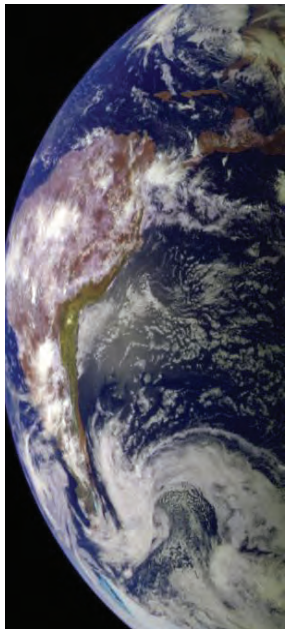
ABSTRACTS

Tuesday, March 19, 2013

1:00 to 5:30 pm

McKimmon Center



Eighth Annual
Graduate Student Research Symposium
NC State University

SYMPOSIUM ORGANIZERS

Graduate School

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

University Graduate Student Association (2012-2013)

Barry Peddycord III, Computer Science (Chair)
Rowan Argent, Marine, Earth, and Atmospheric Sciences
Veronica Mbaneme, Biological and Agricultural Engineering
Keena Mullen, Animal Science
Robert Rouphail, History
Rachel Slivka, Biological and Agricultural Engineering

AGENDA

12:00 pm - 1:00 pm	Poster Set Up	Area 1
1:15 pm - 1:30 pm	Welcoming Remarks and Symposium Overview Bryan Hoynacke, University Graduate Student Association President Dr. Rebeca C. Rufty, Acting Dean of the Graduate School Dr. David Shafer, Assistant Dean of the Graduate School	Room 6
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

TABLE OF CONTENTS

College of Education

College of Engineering

College of Humanities and Social Sciences

College of Management

ABSTRACTS

William Barrington
Graduate Program: Genetics
Advisor: David Threadgill
Poster Number: 11

Societal Influences on Disease Susceptibility as Reflected by Diet

Colorectal cancer is the second leading cause of cancer-related deaths in the United States. Mouse models provide a valuable research tool for investigating cancer susceptibility, and have been used to show that diet plays an important role in the development of colorectal cancer. However, little is known about how diets interact with genetic background to alter cancer susceptibility. In my research, I use mouse models on different genetic backgrounds to compare the impact of six different diets, mimicking popular diets consumed by many individuals today, on susceptibility to developing colorectal cancer. I am using gene expression analysis from mice on different diets to investigate the relationship between diet, gene expression, and genetic background on development of colorectal cancer. Additionally, I am examining the impact these diets have on the mouse gut microbiome, which is emerging as an important mediator of health and disease. Lastly, I am comparing the effect of diets on a variety of phenotypes such as activity level, inflammation, and health biomarkers. Ultimately, this research will determine relationships between diet and cancer susceptibility, identify genes involved in cancer susceptibility, and investigate interactions between diet, gut microbiome, and genetic background on cancer susceptibility.

Matthew B. Bertucci
Graduate Program: Plant Pathology
Advisor: Christina Cowger
Poster Number: 13

Evaluation of the Role of Necrotrophic Effectors in the wheat-*Stagonospora nodorum* pathosystem in the Southeastern United States

Stagonospora nodorum is a necrotrophic ascomycete that causes Stagonospora nodorum blotch (SNB), a harmful disease of wheat in the Southeastern United States. The fungus produces a suite of necrotrophic effectors (NEs) that elicit a hypersensitive response in the host. The NEs are proteins that interact with host sensitivity genes in an "inverse gene-for-gene" manner, with recognition by the host leading to sensitivity. To date, six NEs have been reported in the *S. nodorum* pathosystem. An infiltration bioassay exists to evaluate sensitivity of wheat seedlings to NEs produced by *S. nodorum* in culture. A collection of 26 SNB-susceptible winter and spring wheat cultivars drawn from several Southeastern breeding programs was infiltrated with the NEs produced by *S. nodorum* isolates from across the Southeastern United States. Results indicate that the SnTox3-*Snn3* interaction plays a role in wheat production in this region. The BG population, a series of recombinant inbred lines (RILs) developed from a cross between the spring wheats BR34 and Grandin, includes differential lines for the sensitivity genes *Tsn1*, *Snn2*, and *Snn3*. Molecular markers have been developed for reported sensitivity genes in the BG population. In order to evaluate their diagnostic potential, markers for *Tsn1* and *Snn3* were tested in the same collection of susceptible wheat cultivars. Marker *Xfcp623* for *Tsn1* shows high diagnostic potential in winter wheat. Together, phenotypic and genotypic data will provide wheat breeders a new, reliable method to screen out sources of SNB susceptibility.

Aydin Beseli
Graduate Program: Plant Biology
Advisor: Margaret E. Daub
Poster Number: 14

Characterization of an ABC transporter in resistance to a photoactivated fungal toxin important in plant pathogenesis

A photoactivated perylenequinone toxin, cercosporin, produced by *Cercospora* species has an important role in pathogenesis of this fungus to host plants. Cercosporin has almost universal toxicity due to its production of reactive oxygen species including singlet oxygen and superoxide. Understanding the mechanisms of resistance against this toxin will not only enable us to engineer resistance in important crops against these damaging pathogens, but also give a basic understanding of cellular resistance to photoactivated perylenequinone compounds and the reactive oxygen species they produce. Because cercosporin has broad-spectrum toxicity, we are interested in understanding toxin-resistance mechanisms in *Cercospora* species. Studies have documented the importance of membrane transporters in self-resistance of *Cercospora* to cercosporin. Eight transporters were identified in a subtraction library between a *Cercospora nicotianae* wild type and a mutant, *crg1*, severely attenuated in cercosporin biosynthesis and self-resistance. Quantitative RT-PCR analysis of expression under conditions of cercosporin toxicity in a cercosporin-sensitive mutant strain showed significantly increased expression of two of the library transporters, the

ABC transporter *ATR2* and a previously characterized MFS transporter, *CFP*. Transformation and expression of ATR2 into the cercosporin-sensitive fungus *Neurospora crassa* provided increased resistance to cercosporin toxicity. Targeted gene disruption of *ATR2* in the wild type *C. nicotianae*, however, did not decrease cercosporin resistance. Production of cercosporin was also unaffected in *C. nicotianae atr2* knock-out mutants. Analysis of expression of other transporters in the *atr2* mutant under conditions of cercosporin toxicity showed significantly induced expression of CFP. We conclude that ATR2 can provide protection against cercosporin toxicity, however, up-regulation of other genes in *C. nicotianae* can compensate for a loss of resistance in *atr2* mutants. ATR2, alone or in combination with CFP, may have utility in engineering crop plants for Cercospora disease resistance.

Shante Bryant
Graduate Program: Genetics
Advisors: David Threadgill and Deborah Threadgill
Poster Number: 21

Genetic Analysis of a Post-Infectious Model of Irritable Bowel Syndrome

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 multi-factorial; 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 treatment options is the absence of a valid animal model. Existing animal models can be categorized as either post-inflammatory or post-infectious. The use of a post-infectious model is highly appealing because it has been shown that up to a third of human IBS cases occur after an episode of gastrointestinal infection We plan to address the following specific aims related to IBS: 1- Develop an appropriate mouse model in which symptoms of human IBS can be replicated and examined collectively 2- Examine the role that host genetics play in the development of IBS symptoms using the Collaborative Cross (CC) genetic reference panel. To achieve these specific aims we will compare three post-infectious models for their ability to induce two major problematic symptoms that IBS patients experience, intestinal motility dysfunction (abnormal intestinal contractions) and visceral hypersensitivity (an experience of pain within the inner organs). The infectious agents to be examined include *Trichnella spiralis* (pathogenic worm), *Cryptosporidium parvum* (infectious protozoan species), and *Citrobacter rodentium* (gram-negative bacterium).

Christine E. Cade, Paul Swartz, Carla Mattos, and A. Clay Clark
Graduate Program: Structural and Molecular Biochemistry
Advisor: A. Clay Clark
Poster Number: 22

Allosteric Inactivation of Caspase-3

Caspases (**c**ysteinal **asp**artate-specific prote**ases**) are the enzymes which commit the cell to apoptosis (programmed cell death). Therefore, they are potential drug targets for the treatment of neurodegenerative diseases in which there is too much apoptosis, and cancer in which there is not enough. These enzymes are homodimers which have been found to contain an allosteric site at the dimer interface. Both binding of drugs and mutation of a key residue at the dimer interface (V266H) are able to cause inhibition of caspase-3. However, the structural changes accompanying inhibition by these two methods are very different. Binding of drugs to the dimer interface causes massive loop rearrangements which revert the enzyme to a state similar to that of the inactive procaspase. On the other hand, the V266H mutation causes very minor structural changes and it is unclear from the mutant structure alone which ones are important for inactivation. The goal of this research is to understand how these small changes are able to effect the allosteric inactivation of caspase-3. Mutations have been made of several of the residues which shifted in the V266H enzyme. One set of mutations attempts to mimic the V266H enzyme by introducing steric clashes in the wild-type (WT) enzyme. A contrasting set of mutations attempts to restore activity in V266H by decreasing steric clashes. Activity of these mutants was assayed using fluorogenic substrate. Crystal structures were determined and 50 ns molecular dynamics simulations were performed for each mutant in order to get a better sense of the movement of the enzyme. One key finding is rotation of helix 3 in the inactive mutants towards the dimer interface. This helix connects the dimer interface to the active site and is therefore likely to be important in conferring loss of activity.

Amanda Cross
Graduate Programs: Animal Science
Advisor: Joe Cassady
Poster Number: 31

The effect of litter size and parity on birth weight in pigs

Agriculture is a critical part of the North Carolina economy and pork production accounts for 23.8% of farm cash receipts. North Carolina's swine industry ranks second nationally in number of pigs slaughtered. To improve efficiency of production pigs have been genetically selected for increased litter size at birth. This selection has resulted in substantial increases in number of pigs born. As number born has increased, individual piglet birth weights have decreased. Low birth weight piglets tend to have lower weights in subsequent phases of production. The aim of this study was to evaluate the influence of number born and birth sow parity on piglet birth weight. In the current study, number born ranged from 1 to 26 piglets, with an average number born of 15 (± 3.53). Parity ranged from 1 to 8, with an average parity of 2.85 (± 1.60). A general linear model was used to examine the effect of number born and parity on birth weight. Number born, parity and sex ratio were included in the model as fixed effects. Number born and sow parity were both significant ($P<0.01$). Birth weight is negatively correlated with number born. An increase in one pig results in a decrease in birth weight by 0.031kg (±0.0011). Parity 1, first litter females, had the lowest birth weight piglets. It was concluded that selection on increased number born results in a decreased birth weight, but birth weights increased with increasing parity. Producers should select for increased sow longevity in combination with selection for increased litter size. Selection for increased longevity would be expected to increase the average number of parities which may result in increased birth weights.

Angel E. Cruz, Michelle Schroeder-Moreno, and Dolly Watson
Graduate Programs: Crop Science
Advisor: Michelle Schroeder-Moreno
Poster Number: 32

The role of arbuscular mycorrhizal fungi diversity in crop response to drought stress

Arbuscular mycorrhizal fungi (AMF) have been found to increase plant resistance to drought stress although the effect has not been consistently found. Since different AMF species individually and in combination have been found to affect plant growth, nutrient uptake and response to stress differently, we hypothesized that a diversity of AMF species may increase corn resistance to drought stress more effectively than single AMF species. We were also interested to examine if some individual AMF species were more effective than others in enhancing corn resistance to drought. In an 8 Week experiment in the Phytotron at NCSU, corn plants were inoculated with 5 different single AMF cultures (*Glomus intraradices, Acaulospora spinosa, Gigaspora rosea, Glomus clarum, Glomus etunicatum*), a combination of 3 AMF species, and a combination of all 5 AMF species as well as a control with sterilized AMF inoculum. After 4 weeks of well watered growth, a drought treatment (50% field capacity) was initiated in half of the pots of all treatments and lasted for 4 weeks. A variety of response varaibles were measured including plant dry weights (shoot and roots) at harvest, plant heights, growth stage, shoot nutrients at harvest, and photosynthesis at 8 weeks. Preliminary analysis suggests differences between the drought mycorrhizal plants and the drought non mycorrhizal plants in total biomass. Inoculation with AMF seemed to reduce root dry weights compared to the controls, but in most treatments (the aboveground biomass appeared to be greater in AMF treated plants. The *Glomus etunicatum* and the 3 AMF species combination treatments appear to have greater photosynthesis and increased shoot nutrient concentrations compared to controls and other treatments. Further analysis will help clarify the role of AMF in crop response to drought.

Kathy M. DeBusk
Graduate Program: Biological and Agricultural Engineering
Advisor: William F. Hunt III
Poster Number: 36

Using Rainwater Harvesting to Meet Irrigation and Stormwater Management Needs

Rainwater harvesting (RWH) systems provide the dual benefits of (1) acting as alternate water supply sources and (2) providing detention/retention of roof runoff that would otherwise become stormwater runoff. However, storage for water supply and storage for runoff detention are sometimes opposing functions. That is, for a RWH system to detain water there must be room available in the cistern for runoff. While a full cistern is ideal for water conservation, a full cistern cannot provide the stormwater-management benefit of detention. The purpose of this study is to document how well a RWH system can meet irrigation demands for turfgrass while maximizing stormwater mitigation. The conventional irrigation approach of applying minimum required volumes conserves water, but does not benefit stormwater management. Irrigating at higher rates will draw down cistern-stored water more frequently, making more storage available for runoff during the next rainfall. A 45,425L RWH system was installed in River Bend, NC and captures runoff from approximately 1,200m^2. The collected water is used to irrigate 835m^2 of Bermuda turfgrass. The irrigated area is divided into 3 zones. Zone 1, the control, receives a rate equivalent to

evapotranspiration, less effective rainfall, April-October. Zones 2 and 3 receive 2.5cm and 5.1cm per week, respectively, year-round. The following data have been collected: rainfall intensity, rainfall depth, overflow from each tank, irrigation water applied to each zone, volume of water in each tank, and soil moisture, soil nitrate concentrations and turfgrass quality in each zone. Preliminary observations indicate that the zone/tank systems with greater irrigation rates provide substantial stormwater management benefits; however, these systems cannot meet irrigation demands as well as the control system during extended periods of drought.

Laura Edwards[1], Kyle Grant[2], Kevin Blackburn[1], Jason Haugh[2], and Michael Goshe[1]
Graduate Programs: Molecular and Structural Biochemistry[1]; Chemical and Biomolecular Engineering[2]
Advisors: Michael Goshe and Jason Haugh
Poster Number: 40

Global phosphoproteomic analysis of PDGF-stimulated mouse fibroblasts using LC-MS/MS

The dogma of signal transduction as an ordered series of activation processes (exemplified with the Ras/Raf/MEK/ERK pathway) has recently been challenged with the discovery of cross-talk, as well as positive and negative feedback loops. These dynamics play a critical role in the level of activation of key proteins in pathways such as the mitogen-activated protein kinase (MAPK) and phosphoinositide 3-kinase (PI3K) signaling pathways. Both of these pathways have been extensively studied due to their role in the regulation of cell growth and proliferation which, if misregulated, can modulate the progression of cancer. In order to understand the dynamic features of these pathways, experiments that quantify the level of activation (i.e., phosphorylation levels) must be performed. Previously, these data have been generated by quantitative immunoblotting; however, this technique only tests site specific modifications one at a time rather than a comprehensive, network wide context. To obtain a more global depiction of the phosphoproteome, initial studies were conducted using platelet-derived growth factor (PDGF) to stimulate mouse fibroblasts for 15 and 120 minutes followed by enrichment of phosphopeptides. The enriched phosphopeptides were analyzed using liquid chromatography-tandem mass spectrometry (LC-MS/MS) with an Easy-nLC 1000 coupled to an Orbitrap Elite MS (Thermo Scientific). Thousands of unique phosphopeptides were identified, including several in the MAPK and PI3K pathways. Efforts to quantify these phosphorylation events using an LC-MS/MS label-free method are underway. To illustrate that this approach is valid, preliminary LC-MS/MS quantitative results of phosphorylated ERK, a major regulatory protein in these pathways, were confirmed by quantitative immunoblotting. Furthermore, quantifiable differences in phosphorylation states of other proteins where no antibody was available were readily observed. Ultimately, this quantitative data will be used to generate and refine computational models, which we anticipate will predict outcomes of interventions targeting molecular players in these pathways.

Jeb S. Fields, William C. Fonteno, and Brian E. Jackson
Graduate Program: Horticultural Science
Advisor: William C. Fonteno
Poster Number: 42

Hydrologic properties of potential wood components of greenhouse substrates

Much work has been done to determine the moisture characteristics of various components of horticultural substrates. However, wood based components have not been fully explored. Moisture retention curves of two wood materials were compared to some traditional substrate components peat, coir, and perlite. Freshly harvested loblolly pine (*Pinus taeda* L.) logs were hammer-milled through a 6 mm (1/4 in.) screen after being initially processed with either a wood chipper or a wood shredder. The chipped process produced a "blockular" aggregate type product (WC), while the shredding process produced a more fibrous material (SH). The WC and SH had total porosities of 78% and 84%, respectively, which was lower than that of the peat and coir and higher than the perlite. Air filled porosity between 0 and free drainage (3.8 cm) was two to three times greater in WC and SH compared to peat, coir, and perlite. WC and SH tended to have very similar curves as a whole, yet SH tended to hold slightly more water at all points than WC. The WC and SH tended to release a larger majority of their water at very low pressures than that of the peat, coir, and perlite. Under the highest pressure settings, 100, 200, and 300 cm, the WC and SH tended to hold water similarly to peat and perlite, with coir releasing more than the others. This research has identified the water retention properties of SH and WC which will be helpful in finding the best scenarios for their use as components for greenhouse substrates.

Colin Funaro
Graduate Program: Entomology
Advisor: Edward Vargo
Poster Number: 46

Chemical mediation of queen and king recognition in subterranean termites (*Reticulitermes flavipes*)

Chemical mediation of reproductive caste is common in many eusocial insects. Functionally sterile workers identify and tend queens or kings within the colony using unique volatile or contact based chemicals. Many of these signals in ants, bees and wasps consist of reproductive-specific cuticular hydrocarbons. In termites, recognition and tending behavior towards queens and kings is not well-studied and no recognition pheromones have been identified to date. Egg recognition pheromones and cuticular hydrocarbons indicating fertility have been identified in a few termites, but there is little information regarding queen and king tending behavior. I investigated the recognition and tending behavior of reproductive individuals in the eastern subterranean termite *Reticulitermes flavipes*. In many termites, including subterranean species, individuals will sometimes shake violently while remaining in place. Although this behavior sometimes occurs in response to various stimuli, it occurs quite conspicuously and frequently in close proximity to reproductively active individuals. Using behavioral assays and classical chemical ecology techniques, we documented the strong behavioral response of termites towards neotenic (secondary) queens, kings, workers, and soldiers, and investigated the potential chemical sources for queen and king recognition. Results of these ongoing analyses will be presented.

Miranda Ganci
Graduate Program: Plant Pathology
Advisors: Kelly L. Ivors and D. Mike Benson
Poster Number: 49

Evaluating the Role of Microsclerotia in the Disease Cycle of Boxwood Blight, Caused by the Fungus *Cylindrocladium buxicola*

North Carolina is the largest producer of boxwood in the U.S. Box blight, caused by the fungal pathogen *Cylindrocladium buxicola (=Cylindrocladium pseudonaviculatum*), is a foliar disease characterized by circular black to brown leaf lesions and elongated black stem lesions on infected boxwood. Infection leads to severe dieback and defoliation of the plant. The pathogen produces microsclerotia within dying leaves and stems. The microsclerotia are capable of enduring harsh environmental conditions. When conditions are favorable for disease development, the microsclerotia will germinate to produce hyphae and asexual spores called conidia. The microsclerotia are an important source of inoculum and their survival contributes to increased box blight disease incidence. The objective of this study was to determine the survivability of this pathogen when infected plant material was stored and exposed to the different environmental and site conditions where boxwood debris is commonly found in commercial boxwood fields and nurseries.

Viability of *Cylindrocladium buxicola* was assessed in plant material over the fall and winter of 2012-2013 in an experiment at the Mountain Horticultural Crops Research Station in Mills River, NC. Viability of the fungal pathogen was assessed monthly in naturally-infected plant material maintained under four different outdoor scenarios: on the surface of field soil, in the subsurface of field soil (5cm), on the surface of soil-less potting media, and in the subsurface of soil-less potting media (5cm). Viability was verified by inducing sporulation of the fungus within the samples collected, and the presence of microsclerotia was determined using microscopy. Preliminary data suggest that *C. buxicola* is most likely to survive as microsclerotia in plant debris maintained within the subsurface of soil-less potting media and least likely to survive on the surface of field soil. This information can be used to optimize cultural control recommendations to improve management of the box blight disease.

Robert D. Grinshpon
Graduate Program: Molecular and Structural Biochemistry
Advisor: A. Clay Clark
Poster Number: 55

Retracing Ancestral Caspase Functional Divergence: Unlocking the Mysteries of the Dimer Interface

Humans create roughly 10 billion new cells every day, and must remove a similar amount via apoptosis in order to maintain homeostasis. An imbalance can lead to degenerative disorders like Alzheimer's, or conversely, proliferative disorders like cancer. The CED-3-like apoptotic subset of the caspase family of cysteine proteases is integral to the cascade leading to apoptosis. Apoptotic caspases are further categorized as initiators or effectors. The initiators exist as stable monomers that require dimerization for activation. The effectors exist as dimeric zymogens that are processed by the initiators in response to a death stimulus. The stability of the dimer may be attributed to interactions in the dimer interface; which is unique to each caspase. The goal of this project is to understand how the design elements of apoptotic caspases evolved by using bioinformatics techniques to reconstruct ancestral caspases in an attempt to delineate the divergent trends that led to the intricacies of the caspase signaling pathway. The goal of our lab is to enhance our ability to manipulate the activity of procaspase-3 by allosteric control. Our lab has previously shown that site directed mutagenesis in the dimer interface results in a spectrum of activity ranging from

no activity to fully active. Gene duplication events give rise to two identical genes; multiple gene duplications lead to gene families. The molecular clock hypothesis postulates that duplicated genes will begin to accumulate mutations proportional to the time since they diverged. Aligning the sequences of homologous proteins can reconstruct evolutionary history by dating duplication events, and predicting the ancestral sequence prior to diverging. Construction of a phylogenetic tree that represents "true" evolutionary events is no trivial task. In this project I will decipher and utilize the appropriate bioinformatics resources available in order to probe the regulatory elements of caspase family proteins.

Sang Won Han, Maria F. Rodriguez-Welsh, Jiameng Zheng, and Marcela Rojas-Pierce
Graduate Program: Plant Biology
Advisor: Marcela Rojas-Pierce
Poster Number: 59

The *impaired traffic to tonoplast* 5 mutant displays abnormal localization of Tonoplast Intrinsic Protein 2;1

The plant vacuole is an essential and multifunctional organelle, and in some cells, defined membrane structures named "bulbs" are visible inside plant vacuoles. Two putative functions for vacuolar bulbs have been proposed, but the mechanisms for bulb biogenesis and their functions in the vacuole are largely unknown. Bulbs may serve as membrane reservoirs for the quick expansion of vacuoles, or they may be involved in tonoplast protein degradation. Tonoplast Intrinsic Proteins (TIPs) are aquaporins that localize to the vacuolar membrane, or *tonoplast*, and are often used as vacuolar membrane markers. Some tonoplast membrane proteins such as TIP1;1 are enriched in bulbs, while others such as TIP2;1 are not. To identify proteins that regulate the biogenesis of vacuoles, we recently completed a screen for Arabidopsis mutants that had abnormal tonoplast protein localization or vacuole morphology. The *impaired traffic to tonoplast5* (*itt5*) mutant was identified because it had more bulb structures that were labeled with a GFP-TIP2;1 fusion protein when compared to the parental control. This phenotype was most severe in hypocotyls than in roots. In addition, the appearance of bulbs was restricted to lytic vacuoles in vegetative tissues mutant because no differences were observed in protein storage vacuoles of mature embryos. These results indicate that the *ITT5* may play a major role in bulb biogenesis in vegetative tissues. In order to understand the process of bulb biogenesis, Fluorescence Recovery After Photobleaching (FRAP) experiments was performed. This experiment revealed that the mobility of GFP-TIP2;1 protein in the vacuolar bulbs is slower than that of transvacuolar membranes, supporting the complexity of bulb membrane structure. Candidate genes for the *ITT5* locus were identified in chromosome 5 using map-based cloning and whole-genome sequencing. Current efforts include characterizing the function of *ITT5* in bulb biogenesis.

Elizabeth Harris[1], Oscar Fletcher[2], Kenneth Anderson[3], James Petitte[3], Levy Kopelovich[4], and Paul Mozdziak[1]
Graduate Programs: Physiology, North Carolina State University[1]; Population Health and Pathobiology, North Carolina State University[2]; Poultry Science, North Carolina State University[3]; Division of Cancer Prevention, National Cancer Institute[4]
Advisor: Paul Mozdziak
Poster Number: 61

Rescue of mutant p53 by CP-31398 Prevents Spontaneous Ovarian Cancer in the Domestic Hen

Ovarian cancer is a devastating disease associated with a reduction or loss of function in the p53 tumor suppressor gene. CP-31398 is a p53 stabilizing compound for chemoprevention, but it has not previously been studied in a spontaneous ovarian cancer model. The present study demonstrates the effect of CP-31398 on the spontaneous development of ovarian adenocarcinoma in the 2-year old laying hen, which is an excellent model for the pre-menopausal woman. Beginning at 104 weeks of age, 576 laying hens (*Gallus domesticus*) were provided with feed containing varying amounts of CP-31398 for 23 months. The control (C) group (n=144) was provided a diet containing 0 ppm (mg/kg) CP-31398, the low dose treatment (LDT) group (n=144) was provided a diet containing 100 ppm CP-31398, the moderate dose treatment (MDT) group (n=144) was provided a diet containing 200 ppm CP-31398, and the high dose treatment (HDT) group (n=144) was provided a diet containing 300 ppm CP-31398. Feed intake, weight and egg production were closely monitored throughout the trial. At 192 weeks of age, the birds were killed to determine the incidence of adenocarcinomas, whose etiology was verified with histological analysis. Hens in groups MDT and HDT showed a significantly lower incidence of reproductive and metastasized malignancies compared to those in groups C and LDT ($P < 0.05$), with up to a 77% lower incidence of ovarian cancer. The incidence of localized oviductal cancer was the same across all treatment groups, indicating that CP-31398 does not have the same protective effect on the oviduct that it does on the ovary. The current study suggests that CP-31398 inhibits the initiation and progression of ovarian cancer in the hen by directly targeting mutant p53, and is an effective tool for chemoprevention against ovarian malignancies that could eventually be applied to human cancer prevention.

Arun Jani
Graduate Program: Soil Science
Advisor: Julie Grossman
Poster Number: 73

Effect of Root Morphology and Termination Approach on Legume Cover Crop Root Decomposition

Winter annual cover crops are plants grown between cash crop cycles to improve soil physical properties and crop nutrient availability, commonly terminated prior to summer crop planting. Cover crop roots are predicted to be a major contributor to long-term soil organic carbon (C), but root retention in soils under different termination strategies has not been thoroughly investigated. Root morphology is known to influence root decomposition. Our goal is to investigate the extent to which leguminous cover crop roots contribute to soil C and how this may be affected by root morphology and termination method. Objectives are to i) determine root morphological differences between the cover crops Austrian winter pea (*Pisum sativum*), crimson clover (*Trifolium incarnatum*), and hairy vetch (*Vicia villosa*), ii) measure the effect of two termination methods (disking and roller-crimping) on decomposition rate of these species, and iii) determine the effect of soil inorganic N and root particle size on decomposition. To determine root morphological characteristics, plants were grown in PVC cylinders for 12 weeks and analyzed with WinRhizo software. Field decomposition studies were carried out in Goldsboro and Kinston, NC using a split plot design. Air-dried roots of three species were placed in mesh bags, buried in plots to a 15 cm depth, and collected 2, 4, 6, 8, 12, and 16 weeks after burial. Root morphological differences were observed between species with crimson clover having greater total root length, fine root length, and surface area than other species. Crimson clover roots also decomposed faster than other species in Kinston, while differences were not observed in Goldsboro. Roots from all species in rolled plots decomposed faster in Kinston, while in Goldsboro differences were only observed at week 16. Further studies are planned to investigate the role of soil N and root diameter on legume cover crop root decomposition.

Lesley A. Judd, Brian E. Jackson, and William C. Fonteno
Graduate Program: Horticultural Science
Advisor: Brian E. Jackson
Poster Number: 77

Novel Methods for Observing and Quantifying Root Growth of Horticultural Crops

A large portion of the U.S. horticulture industry is involved with growing plants in containers, including nursery and greenhouse crops. To achieve optimal plant growth it is critical for plants to have healthy roots, something that is difficult to measure. Two techniques are being investigated as potential new methods of measuring root growth; 1) mini Horhizotron and 2) Rhizometer. The mini Horhizotron has a clear, three sided configuration suitable for observing root growth of small plants. The clear quadrants allow visibility of the roots for measurements to be taken. Potential measurements include root length, quantity of root hairs, and root architecture. Three substrates were used in the initial testing of the mini Horhizotron; 70:30 (v/v) peat:perlite, peat:pine-wood-chips and peat:shredded-pine-wood. Three mini Horhizotrons were filled with each substrate on 2 June 2012, and one *Echinacea purpurea* 'Prairie Splendor' plug was planted into the center. Root length measurements (cm) were taken on the three longest roots in each quadrant on 11, 25 and 39 days after planting (DAP). The Rhizometer is made from a clear cylinder that is 7.6 cm tall x 7.6 cm inside diameter which allows for visible root observations including root count, root architecture, etc. Rhizometers were filled on 18 May 2012 with a standard substrate and one *Tagetes erecta* 'Inca Orange' (marigold) plug was planted into the center of 20 Rhizometers and 5 were harvested at 7, 14, 21 and 28 (DAP). In the mini Horhizotrons, at 39 DAP root length was greater in the shredded wood substrate. Rhizometer data indicate that marigold roots have no effect on substrate physical properties over four weeks. These two techniques for quantifying undisturbed root growth have yielded promising results. The ability to visualize, observe and measure the growth of roots will further expand root growth research and understanding.

Gourishankar Karoshi
Graduate Program: Biological and Agricultural Engineering
Advisor: Praveen Kolar
Poster Number: 78

Exploring novel catalysts for selective oxidation of methane into value added chemicals

There is a significant interest in converting methane into oxygenated and other value-added chemicals. The goal of this research is to explore novel, inexpensive, and stable catalysts developed from agricultural waste source that are capable of activating C-H bond in methane and hence facilitate selective oxidation. The catalysts were synthesized by high-temperature activation (1000°C) of chicken eggshells. When tested in fixed-bed reactor at 650°C and atmospheric pressure, the catalysts were able to convert methane into hydrogen, olefins (Acetylene, Ethylene, Propene, 1,3-Butadiene and 1,3-Pentadiene), aromatic hydrocarbons (Benzene & Toluene) and aldehydes (2-Propenal). The fractional conversion was in the range of 15-30% depending on the conditions used. The conversion of methane to value added target products was oxygen dependent reaction.

Proportionate reduction of oxygen concentration in the feed was observed to reduce selectivity towards waste products like carbon oxides significantly. Subsequent analysis of the catalytic surfaces via time-of-flight secondary ion mass spectrometry revealed that the CaO represented the active sites in calcined eggshell. Eggshell catalysts were found to be stable and can be regenerated periodically for extended application. Effect of metal coatings on eggshells is also being investigated. It is proposed that low specific surface area and pore volume characteristics of the eggshell catalysts were also partly responsible in partial oxidation as well as aromatization of methane.

Erin M. Kollitz and Seth W. Kullman
Graduate Program: Environmental and Molecular Toxicology
Advisor: Seth W. Kullman
Poster Number: 87

Functional Diversification of Vitamin D Receptor Function in Aquatic Vertebrates

The ray-finned fish comprise ~24,000 extant species and are among the most diverse and successful groups of vertebrates. Much of the complexity of the teleost genome is a result of successive rounds of whole genome duplications (WGD). The retention of genes after the WGD provides insight into how genes evolve through neo-functionalization and the partitioning of ancestral functions. This study examines whether ancestral and paralogous vitamin D receptor genes (VDRs) have acquired novel function(s) and/or partitioned ancestral sub-functions subsequent to successive duplication events. VDRs were cloned from aquatic vertebrates that diverged at key time points in evolution, including two post WGD teleosts. Using a transient transactivation system we demonstrate that VDR transactivation activities significantly differ between individual species and between VDR paralogs. Dose response of VDR transactivation with 1α, 25-dihydroxyvitamin D_3 suggest that while the affinity of each VDR is highly similar, maximal transactivation activity is significantly different between VDR forms. Protein-protein interactions were investigated using co-transfection, mammalian two-hybrid and mutation of co-regulator activation domains. We found that functional differences between VDRs are driven through differential interactions between receptors and their co-regulators including RXR and the p160 family of nuclear receptor co-activators. While these studies demonstrate conserved molecular interaction of VDR and co-regulators within Actinopterygii, they also demonstrate the importance of nuclear receptor co-regulator interactions in mediating transactivational activity. DNA binding studies using EMSAs found that VDR paralogs bound with significantly different affinities in the presence of vitamin D. All VDR binding was highly specific, and the presence of the heterodimer partner RXR was necessary for DNA binding to occur. From an evolutionary context our studies illustrate how slight modifications in VDR gene/protein sequence may impact functional activities of VDR consistent with neofunctionalization. These results suggest that VDR may have acquired novel functions with the divergence of 1R to 3R species.

Shangtao Liang, Julie Grossman, and Wei Shi
Graduate Program: Soil Science
Advisor: Wei Shi
Poster Number: 92

Microbial Response to Winter Cover Crop Management During Transition to Organic Farming

The use of cover crops is an effective strategy to provide nitrogen source for following plants in organic farming systems. The aim of our current work is to elucidate: (1) the direct effect of cover crop quality and termination approach on soil microbiological properties and (2) the best microbiological parameter for detecting short-term plant residue impacts on soil. In this study, we examined the influence of three legume cover crops [australian winter pea (AP), hairy vetch (HV), and crimson clover (CC)], and three killing methods (flail, spray and till) on soil microbial biomass carbon, C and N mineralization, nitrification potential and enzyme activities (β-glucosidase, exoglucanase, and β-glucosaminidase). Our experiment was conducted on a field during conversion from conventional to organic farming in North Carolina. The results suggest that soil microbiological properties have no significant difference among three cover crop species, but cover crop treatments, in general, do show higher soil net nitrogen mineralization (18.3 μg N g^{-1} soil in average), nitrification potential (0.197 μg N g^{-1} h^{-1} in average), exoglucanase, β-glucosidase and β-glucosaminidase (0.223, 1.371 and 0.405 μmol h^{-1} g^{-1} soil in average, respectively) than control soil (16.6 μg N g^{-1} soil, 0.141 μg N g^{-1} h^{-1}, 0.202, 0.191 and 0.366 μmol h^{-1} g^{-1} soil, respectively). In addition, we observed greater microbial activity response to flail method treatments than other two killing methods in terms of all the non-enzymatic parameters except for net N mineralization. However, the same trend was not found in enzymatic parameters. This may due to the high sensitivity of non-enzymatic parameters to the favorable temperature and moisture condition and higher microbe accessibility provided during surface spreading and chopping processes. This knowledge can be important for selecting microbiological parameters for similar future studies.

Renée M. Marchin[1], Rob R. Dunn[2], and William A. Hoffmann[1]
Graduate Programs: Plant Biology[1]; Biology[2]
Advisor: William A. Hoffmann
Poster Number: 103

Some like it hot? Warming effects on growth and reproduction in a wintergreen understory orchid, *Tipularia discolor*

Winter temperature in the eastern United States has been increasing nearly twice as fast as the annual average, but studies of warming effects on plants have focused on plants that are photosynthetically active in summer. The terrestrial orchid *Tipularia discolor* is summer-deciduous and acquires carbon primarily in winter. Like many plant species, the optimum temperature for photosynthesis in *T. discolor* is higher than the maximum temperature throughout most of its growing season. The southeastern US is expected to be 2-5°C warmer by 2100, so growth of *T. discolor* should increase with warming. Using a series of open-top chambers that heated the forest understory by 1.2 to 5°C, we measured warming-induced changes in reproduction, physiology, and growth of *T. discolor*. As a consequence of heating, mean VPD also varied among chambers, ranging from +0.18 to +0.53 kPa. Experimental warming negatively affected reproductive fitness (number of flowering stalks, flowers, fruits) in *Tipularia*. Temperature in June–July was critical for flowering in late July. Mean July temperatures greater than 29°C, corresponding to a +3°C treatment, inhibited flowering. Warming of +1.2°C delayed the onset of flowering in *Tipularia* by an average of 10 days and fruiting by an average of 5 days. Growth declined with increasing temperature, which was contrary to expectations and occurred despite higher light-saturated photosynthetic rates in heated chambers compared to controls (11.0 vs. 7.6 μmol m^{-2} s^{-1}, *P*=0.0002, respectively). The confounding of temperature and VPD in this experiment makes it difficult to determine the mechanism controlling the growth response. Differences in gas exchange rates and foliar carbon isotope ratios indicate restrictions in stomatal conductance of orchids in heated chambers, likely due to higher VPD. Increasing temperature in the future will be an important limiting factor to the distribution of *Tipularia*, especially along the southern edge of its species range.

Keith R. Merrill[1,2], Gina L. Brown-Guedira[1,2], Marcio Pais De Arruda[3], and Frederic L. Kolb[3]
Graduate Programs: Crop Science, North Carolina State University[1]; Eastern Regional Small Grains Genotyping Lab, USDA-ARS, Raleigh, NC[2]; Crop Science, University of Illinois, Urbana, IL[3]
Advisor: Gina L. Brown-Guedira
Poster Number: 113

Comparative Genotyping-by-Sequencing Analyses in a Soft Red Winter Wheat Bi-Parental Mapping Population with Differing Levels of Sequencing Coverage

With the advent and increasing popularity of genotyping-by-sequencing (GBS) as a tool for use in association studies as well as genomics approaches to breeding, one area of interest is the level of coverage and genomic reduction at which one obtains 'optimal' amounts of sequence. One of the drawbacks to GBS is that there often exists a large amount of missing data between individuals within and between analyses. Factors such as genome size, level of coverage, cost of sequencing, and the number of desired markers all must be evaluated to determine how much sequence to obtain.

We investigated the level of optimal coverage in a soft red winter wheat bi-parental mapping population ('Clark' x IL97-1828). A sparsely populated linkage map with 202 DArT and SSR markers is available for this population and analyses with DArT and the Illumina Wheat iSelect assay having approximately 9,000 SNPs revealed a low level of polymorphism between the parents. We obtained two lanes of sequence from an Illumina HiSeq 2000 run with the same 95 individuals per lane, including the two parents and 93 progeny. We used a two-enzyme restriction digest GBS protocol with *PstI* and *MspI* for library preparation and genomic reduction prior to sequencing. Sequence data was analyzed using the TASSEL GBS and UNEAK Java Pipelines. We performed separate analyses for: 1) each lane individually, 2) each lane individually with the parental sequences from the other lane added in (single lanes with 2x parents), and 3) both lanes combined. Here we present a comparison of these analyses including tag and SNP counts.

Additionally, we used the GBS_SNPs from the combined data analysis for linkage mapping in Map Disto. We used the panel of 202 SSR and DArT Markers with known chromosome assignments and for which the population was segregating to anchor our map.

Stephanie Mixson
Graduate Program: Plant Biology
Advisor: JoAnn Burkholder
Poster Number: 116

Enhancing lipid production in the marine microalgae *Dunaliella* spp. through environmental stressors

Agricultural crops have been investigated as potential sources for biofuel; however, they produce only a fraction of the oil percent biomass as compared to that of microalgae. Almost 80% of the total biomass of some microalgae can be lipids, compared to 5% found in oil palm. Many species of microalgae produce lipids in response to nutrient deficiency and other

environmental stressors. We assessed 14 strains of *Dunaliella* within five species, using a modified technique with Nile Red stain to rapidly screen cultures for neutral lipid content. Several strains with high growth and high lipid production were selected to enhance lipid production using stress levels of salinity, nitrogen, and pH, bubbling with CO_2, and continuous light. High salinity and pH stress (7 or 10) yielded the maximum total fatty acid (FA) content (up to 65% by dry weight) in comparison to controls (~10-25% total FAs). N and/or P limitation, bubbling with CO_2, and continuous light did not enhance lipid production. During osmoregulation, *Dunaliella* either produces or excretes glycerol (under hyper- or hypo-osmotic conditions, respectively), which returns the cell to its original volume. Glycerol production was measured in a short-term salinity stress experiment and found to significantly increase 30 min to 1 hr after exposure. Real-time PCR experiments were designed to evaluate the relative expression of two glycerol biosynthesis genes (GPI and GPDH) during short-term salinity stress. Preliminary results indicate that GPDH was expressed 24 hr after salt stress, whereas GPI was expressed immediately after exposure. Future research can build upon this study to genetically modify selected "best" strains for maximum quantities of desired lipids, and to develop and refine innovative technologies to use these lipids from *Dunaliella* as a sustainable source of biofuel.

Nape Mothapo[1], Huaihai Chen[1], Marc A. Cubeta[2], and Wei Shi[1]
Graduate Programs: Soil Science[1]; Plant Pathology[2]
Advisor: Wei Shi
Poster Number: 119

Nitrous Oxide Producing Activity of Diverse Fungi from Distinct Soil Systems

Fungi represent a significant component of the soil microbial community and play critical ecological roles in carbon and nitrogen mediated processes. Therefore, fungi capable of nitrous oxide (N_2O) production may have great implications to soil N_2O emission. The primary objective of this research was to identify and characterize N_2O-producing fungi in agricultural soil systems and determine their relative physiological responses to inorganic N species, pH and oxygen availability. Soil samples were collected from five agroecosystems: conventional farming, organic farming, integrated crop and livestock, plantation forestry, and an abandoned agriculture field subjected to natural succession, located at the Center for Environmental Farming Systems, Goldsboro, NC. Fungi were isolated from soil and examined for N_2O production in a nitrate-containing liquid Czapek medium amended with or without cycloheximide or streptomycin. Sixty-eight isolates representing at least 16 genera and 30 species of filamentous fungi produced N_2O. *Neocosmospora vasinfecta* exhibited the highest production of N_2O in laboratory based assays, followed by *Aspergillus versicolor*, *A. oryzae*, *A. terreus*, *Fusarium oxysporum* and *Penicillium pinophilum*. Furthermore, fungi of high N_2O-producing activity were associated more frequently with intensively managed agroecosystems than successional and plantation forestry systems, suggesting that management practices may create environments favorable for fungi that exhibit high N_2O-production. Ten selected N_2O-producing fungus isolates were subsequently evaluated to determine the influence of N species, pH and O_2 on N_2O production. Seven of the 10 selected isolates had 65% or greater N_2O production in a nitrite than a nitrate medium. Ninety and 60%, of isolates showed greater N_2O production at neutral pH 7.0 and ≤5% headspace O_2 conditions, respectively. Our results demonstrate that N_2O-producing fungi are prevalent in the five soil systems and that production of N_2O varied among isolates examined under different imposed abiotic conditions in the laboratory.

Keena A. E. Mullen[1], Amanda R. Lee[2], Roberta L. Lyman[2], Steven P. Washburn[1], and Kevin L. Anderson[2]
Graduate Programs: Animal Science[1]; Population Health and Pathology[2]
Advisors: Steven P. Washburn and Kevin L. Anderson
Poster Number: 123

An *in vitro* Assessment of the Antibacterial Effects of Various Plant Essential Oils

In the growing organic dairy industry, there is need for non-antibiotic treatments for mastitis. Plant essential oils have anecdotal efficacy for treatment of mastitis in dairy cattle. The potential mechanism of action of essential oils in mastitis therapy has not been well studied. The objective of the current study was to evaluate the antibacterial activity of the essential oil components of Phyto-Mast, an herbal intramammary mastitis treatment, against three mastitis-causing organisms (*Staphylococcus aureus, Streptococcus uberis,* and *Staphylococcus chromogenes*). The essential oils evaluated were *Thymus vulgaris*, *Gaultheria procumbens*, *Glycyrrhiza uralensis*, *Angelica sinensis*, and *Angelica dahuricae.* Broth dilution testing according to standard protocol (CLSI) was performed using pasteurized whole milk. Controls included milk only (negative control), milk + bacteria, and milk + penicillin-streptomycin (positive control, at 1% and 5% dilutions). Essential oil of *Thymus vulgaris* was tested by itself and not in combination with other oils. The other essential oils were tested alone and in combination for a total of 15 treatments, each replicated three times and tested at 4%, 2%, 1%, and 0.5% to simulate concentrations achievable in the pre-dry off udder quarter. Of all the individual essential oils tested, only *Thymus vulgaris* oil had consistent antibacterial activity against all three pathogens tested, and activity was seen at or above 2%. Though the combinations of oils did not show typical dose-response effects, some concentration levels were consistently antibacterial across all three replications. Our results indicate the presence of antibacterial activity in some essential oils and further evaluation is recommended to determine the effect of essential oils for mastitis treatment.

Jesse Noar
Graduate Program: Microbiology
Advisor: José M. Bruno-Bárcena
Poster Number: 126

***Azotobacter vinelandii* CA6 is an Aerobic Hydrogen-Producing Heterotroph**

Hydrogen gas is an energy-dense yet carbon-free fuel. The microbes used to produce biohydrogen have all been anaerobic fermentative bacteria or photosynthetic organisms. *Azotobacter vinelandii* CA6 is a mutant strain that produces hydrogen when fixing nitrogen because of a large genomic deletion that knocked out its uptake hydrogenase. Using a series of chemostat experiments, we characterized the hydrogen productivity and yield of CA6, its wild-type parent CA, and an engineered hydrogenase knockout strain HS2. These experiments showed that CA's hydrogen production is negligible and confirmed the mutant strains' consistent production and their potential as hydrogen-producing organisms.

Jessica Nye
Graduate Program: Genetics
Advisor: Trudy F.C. Mackay
Poster Number: 130

Genetic variation of heart rate in *Drosophila*

Cardiovascular disease is the leading cause of death in the world and claims a life every thirty-nine seconds in the United States. The heritability of cardiovascular disease in humans is currently estimated between 38% and 66%. While this disease has a high genetic component, other factors are known to impact its prevalence such as environment, diet, exercise, and personality characteristics. All these confounding factors make determining the genetic basis of variation in susceptibility to cardiovascular disease difficult in humans. *Drosophila* is the only invertebrate model organism with a pumping heart developmentally homologous to that of a vertebrate. By combining the advantages of the invertebrate model system with evolutionary conservation of basic biological processes between *Drosophila* and humans, *Drosophila* can be used to identify genes homologous to those affecting vertebrate heart rate. The *Drosophila* Genetic Reference Panel (DGRP) is a newly created collection of inbred lines derived from a wild population, and poses a promising model for identifying genes affecting natural variation in heart rate. I have screened DGRP lines for heart rate variation. Larval heart rate has significant genetic and phenotypic variation. I have identified 78 candidate genes from a genome-wide association study to identify the molecular variants associated with heart rate and their human orthologs.

Joseph C. Oakes[1], Ronnie W. Heiniger[1], J. Paul Murphy[1], Carl R. Crozier[2], and Gail G. Wilkerson[1]
Graduate Programs: Crop Science[1]; Soil Science[2]
Advisor: Ronnie W. Heiniger
Poster Number: 131

Adaptive Wheat Management

In many ways, wheat (*Triticum aestivum* L.) is a difficult crop to manage due to its ability to adapt to changing environmental conditions. Therefore, instead of a standard prescription management system similar to those in use today, an adaptive management system that changes from season to season based on conditions and weather predictions should be considered. The key to this adaptive management system is the ability to understand plant growth in response to the environment, and the ability to predict and adjust for weather conditions occurring over the next four weeks. Since little research has been done in North Carolina quantifying kernel set, this study will examine the influence of plant density, light interception, fungicide, and N rate on kernel development.

Research was conducted at the Tidewater Research Station in Plymouth, NC. Six treatments were included to examine grain fill: an untreated control with a standard seeding rate of 25 seeds/row ft.; an application of the fungicide Quilt applied at 14 oz/a at GS70; an application of 10 lbs. of N at GS70, shading from pollination to harvest, Treatment five was a low seeding rate thinned; a low seeding rate thinned; and a high seeding rate of 35 seeds/row ft. with an additional 60 lbs. of N applied in late December. Samples consisting of 15 plants per plot were taken at intervals from GS70 to maturity. Plant weight, seed number, and seed weight were all measured.

Among the first five sampling dates, there was no significant difference in seed weight except for the shaded treatment which was significantly lower. At the final sampling date, the low seeding rate had the highest seed weight, while the shaded plots had the lowest seed weights. The plots treated with fungicide at GS70 had the highest yield, while the shaded plots and low seeding rate had the lowest yield.

W. Garrett Owen, Brian E. Jackson, William C. Fonteno, and Brian E. Whipker
Graduate Program: Horticultural Science
Advisor: Brian E. Jackson, William C. Fonteno, and Brian E. Whipker
Poster Number: 134

Liming Requirements for Greenhouse Substrates Containing Wood Aggregates

Perlite is the primary aggregate in greenhouse substrates and is the most expensive (by volume) component of greenhouse mixes. Due to rising costs and the non-renewable nature of perlite; alternative aggregates are currently being investigated for use in greenhouse substrates. This research evaluated loblolly pine (*Pinus taeda* L.) chips as one such alternative. Loblolly trees were harvested, chipped and hammered milled through a 6.35-mm screen on 8 Mar. 2011. On 8 July 2011 plastic pots (1.5 L) were filled with peat-based substrates that had been amended (v/v) with 20 or 40% perlite (PL) or pine wood chips (PWC) for a total of four substrates. All substrates were amended with 0, 1.78, 3.56, 5.34, 7.12 kg•m^3 (0, 3, 6, 9, and 12 lbs/yd^3) dolomitic limestone, resulting in 20 substrates treatments. Rooted liners of *Chrysanthemum* x *morifolium* 'Mildred Yellow' were transplanted into six reps of each substrate. Plants were fertilized as needed with 200 mg•L^{-1} nitrogen (N) (derived from a 20-10-20 water soluble fertilizer) and pour-throughs were conducted weekly to monitor substrate pH. After nine weeks shoots were harvested for dry weight determination. Shoot growth of chrysanthemum in all substrates containing PL or PWC increased as lime rate increased from 0 up to 6 lbs/yd^3 where plant growth was greatest. Shoot growth was statistically similar and showed the same growth trends between PL and PWC substrates (at 20 and 40%) and at all lime rates in this study. Substrate pH was often higher in 40% PL or WC than in 20% all lime rates and at all measuring dates. pH of PWC amended substrates was always equal or higher than PL at the same percentages and at the same lime rates throughout the study. Results indicate that PWC can replace PL in a peat-based substrate with no changes in plant growth or liming requirements when growing chrysanthemum.

Andrew Pais[1], Yuelong Guo[1], Alan S. Weakley[2], and Qiu-Yun (Jenny) Xiang[1]
Graduate Programs: Plant Biology, North Carolina State University[1]; University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill[2]
Advisor: Qiu-Yun (Jenny) Xiang
Poster Number: 135

Time and space of early diversification of the Mock Orange genus *Philadelphus* (Hydrangeaceae) and a close affinity to *Carpenteria*, evidenced from molecular data and phylogenetic analyses

Phylogenetic analyses using molecular data have been valuable for elucidating evolutionary relationships, origins, and diversification patterns. Research was conducted for a poorly understood plant genus *Philadelphus* (Mock Oranges; Hydrangeaceae). This genus consists of many popular ornamental plants with numerous varieties bred for horticulture purposes. Improved understanding of this genus' evolutionary relationships can contribute to improved taxonomy, breeding, and conservation of these plants. Our objective is to use molecular phylogenetic analyses to test previous morphology-based hypotheses regarding relationships within *Philadelphus* and between *Philadelphus* and *Carpenteria* (Tree Anemones). We generated DNA sequences of five nuclear and chloroplast gene regions for 27 species representing all current classification groups. Phylogenetic analyses of these data were conducted using Maximum Likelihood and Bayesian Inference methods implemented in the programs RAxML and MrBayes to infer species relationships. Divergence time between phylogenetic lineages was estimated in BEAST using molecular data and a Bayesian method with a relaxed molecular clock and fossil calibration. The genus and its constituent lineages' ancestral distributions were reconstructed by biogeographic analyses using RASP, a recently developed program accounting for phylogenetic uncertainty. Findings suggest the following: (1) *Philadelphus* is paraphyletic to *Carpenteria* (derived within *Philadelphus*); (2) Origin and early diversification of the *Philadelphus-Carpenteria* clade into three major lineages occurred in North America's southwest in the Eocene-Oligocene epoch, corresponding to the global cooling period in the early Tertiary; majority of modern species evolved from radiation during and after the Miocene; (3) The subgenera, sections, and series recognized in the single, existing classification system proposed for the genus based on morphological features is largely incongruent with the phylogenetic relationships supported by the molecular data. Furthermore, *Carpenteria* should be included in *Philadelphus,* or *Philadelphus* needs to be segregated into two distinct genera. More data and species sampling are required to better resolve relationships within the large subgenus Euphiladelphus.

Melissa A. Pickett and Nanette M. Nascone-Yoder
Graduate Program: Environmental and Molecular Toxicology
Advisor: Nanette Nascone-Yoder
Poster Number: 142

A Novel Non-cholinergic role for Acetylcholinesterase in Gut Morphogensis

Gut malformations comprise the most common of all human birth defects, yet the underlying etiologies are poorly understood. Acetylcholinesterase (AChE) is a serine protease that hydrolyzes the neurotransmitter, acetylcholine, at cholinergic synapses. Several recent studies suggest that, in addition to this well-understood classical role, AChE also has non-catalytic functions,

particularly during neurite development in the brain. Since the gut develops in close association with the cholinergic enteric nervous system, we hypothesized that AChE may also have important classical and/or non-classical functions in gut development. Indeed, exposure of *Xenopus laevis* tadpoles to three different chemical inhibitors of AChE caused severe gut elongation defects. However, exposure to an acetylcholine agonist, which mimics the increased acetylcholine signaling caused by inhibition of AChE catalytic activity, did not produce gut defects. Additionally, the gut defects elicited by AChE inhibitors could not be rescued by antagonistically blocking acetylcholine signaling receptors. Together, these results suggest that AChE has important non-catalytic roles in gut development. AChE shares homology with a family of cell-matrix adhesion molecules and, during neurite outgrowth, the non-catalytic role of AChE is thought to involve its binding to the extracellular matrix protein, laminin. Consistent with this mechanism, guts developing in the presence of AChE inhibitors exhibit disrupted laminin organization, accompanied by disorganization of the adjacent smooth muscle and increased apoptosis in the underlying gut epithelium. These data provide evidence of a previously unrecognized non-classical role of AChE in vertebrate gut development, and increase our understanding of the potential etiology of congenital human gut defects.

Joseph Roberts[1], Bangya Ma[2], Lane Tredway[3], Bruce Clarke[4], and David Ritchie[1]
Graduate Programs: Plant Pathology, North Carolina State University[1]; SePRO Corporation[2]; Syngenta Crop Protection[3]; Plant Biology and Pathology, Rutgers University[4]
Advisor: David Ritchie
Poster Number: 149

Distribution and Pathogenicity of Bacteria Associated with Etiolation or Decline in Creeping Bentgrass

In recent years, bacteria have been implicated as causal agents in multiple cases of decline of creeping bentgrass (CBG; *Agrostis stolonifera* L.), but little research has been completed to characterize potentially pathogenic bacteria in turf. During 2011 and 2012, 156 bacterial isolates were obtained from CBG turf exhibiting etiolation, chlorosis, or general decline. Preliminary identification was obtained by sequencing of the 16S and ITS rDNA regions. Sixteen genera including several species of *Pseudomonas*, *Pantoea*, *Microbacterium*, *Acidovorax*, and *Xanthomonas* were identified based on high similarity (i.e., >95%) to deposited sequences in GenBank. Selected isolates for each genus were tested for pathogenicity by submerging freshly trimmed 4-wk old 'G-2' CBG seedlings in a bacterial suspension (10^9 CFU ml^{-1}) for 6 min. Inoculated plants were placed on a mist bench (misting 5 min/6 hr) in the greenhouse (28-30 C) for 7-days, followed by placement on a greenhouse bench that received hand-held irrigation 2X daily. Plants were evaluated periodically for symptom development. *Acidovorax avenae, Pantoea ananatis*, and *Xanthomonas translucens* visually reduced turf quality compared to the untreated check within 10 days post inoculation. Inoculated plants developed leaf tip dieback that progressed into an overall decline. The pathogenicity of *A. avenae, P. ananatis*, and *X. translucens* was tested in the field by applying 100 ml of a 10^8 CFU/ml suspension of individual isolates to a 113 cm^2 turf area and then covering plants overnight with a clear plastic bowl. Day and night temperatures during field inoculations were approximately 35 and 20 C, respectively. While dieback or decline was not observed, plants treated with *A. avenae* had significantly more etiolated tillers 48 hr post inoculation compared to those inoculated with *X. translucens*, *P. ananatis*, and non-inoculated plants. Additional research is being conducted to further assess the pathogenicity of *X. translucens* and *P. ananatis* on CBG turf.

Walter J. Sandoval, Mari Chinn, and J.M. Bruno-Barcena
Graduate Program: Microbiology
Advisor: José M. Bruno-Bárcena
Poster Number: 153

Difference in sugar utilization between *Clostridium beijerinckii* NCIMB 8052 and its offspring SA-1/ATCC35702

Bio-butanol, or butanol derived from the fermentation plant biomass sugars, is gaining relevance as an alternative biofuel commodity. *Clostridium* species, especially *C. beijerinckii* NCIMB 8052 and *C. beijerinckii* SA-1/ATCC35702, its butanol tolerant offspring, are employed for this task taking advantage of their Acetone-Butanol-Ethanol (ABE) fermentation capabilities and their wide range of substrate utilization. Since sugar solutions generated from plant biomass are heterogeneous mixtures of sugars, the objective of this work was to evaluate the physiological differences in sugar utilization between NCIMB 8052 and SA-1/ATCC35702 growing in a carbon- and energy-limited medium. Comparative small scale batch fermentation were performed using a previously validated medium containing 6% (w/v) final concentrations of sucrose, a mix of glucose and fructose, or fructose alone. The results show that both strains have non-significantly different specific growth rates when growing using glucose and fructose mixtures or sucrose. However, while NCIMB 8052 was able to co-ferment both sugars and to readily utilize fructose, SA-1/ATCC35702 showed preference for glucose and a deficiency in fructose utilization, evident by a diauxic growth and slow specific growth rate in fructose of 0.09 h^{-1}. Overall, our results confirm that NCIMB 8052 co-ferments glucose and fructose, while sucrose was not completely utilized at the concentration tested. SA-1/ATCC35702 has a fructose transport deficiency and completely utilized sucrose.

John R. Shorter[1], Charlene Couch[1,2], Robert Anholt[2], and Trudy F.C. Mackay[1]
Graduate Programs: Genetics[1]; Biology[2]
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 the individual and 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 fromgenetic analysis using a model system. We investigated the natural genetic variation of aggression using the *Drosopihla melanogaster* Genetic Reference Panel (DGRP), a collection of 192 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 will perform QTL mapping to identify loci associated with aggression. We will then compare results between the outbred population and the DGRP to identify overlap between genes and gene networks that influence aggression. We will confirm candidates by using RNAi knockdown to reduce gene expression and quantify its effect on aggression. These experiments will provide insight into the genetic architecture of aggression and identify novel genetic variants responsible for naturally occurring variation in this complex trait.

Xiaomei Shu[1], David Livingston[2], Robert G. Franks[3], and Gary A. Payne[1]
Graduate Programs: Plant Pathology[1]; Crop Science[2]; Genetics[3]
Advisor: Gary A. Payne
Poster Number: 158

Tissue Specific Gene Expression in Maize Seed in Response to *Aspergillus flavus* Infection

Aspergillus flavus invades humans and plants and is capable of killing many tissue types. The interaction of the fungus with each cell type appears to differ, but the interaction of the mycelium with host tissue and the response of invaded tissue to colonization remain poorly understood. To gain a better understanding of the dynamics of this pathogen-host relationship we chose maize seeds, which contain many tissue types, each of which are known to produce different profiles of nutrients and antifungal compounds. Seed developing in the field were inoculated 21 days after pollination with *A. flavus* and harvested at 4, 12, 24, 48, and 72 hours post inoculation (hpi) for histological examination and RNA *in situ* hybridization. Within the first 48 hpi *A. flavus* had colonized the aleurone and endosperm tissue adjacent to the site of inculcation. By 72 hpi, the fungus was observed in some areas of the aleurone, endosperm and at the endosperm-embryo interface. Timing and tissue specific expression of two genes associated with host defense, *PRms* (*Pathogenesis related protein*, *maize seeds*) and *UGT* (*UDP-glucosyltransferases*), were followed by RNA *in situ* hybridization. Transcripts for both genes were found in aleurone cells at 48hpi and in the tip and outer layer of scutellum at 72 hpi in seeds infected with *A. flavus* but not mock inoculated seeds. By comparing histological examination and RNA *in situ* hybridization results in adjacent serial sections, we found that these genes were expressed in the tissue before mycelium of the fungus was apparent in these cells. These results show that *A. flavus* can colonize three major tissue types of the seed and induce the expression of host resistance genes in a tissue specific fashion. Presumably, the host recognizes the presence of the fungus in advance of the invasive hyphae and induces the innate immunity response.

Alicia N. Simmons and Jun Ninomiya-Tsuji
Graduate Program: Environmental and Molecular Toxicology
Advisor: Jun Ninomiya-Tsuji
Poster Number: 160

TAK1 kinase signaling regulates Nrf2 and intestinal homeostasis

Inflammatory bowel disease is a chronic disease that causes inflammation of the intestine: Crohn's disease and ulcerative colitis, and is one of the major health problems in the US. However, effective treatments remain to be explored. Understanding the mechanism of intestinal inflammation and damage will aid in effective treatments.

TGF-β activated kinase 1 (TAK1), which is a member of the mitogen activated protein kinase kinase kinase (MAPKKK) family and is known to be activated by various different stressors and cytokines. We have previously shown that TAK1 deficiency in the intestinal epithelium causes oxidative damage including intestinal epithelial cell death, which resemble IBD pathology. However, the mechanism of how reactive oxygen species (ROS) are accumulated was not known. We tested the hypothesis that TAK1 signaling prevents commensal bacteria-induced ROS. We found that depletion of commensal bacteria or ablation of bacteria activated Toll-like receptor (TLR) signaling could rescue the ROS accumulation in TAK1 deficient intestinal epithelium. We next

investigated the molecular mechanism by which TAK1 prevents bacteria-induced ROS, and identified that TAK1 interacts with and modulates the stability of an antioxidant transcription factor Nrf2. These results suggest that TAK1 regulation of Nrf2 is important for elimination of bacteria-induced ROS in the intestine. Activation of TAK1 may be a possible new approach to reduce oxidative damage in the intestine.

Kevin D. Stallings
Graduate Program: Crop Science
Advisors: Rob Richardson and Danesha Seth Carley
Poster Number: 164

A Native Plant Assessment of Pinehurst No. 2 Golf Course

Beginning March of 2010, Pinehurst No. 2 underwent a significant restoration to return the course to the way designer Donald Ross originally intended. The new design better reflects the course's natural ecological surroundings in the Sandhills Region of NC. This design included reduction of bermudagrass acreage by about 30%, an increase in native habitat, and a reduction in water inputs. The golf course superintendents and staff continue to develop innovative management solutions to meet emerging challenges in order to drive sustainability in the golf industry forward. This poster covers current NC State University projects directed at cataloging and managing the native Sandhill's vegetation at historic Pinehurst No. 2 and the ecological challenges of managing emerging vegetation. To date we have created a detailed log of golf course vegetation through the use of photography and vegetation sample collecting. A Pinehurst No. 2 Plant Identification booklet was developed as a resource for course management.

Rachel Suits
Graduate Program: Entomology
Advisors: Dominic Reisig and Hannah Burrack
Poster Number: 172

Determining if flower feeding in soybeans causes a yield loss by *Helicoverpa zea* (Boddie)

Helicoverpa zea (Boddie), corn earworm, can be a damaging insect pest of many crops in the southern U.S., including soybeans. In the southeastern United States, an economic threshold while soybeans are in their reproductive growth stages includes flowering and pod filling stages. Flower feeding may directly impact soybean yields by reducing the number of potential pods, but this relationship is poorly understood. Currently, pesticide applications are the main method of management when insect pressure rises above reproductive threshold levels; however, if flower feeding does not cause significant economic damage, reducing pesticide applications may be recommended. This research is designed to illuminate the interactions of soybean and corn earworm by determining the yield impact of corn earworm feeding during the flowering stages of soybeans. A split-plot design experiment was set up during the summers of 2011 and 2012 in eastern North Carolina and the flowering stages of soybeans were studied in relationship to pesticide manipulated insect pressure. An insect pressure two and three times the normal reproductive threshold during 2011 and 2012 field seasons did not significantly affect yield. This suggests that the reproductive threshold may be too conservative when soybeans are in their flowering stages because they have the ability to compensate for loss during pod and seed filling stages. Also, during the summer of 2012, there was no correlation between corn earworm pressure and the number of injured flowers further suggesting that flower feeding did not significantly affect soybean yield.

Adrienn Uzsák[1], James Dieffenderfer[2], Alper Bozkurt[2], and Coby Schal[1]
Graduate Programs: Entomology[1]; Electrical and Computer Engineering[2]
Advisor: Coby Schal
Poster Number: 183

Artificial Antennal Stimulation Accelerates Female Reproduction in the German Cockroach

The onset and pace of reproduction in most animals are dependent upon specific internal and external stimuli. Internal stimuli include the animal's nutritional state, blood composition and osmolarity, and whether it has been inseminated. External stimuli include environmental conditions (e.g., temperature, humidity, photoperiod, host plants) and social interactions. Behavioral modulation of reproduction might be expected in social animals. For example, in some social insects, the queen pheromonally inhibits reproductive maturation in sterile workers and she maintains a certain division of labor within the colony. Social facilitation or suppression of reproduction are less common in non-social animals. Yet, examples have been documented of reproductive effects due to presence of conspecifics. In some insects, reproduction can be accelerated in females by individuals of various developmental stages, both sexes, and even different species. Social interaction has been found to have such an influence on the physiology and behavior of individuals in the German cockroach, *Blattella germanica*, where not only nymphs develop faster when grouped, but females in groups reach sexual maturity earlier compared to isolated females. Oocyte length

is a reliable measure of the reproductive rate in females. While testing sensory pathways, we have found that mainly the tactile channel is responsible for accelerated reproduction in *B. germanica* females and the transduction of social signals occurs through a sensory pathway involving tactile stimulation by the antennae. Our aim in this study was to identify the specific elements of a social tactile stimulus responsible for accelerating reproduction in *B. germanica* females. First, we established a system for testing physiological responses of females to artificial, motor-driven tactile stimulation that mimicked the cockroach antenna. Then, we dissected the tactile cues focusing on features such as speed of movement, duration of stimulation and morphology of the tactile stimulus.

Erin Yost[1], Michael T. Meyer[2], Julie Dietz[2], Benjamin Meissner[2], Boknam Lee[3], Lynn Worley Davis[4], C. Michael Williams[4], and Seth W. Kullman[1]
Graduate Programs/Organizations: Environmental and Molecular Toxicology, North Carolina State University[1]; Organic Geochemistry Research Laboratory, United States Geological Survey, Lawrence, KS[2]; Duke Environment at the Nicholas School, Duke University, Durham, NC[3]; Poultry Science, North Carolina State University[4]
Advisor: Seth Kullman
Poster Number: 198

A Mass Balance for Steroidal Estrogen on a Swine CAFO

The waste from concentrated animal feeding operations (CAFOs) contains appreciable levels of steroidal estrogens, which have the potential to produce established physiological alterations in exposed wildlife. Here, we take a mass balance approach to track the fate of these compounds within the waste management system of a North Carolina commercial swine farrowing CAFO, which houses 2500 pregnant and lactating sows. Analysis of estrogens was made in relation to: 1) excretion by individual animals; 2) stability in anaerobic lagoons during waste storage; and 3) mobility and attenuation following sprayfield application of swine waste as fertilizer. LC/MS-MS results indicate that the excretion of natural estrogens by the sows increases dramatically during the late stages of pregnancy, highlighting the importance of sow reproductive status in determining the estrogen load of the waste. During storage in the lagoon, the natural estrogens contained in the raw swine excreta (e.g. 17β-estradiol, 17α-estradiol, estrone, estriol) appear to undergo a biotic and/or abiotic transformation, resulting in the emergence of estrone as the predominant form of natural estrogen in the lagoon. Total estrogen concentrations in the lagoon wastewater average 9.2µg/l, with slightly higher concentrations prevailing during the cold winter and early spring seasons. Due to adsorption of these compounds to solids in the lagoon, total concentrations of estrogen in the lagoon sludge are highly elevated (~20-fold higher) compared to concentrations in the lagoon wastewater. Following the land application of lagoon wastewater to sprayfields, steroidal estrogens are attenuated relatively quickly (half life = 3.3 days); however, estrone was found to persist in soil at parts-per-trillion concentrations for up to 2 months following the land application. An expected outcome of this project is an increased understanding of the operational practices that affect the fate of estrogen on a swine CAFO, and prioritization of practices that may mitigate the off-site transport of these compounds.

Julie Barghout
Graduate Program: Architecture
Advisor: David Hill
Poster Number: 10

Digital Material Translation: A study and exploration of an architectural prototype using the infinite boundaries of the digital realm while introducing the physical properties of a building material

As the world of architectural design is rapidly changing, the design process can often first begin in the realm of a digital medium. As one dives deeper into three-dimensional modeling soft wares and tools creating undulating forms and a myriad of complex geometries, a form of a building, an interior space, or even furniture pieces and small objects begin to emerge. What happens to that design when a material is introduced? Certain characteristics of a chosen material can modify, if not, dramatically alter the design. This is an investigation on an alternating design process starting with a digitally generated form then constructing the design with a selected physical material allowing its limitations to redefine the shape and its function. Using wood as the material, a prototypical object has been developed through three-dimensional soft wares then tested with a CNC router. It was found that through the subtractive process of carving, the form was generated will little to no complications. However, the amount of material that was removed in order to create the project was substantial resulting in analytical questions. Still using wood as the material, can the designated form be created using an additive process? Should the form be modified? Is wood the appropriate material for this particular design? Using the findings of the latest results, the goal is to continue to develop an architectural prototype that should be scalable, economical, efficient, and functional for human use through the interchanging design process between a digital and a tangible medium.

Mike Brown[1], James Dieffenderfer[2], and Leigh Johnson[3]
Graduate Programs: Industrial Design[1]; Biomedical Engineering[2]; Business Administration[3]
Advisors: Haig Khachatoorian and John Muth
Poster Number: 19

Innovation in the Peak Flow Meter Market through Business Analysis, Product Development and Engineering Advancements

Over 25 million Americans have been diagnosed with asthma, and of those, 16 million are between the ages of 18-64. Over 60% of asthmatics own a peak flow meter (PFM); however, only about 35% actually use their PFM due to varying factors. Regular use of a reliable PFM and monitoring of one's respiratory vitals would create a better asthma management plan, and in-turn, reduce the effects and severity of their asthma. A rapidly aging population, rising incidences of COPD, technical advances in the respiratory care devices market and tight budgets of healthcare institutions are among the major factors influencing the US market. Convenience and comfort in a home-care environment, coupled with cost advantages are the major factors driving the home healthcare market for respiratory care devices. The project was started by first using situational analysis tools, then moved to product development, and engineering through technical advancements and finally completed with a business plan including financial analysis and a marketing plan. The advantage of having professionals from a variety of backgrounds allowed for the simulation of a real-time company and the conception of a fully functional, market-ready device. Our final product offers a reliable monitoring solution that helps consumers monitor their breathing, while delivering an education solution showing the best ways to manage and treat changes in their breathing through integration with their smart phone. It fills current un-met needs by utilizing the most accurate lung capacity measuring abilities, reducing overall device size for ease of transport and storage, integrating wireless technology to seamlessly transmit data to any smart phone or PC, functioning fully as a standalone device and offering a dashboard of additional features and benefits. Together, these benefits increase the usability and value of the device for the user and their doctor.

Shawna M. Hammon
Graduate Program: Architecture
Advisor: Wayne Place
Poster Number: 58

Woven: A wooden skyscraper

Why wood? According to the United Nations, Department of Economic & Social Affairs (UNDESA), 70% of the world's population will be urban by 2050. Cities are growing, and so is the need to preserve our environment. Since wood has a lighter environmental impact than today's structural materials - steel & concrete - the question we should really be asking is "why not wood?"

Located prominently on Chicago's Wolf Point, Woven takes advantage of the view corridors of the rivers that converge at the site. There could be no better place than Chicago for this advancement in wood technology; it is already considered the birthplace of skyscrapers and has a long history as an incubator to innovations in the high-rise industry.

Woven challenges the public's perception of wood as a viable structural material for skyscrapers - not only is it possible, but it is more sustainable by far. Engineered wood sequesters carbon, requires less embodied energy to produce, has a comparable strength-to-weight ratio, and is a renewable resource.

A study of atria played an important role in the realization of the form. Not only does the core atrium provide day lighting, it also assists with natural cooling and heating by inducing natural ventilation in the summer and acting as a buffer in the winter. This helps the building maintain a constant temperature with little fluctuation. A chilled beam cooling system supplements these strategies by using the Chicago River to cool the water before chilling it.

Woven uses weaving as a metaphor to create continuity through joints by utilizing the lamella pattern, which provides a layering system that allows the building to expand ever upward by increasing the column size to accommodate additional loads. Woven demonstrates that wooden skyscrapers are not only possible, but characterize the future of the high-rise building industry.

Christina N. Harrington
Graduate Program: Industrial Design
Advisors: Sharon Joines, Meredith Davis, and Susan Osborne
Poster Number: 60

Inclusive Participatory Design: A Methods Study Assessing Peer Interactions of Children with Autism

Nearly 614,000 individuals in the U.S. aged 3 to 21 are living with some level of intellectual disability (U.S. Department of Education, 2006). Compared to physical disabilities, individuals with intellectual or developmental disabilities are given slight consideration within universally designed products. Integrating beneficial product interaction in the phase of schema formation of a learned and routine activity can allow for simpler task completion and positive associations with a product. In attempts to enhance the inclusivity of universal design beyond physical considerations, an assessment and refinement of current design

methods is proposed to allow individuals with developmental challenges to participate and provide feedback in the design process.

The primary focus of this research investigation is to explore traditional design methods in assessing product interaction feedback among primary school children with Autism Spectrum Disorder. As a secondary focus, these methods have been refined based on aggregation of qualitative data and applied into the process of developing an inclusive method and toolkit for design researchers working with individuals spanning a broad range of developmental disabilities. This research utilizes traditional contextual inquiry methods of interviews, observations, and focus groups, as well as participatory design methods aimed at holistic inclusive design.

This study is based on findings in cognitive science, developmental psychology, behavioral analysis and instructional techniques. As such, inclusive design when incorporated into co-participatory methods can foster key fundamental social skills and healthy peer relationships. This study highlights key methodological refinements in assessing preference and interaction among children with autism and recommends a design intervention to promote healthy interaction within these peer groups. It is the goal of this research to produce a documented foundation of methods for future use in the field of design. Findings from this study will broaden the inclusiveness of design and how we as designers capture information of product experience from all audiences.

Cheryl S. Harrison
Graduate Program: Art and Design
Advisor: Susan Brandeis
Poster Number: 62

Shamanism, Symbolism, Science and Separation: A Construct for Understanding the History of the Human-Animal Relationship

As an artist and designer, I believe that design can be used to enhance our relationships with the natural and animal world. While most people in western industrialized countries might say they understand themselves as a part of nature, they simultaneously see natural environments as areas untouched by humans (Vining, et al.). To understand the seeds of this separation, I surveyed and studied art history literature and primary sources, and in the process, I developed a construct to describe the human-animal relationship across time. I believe our historical relationship with animals could be described through a series of sequential lenses—shamanism, symbolism, science and separation. Shamanism describes the close, dependent relationship of the Hunter/Gatherer to the animals they represented on the walls of caves. Symbolism denotes the change that occurred as humans moved to agrarian and urban societies, and the image of the animal became associated with power and wealth. Science became the predominant lens through which mankind viewed animals in both the Classical and Renaissance periods where the animal image was based on rationality and scientific exploration. As an extension of this rationality, and a result of continued urbanization, the separation between man and animal has grown increasingly vast and defines the image of the animal today. This separation is seen in three distinct responses to animals reflected in modern and post-modern art—as objects, as the recipients of overly sentimental human emotion, or as the sentient other. As an aspiring author/illustrator of children's literature, I seek to answer the question, "Are there stories that we can read to children that will influence the way that they view animals and positively affect their relationships to animals and the natural world, thus minimizing this sense of separation?" I am currently writing and illustrating children's books with this question in mind. [Vining, Joanne; Melinda S. Merrick; Emily A. Price. "The distinction between humans and nature: Human perceptions of connectedness to nature and elements of the natural and unnatural." *Human Ecology Review* 15.No. 1 (2008): n. page. Web. 27 Dec. 2011.]

Liz Hume
Graduate Program: Art and Design
Advisor: Marc Russo
Poster Number: 71

Digital Matte Painting: Creating invented environments for film

Since the early days of film, directors have had the desire to create settings for their stories that did not exist, or would be too expensive to build. The solution was to hire matte painters. These artists would paint realistic scenes on glass that would be incorporated into the filmed footage. In the mid-1990s, digital imaging processes were introduced that began to replace glass matte paintings. This research investigates historical and current techniques used in developing cinematic environments. Further research into the theories and techniques of traditional landscape painting by the Hudson River School artists will be utilized in the design of matte paintings for this project, creating a bridge between traditional and digital painting. The story for which the environments are being created is that of Apollo and Daphne. This Greek myth has been re-imagined, resulting in two drastically different settings. Since matte painting typically focuses solely on the creation of an environment, the characters themselves will not be incorporated into the final visuals. However, consideration has been given to the development of the characters in order to better design the setting for each interpretation of the story.

Claire Kohler
Graduate Program: Graphic Design
Advisor: Meredith Davis
Poster Number: 86

Improving Financial Literacy and Preparedness in Young Adults Through Design

A sense of financial well-being has been shown to have positive and far-reaching impacts on many aspects of life, such as psychological adjustment and physical health. Yet many important financial concepts are very complex, and young adults lack formal education in this realm. Consumer culture elevates the notion of the frivolous spender, and opportunities abound for teenagers and young adults to solidify detrimental spending habits before they are financially independent. Additionally, young adults are in an exceptionally tumultuous period of their lives, and events such as becoming financially independent, relocating, or paying off student debt put a heavy financial strain on individuals. Through a series of semi-structured interviews with 22- to 28-year-olds as well as financial industry experts, I have found that young adults are surprisingly financially responsible (e.g., paying off credit bills in full every month) and extremely aware of a need to save money and live "within their means". However, they expressed a desire to have a more open dialogue with others regarding the topic of money and a deep concern about being prepared for the future in light of the recent financial crisis. Therefore, I am designing and prototyping a digital system that aims to improve young adults' financial preparedness for future life events through virtual dialogue with experts and advice from peers. Through an iterative design process that consists of creating user paths, personas, wireframes, prototypes, and a compelling visual design, I am developing a secure, confidential, and reliable space that encourages young adults to think carefully and critically about their finances.

Jong Seon Lee
Graduate Program: Design
Advisor: Robin Moore
Poster Number: 89

Where Are Children Active? Using Accelerometer, GPS, and GIS in the Study of Physical Activity and Mobility of Children

Recently, the topic of the impact of built environment on physical activity (PA) and active travel (AT) such as walking and biking has been widely examined. Yet, little research exists that supports a direct relationship between urban form and children's behavior. Additionally, in most studies, the evidence is limited because the data is mainly self-reported. To address this, the present study objectively measured children's PA with accelerometer and AT with portable global positioning system (GPS) units simultaneously. The goal of the study was to test how combined two data sets provide useful information of where children go and their PA occurs, and where it does not. The study further examined methodological issues associating accuracy, feasibility, and limitation of the method from literature.

Volunteer participants (four 4-5th grades) were asked to wear an accelerometer (Actigraph, GT1M) and GPS units (Qstarz Travel Recorder BT-Q1000X) for 6 days continuously except when sleeping or bathing. Both were attached to a belt and worn on the right hip recording the data in 30sec epochs. Participants recorded the time that they put on and take off the devices in the provided diary. Data from accelerometer and GPS were screened, cleaned and processed using software. Two data sets were joined based on time stamps and geographically located in GIS for further analysis. Each participant's neighborhood built environment variables were measured in GIS.

General challenges included battery life, memory capacity, and signal drop out, and participants' noncompliance. In utilizing GIS variables of neighborhoods, several limitations were identified: arbitrary use of buffer methods; limitation of network analysis; and inaccuracy of street network data. Although this method is methodologically challenging, it has strong potential to be implemented on a range of themes of active living in community.

Vin Lim
Graduate Program: Design
Advisor: Haig Khachatoorian
Poster Number: 94

Finding a New Role for Aesthetic Taste in Motivating Sustainable Disposal Behavior

Aesthetics was originally studied more in the discipline of marketing and in the area of design industry. Both fields focused on utilizing consumers' aesthetic taste as a 'marketing tool' that would stimulate consumer desires of possession and consequently increase corporate profit by promoting consumption. From many studies done by marketers and designers in industry, it has been indicated that aesthetics takes a significant role in the stages, where products are produced, purchased and used.

However, almost none of the studies have looked into the influence of aesthetics at the end stage of a product life-cycle, where a product is being disposed of. If aesthetics is so influential in people's behavior in the early three stages of product life-cycle, it should also have an influence in people's behavior toward the wasting and disposing of products. What I claim is that the role of

aesthetics can be greater than simply stimulating consumption and promoting corporate profit. I argue that aesthetics can be seen as a catalyst for change in promoting sustainable disposal behavior, as well.

The aim of my doctoral study is 1) to identify and establish the persona types of 'wasters'; 2) to confirm the relationship between aesthetical taste and sustainable behavior; and 3) to propose a new role for aesthetics in motivating wasters to actively and voluntarily engage in a sustainable disposition culture. Mixed methods of quantitative and qualitative approaches will be employed in this study. Correlational research and structured questionnaires will be used as a quantitative approach; focus group, semi-structured interviews and behavioral journals will be utilized for the qualitative strategy of data generation. The study is currently in the early stage of data collection for focus group and structured questionnaire, thus findings are expected to be reported in summer.

Adrienne McKenzie
Graduate Program: Art and Design
Advisor: Susan Brandeis
Poster Number: 106

Full Circle

In the past, I have used the external perspectives of other people's stories, scripts, and experiences as inspiration and foundations for costume design. Now I have addressed a new challenge in my design work—that of personal experience as a story for garment making. For this project, I created two costume designs which exemplified into character form my emotions of *Melancholy/Grief* and *Recovery/Hope* in response to the death of my father. These two costume designs create a distinct juxtaposition in character, a common tool used in literature and the professional theatre. The use of specific silhouettes, forms, textures, color, and materiality in the costume designs all play an important role in establishing and suggesting specific character traits beyond what the actor/actress brings to the role. By doing this I address the importance the role of the costume designer plays in establishing character through their craft and visually communicating and translating stories and information to their audience members through garment alone.

Marysol Ortega Pallanez
Graduate Program: Graphic Design
Advisors: Meredith Davis, Santiago Piedrafita, and Denise Gonzales Crisp
Poster Number: 137

Interactive Experiences through Social Play and Bimanual Activities for Children with Cerebral Palsy

Children with unilateral spastic Cerebral Palsy (CP)–a disability that affects one side of the body, frequently impacting the hand more than the leg–often have limited bimanual upper extremity use (i.e. activities that involve both hands simultaneously). Limited bimanual activity in children with CP is linked to developmental disregard–the habit of underusing an extremity regardless of its functional state–which negatively impacts their social development and performance in everyday activities.

As enthusiastic adopters of new technological environments, children spend a large amount of time in screen-related activities such as videogames. The incremental challenges and storytelling of computer-based games make them attractive to children. Yet, in the case of bimanual activities and their transference to the performance of daily tasks, videogames lack the therapeutic benefit gained through the manipulation of physical objects. This investigation develops the design of a digital interactive system as a means for promoting social play and the mastery of bimanual activities in children with CP. Exploratory research consisted of semi-structured interviews with teachers, physical therapists, and videogamers. Additionally, an observational study featured children's activities and interactions in a *learn through play* setting. The purpose of the exploratory research was to investigate the affordances of various physical artifacts and potential leverage points created by the combination of those artifacts with digital technologies.

The designed prototypes feature multiplayer interactive experiences created through Tangible User Interfaces (TUI)–a type of interface that combines physical objects and digital interfaces. Increasing bimanual activity levels for children with CP can prevent subsequent functional limitations resulting from muscle weakness, and decrease their risk for joint disease and musculoskeletal pain. The design of collaborative experiences can also facilitate children's social development and ultimately help children with CP improve their quality of life.

Joshua A. Stephens
Graduate Program: Architecture
Advisor: J. Wayne Place
Poster Number: 168

Hypersonic Transport Systems: The Next Big Demand on Architecture

We are living in an age when our daily lives change almost as fast as the technology that we depend on. Of particular concern is our current transportation system, which can barely keep up with the needs of the current population and has no hope of addressing anticipated population growth. At any given moment there can be as many as 10,000 aircraft aloft, which is approaching a critically dangerous number. Hypersonic flight holds the promise to:

1. Enhance life quality by drastically reducing travel times across the globe
2. Reduce the number of aircraft aloft by providing much faster turnaround times
3. Further reduce congestion by moving a large part of the air traffic to an altitude currently not utilized

Infrastructure master planning and new architectural paradigms are going to be crucial parts of facilitating this new technology. This project, a *Hypersonic Airport for New York City*, delves into areas of research related to these issues. Multiple surveys of existing airport systems, fuel production systems, waste systems, building technologies, and transport vehicles past and future went into this project. The master planning portion of this project relies heavily on application of what we already know while preparing a space for newer more efficient systems soon to come on line. The increase of passenger and cargo alike, demand better architecture to serve as the transition between these two states; the existing, wasteful slower state of the past and the newer, efficient hypersonic state of the future.

Lisa Beth Bergene
Graduate Program: Leadership, Policy and Adult and Higher Education
Advisor: Carol Kasworm
Poster Number: 12

A Phenomenological Approach to Uncovering the Essence of Grieving Experiences of Undergraduates

Past studies have suggested that during their time on campus, as many as half of all undergraduates will experience the death of a loved one. The purpose of this study is to uncover a thick, rich description of the lived experience of grieving.

Seven undergraduates took part in the study, participating in two semi-structured interviews and a third meeting to review and confirm initial findings. Interviews were transcribed and data was analyzed by reducing the interviews into units of meaning and then clustering those units of meaning into themes that revealed the essence of the experience of grieving. Participants were asked to review and edit themes to ensure they accurately expressed the experience of the participant.

Findings of the study suggest the presence of four major themes: (1) the importance of relationships, (2) the distraction of responsibilities, (3) the inner world of grieving, and (4) the experience of moving forward. Participants revealed that the feeling of being alone, even amongst thousands of classmates, was a prominent part of the lived experience of grieving. Since death and grief are not openly talked about on campus, participants wondered if what they were experiencing was normal and had few peers who were able to offer guidance. By the same token, peers who were present and consistent in expressing care and concern were an important source of support. Participants reported a lack of energy from feeling the need to appear composed in class and in social settings. This lack of energy translated to an inability to focus on academic work. Participants searched for meaning in the loss, sometimes resulting in a re-prioritization of values and relationships.

Ethan Boehm
Graduate Program: Mathematics Education
Advisor: Karen Hollebrands
Poster Number: 15

Discourse in 1-1 Laptop Secondary Geometry Classrooms: Does Technology Play a Role?

Technology is becoming increasingly prevalent in high school mathematics classrooms. Recent curriculum reforms suggest more emphasis on students using appropriate technology tools in the mathematics classroom and being able to clearly communicate about mathematics. Three geometry teachers in 1-1 laptop classrooms using Geometer's Sketchpad were the focus of this study in which classroom discourse was analyzed over two years using the Oregon Mathematics Leadership Institute (OMLI) discourse analysis instrument. In this analysis two questions were investigated: 1) What is typical classroom discourse with technology and without technology? and 2) Is there change in classroom discourse over time with technology and/or without technology? Particular interest was paid to types of discourse--the nature of the mathematical depth of the discourse (e.g. Statements, Explanations, Challenges)--and modes of discourse--what direction discourse occurred (e.g. Teacher-to-Student or Student-to-Group). The findings suggest that although the modes of discourse change significantly when technology was used, there is less

evidence to show that the types of discourse change in a consistent way. The modes of discourse tend to become more student-centered when technology is present. The results can be useful for future research, curriculum developers, current teaching practitioners, and pre-service teacher programs.

Hannah Carson Baggett
Graduate Program: Curriculum, Instruction, and Counselor Education
Advisor: Heather Davis
Poster Number: 24

When Worlds Collide: An Exploration of Differing Worldviews in Coaching Relationships

Research in the field of teacher education indicates that the supervisory process, particularly coaching cycles, can best provide novice and practicing teachers with the support needed to develop professional competencies for effective teaching (Reiman & Theis-Sprinthall, 1998; Glickman, 2007). These competencies include knowledge of the discipline, knowledge of learners, pedagogical competence and performance, and dispositional competence, or the competence to make "reflective and ethical judgments" about classroom practice (Reiman & Theis-Sprinthall, 1998). When effective coaching relationships are in place, teachers regularly experience growth and increased student learning (Cohen & Ball, 1999). Unfortunately, these effects can be lost if relationships are not built on trust, or become strained at any point (Tschannen-Moran & Hoy, 2000). In this case study (Stake, 2000), I analyzed data that Felicia, a veteran teacher and doctoral student, and her classmate Lucy generated as part of their practicum as novice supervisors. Preliminary findings indicate that both supervisors' worldviews (Delpit, 1995), or the attitudes and beliefs that they bring to their work as teachers, differed profoundly from their supervisees'. These differences manifested in their interactions and caused a particular set of outcomes, including a pervasive 'threat' mentality. Previous research suggests that when working in a supervisory context (i.e. coaching relationships), teachers can sometimes develop this 'threat' stance, which is characterized by failure to engage in the reflective process and/or a lack of motivation to implement reform or change (Gregoire, 2003). In my analysis, I explore the intersection of worldview and 'threat', include implications for reframing 'threat', and identify processes for reaching common ground when differences seem elemental.

Charity Cayton
Graduate Program: Mathematics Education
Advisor: Karen F. Hollebrands
Poster Number: 25

Teachers' Implementation of Pre-Constructed Dynamic Geometry Tasks in Technology-Intensive Algebra 1 Classrooms

Technology use with a focus on 21st century skills, coupled with recent adoption of Common Core State Standards for Mathematics, mark a new challenge for mathematics teachers. Communication, discourse, and tools for enhancing discourse (NCTM, 1991, 2000) play an integral role in successful implementation of technology and mathematics standards.

This study utilized a qualitative, multi-case observational research design to examine the combined influence of mathematical discourse, pedagogical strategies to facilitate mathematical discussions, and the use of dynamic geometry software on level of cognitive demand within three 1:1 laptop Algebra 1 classrooms.

Data collection and analysis included initial/summative teacher interviews, classroom observations with pre/post-interviews, verbatim transcripts of the observations, and pre-constructed dynamic geometry tasks from the observations. The conceptual framework for the study combined the Mathematical Task Framework (Smith & Stein, 1998) and five practices for orchestrating productive mathematical discussions (Stein, Engle, Smith and Hughes, 2008). Triangulation of results from discourse, use of the five practices, and technology use was compared to an existing instructional quality rubric to evaluate the implemented level of cognitive demand.

Discourse findings indicated: 1) teacher to whole class was the predominant mode of mathematical discourse, 2) questions and statements were the most common type of mathematical discourse, 3) questions were used slightly more often than statements, and 4) higher level questions were posed more often than lower level questions. Teachers' incorporation of the five practices varied, but when using technology, teachers most often orchestrated pre-constructed dynamic tasks by discussing the screen or explaining the screen. Two themes emerged for level of cognitive demand; 1) when teachers employed higher level questions/statements while discussing the screen the implemented level of cognitive demand remained high and 2) when teachers employed lower level questions/statements to explain the screen the implemented level of cognitive demand decreased.

Stephany Dunstan
Graduate Program: Leadership, Policy, and Adult and Higher Education
Advisor: Audrey J. Jaeger
Poster Number: 39

The Influence of Speaking a Dialect of Appalachian English on the College Experience

Many students will arrive to college speaking a dialect that is considered nonstandard or stigmatized due to the socially stratified nature of language. In the United States, where there are commonly held ideologies about the type of language that is considered "correct" or "proper," students who speak nonstandard dialects may find themselves at a disadvantage in educational settings. Dialects of Appalachian English are often stigmatized in mainstream American culture, and some elements of dialects of Southern Appalachia are particularly stigmatized, even by other Southerners. This qualitative study explored the influence of speaking a dialect of Appalachian English on the college experiences of students from rural, Southern Appalachia. Qualitative interviews were conducted with 26 participants attending a large research university in an urban center in a Southern state, and sociolinguistic analysis of participants' speech (acoustic formant analysis and analysis of nonstandard morphosyntax) was performed to provide rich description of their speech in order to better understand the role it played in their college experiences. Sociolinguistic analysis focused on features of participants' speech which are noted as being salient markers associated with Southern Appalachian dialects, and would thus perhaps be markedly different from normative speech patterns on campus among non-Appalachian peers. Findings suggest that dialect is influential in three main areas: 1) academic experiences 2) sense of belonging and perceptions of campus environment and 3) in interactions with others on campus. Findings have significant implications for sense of belonging and persistence models; diversity education and programming; understanding language as a student characteristic to better explain the experiences of student populations such as rural, first generation, low SES, and racial and ethnic minorities; and creating inclusive campus environments.

Meredith Weaver Kier
Graduate Program: Science Education
Advisor: Margaret R. Blanchard
Poster Number: 83

How does exploration and creation of STEM career videos affect the interests and science identities of rural, minority middle school students?

Educational studies suggest minority students have many barriers to going into STEM careers. There is little research on how students' interest in STEM is affected by these barriers, as well as how their interest changes when they are exposed to interventions. With educational organizations recommending that career discussions and STEM activities take place prior to high school, this study exposed 75 eighth grade students to opportunities available in STEM through career videos. These students were predominately African American, living in a rural community. For one semester, students explored STEM career videos featuring female and minority professionals and created their own STEM career video featuring themselves. The research questions of this study are: *How do students' STEM career interest change after exploring and creating STEM career videos?*; and, *How do students incorporate their race, gender, and regional identity into a potential STEM career identity when exploring and creating STEM career videos?* This study was guided by the Social Cognitive Career Theory (SCCT) and identity. Data was collected using a pre and post STEM career interest survey, video exploration sheets, career video planning guides, original student scripts, and their videos. Findings suggest that when students engage in STEM career explorations, they think more carefully about how a STEM career fits their perceived future goals. Also, findings suggest that career identities are still developing in middle school students, as they prioritize family and their ethnicity, and combat racial stereotypes. Finally, career videos show that students role play careers familiar to them, with most females selecting health science professions, and most males selecting engineering careers. These findings shed light on how minority students from rural areas may better see a 'possible self' in STEM. This study also poses practical classroom strategies to include STEM career awareness in middle school curricula.

Jackson Olsen
Graduate Program: Educational Leadership
Advisor: Kevin Brady
Poster Number: 133

The school building principal as chief legal instructor: developing professional development legal lesson plans for educators

Today's teachers are expected to know and comply with literally thousands of laws and statutes, both federal and local. Yet most teachers never take a school law course in their undergraduate studies, especially teachers who enter the field through alternative licensure. Principals also suffer from a legal knowledge deficit. A 2008 study that surveyed school administrators from across the country indicated that 80 percent of school administrators would change their practices and/or outlook toward leading if they only knew the law. *Is corporal punishment legal? Can a teacher be friends with a student on Facebook? What rights to the parents of a special needs student have?* This case study examines the need for general legal literacy within a school, then

outlines the process for implementing professional development sessions therein. It focuses on increasing general legal literacy throughout the school, informing teachers of case histories of their profession, disseminating best practices, and empowering teachers to act with prudence and confidence in dealing with any and all legal matters they encounter in the course of educating young minds.

Malinda L. Pennington, Douglas A. Cullinan, and Louise Southern
Graduate Program: Curriculum, Instruction, and Counselor Education
Advisor: Ed Sabornie
Poster Number: 140

Defining Autism: Variability in State Eligibility Requirements

As the autism incidence rate rises, the number of students with autism attending public schools and general education classrooms has also increased. To provide the most appropriate services to the students who need them, it is important that special education personnel recognize the differences in autism diagnoses from state to state. For this study, state definitions of autism were located for all 50 states and the District of Columbia by reviewing the websites of each state department of education. Components of each definition were compared to the standard autism characteristics listed in the Diagnostic and Statistical Manual of Mental Disorders, Version Four-Revised (DSM-IV). After locating the appropriate state definition, the same procedure was used to determine state-mandated evaluation requirements for identifying autism. Elements of state eligibility procedures were compared against evaluation requirements listed in the Individuals with Disabilities Education Act (IDEA) and research-recommended items such as a standardized autism diagnostic instrument. Results of this review indicated that 35 states based their autism definition on IDEA terminology, 14 states utilized the DSM-IV criteria, and 2 states developed their own criteria without basis in either IDEA or DSM-IV. Evaluation procedures were found to vary even more with little consensus from state to state. Greatest agreement, 88.2%, occurred regarding the administration of psychological and educational testing. Although most states (86.3%) agreed that sensory functioning was a key component of diagnosing autism, only 17.7% required sensory processing assessments. Additionally, merely 29.4% required a formal autism assessment. Information from this review can provide a foundation for a national eligibility standard for autism so that schools can consistently identify and meet the needs of this population.

Jenna Rice
Graduate Program: Mathematics Education
Advisor: Hollylynne Stohl Lee
Poster Number: 147

Teachers' Use of Technology in Solving an Informal Inference Problem

Inference is generally regarded as one of the most difficult statistical topics to teach. Many educators and researchers have been advocating that students start learning this topic by solving informal inference problems. These problems should be embedded in a real-world context that would allow students to collect data and make judgments based on data. The research for this project examines the responses of 62 pre-service and in-service teachers who chose one of four technologies to answer an informal inference problem. By analyzing how technology choice may influence one's inference, teachers can make more sound pedagogical decisions about which technology to choose when teaching informal inference.

Linda Pigott Robinson
Graduate Program: Curriculum and Instruction
Advisor: Carol A. Pope
Poster Number: 150

What Works With Secondary Gifted Learners: A Qualitative Case Study of the Curriculum and Instructional Approaches of the North Carolina Governor's School

The need to develop academic talent in our country has never been greater. However, because secondary gifted program services usually entail offering honors, AP and IB courses, little research has been done nationally on what constitutes an effective secondary curriculum for gifted learners. Yet, the Governor's School of North Carolina, the oldest such program in the nation, developed a curriculum in 1962 and has implemented it for fifty years. The purpose of this qualitative case study was to examine how the Governor's School's curriculum and instructional approaches have addressed the needs of secondary academically gifted learners. Rich, descriptive data included content analysis of curriculum documents; classroom observations; and interviews with 2012 students, past participants from each of the five decades, instructors, administrators, and key curriculum developers. Parameters for this study focused on the content areas of mathematics, English, social science, and natural sciences, as well as two interdisciplinary courses.

Constant comparative analysis of all data employed *a priori* coding using the three dimensions of the Integrated Curriculum Model (ICM) as the theoretical model. These three major dimensions include 1) advanced content knowledge, 2) higher order thinking and processing, and 3) major themes, issues and ideas of disciplines. Findings confirm that all three of these dimensions, which research has proven as being effective with gifted learners, are integral components of the Governor's School's curriculum. Other themes which emerged as significant and beneficial elements of the instructional program included a focus on contemporary theory, the value of curriculum integration, the need for self-reflection and self-understanding to be addressed through specific coursework, and the power of open discussion. Interviewees' comparisons to both their secondary and college experiences highlighted the uniqueness of the Governor's School's instructional program. Lifelong benefits described accentuate the need for appropriate and effective differentiation for secondary gifted learners.

Megan Ryals
Graduate Program: Mathematics Education
Advisor: Karen Keene
Poster Number: 152

The Transition from AP to College Calculus: A Study of the Factors Influencing Success

A longitudinal study reported by the College Board in 2008 found that students who took the Calculus I AP test and did not place out of college calculus performed at a significantly lower level in their college calculus course than students who were taking calculus for the first time (Keng & Dodd). The question arises – how does taking calculus in high school affect a student's performance in the same course in college? What challenges does this group of students face as they transition from high school to college mathematics, and what may be done at each level to smooth this transition?

Data was collected in the forms of written classroom materials (problems from tests, homework, and class notes on the topics of limits and continuity from various AP and college classrooms) and interviews of first-semester college calculus students. Problems from classroom materials were coded to determine the types of reasoning most required to be successful on tests in AP and college calculus. In the interviews, students first discussed their transition from AP to college calculus and then analyzed why they missed the questions they did on a recent college calculus exam. The two pieces of interview data for each student will be merged to create a student profile that illuminates the greatest barriers to success in college calculus for that student. These profiles will then be viewed in conjunction with the results of the classroom materials analysis.

Preliminary findings suggest college calculus tests do not require significantly higher order reasoning than do AP Calculus tests. Students who underperform on college calculus tests do so not because of a lack of ability to learn to work the types of problems on tests but because of a lack of practice of these problems prior to the test.

Dina C. Walker-DeVose
Graduate Program: Curriculum, Instruction, and Counselor Education
Advisor: Jessica T. DeCuir-Gunby
Poster Number: 187

The Story NOT Told: Parental Involvement from the Perspective of the Low-SES African-American Mother

There is general agreement in the relevant research literature that parental involvement in home- and school-based educational experiences leads to positive academic, social/emotional, and behavioral outcomes for children. More specifically, low-income African-American children have shown to benefit the greatest when their parents are involved in their educational experiences. There is also general agreement that to the extent trust and collaboration between parents and teachers are developed and maintained, the more likely parents are to become and remain involved. Trusting relationships between parents and teachers, however, are not always easily acquired. Race and social class have been shown to impact levels of trust within the relationship. Through semi-structured interviews, this qualitative study examined the lived experiences of 7 low-SES African-American mothers who participated in a year-long, faith-based program designed to assist them in creating more stable lives. Interviews with case managers familiar with the mothers' school-based experiences were also conducted. Utilizing a critical race perspective, this study examined (1) participants' conceptualization of the role of parent, teacher, community, and student within the realm of education; (2) how differences in race and SES influence the parent-teacher relationship; (3) participants' perceived levels of home- and school-based involvement and the barriers that may exist that negate involvement; and (4) the strategies participants' recommend schools and teachers use to increase their levels of school-based involvement.

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

Consequences of Neutron Irradiation on ECAP Steel

In advanced nuclear systems, the core structural components and fuel cladding are exposed to very high radiation levels which require materials with superior radiation resistant properties. In order to fulfill these needs, development of new materials that undergo these severe conditions becomes a major challenge in the nuclear materials field. 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. Effects of neutron radiation exposure on microstructure and mechanical properties are examined on low carbon steel following equal channel angular pressing (ECAP) to obtain ultra-fine grain size (UFG). Corresponding studies are made on conventional grain (CG) sized counterparts. The materials were exposed to high energy neutrons in the PULSTAR reactor at North Carolina State University at 1 MW for 200 hours. Irradiation to $1.15x10^{-3}$ dpa shows that the CG steel exhibits increased hardness and strength accompanied by decreased ductility as per the expected radiation hardening and embrittlement. However, the UFG steel clearly indicates no significant changes. Current studies are performed at relatively low dpa and investigations are underway to characterize radiation effects in these steels following 1 and 2 dpa levels being irradiated in the ATR test reactor at Idaho National Laboratories.

Sarah Atanasov[1], Christopher J. Oldham[1], Kyle Slusarski[2], Gregory N. Parsons[1], Kris Senecal[3], Shaun Filocamo[3], and Eric D. Wetzel[2]
Graduate Programs: Chemical and Biomolecular Engineering, North Carolina State University[1]; Army Research Laboratory, Aberdeen Proving Ground, MD[2]; US Army Natick Research, Development and Engineering Center, Natick, MA[3]
Advisor: Gregory N. Parsons
Poster Number: 5

Nanoscale Modification of Kevlar via Atomic Layer Deposition for Enhanced Force Protection

Organic aramid fibers (Kevlar®) have become standard materials in protective garments. The success of these fibers is due to their high tensile strength, high modulus, and low density[1]. Despite these excellent properties, 20-50 layers of aramid fabric are still required to provide appropriate ballistic protection; this results in stiff, cumbersome armor and restricts the fiber's use to torso protection (Kalman et al., 2009). In addition, the poor cut resistance of these fibers often requires supplemental equipment for full protection, further adding to the armor's burden.

Atomic Layer Deposition is a vapor phase deposition process which can achieve uniform coatings of metal oxides over high aspect ratio surfaces, including polymers, and has been shown to improve the tensile strength of aramid fibers (Peng et al., 2007). This work presents the effect of alumina and titania thin films on the cut resistance of Kevlar yarns. Bi-layer titania/alumina films resulted in the most significant increase in cut resistance of up to 19%. *In situ* infrared and x-ray photoelectron spectroscopy were used to elucidate the interaction of alumina and titania with the Kevlar yarns. Analysis suggests that the improved cut resistance from the bi-layer coatings is the result of protecting the Kevlar structure with titania while taking advantage of the superior material hardness of alumina.

Abhijeet Bagal and Chih-Hao Chang
Graduate Program: Mechanical Engineering
Advisor: Chih-Hao Chang
Poster Number: 8

Liquid-Immersion Lloyd's Mirror Interference Lithography

Periodic nanostructures have many applications, such as spectroscopy, biomimetic surfaces, and physical templates for self-assembly. With the use of interference lithography, it is possible to fabricate high-precision periodic nanostructures over large areas to suit the desired application. However, this top-down lithographic approach is limited by the light diffraction, and the smallest period that can be fabricated is roughly half of the wavelength. In this work, we present an all-liquid immersion scheme to fabricate subwavelength periodic structures using Lloyd's mirror interference lithography, by taking advantage of high refractive index of immersion fluids. The proposed set up can be a simple method to increase fabrication resolution in a laboratory setting, and can find applications in textured surfaces with high surface to volume ratio. Using the mechanism proposed in this work, we have successfully fabricated 1D structure having periodicity of 112 nm using light of 325 nm wavelength, achieving numerical aperture of 1.45. We also present results using multiple immersion fluids, exposure configurations, and discuss the effect of light absorption in the immersion fluid on the quality of the structure produced.

Youngsuk Bang
Graduate Program: Nuclear Engineering
Advisor: Hany S. Abdel-Khalik
Poster Number: 9

Hybrid Reduced Order Modeling for Reactor Physics Calculations

Reactor physics is the key element of the reactor core analysis wherein the radiation transport and interactions with the reactor materials are modeled via the Boltzmann equation. Given the huge level of heterogeneity deliberately introduced in the design for safety and economic reasons and the inherent complexity of cross-sections characterizing the interaction probabilities with reactor materials, numerical methods with approximations have been used to render predictions of reactor behavior in practical computational times. While the accuracy of reactor physics calculations has considerably improved due to the increase in computer power enabling more refined description of the phase space and use of more sophisticated numerical algorithms, the computational cost continues to increase and limits the full utilization of their effectiveness for routine engineering analysis, e.g. sensitivity analysis, uncertainty quantification, data assimilation and design optimization. To alleviate the computational cost, we introduce the reduced order modeling (ROM) techniques in which a surrogate is constructed only with major features of model behaviors. Once constructed correctly, ROM can be used for subsequent engineering analysis in lieu of the original code. The main idea is to identify correlations in model parameter variations and transform the original model into low dimensional form. Previous works demonstrated the applicability of ROM mainly for a single physics code. This study extends the previous approaches to handling serially coupled code systems, which is commonly encountered in nuclear engineering. By rendering reduction of the data streams between the different physics codes, ROMs for both codes can be constructed without compromising the overall accuracy. We develop the efficient algorithm for extracting the influential components for both coupled codes which is referred to intersection subspace. Numerical demonstrations using realistic assembly models show that while each physics code is independently reducible, the idea of subspace intersection could achieve further reduction.

Geoffrey K. Bradshaw[1], Joshua P. Samberg[2], C. Zachary Carlin[1], Peter C. Colter[1]
Graduate Programs: Electrical and Computer Engineering[1]; Material Science and Engineering[2]
Advisor: S.M. Bedair
Poster Number: 17

Solar Cell Efficiency Enhancements using InGaAs/GaAsP Multiple Quantum Wells

Multijunction photovoltaic (PV) cells consisting of GaInP/GaAs/Ge hold the current record conversion efficiency of above 40% at high solar concentration. In multijunction PV, absorption of the solar spectrum is divided efficiently amongst two or more solar cells stacked in series both electrically and optically. Ideally, each of the cells would be fine-tuned to absorb a specific region of the spectrum. Further improvements are hampered by current-matching limitations that arise from the non-ideal bandgap (E_G), a material property that dictates a cell's absorption range, of the GaAs subcell. We report on a preliminary study of GaInP/GaAs dual junction (2J) devices containing an InGaAs/GaAsP multiple quantum well (QW) structure incorporated into the GaAs subcell. The absorption from the lower E_G InGaAs QWs extends the absorption threshold of the GaAs cell and increases photocurrent. Ultra-thin, very high phosphorus content GaAsP layers provide counterbalance strain for the QWs to reduce defect formation and promote carrier tunneling through this structure. The 2J GaInP/GaAs-MQW cells exhibit an increase in the theoretical AM0 short circuit current density and maintain an open circuit voltage only slightly lower compared to that of a dual junction GaInP/GaAs control cell, indicating that the MQW structure has minimal impact on the InGaP top cell performance.

Extension of the MQW absorption threshold close to 1μm or beyond is required to optimize performance of the 2J structure. Comparisons of QW photoluminescence measurements structures and quantum size effect modeling indicate that InGaAs well E_G can vary greatly (~40%) from expected bulk InGaAs MOCVD growth calibrations. We have investigated this phenomenon in several test structures in which GaAs transition layer thickness at both the GaAsP to InGaAs and InGaAs to GaAsP interfaces were varied. These results confirm that phosphorous carryover at the GaAsP to InGaAs interface affect significantly raise bandgap of the wells.

Rita Brugarolas Brufau[1], David Roberts[2], Barbara Sherman[3] and Alper Bozkurt[1]
Graduate Programs: Electrical and Computer Engineering[1]; Computer Science[2]; Clinical Sciences[3]
Advisor: Alper Bozkurt
Poster Number: 20

Posture estimation for a canine machine interface based training system

Effective training and accurate interpretation of canine behaviors are essential for dog welfare and to obtain the maximum benefits provided by working dogs. We are developing a canine body area network (cBAN) based interface to incorporate electronic sensing and computational behavioral modeling into canine training. In this study, we investigated the sensor sites along a worn harness for reliable posture identification and the accuracy of machine learning algorithms to identify postures of canines through wireless inertial sensing using 3-axis accelerometers and 3-axis gyroscopes. Data was collected from three

subjects of different size and breeds (Labrador, Kai Ken and Shiva Inu) performing a sequence of 5 postures (sit, stand, lie, stand on two legs, and eat off the ground) and simultaneously the activities were video recorded for offline analysis. We used two stage cascade algorithms: one for differentiating behaviors and transitions, and one for posture classification. The algorithms achieved high classification accuracies, providing strong evidence that our cBAN interface will be useful for training. The assessed posture information will eventually be fed to the computational behavioral model, along with physiological information, to provide real time feedback to canine trainers and handlers.

Jeremy Cole
Graduate Program: Electrical Engineering
Advisor: Edgar Lobaton
Poster Number: 28

An Optimal Control Approach to Multi-Target Path Planning for Robotic Medical Needles

Advances in robotics have enabled the creation of concentric tube robots that resemble a flexible bevel-tip needle. These robotic devices can be steered around obstacles, allowing them to complete complex medical procedures, such as biopsies and brachytherapy, with minimal invasiveness. These procedures often require the robotic needle to traverse living tissue to reach a set of designated areas while avoiding sensitive regions. Furthermore, the robot dynamics limit how much the needle can bend at any given point. As such, the optimal path for the device will traverse all target locations while minimizing tissue trauma, avoiding sensitive regions, and satisfying the robot dynamics. We show that optimal control theory can be applied to resolve the challenge of finding a locally optimal path. We pose path planning as a constrained optimization problem with a cost functional based on the length of the robot's trajectory. Characteristics of this path are encapsulated in a tree data structure that is optimized to further refine the robot's trajectory. The effectiveness of our algorithm is analyzed for several multi-target scenarios.

Meghan S. Hegarty, Edward Grant, and Lawrence Reid, Jr.
Graduate Program: Biomedical Engineering
Adviser: Edward Grant
Poster Number: 63

Methods for Continuously Assessing the Peripheral Vasculature: Design of a Wearable Bioimpedance Analysis System

Introduction. Compression therapy, which is delivered in the form of bandages, stockings, and pneumatic devices, has historically been used to treat and manage a variety of venous diseases. While this therapy has produced positive results with respect to alleviating symptoms, the mechanism by which compression affects the body has remained largely uncharacterized. In order to gain a better understanding of how the peripheral vascular system performs both with and without compression, blood distribution and edema/swelling need to be monitored throughout the day. ***Objectives.*** Traditional systems for measuring changes in blood distribution and edema/swelling are not suitable for wearable applications. Therefore, we created a wearable bioimpedance analysis system that can be used to study the body's response to different stimuli. ***Methods.*** A custom system was built and optimized for wearability by employing a modular design that was small, lightweight, and low-power. The system was designed to deliver a range of frequencies (10-100kHz) so that different responses could be studied. A wear test was conducted with healthy participants in order to verify the functionality of the system. The impedance of the lower leg was measured continuously by sweeping through 10kHz, 50kHz, and 100kHz stimulating frequencies. ***Results & Conclusion.*** The custom bioimpedance analysis system was able to measure small changes in impedance both in the laboratory and during a wear test. The output current was maintained at a constant level of 50-55uA to meet the safety limits imposed by the IEC 2007 60601-1 guidelines. The response of the system was also found to be linear for load resistances within an extended range of 50-300Ω (sensitivity of 1Ω). Compared to other Bioimpedance analysis systems, the circuitry was simplified, which also allowed the sampling frequency to be lowered so that measurements could be taken nearly instantaneously. Additionally, power consumption was also greatly reduced (20mW).

Alina K. Higham, Alexandra M. Landry, and Anthony L. Andrady
Graduate Program: Chemical and Biomolecular Engineering
Advisor: Saad A. Khan
Poster Number: 64

Nanofibers of Water-Soluble Polymers *via* Foam Electrospinning

We present a multiple jet, needle-less electrospinning process to fabricate polymer nanofibers from foamed columns. Such fibers are desirable for a wide range of applications such as energy storage, tissue scaffolding, and catalysis, because of their high aspect ratios. These nanofibers are typically fabricated from low concentration, low viscosity polymer solutions using a needle-plate configuration, inherently limiting polymer throughput. Electrospinning from a foamed column may improve throughput as higher concentration, higher viscosity solutions may be used. Additionally, discontinuities in the electrospinning

process are introduced as the bubbles burst, which may allow for the production of fibers of finite length. Foams are produced by injecting a compressed gas through a porous surface into a polymer-solvent solution. As an electric field is applied to the system, jets eject from perturbations formed on the bubbled foam surface, producing nanofibers. Using polyvinyl alcohol (PVA), we identify key process and solution parameters for producing a web with uniform fiber morphology, with an average diameter of approximately 300 nanometers. Increasing the electrode surface area led to thicker electrospun mats, suggesting that distribution of charges through the bulk solution facilitates electrospinning. Similar trends between foam and needle-plate electrospinning were seen for collection distance and electrical field strength. Operating at close collection distances hinders sufficient solvent evaporation, while a critical electric field is required to fabricate fibers. Finally, a shift in the critical concentration required for producing uniform fibers is seen. The onset of beaded and uniform fibers occurs at 5 wt.% PVA and 7 wt.% PVA, respectively, both of which are higher than reported with needle electrospinning.

Wei Jing[1], William L. Roberts[1,2], and Tiegang Fang[1]
Graduate Programs: Mechanical Engineering, North Carolina State University[1]; Clean Combustion Research Center, King Abdullah University of Science and Technology[2]
Advisor: Tiegang Fang
Poster Number: 74

Effects of ambient temperature and oxygen concentration on diesel spray combustion using a single-nozzle injector in a constant volume combustion chamber

In order to reduce the particulate matter (PM) and oxides of nitrogen (NOx) emissions from diesel engines, low temperature combustion has been proposed and achieved in several combustion modes (HCCI, PCCI and RCCI). Understanding diesel spray combustion under different ambient conditions will help achieve these low temperature combustion modes. This work investigates the effects of ambient conditions on diesel spray combustion in an optically accessible, constant volume chamber using a single-nozzle fuel injector. The ambient O_2 concentration was varied between five discrete values from 10% to 21% and three different ambient temperatures (800 K, 1000 K, and 1200 K). These conditions simulate different EGR levels and ambient temperatures in diesel engines. Both conventional diesel combustion (ambient temperature should be around 1000K when the spray is injected) and low temperature combustion (ambient temperature should be around 800K when the spray is injected) modes were observed under these conditions. A transient analysis and a quasi-steady state analysis are employed in this paper. The transient analysis focused on the flame development from the beginning to the end, illustrated how the flame structure changed during this process; the quasi-steady state analysis only contained the part which experienced the stable flame structure process. The transient analysis was conducted using high speed imaging of both OH* chemiluminescence and natural luminosity (NL). In addition, three different images were acquired using an ICCD camera, corresponding to OH* chemiluminescence, narrow-band flame emission at 430 nm (Band A) and at 470 nm (Band B), and used to investigate the quasi-steady state combustion process. From the transient analysis, it is found that NL signal becomes stronger and confined to narrow regions when the temperature and O_2 concentration increase during the development of flame. The OH* intensity is much lower for the 10% ambient O_2 and 800 K conditions compared to the higher temperatures and O2 levels. This implies the occurrence of low temperature combustion under these conditions. Results from the quasi-steady state combustion stage indicate that high temperature reactions effectively oxidize the soot in the downstream locations where only OH* signal is observed. The area of Band A and Band B emissions in these images is larger than the area of OH* emissions at the lower O_2 concentrations while the area of OH* emissions is larger than the area of Band A and Band B emissions at higher O_2 concentrations, for a given ambient temperature. Moreover, the mixture stoichiometry was analyzed using a reformulated definition of excess air ratio for diluted combustion, and this shows that more mixing is required to achieve complete combustion for low ambient oxygen concentration conditions where longer and wider flames are observed. This observation is also verified by the flame length estimated from the NL images.

Mohammad Rashed Khan, Chris Trlica, Ju-Hee So, and Michael D. Dickey
Graduate Program: Chemical and Biomolecular Engineering
Advisor: Michael D. Dickey
Poster Number: 81

Engineering the Shape of a Liquid Metal Alloy by Tuning its Surface Oxide

The ability to control, actuate and manipulate liquids at sub mm scale is an attractive pursuit for many applications including MEMS devices (e.g., sensors, actuators, and RF electronics), micro-total analysis systems, and patterning. The aim of this research is to study, control, and manipulate the shape of a room temperature liquid metal alloy, eutectic gallium indium (EGaIn), by controlling the interfacial properties of a passivating surface oxide layer (skin, Ga_2O_3) that forms spontaneously at ambient temperature. The skin provides mechanical stability to the liquid metal such that it can be molded into non-spherical shapes such as wires. The ability to flow and stabilize the liquid metal on demand for shaping it into useful and responsive structures (e.g., antennas, switches, sensors, electronic filters) relies on the rupture and reformation of the oxide skin and this is critical for tunable reconfigurable micro systems. Here, we describe the utility of this liquid metal by characterizing a shape

shifting device. We also demonstrate a simple electro hydrodynamic approach to withdraw fluidic metal wire from microfluidic channels. This electrochemical approach reduces the passivating oxide skin and induces capillary motion of the metal from the microfluidic channels. Our approach relies on changing the physicochemical properties of EGaIn interface. We also utilize conventional rheological and electrochemical principles that provide fundamental and quantitative information about the behavior of this skin under various mechanical and chemical environments.

Prasenjit Khanikar
Graduate Program: Mechanical Engineering
Advisor: M.A. Zikry
Poster Number: 82

Predictions and Modeling of Failure Modes in Crystalline Layered Aluminum Composites

Layered Aluminum alloy composites are lightweight and can achieve high strength and/or toughness. Their applications include aerospace, automotive and armor industries. The primary objective of this study is to design a layered roll-bonded Aluminum composite with optimal arrangement for a damage tolerant armor system. Therefore, it is important to predict failure modes and scenarios at different physical scales that occur due to a myriad of microstructural factors, such as texture, grain size and shape, precipitates, dispersed particles, and grain boundary misorientations and distributions. The microstructurally based formulation for inelastic deformation is based on coupling a multiple-slip crystal plasticity formulation to a dislocation-density formulation. This dislocation density based multiple-slip crystal plasticity formulation is then coupled to specialized finite-element methods to predict how scale-dependent microstructural behavior and the evolving heterogeneous microstructure affect the strength and failure of the layered composite, and how failure initiates and propagates. The computational results showed that there are different slip incompatibilities at different length scales and these locations can be potential sites for failure initiation. These slip incompatibilities include slip incompatibility at particle-matrix interface, slip incompatibility across grain boundary and slip incompatibility across roll-bonded interface. For a bilayer composite, the harder layer is prone to dynamic cracking at high strain rate while the softer layer tends to form shear bands. These two competing mechanisms can be optimized to design a bilayer composite with desired behavior. The effects of strain rate and layer thickness were also studied to understand the mechanical behavior of layered Aluminum composites under high strain rate loading.

Yuan Lu
Graduate Program: Electrical Engineering
Advisor: Alexandra Duel-Hallen
Poster Number: 100

Channel-Adaptive Sensing Strategy for Cognitive Radio Ad Hoc Networks

In Cognitive Radio (CR) ad hoc networks, secondary users (SU) attempt to utilize valuable spectral resources without causing significant interference to licensed primary users (PU). While there is a large body of research on spectrum opportunity detection, exploitation, and adaptive transmission in CR, most existing approaches focus only on avoiding PU activity when making sensing decisions. Since the myopic sensing strategy results in congestion and poor throughput, several collision-avoidance sensing approaches were investigated in the literature. However, they provide limited improvement. A channel-aware myopic sensing strategy that adapts the reward to the fading channel state information (CSI) of the SU link is proposed. This CSI varies over the CR spectrum and from one SU pair to another due to multipath and shadow fading, thus randomizing sensing decisions and increasing the network throughput. The proposed joint CSI adaptation at the medium access control (MAC) and physical layers provides large throughput gain over randomized sensing strategies and/or conventional adaptive transmission methods. The performance of the proposed CSI-aided sensing strategy is validated for practical network scenarios and demonstrated to be robust to CSI mismatch, sensing errors, and spatial channel correlation.

Joshua P. McClure[1,2], Rongzhong Jiang[2], Deryn Chu[2], Jerome J. Cuomo[3], Gregory N. Parsons[1], and Peter S. Fedkiw[1]
Graduate Programs: Chemical and Biomolecular Engineering, North Carolina State University[1]; Army Research Lab–Sensors and Electron Devices, Adelphi, MD[2]; Materials Science and Engineering, North Carolina State University[3]
Advisor: Peter S. Fedkiw
Poster Number: 104

Non-Platinum Group Metal Electrocatalysts for Polymer Electrolyte Membrane Fuel Cells

Platinum group metal (PGM) cathode electrocatalysts are common in polymer electrolyte membrane fuel cells and provide desired selectivities, high turnover frequencies and low overpotentials for the oxygen reduction reaction (ORR). However, PGM materials are expensive and alternatives are being explored. As a contribution to this goal, we explore three different approaches for generating non-PGM electrocatalysts. In our first approach, we synthesize carbon nanowalls (CNWs) using plasma-enhanced chemical vapor deposition (PECVD). The CNWs are nitrogen-doped with varying N-atomic % and CN_x bonding

configurations, and are found to increase the ORR selectivity and kinetic activity compared to non-doped samples. For our second approach, we studied the ORR on pyrolyzed electrospun polyacrylonitrile (PAN) fibers with and without the addition of Fe or Co precursors in the spinning solution. The ORR is studied in low and high pH environments, and fibers containing Fe species are more electrochemically active than native fibers or Co-containing fibers. Although the heat-treated catalysts are promising, we find that the electrochemical activity quickly diminishes in low pH after potential cycling. For our third approach, we add Ti species to Fe-containing catalysts using atomic layer deposition and find that electrocatalysts with Ti species retain a higher percentage of the initial activity compared to samples without Ti species after potential cycling in low pH.

Letisha Annette McLaughlin
Graduate Program: Mechanical and Aerospace Engineering
Advisor: Mohammed A. Zikry
Poster Number: 108

The Mechanics and Stability of Gold Nanoparticle-Oligo-Ligand-DNA Systems

Systems in which DNA is adsorbed onto gold nanoparticles have the potential for applications in gene regulation therapies, drug delivery, sensing, and DNA scaffolding. However, the mechanical stability of gold nanoparticles (AuNPs) and interfacial behavior between the gold nanoparticles and thiol ligands are not well understood or quantified. The stability of DNA-AuNP) systems is, therefore, examined using a large-scale specialized finite-element approach with a dislocation-density based crystalline plasticity framework to model the AuNPs and an elastic description to model thiol ligands, DNA, and the ionic solution. For compressive loading conditions, the system exhibited morphological instabilities in the nanoparticles, as well as high stress and dislocation-density gradients at the thiol-nanoparticle attachment sites, which can affect system stability and attachment strength.

Moataz Bellah M. Mousa[1], Christopher J. Oldham[1], Jesse S. Jur[2], and Gregory N. Parsons[1]
Graduate Programs: Chemical and Biomolecular Engineering[1]; Textile Engineering Chemistry and Science[2]
Advisor: Gregory N. Parsons
Poster Number: 120

Effect of temperature and gas velocity on growth during atomic layer deposition at atmospheric pressure

Atomic layer deposition (ALD) process is useful for nanoscale coatings with high conformality and precise thickness control. Low temperature ALD processes, for example, can be used to modify and/or coat synthetic polymers, biologically-derived materials, printed electronics or organic electronics. Most commercial ALD processes are developed for batch or single-wafer semiconductor device processing, and operate under optimized conditions at pressures in the 0.1~1.0 Torr range. New faster continuous ALD processes will enable ALD for lower cost continous applications as smart textiles, flexible electronics and organic solar cells printing. Moreover, working at ambient pressure could facilitate ALD integration for in-line manufacturing and eliminate the time needed for reactor evacuation and pressure control.

In this work, the authors compared the ALD growth of Al_2O_3 and ZnO at atmospheric pressure and under vacuum conditions as a function of temperature and gas flow dynamics. The overall growth rate was found to be nearly the double at higher pressure and the magnitude of the growth increase can be adjusted by controlling the gas velocity near the growth surface. At high pressure, large gas flow rates keep the reactions within the ALD regime which is consistent with more efficient removal of excess water. The observed trends were explained through analytical expressions for the boundary layer thickness and species diffusivity. Also, a new reactor design is proposed to accommodate the new requirements for the ALD process under atmospheric pressure in open air.

Jaspreet S. Notey, Derrick L. Lewis, Charlotte R. Cooper, and Robert M. Kelly
Graduate Program: Chemical and Biomolecular Engineering
Advisor: Robert M. Kelly
Poster Number: 128

Stress response: Understanding growth physiology, spontaneous change and management strategies in hyperthermophilic microorganisms

All microorganisms experience a multitude of challenging conditions in the environment they grow in; a few examples of note are thermal, pH, metal toxicity, osmotic, nutritional stresses. These conditions are known to effect spontaneous change in their genomes and microorganisms have evolved various stress management systems to sustain and recover from such challenging situations. These responses and systems are known to play a significant role in triggering physiological changes such as cessation of growth or onset of stationary phase, biofilm formation, release of antimicrobials etc., phenomena which are relevant to biotechnology industry, pharmaceutical and health sector. In our lab, we work with hyperthermophilic ($\mathbf{T_{opt}} \geq 80°C$) microorganisms and this study involves two parts, first with *Pyrococcus furiosus* (an anaerobic heterotrophic archaeon) and, second with, *Sulfolobus solfataricus* (an aerobic acidophilic crenarchaeon) and *Thermotoga maritima* (an anaerobic fermentative

heterotrophic bacterium). In the first part, we have performed a functional genomic analysis in conjunction with re-sequencing of the genome of a spontaneous mutant of *P. furiosus*, which was accidently discovered while performing growth medium improvement experiments. The second part deals with microarray experiments performed to study heat shock response in *S. solfataricus* and identifying key genomic elements (Toxin-Antitoxin [TA] systems) involved presumably in RNA management inside the cell. While comparing *P. furiosus* wild-type with its spontaneous mutant, significant differences in the regulation of amino acid biosynthetic pathways were seen, indicating a lack of nutritional control which seemingly caused the mutant to grow 2-3 more doublings than the wild-type. Also, the disruption of the flagellar biosynthetic pathway due to frameshift mutations led to a phenotype having very different cell-cell connections as observed through SEM/TEM microscopy. For studying RNA management and control of cell growth rate, current efforts are underway which include characterization of purified cloned TA proteins and assessing their proposed ribonucleolytic activity.

Tom R. Nudell
Graduate Program: Electrical Engineering
Advisor: Aranya Chakrabortty
Poster Number: 129

A Graph-Theoretic Algorithm for Disturbance Localization in Large Scale Networked Dynamic Systems using Discrete Nodal Domains

The US power grid is a highly complex dynamic network, where blackouts outages can cost millions dollars. This highlights the importance of localizing critical disturbances in modern power system operation and control. With this objective in mind, this poster presents a novel measurement-based algorithm to detect such disturbances in a generic first-order networked dynamic system. Considering that the network exhibits a clustering structure, we first collect measurements from sensors located within the network, apply system identification methods to estimate a transfer function representation of the system response, and apply a graph-theoretic analysis of the residues of the transfer function, from which the input disturbance can be localized. The theoretical analysis can be naturally extended to the second-order swing model of a power grid. The effectiveness of the proposed algorithm is demonstrated with numerical simulations of a power grid model.

Peiman Shahbeigi Roodposhti
Graduate Program: Materials Science and Engineering
Advisor: K.L. Murty
Poster Number: 151

Creep behavior of Mg alloys

Because of their light weight magnesium and their alloys are sought for application in automotive industry. However, their mechanical properties limit their use and appropriate alloying and heat treatments are proposed for utilization in transportation technologies. A major property of significance is on the time dependent deformation known as creep at operating temperatures. By characterization of the creep behavior of these alloys at different stresses and temperatures under uniaxial loading, we plan to characterize the creep behaviors of various magnesium based alloys to predict the best conditions of using these alloys in service. AM 60, AM50, AZ31 and AZ91 are some cast and wrought alloys of magnesium, used mostly to produce many parts in electronics, aerospace, telecommunication and automotive industries. Many metal phases such as $Mg_{17}Al_{12}$, revealed by XRD analysis, play a vital role in deformation behavior of these kinds of soft alloys by providing many obstacles in the path of dislocation movements. Creep characteristics of these alloys are investigated with emphasis on possible transitions in creep mechanisms from dislocation-based at high stresses to point-defect-dominated mechanisms such as Nabarro-Herring and Coble at lower stresses. Deformation microstructures using transmission electron microscopy are planned to correlate the mechanical behaviors. [This research is supported by the National Science Foundation grant 0968825.]

Zhuo Tan and Rohan A. Shirwaiker
Graduate Program: Industrial and Systems Engineering
Advisor: Rohan A. Shirwaiker
Poster Number: 175

Electrically-Activated Dual-Metal Orthopedic Implant Design for Antimicrobial Prophylaxis

Post-operative infections associated with medical prostheses are often accompanied by high risk and significant treatment costs. Approximately 1-4 % of patients receiving total hip and total knee arthroplasties (THA and TKA, respectively) are affected by postoperative bacterial infections. Given that a combined total of 711,000 THA and TKA are performed yearly in the US alone (American Academy of Orthopaedic Surgeons, 2011), the relatively low infection rates still translate to a substantial number of actual infection cases. We have developed a new dual-metal prophylactic antimicrobial system for application in residual hardware prostheses. While silver, in general, is known to exhibit broad-spectrum antimicrobial activity, we have configured our

system to induce controlled local administration of antimicrobial ions from partial silver film-coatings on titanium prostheses using low intensity direct current (<30 μA). Essential elements and mechanisms of the design are based on oligodynamic iontophoresis, a process of regulating silver ion diffusion via external electric field. We have identified the important design metrics for the system according to FDA regulations and EPA standards. We have also developed a three-dimensional (3D) in vitro antimicrobial efficacy testing methodology that mimics residual hardware-associated osteomyelitic infections, in order to analyze our system. The results of this study demonstrate the antimicrobial effectiveness of scaled system prototypes against *Staphylococcus aureus* (Gram-positive bacteria) and *Escherichia coli* (Gram-negative bacteria), both of which are frequent causes of osteomyelitic infections. The study also highlights the importance of sustaining silver ion concentration at levels that are detrimental to bacteria cells and biofilms without inducing human cellular toxicity. Empirical results and theoretical calculations indicate that this can be achieved by appropriately controlling the system's current and duration metrics. This investigation will be a part of a future study also involving scale-up and in vivo characterization.

Congjian Wang
Graduate Program: Nuclear Engineering
Advisor: Hany S. Abdel-Khalik
Poster Number: 188

Stochastic higher order generalized perturbation theory for nuclear reactor design and analysis

The role of scientific computing has been heavily promoted in many fields to improve understanding the physics of complex engineering systems in recent years while conduct the experiments can be time-consuming, inflexible, expensive and difficult to repeat, e.g. nuclear reactor systems. The ultimate goal of scientific computing is to provide more reliable predictions for engineering systems within certain acceptable tolerance. To realize the benefits of scientific computing, extensive effort has been devoted to the development of efficient algorithms for sensitivity analysis (SA) and uncertainty quantification (UQ) whose numerical errors is under control and understood. However, the repeated execution of the simulations with different samples is computationally intractable for large-scale system with large number of degrees of freedom (DOF). The object of this poster will be focus on presenting our own development of stochastic higher-order generalized perturbation theory to address the explosion in the computational burden. Additionally, an overview of the current state-of-the-art of SA/UQ will also be provided.

Xiaoming Wang, Ajay S. Nagpure, Joseph F. DeCarolis, and Morton A. Barlaz
Graduate Program: Civil, Construction, and Environmental Engineering
Advisor: Morton A. Barlaz
Poster Number: 190

Using Observed Data to Improve Estimated Methane Collection from Select U.S. Municipal Solid Waste (MSW) Landfills

An estimated 389 million tons of municipal solid waste (MSW) was generated in the U.S. in 2008, of which 69% was disposed by landfill (van Haaren et al., 2010). The anaerobic decomposition of solid waste in a landfill produces methane, a potent greenhouse gas, and if recovered, a valuable energy commodity.

Methane generation from U.S. landfills is usually estimated using the U.S. EPA's Landfill Gas Emissions Model (LandGEM). Default values for two key parameters within LandGEM, the first order decay rate (k) and the ultimate methane yield (L0) are based on data collected in the 1990s. Changes in waste composition and landfill operations over the past decade suggest that it is appropriate to revisit the default values for k and L0 as specified by the EPA. In this study, observed methane collection data from 11 U.S. landfills coupled with estimates of gas collection efficiencies developed from site-specific cover and gas well installation data were included in a reformulated LandGEM equation. Formal search techniques were employed to optimize k for each landfill by minimizing the sum of squared errors (SSE) between the LandGEM prediction and the observed collection data. Across nearly all landfills, the optimal k was found to be higher than the default AP-42 value of 0.04 yr-1. The results suggest that the default k value assumed in LandGEM is likely too low, which implies that more methane is produced in the early years following waste burial when gas collection efficiencies tend to be lower.

Currently, work to characterize uncertainty in estimates of the decay rate is ongoing. Monte Carlo simulations of landfill gas collection efficiencies have been applied to obtain probability distributions for k. Moreover, alternative formulations to LandGEM such as a two-phase model that could provide an improved representation of landfill methane data will be explored.

Joseph E. Weaver
Graduate Program: Environmental Engineering
Advisor: Morton A. Barlaz
Poster Number: 192

Development of a Protocol to Test the Anaerobic Biodegradability of Plastics

Consumers expect plastics labeled as biodegradable to decompose in a landfill. The existing standards intended to test and classify the increasing number of these polymers use assumptions which do not accurately reflect conditions in a landfill. For example, ASTM 5511 requires that tests be run at 52°C (125.6°F) while landfills rarely experience temperatures in that range.

We are developing an accurate, robust, and practical protocol to characterize the fate of biodegradable plastics relative to other materials within a landfill. Reactors simulating ideal but realistic landfill conditions have been loaded with reference substrates (copy paper, newspaper, grass) or test polymers and inoculated with a source of anaerobic microorganisms. Biodegradability is determined by methane production.

To determine the effects of inoculum source, four series of reactors have been inoculated with decomposed municipal solid waste, landfill leachate, anaerobically digested municipal wastewater treatment sludge, or an inoculum derived from a lab-scale anaerobic digester that was fed with the organic fraction of municipal solid waste. Relative insensitivity of results to inoculum source would allow flexibility and indicate robustness in the protocol.

Total methane yields for a given substrate were roughly similar between inocula, however, peak methane production rates and the time to peak rates varied. With the exception of grass, methane yields from current reactors inoculated with degraded MSW correspond to previously determined values.

None of the tested plastics exhibited significant biodegradation. Ultimate methane yields for a substrate were similar between inocula but production rates varied. Newspaper was more likely than office paper to stabilize within a reactor and degraded over a time frame short enough for timely results but long enough for sufficient data collection. These results will be used to improve the next revision of the existing ASTM standard, allowing end users to make better informed purchasing decisions.

Bruce Wiggin
Graduate Program: Biomedical Engineering
Advisor: Gregory Sawicki
Poster Number: 194

A Passive Elastic Exoskeleton Reduces the Metabolic Cost of Walking Using Controlled Energy Storage and Release

Wearable robots are a promising approach to augment healthy or restore impaired locomotion in humans. However, due to large mass, high power consumption, and design approaches that do not consider the human physiological response; current devices drastically increase the users energy cost to move, in some cases by as much as 40%. Coordinated ankle propulsion is the cornerstone of efficient human walking. The ankle plantar flexors provide the majority of the mechanical work for the step-to-step transition and much of this work is delivered via elastic recoil from the Achilles' tendon - making it highly efficient. Even though the plantar flexors play a central role in propulsion, body-weight support and swing initiation during walking, very few assistive devices have focused on aiding ankle plantarflexion. Our goal was to develop a portable ankle exoskeleton taking inspiration from the passive elastic mechanisms at play in the human triceps surae-Achilles' tendon complex during walking. The challenge was to use parallel springs to provide ankle joint mechanical assistance during stance phase but allow free ankle rotation during swing phase. To do this we developed a novel 'smart-clutch' that can engage and disengage a parallel spring based only on ankle kinematic state. The system is purely passive - containing no motors, electronics or external power supply. This 'energy-neutral' ankle exoskeleton could not only be used to restore symmetry and reduce metabolic energy expenditure of walking in populations with weak ankle plantar flexors (e.g. stroke, spinal cord injury, normal aging), but also shows benefits to healthy populations as well. By reducing the forces on the triceps surae muscles during the stance phase of walking, we ultimately aim to significantly reduce the metabolic cost of walking.

Xu A. Zhang, Jonathan Elek, and Chih-Hao Chang
Graduate Program: Mechanical and Aerospace Engineering
Advisor: Chih-Hao Chang
Poster Number: 200

Fabrication of Functional 3D Nano-Volcano Structures Using Light Scattering from Colloidal Elements

3D nanostructures have recently advanced several key innovations in nanoscience, such as photonic crystals, and ultrafast battery electrodes. The demand for high-quality 3D nanostructures requires the fabrication techniques to be cost-effective, simple, and versatile to achieve a wide range of 3D nanostructures. The conventional 3D nanofabrication techniques are based on the highly mature 2D microfabrication techniques in the semiconductor industry. However, they generally suffer from high cost and process complexity when applied to 3D nanostructure fabrication. Among the diverse newly-developed 3D

nanofabrication techniques, the colloidal lithography, which usually uses the assemblies of colloidal elements as etching or deposition masks, is a promising approach in fabricating complex 3D nanostructures. Here we present a novel fabrication technique using colloidal elements as light scattering masks, which can produce various types of functional 3D nanostructures and add additional flexibility to colloidal lithography. This technique eliminates the costs of mask fabrication and the close-contact issues often seen in the contact lithography. In this work, we used spherical colloidal nanoparticles and fabricated hollow-shell 3D volcano-like nanostructures via this technique. The geometry of such structures is controllable by varying the particle size and exposure wavelength ratios. Periodic arrays of nano-volcanoes were also investigated using light scattering from a monolayer of hexagonal non-close-packed polystyrene particles. The hollow nano-volcanoes were used as particle trapping surfaces to store small silica particles inside the nano-scale volume. This demonstration of particle trapping paves the way to the more advanced application of precise and efficient drug delivery using the periodic arrays. Other types of colloidal elements besides spheres can be easily incorporated into this fabrication technique, which promises a wide variety of achievable 3D nanostructures.

Stephanie N. Raney[1], **Jennifer L. Kager**[1], **Noah J. Hayden**[1], **and Ronnie Z. Bouemboue**[2]
Graduate Programs: Communication[1]; Liberal Studies[2]
Advisor: Kami A. Kosenko
Poster Number: 16

Intact Romantic Relationships: A Meta-Synthesis of the Relational Dialectics Literature

Since its first formal articulation in 1996, relational dialectics theory (RDT) has proven useful in examining and understanding the discursive struggles that occur within romantic relationships. A vast majority of the studies about relational dialectics have employed qualitative methods; however, no synthesis of the results of these studies has been conducted. Meta-synthesis has been deemed an effective tool for conducting interpretative assimilations of qualitative research findings. Synthesizing the findings of qualitative studies of relational dialectics has important implications for the use of qualitative research in the examination of relational dialectics, as well as for the continued growth and development of the theory itself. In particular, a synthesis of the findings of dialectics studies will provide scholars with tangible information regarding the current state of dialectics research and how it has changed over time. This meta-synthesis lends special attention to gaps in the literature and provides researchers with directions for future research. The purpose of this study is to coalesce and synthesize the relational dialectics literature. Specifically, this meta-synthesis involves the synthesizing of the findings of dialectics studies that have employed qualitative research methods to examine intact romantic relationships. Implications, limitations, and future directions are discussed.

Erinn Brooks
Graduate Program: Sociology
Advisor: Martha Crowley
Poster Number: 18

Paternalistic and Empowering Ideologies among Nonprofit Organizations: The Effects of Race, Religiosity, and Organizational Focus

Many nonprofits set out to challenge social inequalities by addressing contemporary problems, such as unemployment, homelessness, and domestic violence. Yet, nonprofit organizations and practitioners must engage with ideologies that justify stratification. Paternalism often underscores unequal relationships when dominant and subordinate group members interact in socioeconomically and racially diverse settings. Even in nonprofits, the appearance that privileged individuals care hides and preserves inequality. What factors promote the adoption of paternalistic versus empowering ideologies? This study emphasizes race, religion, and organizational focus, relying on content-coded qualitative data from a random sample of 40 nonprofit organizations in the United States. Analyses suggest that paternalistic ideology emerges when majority (white) staff serve minority (Black or Latino) participants, as well as when organizations display religious ties, or missions related to employment, family, or housing issues. In contrast, empowering ideology develops when minority staff serve same-race participants, as well as when organizations focus on advocacy or domestic violence issues.

Kelsey Chandler, Kelly Murray, and Krista B. Sorenson
Graduate Program: Public History
Advisors: Craig Friend and Susanna Lee
Poster Number: 26

Sowing History at the North Carolina Farm Bureau

In 1936, the North Carolina Farm Bureau (NCFB) became a grassroots organization which politically represented North Carolina's farming communities. Farmers contribute extensively to regional culture, the state economy, and the production of food found

on our dinner tables. In turn, the Farm Bureau serves its members through political action, educational programs, financial benefits, insurance options, and scholarship funding. Preservation and organization of its own history, however, has never been a focus of the Farm Bureau.

In order to address its need for historical content and context, we are preserving and organizing NCFB's records, creating a structure for future archival acquisition and preservation, as well as developing a historical narrative. By employing archival practice and museum theory, we have empowered the Bureau in furthering its ability to serve as the farmer's voice by employing its own history in outreach and community building.

Our efforts include best practices in historical research, archives, digital preservation, and the digital humanities to highlight NCFB's photographs, oral histories, and documents. These efforts will manifest as a digital space relating the story of North Carolina farmers to Bureau members and the state's citizens.

In the process of providing practical solutions for NCFB's history needs, our project has exposed key findings about the relationship of non-profit organizations to their histories. First, such organizations often lack a sense of their historical trajectories but have a strong desire to know them. Second, a historical narrative based upon thorough and thoughtful documentation allows members to relate to state and regional agricultural tradition. Lastly, preservation of historical materials is possible with moderate financial investment, but provides promotional rewards—including nostalgic and effective connections that can lead to donations and volunteerism; greater sense of historic perspective for contemporary political undertakings; and greater resources for educational and advocacy programming.

Yanhua Cheng and Daniel Grühn
Graduate Program: Psychology
Advisor: Daniel Grühn
Poster Number: 27

Life Satisfaction, Emotional Support, Health, and Income: The Impact of Race-Based Rejection

Chronic social rejection may have negative long-term effects on individuals' mental and physical health. In the present study, we investigate the effects of chronic rejection in the context of race. Race-based rejection is social rejection due to one's race or ethnicity. It can affect individuals' well-being both directly (e.g., emotional distress) and indirectly (e.g., social barriers in obtaining health care). We expected that individuals experiencing more race-based rejection not only report more rejection-related mental and physical symptoms, but also report a less optimal general health, well-being, and income profile. We also expected that the perception of race-based rejection is most prevalent in younger ages when limited educational, economical, and social opportunities are more pressing for pursuing life goals. To test this idea, we used data from a module of the Behavioral Risk Factor Surveillance System (BRFSS); a representative telephone survey of U.S. adults. Participants reported how they were treated compared to other races as well as physical and mental symptoms due to race-based rejection. For our research question, we only included non-white adults (N = 12,230) ranging from 19 to 99 (M = 49.0, SD = 16.7) years of age. Results from a path model showed that race-based rejection predicted more rejection-related emotional and physical symptoms, which in turn were associated with lower life satisfaction, lower emotional support, lower income, and poorer self-reported health.

Race-based rejection also directly negatively predicted life satisfaction. Contrary to our expectations, race-based rejection was predictive of higher income. Age was negatively associated with race-based rejection and its symptoms. Age also moderated the relationship between rejection and related symptoms. Older adults were less likely to report being treated worse than other races and less likely to report symptoms due to race-based rejection. Findings are discussed in the context of theories of rejection and aging.

Caroline Myrick and Arika Dean
Graduate Program: English
Advisor: Walt Wolfram
Poster Number: 35

What is Saban English?: A Sociolinguistic Analysis of a Caribbean Dialect Isolate

Small Caribbean islands with mixed-ethnic populations offer a unique venue for examining principles of language contact and sociolinguistic variation. What role do contact effects play in the construction of socioethnic varieties? How does this variation compare with English in the Caribbean English diaspora and with North American English varieties? To what extent is inter- and intra-community variation manifested in small, isolated populations? Our research considers English language variation on the island of Saba, a Dutch municipality located in the Eastern Caribbean that is home to less than 1,600 local residents. Data come from over 30 sociolinguistic interviews with long-term residents conducted on the island in 2012. Our study investigates phonological and morphosyntactic traits of Saban English, considering the interrelationship between effects from heritage languages (i.e. Dutch, Afro-Caribbean English, Anglo-Caribbean English, and Scottish English), race/ethnicity, community, and generation. Acoustic analysis reveals inter-community stability in the overall vowel systems across communities, though

differing from other Anglophone and Creole dialects of the Caribbean. Rhoticity shows similarities and differences with other Caribbean and with American English *r*-less patterns, particularly related to phonetic constraints. Some morphosyntactic traits (e.g. copula absence, habitual *be*) align partially with other Caribbean English varieties but lack an ethnic divide characteristically shown in some Caribbean and Southern American English varieties. Other morphosyntactic patterns (e.g. *a*-prefixing, plural-*s* absence on count nouns) show alignment with similar uses in the rural American South. Finally, analyses of prepositional and pronomial systems suggest substrate effects from original Dutch founders. Our study underscores the persistence of long-term variation that can occur on small, historically isolated islands, and reinforces the complex intersection of linguistic, social, and individual variation in small, isolated island communities. [Funded by the William C. Friday Endowment.]

Jessie Feudale
Graduate Program: Foreign Languages and Literatures
Advisor: Shelley Garrigan
Poster Number: 41

Exploring Ecuadorian Cultural Identity through Performance in La Merced Market of Riobamba, Ecuador

As an interdisciplinary field, Critical Food Studies (CFS) deals with analyzing the ways in which humans relate to and represent food in cultural, historical and social contexts. Performance theory, which includes viewing daily activities and social interactions as performances of identity and social scripts, provides a unique perspective when examining how cultural identity manifests through food practices. It is through this double lens – CFS and performance theory – that the present investigation approaches the market-place called *La Merced* located in the highland city of Riobamba, Ecuador. Although this is not the first encounter between CFS and performance theory, very few studies have incorporated both of these within the framework of a traditional food market in Latin America. This analysis seeks to explore how cooks and customers' performances with regard to the food practices of *La Merced* construct and maintain central aspects of Ecuadorian cultural identity. More specifically, I will examine the creation, showcasing and commercial exchange of dishes, as well as the linguistic discourse surrounding the traditional cuisine of the market in order to explore the connections among food, identity and place. This study combines on-site field research, including interviews with market vendors and clients, with research of local internet blogs and newspapers as well as academic publications. Preliminary conclusions indicate that *Riobambeños* from varying social classes associate market meals, such as the nationally renowned pork dish *hornado* and potato tortillas *llapingachos,* with a deep sense of cultural tradition and heritage irreplaceable by more modern, globalized restaurants. Additionally, cultural identity is revealed through the use of Ecuadorian-specific linguistic features and lexical items related to the food practices of *La Merced.*

Nichole Fournier
Graduate Program: Anthropology
Advisor: Ann H. Ross
Poster Number: 43

A Study of Fingerprint Minutiae and the Influence of Sex, Pattern Type, and Population

Dermatoglyphics have been studied extensively in physical anthropology to examine the inter-population variation of friction ridge traits. The majority of the previous studies have tested these relationships on level 1 Detail (e.g. pattern type, total ridge count). Therefore, the results are largely irrelevant in the field of forensic science, where identifications are made based on level 2 and 3 Detail (e.g. minutiae and pores, respectively). The present study applies methodologies developed in physical anthropology for quantifying fingerprint traits of level 1 features to level 2 Detail and tests whether population has an effect at the minutiae level. The influence of sex and pattern type on minutiae is also explored. Five types of minutiae were analyzed and include bifurcations, ending ridges, short ridges, dots, and enclosures, as well as a variable for the total of all minutiae. Each type of minutia was visually counted on the right index finger of 115 individuals (29 African American females; 29 African American males; 29 European American females; 28 European American males). A multiple analysis of variance (MANOVA) was used to analyze the overall effect of sex, pattern type, and population on the minutiae variables. Results of the MANOVA show that only population significantly affects minutiae (p-value=0.019). However, analysis of variance (ANOVA) results indicate that pattern type and sex are also significant for certain variables and therefore, additional testing was explored using contrast statements in the MANOVA to identify which of the minutiae variables are being influenced by which of the 3 main effects. The results of this study show that fingerprint development is driven by a complex biological system. The amount of factors that can influence fingerprints partially explains uniqueness and indicates the importance of considering the variables of interest to anthropologists (sex and ancestry) when constructing models for use in forensic contexts.

Dana C. Gierdowski
Graduate Program: Communication, Rhetoric and Digital Media
Advisor: Susan Miller-Cochran
Poster Number: 51

Geographies of a Writing Space: The Study of a Flexible Composition Classroom

Empirical research on the impact of innovative learning spaces in higher education has been ongoing in the areas of Science, Technology, Engineering, and Math (STEM) and Library Sciences; however, there is a dearth of research in the Humanities in the area of Composition Studies. This ethnographic study examined the role that a "flexible" classroom design played in a first-year writing course at a large southeastern university. The flexible room includes mobile furnishings, mobile whiteboards, and multiple LCD screens for display and is a space where students use their own laptop computers. The goal of the flexible design was to give instructors more flexibility with their pedagogy, engage students more in the writing process, and reduce the expense of maintaining and updating the equipment used in traditional computer classrooms. Typical case sampling was employed to select the participants in this study, which included an instructor, teaching assistant, and students in one section of the university's first-year writing course. The researcher was an open participant observer for an entire semester, attending class alongside students. This study explored both perceptions and behaviors of the users in the flexible space through interviews and classroom observations. Students were also asked to complete conceptual mapping exercises, which were designed to obtain more information about their preferences for certain seating or geographic areas as they pertained to composition-specific activities such as collaborative writing and peer review. The data suggests that the flexible space was used for a variety of pedagogical activities and was perceived by the instructor as being particularly supportive of active, collaborative learning. Student perceptions of the space were largely positive, as they reported that the flexibility of the space allowed them more control over their environment and increased interaction with their peers and their instructor.

Grizel Gonzalez-Jeuck
Graduate Programs: International Studies and Natural Resources
Advisor: Frederick W. Cubbage
Poster Number: 53

Technology transfer of agroforestry methods to small farmers: an assessment of proprietors in Chile's Los Rios Region

Agroforestry technology is an important means to achieve more sustainable use of agricultural lands. Yet, adoption of agroforestry in Chile has met with only partial success. Factors such as farmers' level of formal education, perceptions of proposed technology and the institutions that promote the technology, methods used to communicate technology, and degree of contact with extension professionals, are all thought to affect the efficacy of technology transfer and subsequent adoption of innovative agricultural technologies. We used a multi-purpose research methodology to investigate (1) factors that contribute to effective technology transfer to small farmers, (2) barriers associated with current agroforestry outreach materials (3) topics for which farmers desire information and (4) how to meaningfully deliver information to the farmers. We conducted semi-structured interviews of small farmers in Chile's Los Rios Region who had previously received extension materials on agroforestry technology. The questionnaire used a SWOT format, designed to uncover farmers' perceptions about the strengths, weaknesses, opportunities and threats associated with agroforestry. Results disclosed distrust of government institutions and the forest industry, and a perception that agroforestry and forestry are synonymous. Additionally, evaluation of current extension materials using the Flesch Reading Ease formula and the Huerta Reading Ease formula (a modified version of the Flesch Reading Ease for Spanish language) determined that the readability level was not appropriate for the majority of the farmers in the study.

Ashley Elizabeth Hobson
Graduate Program: Foreign Languages and Literatures
Advisor: Jim Michnowicz
Poster Number: 65

An acoustic analysis of /d/ elision in Peninsular Spanish

There is an abundance of previous research that suggests that intervocalic /d/ is commonly lenited in Peninsular Spanish. However, few studies use acoustic quantification to measure the degree of deletion of the consonant – instead, most rely on impressionistic categorizations of /d/ weakening. The goal of this study is to quantify the degree of /d/ weakening in Peninsular Spanish by means of acoustic analysis.

There were seven participants in the study, 2 women and 5 men. All were from Spain, ranging in ages from 23 to 51, and they came from 4 different regions. All subjects were highly educated, with at least some college education. Each speaker participated in a sociolinguistic interview to obtain speech samples. The data were then evaluated in Praat. The lowest intensity of the /d/ and the highest intensity of the following vowel were measured for each instance of intervocalic /d/, in order to calculate a ratio of /d/ weakening. Other linguistic factors coded include: preceding vowel, following vowel, tonicity, position-in-

word, part of speech, and type of participle. The intensity difference and intensity ratio were analyzed in R and Rbrul for significance. Social factor influence – including gender, region, and age group – was analyzed separately. Preliminary results suggest that intervocalic /d/ is more vowel-like in most cases. In the figure above, an intensity ratio value closer to 1.0 approximates a more open, vowel-like [d], while a value closer to 0.0 approximates a more consonant-like pronunciation. The 2 linguistic factors that showed significance in predicting the intensity of /d/ were preceding vowel (p=2.64e-06) and position-in-word (p=0.044). Speaker *O* had a less vowel-like production of /d/ than the other speakers, and this is attributed it to the fact that she has been living in the United States for over 25 years. Further results and conclusions will be discussed.

Laura Ingerham
Graduate Program: Technical Communication
Advisor: Stan Dicks
Poster Number: 72

Interactivity in the Online Learning Environment: A Study of Users of the North Carolina Virtual Public School

Recent studies of online learning environments reveal the importance of interaction within the virtual environment. Abrami et al. (2011) identify and study three types of student interactions: student-content, student-teacher, and student-student. This research builds on Abrami's classification of interactions as it explores the application of communication theory in the study of online learning, and it builds on the existing knowledge about interaction in online learning by adding data obtained through ethnographic study to the bank of survey data already extant. Observations of users of the North Carolina Virtual Public Schools environment reveal that while most of the students observed tend to interact primarily with the course content and many also engage in interaction with the face-to-face teacher, all engage in a significant amount of idle time, and many interact with other web sites either simultaneously or alternately with NCVPS. These observations serve as the basis of questions for further study of the efficacy of online learning for secondary students, especially credit recovery students, and recommends that steps be taken to maximize opportunities for online teacher-student interaction.

Elizabeth A. Johnson-Young
Graduate Program: Communication, Rhetoric and Digital Media
Advisor: Melissa Johnson
Poster Number: 75

What do pregnant women have to compare themselves?: Exploring visuals of pregnancy in online media content

This research project investigates depictions of pregnancy in medical, pregnancy/parenting, and entertainment Web sites. Little has been researched about the connections between media use and health intentions and behaviors during pregnancy. This project begins to fill the gap in the literature by conducting a quantitative content analysis of the visual information women are likely to come across during pregnancy. This is a first step in effects research to provide an understanding of *what* is being communicated through these media.

Drawing on body image research and social comparison theory, five research questions were developed. These included: (1) What are the most common physical features of pregnant women in the Web sites?; (2) How are most images portrayed on the Web page?; (3) How do the types of sites (Medical/Health, Parenting/Pregnancy, Entertainment) differ in their depictions of pregnancy?; (4) How do the images on the Web sites compare to real world physical expectations of and recommendations for pregnancy?; and (5) Which type of site, if any, adheres most closely to the real world characteristics of pregnancy?

A sample from each type of Web site was collected for a total of $N = 156$ images of pregnancy. Images were coded for demographic characteristics (i.e. race, marital status, celebrity), body characteristics (body size, skin clarity, hair, stretch marks, and linea negra), and general dispositions (facial expressions, environment, and clothing style). Results indicate several common characteristics among all types of sites. These include small body sizes, clear skin, the absence of stretch marks or linea negra, and long hair. Further, images generally depicted women who were White and did not work. Differences between sites and celebrities in body size, skin clarity, and other characteristics are discussed, as well as differences between real world expectations/recommendations and the content on the Web sites.

Katherine M. Ngaruiya, Anne-Lise Knox Velez, and Richard M. Clerkin
Graduate Program: Public Administration
Advisor: Richard M. Clerkin
Poster Number: 85

Testing Public Service and Volunteer Motivations in Nonprofit Volunteers

In the United States the work of the "public sector" is accomplished by organizations in the government, nonprofit and for-profit sectors. As such, the public sector is made up of a broad base of organizational types and it is important that scholars continue to develop a PSM instrument that can be reliably used in a variety of organizational contexts.

Despite a scholarly understanding of PSM as the motivation to perform "public, community, and social service" (Brewer & Selden, 1998), few scholars have focused on testing the validity of the PSM model among nonprofit volunteers. We believe this presents a gap in the PSM literature centered on whether a generic PSM instrument can effectively capture an individual's motivations to contribute to the public good regardless of their organizational context and employment status. Volunteering efforts defined as "unpaid helping activities" (Clary & Snyder, 1999) have largely been measured using Clary and Snyder's (1998) Volunteer Functions Inventory (VFI) which captures different facets of volunteer motivation. Research interconnecting these models may be useful in explaining the connection between how diverse service motivations relate to volunteer attitudes and behaviors.

For this study, nonprofit volunteers across 3 states and 2 regions were surveyed using a Qualtrics online survey. The first research question we address is: *Is the new PSM measurement model psychometrically valid for nonprofit volunteers?* Confirmatory factor analysis was used to determine the fit between the data collected from the volunteers and the PSM model proposed by Kim et al. (2012); after refinement, the model was found to have an acceptable exploratory fit. Additional research questions were constructed to test for factors that might explain volunteer retention and overall contentment with their volunteer service. These questions were addressed using logistic regression. We found that PSM values shape volunteers' decisions to initiate, maintain or terminate their involvement with organizations but that value congruencies (person-organization fit) represented in our model by VFI, contribute to overall satisfaction with their work experience. While neither PSM nor VFI directly explain intent to revolunteer, some PSM dimensions seem to be related to revolunteering.

Xandra Lauch
Graduate Program: Anthropology
Advisor: Ann Ross
Poster Number: 88

Does Height Matter? The Impact of Stature Groups on Height Estimation Technique

Height estimation is a critical part of identifying human skeletal remains. Typically, estimating height is done by using what is known as the mathematical method. This is when the length of a skeletal element is placed into a previously devised equation that predicts height. These equations are population specific and have been shown to over-estimate shorter individuals and under-estimate taller individuals. This study seeks to test the validity of an alternative method that uses stature group specific equations to eliminate this over- and under-estimation. The sample consisted of the long bone lengths and living stature of 123 American males of European descent divided into three groups Short, Average and Tall. ANOVA showed that stature group did have a significant effect on the model. Regression equations for predicting height were created for each stature group. Discriminant function analysis was used to develop a technique for long bone lengths to be placed into their respective stature groups. The height estimates from the stature group equations were compared to estimates given by a single equation and determined to be statistically more accurate. However, significant equations were not able to be developed for those in the Short category so this may have skewed the results to be more significant. Long bone lengths have been shown to be susceptible to poor environment including poor nutrition and a high disease load. This can prevent them from developing to their full potential resulting in a shorter individual. This susceptibility may have caused the lack of significance in the regression equations. In addition, discriminant function analysis failed to accurately place long bone lengths into their respective stature categories making this method difficult to use in practical application.

Jessica Loehman, Anna-Marie Massoglia, Stephanie Barnett, Drew Rothenberg, and Mary Haskett
Graduate Program: Psychology
Advisor: Mary Haskett
Poster Number: 97

Stability of Relational Schemas of Physically Maltreated Children

According to attachment theory, children's schemas about interpersonal relationships develop, in part, through their early relationships with parents. Children's knowledge regarding relationship characteristics and functions is accumulated into an "internal working model" composed of relational schemas comprised of representations of self and caregiver. These schemas

set the stage for the quality of children's subsequent relationships and are related to their social-emotional adjustment. The relationship schemas of physically abused children tend to be negative and conflictual, which can be attributed to their relationship with their parents often being characterized by high conflict, hostility, and lack of trust. The purpose of this study was to examine the association between the schemas of physically abused children and their social-emotional functioning. A second purpose was to examine whether physically abused children's schemas change from kindergarten to first grade. Participants were 66 physically abused children. To measure schemas, children completed a narrative story stem measure which required them to use dolls to complete a story involving family interactions. Scores were generated for the degree to which children's stories were characterized by conflictual themes, moral-affiliative themes, and positive and negative representations of self and parent. Children's adjustment in school was measured by teachers' reports on the Child Behavior Checklist- Teacher Report Form and Student-Teacher Relationship Scale and by observations of negative behavior on the playground. Results revealed that conflictual themes in the relational schemas of physically maltreated children were predictive of higher levels of maladjusted social-emotional behaviors. A significant relation was found between negative parent representations and negative social-emotional behaviors and between positive parent representations and positive social-emotional behaviors. A significant relation between positive self-representations and positive social-emotional behaviors also was found. In regards to the stability of relational schemas, results indicated that these schemas were stable over time for approximately half of the sample.

Michelle Halla Lore
Graduate Program: Sociology
Advisor: Kim Ebert
Poster Number: 98

The 2006 Immigration Reform Protests: Procedural Frustration, Social Movements, and Immigrant Incorporation

Political trust – the belief in a government's effectiveness – is crucial to a properly functioning democracy. Individuals' perceptions that they are holding the government accountable through participation in the political system, such as voting or campaigning can facilitate a sense of trust in the government. Conversely, if they feel like governmental procedures or outcomes are unfair, individuals can experience procedural frustration and develop a sense of cynicism or distrust towards the government. How does political trust change following a social movement – a form of political activity generally thought of as unconventional, contentious, and rising out of cynicism? I use the *Latino National Survey* and logistic regression to study how Latinos' group-level political trust changed after the 2006 immigration reform protests. Additionally, I explore how the communication context, specifically the use of Spanish-language media, is associated with feelings of political trust. The results show that individuals interviewed after the initial protest had decreased odds of reporting trust in the government, while those interviewed at least two months later, after widespread protests, had higher odds of reporting political trust. The relationship, however, is contingent on the use of Spanish-language news media, an important source of information and a rallying force during this time period. Overall, this research shows that protest can address issues of procedural frustration, similar to conventional methods of political participation. By revealing the effects of a successful social movement, it also contributes to theories of social movements – specifically social identity, relative deprivation, and resource mobilization theories. Additionally, this study has important implications for the political incorporation and assimilation of immigrants to America.

Paul Max Love III
Graduate Program: International Studies
Advisor: Mark T. Nance
Poster Number: 99

European Union and NATO Security Cooperation after the Cold War: A Security Community

There is increasing cooperation between the European Union and the North Atlantic Treaty Organization (NATO) despite the lack of a nuclear threat that defined the Cold War era. The nebulous nature of security concerns in the post-Cold War era of human security and destabilizing terrorism creates a void for understanding threat in terms of a common enemy. The EU has attempted to exercise its influence in security affairs autonomously which has created tensions with the U.S. dominated North Atlantic Treaty Organization (NATO) security partner. This autonomous action has been limited to small and independent missions with a focus on peacekeeping and nation building. The EU's action can be seen as complementary rather than in competition with NATO. Structural realism would suggest that the lack of the Soviet threat in the post-Cold War would suggest a lack of cooperation in the security arena across the Atlantic. A constructivist analysis provides insight into this puzzle of continued and increased cooperation by considering the function of what Karl Deustch terms security communities. The maturation of the Western democratic security community was largely driven by the real threat of the Soviet Union, but it helped to establish an enduring group of likeminded actors.

Emily McGuire
Graduate Program: Communication Studies
Advisor: Matthew May
Poster Number: 105

Transnational Perspectives on Reproduction and Production

Globalization and neoliberal ideas of modernity have influenced UN policies that position Third World women's fertility as a hindrance to economic progress. In order for women to participate in their nationalist duty to add to the GDP of their country, they must produce, not reproduce. These ideas are also reflected in US mainstream feminist discourse, organizing access to contraceptives as a way to participate in corporate capitalist progress, and ignoring US programs of eugenics for indigenous women and other women of color. By examining three case studies of Egypt, Thailand, Argentina, through a critical lens, we can examine the way in which the dispersal of reproductive technologies and population control discourses (under the guise of reproductive rights) have shaped the productive duty of women's bodies as one that must contribute to the economic development of their nation.

Kate McKinney Maddalena
Graduate Program: Communication, Rhetoric and Digital Media
Advisor: William Kinsella
Poster Number: 107

The toys of organic chemistry: Material manipulatives and inductive reasoning

Chemical visualizations and models are special kinds of situated, inductive arguments. In this paper, I examine several historical case studies—an archive of images from museums, special collections, and popular magazines—as examples of emergent practices of physical modeling as theoretical play which became the basis for molecular biology and structural chemistry. Specifically, I trace a legacy of visualization tools that starts with Archibald Scott Cooper and Friedrich Kekulé in the late 1800s, crystallizes as material manipulatives in Kekulé's student Jacobus Henricus Van't Hoff and his folded paper "toys," is legitimized in the California lab of Linus Pauling, and is glorified in the popular imaginary with James Watson and Francis Crick's model of DNA. My tracing then follows several threads into contemporary modeling practices. I ultimately argue that modeling play, originally outside of the boundary of deductive, positivist science, is now an accepted mode of inductive reasoning in these related chemical fields.

Lisa McManus
Graduate Program: Sociology
Advisor: Kim Ebert
Poster Number: 109

Individualized Explanations for Structurally Based Problems: A Qualitative Analysis of Black Women Rap and Hip-Hop Artists' Albums

Rap is a particularly important medium to study because past research has found that listening to rap can influence individuals' perceptions of blacks in the United State. In this paper, I seek to examine how black women rap and hip hop artist explain social experiences, as this medium allows for a marginalized population to express publicly concerns and critiques of society (Rose 1994). Because rap has become an increasingly commercialized enterprise, I argue that corporations contribute to the kinds of messages that become broadly disseminated through rap songs, which in turn may be perceived as one tool in shaping prejudice. I conducted a qualitative analysis of a stratified random sample of 90 tracks from albums of black women rap and hip-hop artists that went platinum between the years 1992 and 2008. This analysis revealed that songs focused on the following topics: talent and success, sexual conquests, independence from men and men's financial dependence, distrust, intimate partner abuse, violence and nihilism. Findings reveal that artists frame success as meritocratic, intimate partner relationships as unnecessary or undesirable and street culture as dysfunctional. Framing of the topics in this way reaffirms notions of colorblind racism by presenting social problems as culturally- or individually-driven rather than structurally-based. Because of the presence of rap and hip-hop music in the mainstream media, these findings suggest that rap and hip-hop can help shape prejudice because they reify a dominant ideology which promotes individual explanations for structurally-based problems.

Britta McMullan
Graduate Program: Anthropology
Advisor: Ann H. Ross
Poster Number: 110

A Comparative Study of Metric Sexing Software Using the Pelvis

Sex estimation from the skeleton is of great importance in forensic and bioarchaeological settings. Recently, two computer software programs have emerged that can estimate sex from the os coxa portion of the pelvis using metric measurements. Considering overall size and robustness of the sample os coxae, a pilot study was performed analyzing 35 Bosnian individuals of both sexes to establish the accuracy and sexing ability of FORDISC 3.1, developed by Jantz and Ousley (2005). With a posterior probability of .95 constituting a success, FORDISC was able to sex only 45.71% of the sample, with 95.00% accurate estimation. In the subsequent full study, measurements from 64 male and female individuals of both known and unknown sex were analyzed using FORDISC and DSP (Diagnose Sexuelle Probabiliste), developed by Murail, et al. (2005). Individuals of unknown sex were morphoscopically sexed using the Phenice (1969) method prior to measurements being taken. Per the requirements of the DSP software, the following assessments were performed: all 10 variables, the "best" eight, the "best" four, and the "worst" four. Considering posterior probability of .95 a success, FORDISC was able to assign sex for 23.44% of the sample, with only 73.33% of those estimations found to be accurate. When all 10 measurements were analyzed using DSP, 85.94% were able to be sexed (posterior probability ≥ .95), with 98.18% of determinations found to be accurate. Of the three remaining combinations of DSP variable measurements, the "best" four were found to provide the most successful results, with an 84.38% sexing ability rate and a 100% accuracy rate. Due to higher sexing ability and accuracy rates obtained from DSP and its versatility in employable measurements, this software program may offer researchers better sex estimation from os coxae than FORDISC 3.1, especially if the remains are fragmentary.

L. Michael Mortimer
Graduate Program: History
Advisor: Craig Thompson Friend
Poster Number: 118

Excavating Independence

When Thomas Jefferson denounced the Native American nations residing west of the thirteen colonies as "Merciless Indian Savages" in the Declaration of Independence, his founding document mythologized North America's indigenous people as ruthless henchmen of a tyrannical British king. This was a galvanizing yet not altogether accurate indictment. In 1776, the new United States was at war with Great Britain, but remained at peace with the Indian nations beyond its western borders. So powerful and enduring was Jefferson's narrative that it fully eclipsed earlier alternative visions of American independence. Like the colonists, Native American nations had their own grievances with the British Crown. North America erupted in concurrent revolutions in 1775 as colonial and indigenous nations sought to dismantle British North America, replacing the monolithic empire with a plurality of sovereign nations both indigenous and European in origin. Within weeks of convening in 1775, the Second Continental Congress dispatched envoys to the northern frontier to negotiate treaties of neutrality. In the 1775 treaty councils at Albany and Fort Pitt, Native American and local colonial leaders affirmed Congress as an independent, sovereign body with legitimate diplomatic powers. Fear of a British led Indian war compelled the colonies to cede the power of Indian diplomacy to the embryonic central government; it is a power the federal government has never relinquished. The United States detached itself from Great Britain along western cultural fault lines and my research recovers this liminal world of missionaries, fur traders, clan matrons, and indigenous chiefs who met the eastern elites, the so-called "Founding Fathers," as equals in articulating national sovereignty. The 1775 treaties of neutrality contained the American Revolution – both the war and the political revolution – to the thirteen colonies and temporarily transformed an endemically violent frontier into a neutral space where sovereign American nations were free to pursue their own revolutionary projects.

Emily Nwakpuda and Susan Mwarabu
Graduate Program: Public Administration
Advisor: RaJade M. Berry-James
Poster Number: 124

Risk factors and barriers to shelter in homeless populations

Homelessness is a condition where individuals find themselves on the streets without shelter or are insecure about their ability to maintain consistent adequate shelter. Studies have concluded that lack of affordable housing is a barrier to obtaining shelter. We assisted a nonprofit organization that provides homeless individuals and families with referral services to combat homelessness. Our role was to provide program evaluation services that would describe factors leading to homelessness in the particular population served by the nonprofit. Secondary data analysis was used in the study and was provided by the nonprofit.

To explore causality, we investigated: 1) risk factors associated with homelessness and; 2) barriers to finding shelter. The results of our study will be provided to the nonprofit to help match key services and improve shelter referrals for its client population.

Rachel Phillips
Graduate Program: English
Advisor: John Morillo
Poster Number: 141

The Canonization of Young Adult Literature: Lessons from William Wordsworth in "Preface to *Lyrical Ballads*"

For the second edition of *Lyrical Ballads* in 1802, William Wordsworth wrote a preface which serves as a manifesto wherein he defines and delineates his poetry from what had come before. Wordsworth challenged preconceptions of acceptable art forms in his day and managed to successfully situate himself and other Romantics within the canon of literary tradition. Now, almost two hundred years later, the goals of Wordsworth's "Preface" resonate with the emergent field of young adult literature which similarly seeks to offer a new genre worthy of literary considerations. After surveying the field of young adult literature and its current challenges, I turn to Wordsworth's "Preface" and examine the rhetorical defenses he uses in order to establish his poetry as worthy of literary consideration. Since Wordsworth successfully achieved a place of canonical distinction, I evaluate how his revolutionary ideas of literary experimentation, taste, and universality persist in contemporary young adult literature. This study also investigates how the goals and challenges of twenty-first century young adult literature differ from the principles outlined in "The Preface." The application of Wordsworth's ideologies to the field of young adult literature reveals that the emergent genre does not solely comprise cheap popular novels but actually includes texts worthy of literary discourse. The study also suggests a shift in the taste of literary fiction that resembles the ideals of Wordsworth and British Romanticism. By connecting patterns in young adult fiction with similar principles in an established figure of the canon, this analysis provides a sound legitimization for critical evaluations of young adult literature and encourages scholarly discussions of young adult fiction as texts worthy of analysis.

Amy Pippi
Graduate Program: English
Advisor: Agnes Bolonyai
Poster Number: 144

Informal Research Talk: Investigating How Non-Native English Speakers Negotiate Academic and Expert Identity Discursively

A considerable amount of investigation has focused on academic writing. Although there has been a recent resurgence of interest in spoken academic discourse, much of this work has focused on linguistic and rhetorical features of particular spoken genres. While this body of work has a valid application in English as a Second Language (ESL) studies, there is a need to move beyond the cataloguing of specific features of academic discourse. Specifically, in order for Non-native Speakers (NNS) to successfully present themselves as competent members of their discourse communities, it is necessary that we understand how NNSs negotiate their professional identities through discourse. This study aims to investigate the way that NNS graduate students negotiate their professional identities through informal research talk with their colleagues. Initial research questions include: How do NNSs view their identity within their academic discourse communities? How are agency and expertise negotiated discursively and is there any loss of agency in the Second language (L2)? How do NNS graduate students position themselves in relation to other NNS and NS colleagues? How are NNS graduate students socialized into their academic discourse communities? The data collection will consist of the application of questionnaires and semi-structured group interviews for NNS and NS students in the same field of study, as well as the audio-recording of informal research talk among participants. The data will be analyzed using a narrative analysis and positioning theory framework. Preliminary findings show that informal research talk is a valuable resource for NNS graduate students and some of its social functions include negotiating expectations for the course of study as well as understanding what is expected of the individual student. Informal research talk also appears to be an important site for negotiating academic identity, including the co-construction of expert identity.

Mary Raudez
Graduate Program: Foreign Languages and Literatures
Advisor: Jim Micnowicz
Poster Number: 146

Vowel Systems of Heritage and Native Speakers of Spanish in North Carolina

There is considerable work concerning variation of vowel systems in English in contact with Spanish, but relatively little research has been done concerning the variation of vowel systems in Spanish in contact with English. Spanish is traditionally thought to have a stable, symmetrical vowel system in which vowel quality and duration are relatively unaffected by lexical stress. Recent finding suggest more stress-induced variation across varieties of Spanish than previously believed. Research into bilingual vowel

systems in particular has shown significant centralization of unstressed vowels. The primary goals of this research are to further describe the Spanish vowel system and, more specifically, to compare the vowel systems of heritage speakers of Spanish to native speakers of Spanish in order to better understand potential similarities and differences among the vowel systems. Preliminary results suggest an asymetrical distribution of vowels in the vowel space, contrary to the traditional vowel triangle. Of particular interest, the back vowels /o/ and /u/ exhibit a smaller overall difference in height than the front vowels, and a much smaller difference in backness than the front vowels. In fact, for some speakers, there was no significant difference in height of /o/ and /u/. Analyses reveal that tonic vowels appear to exhibit a more peripheral distribution while atonic vowels appear to be more centralized. There is also evidence of a significant effect of language type (heritage vs. native) on the distribution of vowels. Language type only showed a significant effect for the vowel /e/ demonstrating that native speakers favored a more dispersed distribution for /e/ while heritage speakers favored a more centralized distribution. Additional analyses will include the addition of more participants which will hopefully lead to the establishment of clear patterns of differences (or lack of differences) between the heritage and native speaker groups.

Megan L. Risdal
Graduate Program: English
Advisor: Erik Thomas
Poster Number: 148

There's More than One Way to Raise a BAT: Comparing African American and Southern European American Vowel Dynamics

Thomas (2002:172) notes that while acoustic vowel analysis has thrived since Labov *et al*. (1972), its attention been largely directed to comparing a limited number of F1/F2 values. Disregarding impressionistic analysis, little empirical work has demonstrated the importance of moving beyond midpoint F1/F2 measurements in vowel analysis. In one recent counterexample, the North Carolina low front unrounded vowel (BAT) showed a different trajectory (in vector length and shape in the F1/F2 plane) compared to Ohio and Wisconsin BAT (Fox & Jacewicz 2009). The present study contributes to a small but growing body of literature emphasizing detailed empirical analysis of vowel dynamics.

Data consist of interviews from two Raleigh, North Carolina communities made up of nine young-adult African Americans (AA) and twelve older European Americans (EA). The goal of the present study is to use fine-grained statistical analysis of vowel trajectories to examine differences between these two varieties of American English which show superficial alignment in BAT-raising. This study provides an opportunity to look for differences in vowel dynamics which may serve as perceptual cues used for ethnic identification that are not among those typically studied (e.g., Thomas, *et al*. 2010).

Using Praat (Boersma 2001), twenty-one F1/F2 measurements were extracted at equidistant time points for each vowel. Overall, 744 BAT tokens were obtained. A smoothing spline ANOVA paired with Bayesian Confidence Intervals was used to assess significant differences between vowel trajectories of the two speaker groups. This technique was adopted from laboratory phonology studies which measure differences in tongue curvature (e.g., Davidson 2006; Mielke, *et al*. 2011). Accounting for phonetic context, AA speakers show extreme BAT-raising before voiceless fricatives and display greater monophthongization overall than EA speakers. These initial findings begin to support the notion that fine-grained analysis is useful in exploring nuanced, but potentially perceptually salient, differences in vowel dynamics.

Lauren Kristine Sloan
Graduate Program: International Studies
Advisor: James Kiwanuka-Tondo
Poster Number: 162

Mixing, Selecting, Doing: The Intersection of Structures and Agency for Women in Ghana

With the advent of gendered approaches to community development throughout the developing world, institutional and civil society interventions have urged women to combine their communal resources to exert greater control over their lives. This research uses a feminist approach to the study of rural women's influence in an African sociocultural system, measured throughout the lifespan. Data from participant observation and semi-structured focus group discussions and interviews in the semi-rural village of Agona, Ghana are utilized to evaluate the effectiveness of a Ghanaian community development intervention centered on widowed women and agriculture. The intervention was found to have actually decreased both communal and individual levels of influence for this group of women. It also introduced new power dynamics into the social structure of this community which may inhibit their abilities in the future. Agona is an example of the study of gendered human agency through the intersection of civil society, national policy, and a rural community, and how women suffer disproportionately when interventions are not aligned with their self-reported needs.

John Sprufera
Graduate Program: Psychology
Advisor: Anne Collins McLaughlin
Poster Number: 163

Human Factors Accident Analysis: The Steep Slope to Rock Climbing Safety

Accident analysis, the process of examining the environmental and mental factors leading up to and causing human error, has been commonly performed in structured domains, such as aviation, but rarely in unstructured domains, such as adventure sports. Consequently, accident analysis systems often classify accidents in terms of non-adherence to regulations, problems in the organizational climate, and deviation from a codified safety plan. This limitation in current analysis systems restricts the types of domains that may be classified, meaning that it can be difficult to establish typical accident antecedents for unstructured domains. We reviewed a currently accepted conceptual model, Reason's Swiss Cheese Model (Reason, 1995) and a classification system called the Human Factors Analysis and Classification System (HFACS) (Wiegmann & Shappell, 2003) that was designed for structured domains and adapted HFACS for unregulated adventure sports, specifically rock climbing. The benefits of HFACS were that it allowed analysis of patterns of accidents rather than focusing on 'fad' accidents one might see in the media and avoids assigning blame on an individual. Rock climbing was chosen as an example domain due to the extensive narrative records available regarding accidents. To revise HFACS, we surveyed expert rock climbers on their perceived roles of responsibility and group dynamics. The survey results led to the removal of organizational categories and restructuring of supervisory roles to include team dynamics. Additionally, we revisited the Swiss Cheese Model and adapted the model's layers to match the domain studied. The process of creating the adapted analysis system as well as the coding methods involved apply to multiple unregulated sports or domains that contain the potential for injury and fatality, such as spelunking, diving, and skiing.

Brittany L. Stamey
Graduate Program: Public History
Advisor: Craig Friend
Poster Number: 165

"Deliver Our Country from Dangers": Transcribing the Civil War Diary of Caroline Virginia Taliaferro Miller

Archives across the country hold handwritten diaries, correspondence, and receipts that have not yet been transcribed. For women's history especially, transcribing personal stories like the diary of Caroline Virginia Taliaferro Miller, a woman from a prominent southern family who kept a diary during the Civil War, are important to shedding light on personal histories. In the case of Caroline Virginia Taliaferro Miller, her family's extensive papers were held at one repository while her own diary was held at another. While transcribing her diary, it became apparent that not only was the information in the diary's finding aid inaccurate, the diary had probably been redacted by Caroline Virginia and one of her daughters while Caroline Virginia was sick shortly before her death. For instance, dates were slightly jumbled and events were commented on in entries before they happened historically. She also directed many entries toward her daughters, one of whom was helping her mother edit the journal. After transcribing the first volume of the diary, which included a log of the episodes of sickness Caroline Virginia was having near the end of her life, the county names and events she stressed made it clear that the diary was from South Carolina, rather than Georgia as the archive originally thought. This diary adds to the body of knowledge about confederate women during and after the Civil War. It also adds to the knowledge about this particular family whose numerous papers, spread across multiple archives, are largely waiting to be transcribed. In addition, this project makes clear the importance of transcribing papers stored in archives both to make them more readily available for researchers and to ensure that they are stored under the correct documentation.

Krisa Tailor
Graduate Program: Public Administration
Advisor: Jerrell Coggburn
Poster Number: 174

An Analysis of the Affordable Care Act, it's Implications to Service and Payment Delivery, and the Opportunities Presented for Data Analytics in achieving Quality Improvements and Cost Reductions in State Government Healthcare Systems

Since the passage of the Patient Protection and Affordable Care Act (PPACA) in 2010, healthcare reform has been a top priority for state governments. Furthermore, the significant growth of healthcare expenditures has demanded that states implement new service and payment models that will help improve health outcomes and contain costs. With the transition to new delivery models, healthcare payers and providers alike will rely on meaningful data to meet and exceed the necessary goals for quality and cost. This study explores state government initiatives surrounding the PPACA, and takes a look at how data analytics can help make these initiatives more successful by providing insight into costs, quality, and outcomes. SAS analytical software was used to analyze Medicaid claims data to identify hotspots, high-risk/high-cost patients, cost drivers, and other hidden trends and

patterns. The study also explores the merging of claims data and clinical data to obtain holistic views of provider-patient interactions. Lastly, forecasting methods were utilized to predict costly episodes of care, at-risk patients, and population health. These methods are discussed in the context of reform initiatives such as all-payer claims databases (APCD), health information exchanges (HIE), value-based payment models, and others. Analysis has shown that segmentation, analysis, and forecasting of healthcare data can help states to prevent future costs, prevent negative episodes of care, and better focus their intervention and programmatic efforts. These efforts can help states to significantly improve the health of their population.

Sarah E. Timberlake
Graduate Program: Communication
Advisor: David M. Berube
Poster Number: 177

Social Exploitation Theory and the Children's Healthcare of Atlanta: Exploitation and negative emotions to influence change

The concept of exploitation often conjures up images or children working tirelessly in grimy sweatshops where employees work underpaid and in dangerous situations. However, exploitation occurs on a much more personal level and can be used to motivate people; at least in the short term. There are several theories and perspectives such as affect heuristics, extended parallel process model (EPPM), and fear motivators that help explain the emotional phenomenon associated with strong negative visual and textual messages. There are nevertheless some communication campaigns that cannot be explained using these theories because the messages are not just designed to create an emotional response, but arguably exploit the audience and individuals. Social Exploitation Theory is proposed and used to understand the reaction the Children's Healthcare of Atlanta's communication campaign associated with the Strong4Life program. To further explore this theory and its application, a study was conducted to understand people's perceptions of a situation, present them with images associated with the campaign and then assess their emotional and motivational response to the images. A survey of participants (n=114) revealed that there were negative emotional responses to the campaign and that the participants felt the images were mildly exploitive. Furthermore, in accordance with Social Exploitation Theory, participants were motivated to alter their behavior in accordance with the campaign's message.

Ginny Tyson Inman
Graduate Program: Communication
Advisor: Melissa Johnson
Poster Number: 180

British Petroleum's Crisis Communication: Case Study of the Deepwater Horizon Oil Spill

This case study of the Deepwater Horizon oil spill concentrates on the crisis communication strategies and framing tactics utilized by the corporation, British Petroleum, compared to the local media coverage of Houston, TX and Florida Panhandle newspapers from the date of the rig explosion to the date the spill was capped. These variables are analyzed quantitatively based on Benoit's Image Restoration Strategies and framing theory with the objective to discover a correlation between the persuasive, crisis communication of the press releases from the corporation to the newspaper articles. Gathering descriptive statistics and comparative data, the findings will bring new light to previously undiscovered research. Previous BP media studies have focused on elite newspapers, whose national and international audiences include stockholders, economists, commodities traders, business leaders, and the like, but who are geographically removed from the site of the oil spill's destruction. Focusing on this demographic is an innovative way to investigate the international event.

Crystal D. Unger
Graduate Program: Anthropology
Advisor: James Wallace
Poster Number: 181

Making Resettlement Work: Informal Networks of Newly Arrived Refugees and Service Providers

Refugees who enter the US as legal permanent residents are required to meet US government milestones towards self-sufficiency within three months of their arrival. Finding rapid employment is the primary goal, while other objectives such as English proficiency, education, family reunification and long-term housing are secondary. In practice the process of refugee resettlement is at odds with these US mandates, due to the fiscal and temporal limitations the US government places on refugee assistance. Thus, both the resettlement agencies and refugees must amend government aid in order to manage the reality of the resettlement process. The activation of a complex set of networks enables the agencies and refugees to bridge government restrictions while adhering to basic policy mandates. Fieldwork was conducted in the spring and summer of 2012 in the Triangle and Piedmont areas of North Carolina. I conducted formal interviews with a targeted, stratified sample of refugee men and women, as well as with resettlement agency staff members. Participant observation techniques included attendance

at employment workshops; ESL classes; housing set-ups and visitations to agencies and refugee households. This study suggests that the effectiveness of newly arrived refugees' resettlement and self-sufficiency is directly linked to both the refugees' and the agencies' maintenance of informal networks among former refugees and alternative social service providers, rather than a strict adherence to formal policy procedures.

Jasmin H. Volkel
Graduate Program: Social Work
Advisor: Joan Pennell
Poster Number: 186

In their Own Words: Fostering Youth Educational Stability (YES!)

Nationwide, youth in foster care often experience negative economic, social, and educational outcomes. Youth from foster care are overrepresented in the lowest income brackets, homeless shelters, prisons, mental institutions, and as public assistance recipients. North Carolina youth in foster care experience similarly disheartening outcomes. Cumberland County Department of Social Services, public school system, mental health system, juvenile court system, and the Center for Family and Community Engagement (CFFACE) collaborated to assess the opportunities and obstacles related to the youths' educational stability and success. The participatory research project involved youth in foster care providing input to direct the project objectives as well as potential outputs. From March to May of 2012, focus group interviews with youth in foster care provided direct feedback on perceived obstacles and opportunities for educational success. The youths' responses were coded and analyzed using Atlas.ti and then ranked by a Youth Advisory Council. In late 2012, Cumberland County youth in foster care (n= 40) completed an online mixed methods survey designed to further explore the educational needs and resources. Qualitative and quantitative analyses reveal that youth often feel marginalized and stigmatized by peers and adults in their lives. Combined with the youths' frequent housing and school relocations these problems contribute to their low academic performance, poor interpersonal skills, and negative self-image. In addition, youth often feel isolated and restricted from engaging in extracurricular activities that might help them learn social skills or motivate them to do well in school. In general, the youth feel unprepared and unsupported for the challenges of securing a high school diploma. The findings provide important insight to guide foster care policy and practice.

Natalie A. Wright[1] and Virginia E. Pitts[2]
Graduate Programs: Industrial and Organizational Psychology, North Carolina State University[1]; Psychology, Shippensburg University[2]
Advisor: Adam W. Meade
Poster Number: 195

An Exploratory Study of Differential Item Functioning in Virtual Teams

As organizations expand globally, the use of virtual teams (VT) in the workplace has greatly increased (Martins, Gilson, & Maynard, 2004). VT are comprised of geographically-dispersed employees, who use technology to perform organizational tasks (Kirkman, Rosen, Tesluk, & Gibson, 2004). VT vary on the extent of their virtuality (Kirkman & Mathieu, 2005); some VT may have opportunities to meet face-to-face occasionally, while other VT are comprised of members who never interact outside of the virtual setting. In order for different types of VT to be compared meaningfully, scales measuring focal variables need to exhibit parameter invariance across different types of VT. However, members of different types of VT may conceptualize team processes differently, leading to differential functioning of team process items and scales. If item parameters for the items within these scales are not invariant, then differences in scores between different types of virtual teams cannot be interpreted meaningfully (Drasgow & Kanfer, 1985). Thus, the purpose of the current study was to explore the presence of measurement invariance by comparing item parameters for two types of VT. Item response theory (IRT) differential functioning (DF) analyses were used to examine item parameters for a team cooperation and communication scale across two different types of virtual teams: teams which engaged in teambuilding prior to working on their team task, and teams which did not engage in teambuilding. Results indicated that the team cooperation and communication scale demonstrated parameter invariance across both types of VT, suggesting that any differing mental representations of team processes between teambuilding VT and non-teambuilding VT did not cause significant differential functioning.

Amanda Wyant
Graduate Program: Sociology
Advisor: Sarah Bowen
Poster Number: 196

State Promotion of Labor Migration: The Relationship between Policies and Remittances

This paper aims to analyze the relationship between remittances and governmental policies. I investigate whether governmental policies in emigrants' home countries increase the amount of remittances sent back. I utilize data on dual

citizenship policy, extraterritorial voting policy, and emigrant agency presence for 30 semi-periphery countries, collected using a random-stratified sampling design. I also collected qualitative data on six case studies to demonstrate how historical, political and social differences among countries affect the amount of remittances received. Quantitatively, results of OLS regression demonstrate that a relationship between policies and remittances exists, but only for dual citizenship. My case studies demonstrate that additional factors such as political instability and national culture might be more influential in driving remitting behavior.

Matt Kelly, Christine Reaves, and Evgueni Kountikov
Graduate Program: Business Administration
Advisor: Richard Kouri
Poster Number: 80

Pharmacoeconomic Analysis of Solithromycin

There are three to five million cases of Community-Acquired Bacterial Pneumonia (CABP) per year in the U.S., resulting in over one million hospitalizations with a cost impact of $2.5B to the healthcare system. Currently, β-lactams and macrolides are used for outpatient treatment while third and fourth generation injectable cephalosporins, in combination with macrolides or fluoroquinolones, are used for moderate to severe pneumonia patients requiring inpatient treatment. Fluoroquinolones are available for intravenous as well as oral therapy; however, they cause serious adverse events (AE) and cannot be used for pediatrics.

Cempra, Inc., is developing a novel antibiotic, a first-in-class fluoroketolide called Solithromycin, for intravenous and oral therapy, which demonstrates comparable efficacy to fluoroquinolones, but has an improved safety profile in Phase II trials. The pharmacoeconomic impact of Solithromycin has been evaluated by calculating the costs of hospital stay, drugs, and serious AE associated with the current therapy options against those same costs once Solithromycin enters the market. Our pharmacoeconomic analysis suggests that once Solithromycin becomes available, $200M in hospital stay costs, $157M in drug costs, and $111M in adverse event costs will be removed from the healthcare system for inpatient treatment of CABP. Should Solithromycin use result in reduced length of hospital stay, savings of up to $1.4B may be realized. Despite reducing costs associated with AE, our analysis found that outpatients treated with Solithromycin will not result in a significant financial net impact due to the increased price of this branded drug compared to existing generics. However, Solithromycin could result in direct cost savings due to shorter duration of outpatient therapy and indirect cost savings via a reduced need for repeat visits and fewer lost work days. The introduction of Solithromycin as a treatment for CABP patients will result in significant overall reduction in treatment costs and improved patient care. [This research is sponsored by Cempra, Inc.]

Shu Li
Graduate Program: Economics
Advisor: Walter Thurman
Poster Number: 90

Transport on the Mississippi River and Spatial Corn Basis

This paper analyzes the effects of waterway transportation costs on the spatial distribution of corn prices at U.S. grain markets. Interregional trade theory predicts that in a competitive market price differences between markets are explained by transportation cost. The precise role played by transportation costs can depend on distances that grain needs to travel and also on the extent to which markets are integrated into the transportation system. The Mississippi waterway consists of an efficient barge transportation system that links the Midwest to the largest grain export market, the Gulf of Mexico. In markets with export to the Gulf, I predict that: (1) the magnitude of price differences between two markets increases with an exogenous increase in barge rates; (2) the response of prices to barge rate changes for markets on the river is greater the farther north, or upstream, the market is; (3) the magnitude of the barge-rate effect on prices declines with distance from the market to the river; (4) the barge-rate effect is less pronounced in markets that are less integrated into the river system. I develop theory-based predictions along these lines. I test the predictions and measure the associated effects with a mixture of parametric and nonparametric methods applied to a rich panel data set of corn prices from over one thousand locations.

Zhen Wang
Graduate Program: Economics
Advisor: Tomislav Vukina
Poster Number: 191

Welfare Impact of Truncated Tournament Contracts: A Short-run Analysis in Broiler Production Industry

Piece-rate tournament compensation scheme, with a variable piece rate determined as the difference between one's performance and the group average, is frequently used in settling broiler production contracts between growers and integrator

companies. Despite its favorable theoretical properties in reducing moral hazard, such payment scheme cause strong dissatisfaction among broiler growers due to the difficulties in predicting one's payment. As an attempt to regulate broiler contracts and increase welfare being of growers, GIPSA proposed a truncated tournament compensation in 2010 under which the possibility of negative penalty is eliminated. The main purpose of this article is to evaluate the short-run welfare impacts of switching from a standard piece-rate tournament compensation scheme to truncated tournament policy from both theoretical and empirical perspectives. Under the assumption of risk-neutral growers with heterogeneous abilities, we show theoretically that all growers would exert less effort after the switch in compensation scheme and the magnitude of reduction is smaller for more capable growers. The theory also predicts an increase in grower's welfare driven by higher expected payment with lower effort and a decrease in poultry dealer's profit. An empirical estimation is conducted using contract settlement data for five broiler production contracts and the results strongly support our theoretical prediction. Grower's optimal efforts are expected to decrease by 50% on average under the new policy with only 17% to 31% drop among high ability growers comparing to 68% to 83% decrease for low ability types. Our empirical analysis also shows that grower's total payments are anticipated to increase by $1,000 on average while the integrators are likely to experience losses of more than $2,000 from each grower. The welfare gains for the growers are smaller than the welfare loss of the integrator, rendering the truncated tournament contract less favorable from the economic efficiency perspective.

Carlos E. Aizpurua
Graduate Program: Forest Biomaterial
Advisors: Stephen S. Kelley and Hasan Jameel
Poster Number: 1

Simulation of Ethanol Production Processes Based on Steam Explosion-Solvent Extraction Wood

There is increasing interest in bioethanol and biomaterial production from sustainable wood based feedstocks. Ethanol production from lignocellulosic biomass involves several steps including pretreatment which is considered critical to produce a reactive substrate for enzyme hydrolysis. A factorial experimental design including steam explosion temperature and time was studied to determine its impact on residual solid composition for two wood types. Chemical analyses were performed on raw and treated material in order to determine the component yield loss under various steam explosion conditions. The steam exploded residues were extracted with organic solvents to remove soluble extractives. The residual insoluble materials were subjected to enzymatic hydrolysis. The results show that as the steam explosion temperature and time increases, the amount of insoluble carbohydrates after explosion decrease, and there is a corresponding increase in the amount of organic soluble materials. Furfural and 5-hydroxymethyl furfural are the predominant degradation products formed during steam explosion. This work also showed that the hardwood showed greater extents of carbohydrate solubilization during steam explosion compared to softwood. The material balance data collected around steam explosion and solvent extraction was used to populate a preliminary process model developed in Aspen Plus. The integrated facility operating information generated in Aspen Plus will be used to perform economic assessments to understand the relationships between steam explosion conditions, solvent extraction and product production.

Carlos A. Carrillo
Graduate Program: Forest Biomaterials
Advisors: Orlando Rojas and Daniel Saloni
Poster Number: 23

Tuning O/W microemulsion properties to increase wood accessibility

The microemulsion capacity to effectively impregnate the complex capillary structure of wood is elucidated in relation to composition and formulation effects. Different surfactants and their mixtures were used. The type of surfactant mixture used in the formulation and the resultant microemulsions viscosity were critical in the dynamics and extent of fluid penetration. This was ascribed to the balance of affinities of the surfactant mixture with the surface of the conductive element of the different wood species tested. Owing to the inherent morphological and chemical features, large differences were observed as far as impregnation susceptibility of different wood types. With the appropriate surfactant mixture it was possible to enhance the penetration of the microemulsions in the more recalcitrant wood substrate studied (white pine), from 15% to 83% relative to water at atmospheric pressure and room temperature.

Sarah Fritts[1], Christopher Moorman[1], Dennis Hazel[1], Steven Castleberry[2], Jessica Homyack[3], and Chris Farrell[2]
Graduate Programs: Fisheries, Wildlife, and Conservation Biology, North Carolina State University[1]; Warnell School of Forestry and Natural Resources, University of Georgia[2]; Weyerhaeuser[3]
Advisors: Christopher Moorman and Dennis Hazel
Poster Number: 44

Effects of biomass harvesting guidelines on herpetofauna use of clearcuts

Climate change, high energy prices, and a finite supply of fossil fuels have accelerated interest in renewable-based energy and biofuels. Forest-based sources of woody biomass are expected to comprise a significant percentage of renewables. Gleaning residual woody biomassfrom intensively managed pine forests will reduce amounts of woody debris following timber harvests, but the influence of removal on downed wood-dependent wildlife is unknown. Current Biomass Harvesting Guidelines (BHGs) specify volume and/or arrangement of woody biomass retained after harvesting to ensure protection of biodiversity, water quality, soil productivity and for carbon sequestration. However, whether BHGs enhance sustainability has not been tested empirically.We evaluated amphibian and reptile responsestoBHGs in a randomized and replicated field experiment.We captured herpetofauna from April-August of 2011 and 2012 across eight replicates of six 8-ha treatment plots in the Coastal Plains of North Carolina and Georgia. Treatments were randomly assigned to1)traditional woody biomass harvest with no BHGs, 2) 15% retention with woody biomass dispersed, 3) 15% retention with woody biomass clustered, 4) 30% retention with woody biomass dispersed, 5)30% retention with woody biomass clustered or 6) no woody biomass harvest. We captured 25 species of herpetofauna, with southern toads (*Anaxyrusterrestris*) and eastern narrowmouth toads (*Gastrophrynecarolinensis*) comprising>80% of captures. Neither species richness nor number of captures of the two most common species differed among treatments. Captures of southern toads and eastern narrowmouth toads per drift fence array was not related to the distance of the nearest debris pile to the drift fence array or the volume of all piled debris within 50m of the drift fence array. We plan to incorporate detection probabilities into analysis and monitor species-specific use of residual woody debris at smaller spatial scales in 2013.

Lindsey Garner[1], David Cobb[2], Chris Moorman[1], and Beth Gardner[1]
Graduate Programs: Fisheries, Wildlife, and Conservation Biology, North Carolina State University[1]; North Carolina Wildlife Resources Commission[2]
Advisors: Chris Moorman and David Cobb
Poster Number: 50

Population Status of the American Alligator in North Carolina

The American alligator inhabits wetlands throughout the southeastern United States. Historically, unregulated harvest and habitat loss led to a dramatic decrease in population abundance, resulting in federal protection. Across its range, alligators have recovered and many states have established population monitoring programs, regulated harvest, and nuisance control. In North Carolina, no state-wide surveys of alligators have occurred since 1980 and the population is thought to have remained stable or increased since the early 1980s. However, the relatively short alligator growth season in North Carolina results in a decreased reproductive capacity and potentially higher risk of local extinctions. To inform proposed management strategies, including a potentially regulated harvest season and nuisance control activities, we will determine the current abundance and distribution of American alligators in North Carolina. With assistance from cooperating state agencies, we conducted night counts on rivers, lakes, and estuaries in eastern North Carolina from June until July 2012. Based on presence/absence data, we modeled alligator occupancy in relation to local landscape factors. The uneven distribution of alligators in North Carolina and frequent zero counts suggest heterogeneity in local population sizes. In 2013, we will replicate night counts conducted in 2012 to model relative abundance and distribution. We will compare relative abundance estimates of alligators in North Carolina to estimates from research conducted at the same locations three decades ago.

Kevin B. Hall and J.L. Stape
Graduate Program: Forestry and Environmental Resources
Advisor: J.L. Stape
Poster Number: 57

Assessing the effects of temperature on the growth of *eucalyptus* species during winter months and the biomass potential of *E. benthamii* on varying sites across the southeastern United States

The growing interest in short-rotation forest crops for biomass has encouraged IBSS (Integrated Biomass Supply System) to investigate the growth potential for eucalyptus species in the southeastern United States. The goal of this study is to examine the effects of cold temperatures on the growth rates of eight potential species (*E. badjensis, E. benthamii, E. dalrympleana, E. dorrigoensis, E. dunnii, E. macarthurii, E. nitens, E. viminalis*) from a cold tolerance screening trial and to determine the potential productivity of *E. benthamii* in the southern US using a hybrid growth and yield modeling. The indeterminate buds of eucalypts cause susceptibility to cold or freezing temperatures but also allows the species to grow throughout the year. The selected

species are measured on a weekly basis and compared to a variety of temperature variables, such as average minimal temperature and weekly absolute minimal temperature. Preliminary data have shown a strong correlation between the weekly average minimal temperature and the growth rate of the species through the winter months. However, it has also been observed that during cold weather that freezes the leaves and branches the growth is stopped. The second part of my thesis incorporates some climate variables from process-based models with an empirical-based growth and yield model to evaluate the performance of *E. benthamii* on varying site qualities across the southeastern United States. I will create a hybrid growth and yield model for *E. benthamii* to assess the biomass potential. This could prove to also be a valuable management tool for financial analysis as well as a method of comparing this management regime with other types such as loblolly pine or native hardwood plantations. The aim of this study is to be able to quantify the productivity of eucalypt forests in the SE US with the anticipation of providing a short-rotation hardwood forest crop in regions that are void of a hardwood source or have a demand for a biomass energy source.

Christopher Hopkins
Graduate Program: Forestry and Environmental Resources
Advisor: Joseph P. Roise
Poster Number: 67

In Field Drying Schedules for Woody Biomass in North Carolina

Field dried wood has the potential to increase available biomass energy (lower heating value) by more than 35% over green wood combustion. Field dried wood is also less expensive to transport per unit of energy and can reduce the transportation distances needed to supply a given energy facility. Drying wood from a green state of 50% moisture content to 20% moisture content when field dried has been shown to be possible by a number of studies reviewed by Stokes (1994). Roise (1999) validated a trailer weighing technique of measuring drying rates as being statistically similar to large stack drying and has the benefit of non-destructive sampling of drying trials. The current study uses the trailer drying method and investigates the differences of drying energy wood by piece size (tops and tops plus first stick of pulpwood), species (pine versus mixed hardwood) and with and without paper tarps. Initial results from 2 seasons of drying indicate that paper tarps do not increase drying rates, drying rates for all species and sizes are similar (except for larger pine pulpwood and tops), and drying periods of 5 to 8 months can be expected in the North Carolina climate.

Keith Howard, Jason N. Bocarro, and Michael A. Kanters
Graduate Program: Parks, Recreation and Tourism Management
Advisor: Jason N. Bocarro
Poster Number: 68

Strategies for Creating Successful Joint Use Agreements

As financial resources diminish and the cost and development of land increases, community-school partnerships for the joint use of public school facilities has received growing attention. Although joint use is not a new concept, its resurgence as an effective way to deliver recreational services comes at a time when researchers, practitioners, and policy-makers are examining ways to address challenges faced by an increasingly inactive population. While there are examples of successful joint use partnerships, many entities are reluctant to engage in them due to fears of vandalism, liability concerns, and worries over excessive costs and overuse of facilities. Therefore, the purpose of this study was to use a case study methodological approach to understand factors resulting in a successful joint use agreement between a public school and a municipal parks and recreation agency. The school chosen for this case study was purposefully selected due to the high amount of community and school-related use during afterschool hours. Semi-structured interviews were conducted with the school principal, school athletic director, town parks and recreation director, parks and recreation facility managers, and town manager. Four themes emerged as reasons for success of this agreement: (a) deliberate formation and continued maintenance of relationships; (b) shared vision; (c) mutually beneficial outcomes; and (d) availability of resources to address community demands. Although our findings are limited by an examination of a specific joint use partnership in one region of the country, our results revealed patterns that may be useful for practice. In this case, parks and recreation administrators understood the importance of maintaining positive relationships and how this was linked to their ability to offer quality recreational programs. While development of joint use agreements is not easy, successful partnerships can be established with cooperation, clearly stated objectives, and pursuit of outcomes that are beneficial to both sides.

Wen Lin[1], Asko Noormets[1], JC Domec[1], John King[1], Ge Sun[2], and Steve McNulty[2]
Graduate Programs: Forestry and Environmental Resources, North Carolina State University[1]; USDA Forest Service, Raleigh, NC[2]
Advisor: Asko Noormets
Poster Number: 95

A conifer-friendly high-throughput α-cellulose extraction method for δ13C and δ18O stable isotope ratio analysis

Wood stable isotope ratios (δ13C and δ18O) offer insight to water source and plant water use efficiency (WUE), which in turn provide a glimpse to potential plant responses to changing climate, particularly rainfall patterns. The synthetic pathways of cell wall deposition in wood rings differ in their discrimination ratios between the light and heavy isotopes, and α-cellulose is broadly seen as the best indicator of plant water status due to its local and temporal fixation and to its high abundance within the wood. To use the effects of recent severe droughts on the WUE of loblolly pine (*Pinus taeda*) throughout Southeastern USA as a harbinger of future changes, an effort has been undertaken to sample the entire range of the species and to sample the isotopic composition in a consistent manner. To be able to accommodate the large number of samples required by this analysis, we have developed a new high-throughput method for α-cellulose extraction, which is the rate-limiting step in such an endeavor. Although an entire family of methods has been developed and perform well, their throughput in a typical research lab setting is limited to 16-75 samples per week with intensive labor input. The resin exclusion step for coniferous wood is particularly is time-consuming. We have combined the recent advances of α-cellulose extraction in plant ecology and wood science, including a high-throughput extraction device developed in the Potsdam Dendro Lab, Germany, and a simple chemical-based resin exclusion method. By transferring the entire extraction process to a multiport-based system, it allows throughputs of up to several hundred samples in two weeks, while minimizing labor requirements to 2-3 days per batch of samples.

Jiajia Meng, Junyeong Park, Andrew Moore, David Tilotta, and Sunkyu Park
Graduate Program: Forest Biomaterials
Advisors: Sunkyu Park and David Tilotta
Poster Number: 112

The Effect of Feedstock Torrefaction on the Chemical and Physical Properties of Bio-oil

Under elevated temperatures and oxygen free conditions, fast pyrolysis is used to convert solid lignocellulosic materials into liquid bio-oil. This simple conversion scheme is being developed and promoted because of the severe challenges caused by the depletion of fossil fuel. Essentially, bio-oil is considered as the only alternative liquid fuel to traditional fossil fuel. However, this dark-brown bio-oil is very different from conventional mineral oil in terms of higher oxygen content, acidity, and chemical reactivity (instability). Therefore, crude bio-oil requires significant catalytic upgrading before use. To provide an alternative means for bio-oil upgrading rather than through the use of catalysts, the research presented in this study investigates the effect of thermally pretreating (torrefaction) of biomass feedstock on the chemical and physical properties of pyrolysis bio-oil. Torrefaction is performed at atmospheric pressure in the absence of oxygen and enhances the biomass feedstock properties by increasing energy density and reducing oxygen content. Three torrefied wood samples (loblolly pine) with different torrefaction severities, indicated by weight losses of 16.5%, 24.1%, and 46.5%, were produced from a pilot-scale torrefaction reactor under 270°C, 300°C and 330°C, respectively. These torrefied samples were subsequently pyrolyzed in a lab-scale fluidized bed reactor at 500°C. A decreasing trend of bio-oil yield was observed when the biomass was treated with higher temperatures. The chemical and physical properties of the resulting bio-oils obtained from torrefied wood were compared to those from non-treated wood. The results showed that the bio-oils made from torrefied wood have reduced oxygen contents, water contents, acidities, increased heating values and viscosities when compared to the bio-oil made from raw wood. Also, the results of GC/MS analysis and solvent fractionation of these bio-oils showed that bio-oils made from pretreated wood contain increased amounts of pyrolytic lignin and levoglucosan.

Zachary Miller
Graduate Program: Forest Biomaterials
Advisors: Ilona M. Peszlen and Perry N. Peralta
Poster Number: 115

Mechanical Properties of Young Transgenic Black Cottonwood Trees Modified for Reduction of Specific Genes in Lignin Biosynthesis

Biosynthesis and genetic manipulations of plant secondary cell walls provide a better understanding of cell wall properties which is of significant interest for researchers. The genetic engineering of trees with reduced lignin has the potential to vastly increase pulping yields, but could also lead to significant reductions in mechanical properties. Here we investigate mechanical and physical properties of black cottonwood, *Populus trichocarpa* that was genetically manipulated to study the roles of genes in the biosynthetic pathway of lignin. Black cottonwood was chosen because of its sequenced genome, ease of propagation, fast growth and economic importance. Black cottonwood trees were propagated by rooted cuttings and grown in the Forest Biotechnology greenhouse at NC State. These trees represent a wild type for control and groups that received different genetic

modifications based on the steps in the lignin biosynthesis pathway. Constructs were down-regulated for transcription factors LIM and MYB and genes encoding different enzymes in the lignin biosynthesis pathway, including phenylalanine ammonia ligase, cinnamate 3-hydroxylase, cinnamate 4-hydroxylase, cinnamyl alcohol dehydrogenase, and cinnamoyl coenzyme A reductase. A total of 591 stems were harvested at an age of approximately 6 months. We measured the static modulus of elasticity in bending and density at the green condition. We found that some genetic variations showed reductions in both mechanical and physical properties however other constructs yielded similar results to the control. These results show the variation in mechanical and physical properties resulting from genetic modifications of transcription factors and genes in the lignin biosynthesis pathway.

Cormac O'Doherty
Graduate Programs: Forestry
Advisors: Ryan Emanuel and Matthias Peichl
Poster Number: 132

Comparing Soil Hydrology and Carbon Respiration in Natural, Drained and Restored Wetlands in Eastern North Carolina

The carbon cycle is often over looked in restored wetlands, yet nearly always included when speaking of natural wetlands. As hydrology is one of two determinates of wetlands, and affects the carbon cycle it is important to understand the linkage between land use, hydrology, and the carbon cycle. The purpose of this study is to compare effects of land use and soil hydrology on carbon respiration from wetland soils in Eastern North Carolina. Four landscapes were monitored on NCSU's Hofmann Forest located north of Jacksonville, NC. The landscapes are a pocosin (a non-riparian peatland found on the coastal plain), a restored non-riparian wetland, an agricultural field on a former wetland, and a fallow field on a former wetland. Measurements were taken at four positions on each landscape from May 2011 to August 2012. Sampling was conducted once a week during the growing season and once a month during the winter. Carbon dioxide respiration was measured with a static gas chamber in replicates of three. Soil volumetric water content was measured with a time domain reflectometry probe vertically in the top 20 centimeters of soil. Soil temperature was measured with a soil thermometer inserted in the top 10 cm of soil. Shallow ground water wells (1 meter deep) were installed allow for manual monitoring with an electric water level indicator. Preliminary results indicate significantly more carbon respiration from pocosin and restored wetland as compared to the agricultural field and the fallow field. Landscape position wasn't a determinate factor in soil respiration.

Inés M. Palacios
Graduate Program: Parks, Recreation and Tourism Management
Advisor: Michelle Gacio Harrolle
Poster Number: 136

Negotiation Strategies, Motives, and Constraints: Mexican Latinos to Museums in Wake County, North Carolina

The Latino community in the United States has been steadily growing for three decades. While the growth of Mexican Latinos in North Carolina is not reflected in visitors to museums, managers at informal educational institutions in North Carolina believe it is important to understand Latinos' museum visitation behaviors. This new knowledge gained by museums visitation can improve Mexican Latinos quality of life and, by extension, improve the quality of life in their new community. Hence, the purpose of this study is to examine intentions, motivations, constraints, and negotiation strategies to visit museums for Mexican Latinos.

A conceptual framework based on leisure constraints theory, leisure negotiation, motivations, and intentions to participate was used.

A targeted convenience sampling method was used. A total of 318 usable questionnaires were collected. Data analysis included descriptive statistics, scale reliability testing (Cronbach's alpha), confirmatory factor analysis, and structural equation modeling. The majority of Mexican Latinos in the study were 1st generation immigrants, women, married, and indicated an income below $20,000.

Results showed a strong relationship between motivations and negotiation strategies and a moderate relationship between negotiation strategies and intentions to visit museums. Motives and constraints were not shown to have a relationship with intentions. In addition, it was found that participant's English competency was not related to variables used in the model. Thus, the key to influencing intentions for Mexican Latinos is to understand their motives and to facilitate an increase in negotiation strategies. Therefore, museums could provide family focused programming. In addition, museums could increase marketing efforts by informing Mexican Latinos about the leisure opportunities and free programming. Lastly, managers at museums should consider the lack of perceived accessibility by distributing information to the Mexican Latino population about their hours of operation, parking locations, and free entrance to facilities.

Junyeong Park[1], Kwang Hun Lim[2], Orlando J. Rojas[1], and Sunkyu Park[1]
Graduate Programs: Forest Biomaterials[1] North Carolina State University[1]; Chemistry, East Carolina University[2]
Advisors: Orlando J. Rojas and Sunkyu Park
Poster Number: 138

Chemical and Structural Changes in Thermally-Treated Lignocellulosic Biomass and Its Properties in Applications

There have been emerging interests in using thermally-treated biomass, like biochar and its activated counterparts, in many applications including soil amendment, carbon sequestration, and adsorbent for remediation of water and soil contamination. Despite the recent interest in these applications of the solid products, our knowledge about molecular structure of the thermally-treated lignocellulosic biomass is limited. In this study, we report the changes in aromatic structures such as aromaticity and carbon clusters during thermal treatment under various heating temperatures and atmospheric conditions. Quantitative solid-state NMR, compositional analysis, and other chemical/spectroscopic methods were used to investigate structural changes. It was observed that the aromatic carbon fraction was increasing with higher treatment temperature, which showed 72.5 and 76.5% aromatic carbon out of total carbon in solids with and without activation process, respectively. In addition, when biomass is treated under slightly oxidative atmosphere, the development of aromatic cluster was promoted substantially, resulting in 3-times larger cluster than only with nitrogen. When additional activation process was applied to these thermally-treated lignocellulosics, surface properties of the activated counterparts were governed by the structural characteristics of the feedstock before activation. Activated carbon from the sample treated at 300°C showed the largest BET surface area of 1248.5 m^2/g and pore volume of 1.07cm^3/g, and it could remove phenanthrene in concentrated solution effectively, compared to other commercial activated carbons. Overall, it was observed that carbon structure and surface characteristics can be influenced by controlling parameters for thermal processes, and this observation will make it possible to manipulate the key properties of solid products, thus enhancing their effectiveness in specific applications.

Nitin Kumar Singh
Graduate Program: Forestry and Environmental Resources
Advisor: Ryan E. Emanuel
Poster Number: 161

Using stable isotopes of water to assess spatial and temporal variability of runoff generation in forested mountain headwaters

Runoff from the forested headwaters of the Southern Appalachians supplies anthropogenic and natural water needs for large portions of the Southeast. Although the hydrological processes that form runoff are relatively well understood, the combined roles of topography and vegetation in determining the spatial and temporal variability of these processes are not. Stable isotopes of hydrogen and oxygen in water (^2H and ^{18}O) are natural tracers that provide insight into the spatial and temporal variability of runoff generation. We combine spatially intensive samples of stream-water isotopes with measurements of hydrometric and geospatial variables to understand how topography and vegetation combine to influence runoff generation at the Coweeta Hydrologic Laboratory (CHL) in the Southern Appalachians. We investigated four small catchments, two dominated by broadleaf deciduous vegetation and two dominated by *Pinus strobus* (white pine). We collected monthly water samples in 2011 and 2012 at 25 m intervals along each stream, from 31 shallow groundwater wells, and from 10 rain gauges within CHL. We analyzed samples for delta^2H and delta^{18}O using cavity ring-down spectroscopy. We also recorded shallow groundwater stage and volumetric soil moisture at 30 min intervals from multiple depths and locations within CHL. Our results demonstrate spatial and temporal variability in delta^2H and delta^{18}O for different flow regimes and stream network locations. We also show enrichment of heavy isotopes with increasing contributing area along each stream. We use these results to improve understanding the topography and vegetation as contributors to the variability of runoff generation in forested headwaters.

Kathryn T. Stevenson[1], M. Nils Peterson[1], Howard D. Bondell[2], Angela G. Mertig[3], Susan E. Moore[4], Renee Strnad[4], and Laurell C Malone[5]
Graduate Programs: Fisheries, Wildlife and Conservation Biology, North Carolina State University[1]; Statistics, North Carolina State University[2]; Sociology and Anthropology, Middle Tennessee State University[3]; Forestry and Environmental Resources, North Carolina State University[4]; Educational Leadership, North Carolina Central University[5]
Advisor: M. Nils Peterson
Poster Number: 169

Environmental, Institutional, and Demographic Predictors of Environmental Literacy among Middle School Children

Building environmental literacy (EL) in children and adolescents is critical to meeting current and emerging environmental challenges worldwide. Although environmental education (EE) efforts have begun to address this need, empirical research evaluating drivers of EL is lacking. This study begins to fill the gap in EE evaluation with an examination of school-wide EE programs among middle schools in North Carolina, including the use of published EE curricula and time outdoors while

controlling for teacher training and experience, student attributes (age, gender, and ethnicity), and school attributes (socio-economic status, student-teacher ratio, and locale). Our sample included an EE group, 16 classes randomly selected from schools with registered school-wide EE programs, and a control group, 18 classes randomly selected from NC middle schools. Students were given an EL survey at the beginning and end of the spring 2012 semester. Use of published EE curricula, time outdoors, and having teachers with advanced degrees and mid-level teaching experience (between 3 and 5 years) were positively related with EL whereas minority status (Hispanic and black) was negatively related with EL. Results suggest that school-wide EE programs were not associated with improved EL, but the use of published EE curricula paired with time outdoors represents a strategy that may improve all key components of EL among students. Further, investments in teacher training and efforts to maintain enthusiasm for EE among teachers with more than 5 years of experience may help to boost EL levels in students. Middle school represents a pivotal time for influencing EL levels, as improvement was slower among older students. Differences in EL levels based on gender suggest boys and girls may possess complementary skills sets when approaching environmental issues. Our findings suggest ethnicity related disparities in EL levels may be mitigated by time spent in nature, especially among black and Hispanic students.

Guillermo J. Velarde
Graduate Program: Forest Biomaterials
Advisors: Richard Lemaster and Daniel Saloni
Poster Number: 185

Improvement of Housing Conditions by Assessing and Remediating Moisture Problems in Wood Housing Structures

Moisture build up in houses can originate from many different sources, such as daily human activities (kitchen and bathrooms), rain, thermal performance of the structure, air flow and building materials. Moisture levels need to be controlled in houses because warm and humid environments promote the flourish of wood destroying organisms that can cause tremendous damage to homes. This is also a health concern. From the 21.8 million people reported to have asthma in the U.S., approximately 4.6 million cases were estimated to be attributable to dampness and mold exposure in the home. Studies have shown that there is no foolproof way to keep moisture from getting into the housing structure, therefore the need to control the moisture levels remains as a research need.

The main objective of this research was to improve housing conditions by performing a comprehensive analysis of common wood wall structures and moisture problems associated with them. The research begins with the characterization of water-material interactions of commonly used insulating materials by analyzing the material as a single element as well as in wall structures. On a later phase, the research focuses on remediation techniques to suppress mold formation in wall cavities by means of positive airflow operations.

Results showed the differences between each insulating materials when characterizing them in terms of water-material interactions. Water absorption, dryness and water retention capacity as well as common water paths were found for each material. Potential water problems were also identified. Several alternatives for remediation of water problems were investigated and the results differed depending on the method used. Some alternatives were preferred over other due to time of remediation and ease of application. This study will build upon the current research to develop a monitoring and control system to solve the moisture problem in housing wall cavities.

Tim Antonelli
Graduate Program: Biomathematics
Advisors: Alun L. Lloyd and Fred Gould
Poster Number: 4

Developing a Biologically Accurate Model for Mosquito Larval Growth in Iquitos, Peru

Dengue infects 50 to 100 million people each year and is currently the world's fastest growing tropical disease. There is no treatment or vaccine available, so control efforts focus on the virus's primary mosquito vector, *Aedes aegypti*, which often breeds in artificial containers in and around homes. Mathematical models are useful in assessing the feasibility of such control efforts and in guiding experimental design. Skeeter Buster is a detailed model that was developed to predict the response of an *Ae. aegypti* population in Iquitos, Peru to various control strategies. However, the model consistently overestimates both the proportion of containers with larvae present and the abundance of larvae found in the field, due to an incomplete understanding of food availability and its impact on larval growth. We conducted an experiment in Iquitos in which we placed buckets filled with tap water in six different houses to accumulate debris for varying lengths of time (0, 2.5 and 5 weeks). We then placed 25 newly hatched *Ae. aegypti* larvae in each of the 54 buckets and monitored their growth over 5 weeks. We obtained maximum-likelihood estimates of parameters governing food accumulation and larval growth by fitting the equations in Skeeter Buster to data from the field.

Colleen M. Connelly, Sunghyun Myoung, Meryl Thomas, and Alexander Deiters
Graduate Program: Chemistry
Advisor: Alexander Deiters
Poster Number: 30

Discovery and Application of Small Molecule Inhibitors of Disease-Related MicroRNAs

MicroRNAs (miRNAs), single stranded noncoding RNAs of approximately 22 nucleotides, regulate gene expression in a sequence specific fashion by binding partially complementary sequences in the 3′ untranslated region (3′-UTR) of target messenger RNAs (mRNAs). MicroRNAs down-regulate gene function by inhibiting translation, accelerating the degradation of the target mRNA, or mediating deadenylation of the mRNA. MicroRNAs are involved in the regulation of many biological processes including embryonal development, differentiation, apoptosis, and proliferation and the targets of miRNAs range from signalling proteins and transcription factors to RNA binding proteins. Recently, the aberrant expression of certain miRNAs has been linked to a variety of human diseases including cancer and viral infections, proving miRNAs as potential targets for drug discovery. Small molecule miRNA inhibitors could serve as lead structures for the development of new therapeutics and be useful in the elucidation of detailed mechanisms of miRNA biogenesis and function. Consequently, we developed high throughput screens for small molecule regulators of miR-21, a known oncomiR with elevated levels in almost all cancers, and miR-122, which is necessary for hepatitis C virus (HCV) infection. We successfully identified the first small molecule inhibitors of miR-21 and miR-122 and investigated them through structure-activity relationship studies and secondary assays. Moreover, the therapeutic potential of these small molecules was investigated, and the inhibition of miR-21 was effectively used to reduce viability of several cancer cell lines in combination with anti-cancer therapeutics. Further, small molecule inhibition of miR-122 reduced HCV replication in liver cells. Thus, small molecule regulation of miRNA function has potential in the treatment of cancer and viral infections.

Kyle Dawson
Graduate Program: Marine, Earth, and Atmospheric Sciences
Advisor: Nicholas Meskhidze
Poster Number: 34

Analysis of Sea Spray Optical Properties using Multi-Sensor Spaceborne Observations

Scientists have been investigating climate change since the early 1990s and more recently have been focused on the role of aerosols. However, sea spray, despite being the most abundant natural aerosol, remains poorly characterized. Because forecasting future climate relies on background atmospheric conditions, sea spray must be accurately accounted for. Spaceborne sensors are required to efficiently observe sea spray optics over the oceans; but the accuracy of these observations is challenged by both instrument-specific and environmental factors. NASA's A-Train has made near-simultaneous measurements from multi-sensor instruments possible and has subsequently provided a means to lessen data biases. This study uses the CloudSat radar as well as the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) to retrieve measurements of sea spray aerosol optical depth (AOD) and aerosol extinction-to-backscatter ratio (lidar ratio). The objective is to first observe the variability in the retrieved lidar ratio as a function of location, season, and wind speed as well as assess the bias in CALIOP retrieved AOD. Secondly, statistical distributions of the lidar ratio as a function of the aforementioned variables are investigated. The results of this study have shown 1) the CALIOP lidar ratio selection algorithm is probably biased low (this study median lidar ratio$\cong 30\ sr$; CALIOP lidar ratio$\cong 20\ sr$), 2) variability of this study's lidar ratio ($\approx 10\ sr$) is outside the range allowed by CALIOP ($\pm 6\ sr$), and 3) lidar ratio is regionally dependent on season and wind speed. Taking these results into account will improve the CALIOP algorithms and produce more accurate sea spray retrievals. More accurate background observations will go hand in hand with better radiative forcing estimates made by models for future climate.

Eric Dill, Jacob C.W. Folmer, and Feier Hou
Graduate Program: Chemistry
Advisor: James D. Martin
Poster Number: 37

Size Matters: Experimental determination of the crystallization velocity from a supercooled melt

Crystallization studies were performed on the model halozeotype CZX-1, monitored with differential scanning calorimetry (DSC) and synchrotron 2-D time- and temperature- resolved X-Ray Diffraction (TTRXD). It was discovered that these crystallization experiments performed with DSC and at two synchrotron sources (Advanced Photon Source (APS) and National Synchrotron Light Source (NSLS)) produced different rate constants when analyzed with the Kolmogorov-Johnson-Mehl-Avrami (KJMA) model. As there is no chemical reason for the crystallization rate to be experimental-measurement dependent, it was concluded that these differences were primarily attributable to the significant sample volume difference between the DSC and the two synchrotron sources. Crystallization simulation software was then developed and used to evaluate the relationship between sample volume and the parameters of the KJMA model with specific focus on the KJMA rate constant. Here we demonstrate a

correction to the KJMA rate constant based on the crystallization sample volume which produces the phase-boundary velocity (v_{pb}) of the crystallization front to within a factor of two.

Carl J. Giuffre
Graduate Program: Biomathematics
Advisor: David R. Tarpy
Poster Number: 52

Pesticides and the western honey bee, *Apis mellifera*: how automated tracking may change current practices

The western honey bee (*Apis mellifera*) is a model organism for studying social evolution and behavior. Honey bees also have a substantial economic role as major pollinators and honey producers, spanning a diverse collection of industries. Unfortunately, colony collapse disorder (CCD) is disrupting bee populations by causing established hives to inexplicably and suddenly disappear. CCD is poised to disrupt the global economy, yet the underlying mechanisms are yet unclear. Pesticides have been continually identified as a suspect in the cause of CCD, yet little has been done to identify how pesticide use impacts the behavior of these social insects. One current measurement the EPA utilizes in the pesticide approval process is known as Lethal Dosage-50. This measures the amount of pesticide needed to cause a 50% mortality rate in a non-target organism, such as honey bees. This measurement is quite crude, and does not account for changes in the system that occur before the organism dies. Automated tracking will allow us to cheaply detect behavioral changes in bee colonies as they are exposed to pesticides, potentially changing the pesticide approval process.

John T. Holodnak
Graduate Program: Mathematics
Advisor: Ilse C. F. Ipsen
Poster Number: 66

Accuracy of a Randomized Algorithm for Computing Leverage Scores

The leverage scores of an m x n matrix A (m>n) are the squared row norms of any matrix containing an orthonormal basis for the column space of A. Leverage scores give information about the importance of rows in regression problems and have also been used in the construction of sampling probabilities for low-rank matrix approximation. Recently, randomized algorithms for matrix computations have been developed with the goal of approximating the computation in less time than is required by the deterministic algorithm. In 2011, Drineas et al. developed a randomized algorithm for approximating leverage scores that uses random projections. The purpose of random projections is to reduce the size of the matrix on which computations must be performed, while maintaining properties of interest. The original error analysis of the algorithm requires that the random projections be Johnson-Lindenstrauss transforms, which impose potentially restrictive assumptions on how much the size of the matrix can be reduced. We present new bounds on the error produced by the algorithm that improve upon previous analysis and do not rely on the random projections being Johnson-Lindenstrauss transforms.

Xinfang Hu, Gongfang Hu, and Christopher B. Gorman
Graduate Program: Chemistry
Advisor: Christopher B. Gorman
Poster Number: 69

Investigation of growth and degradation behaviors of biodegradable polymer brushes and their bio-applications

The growth and degradation behavior of grafted and spin coated poly (glycolic acid) (PGA) and poly (ε-caprolactone) (PCL) brushes were studied in parallel. Optimal conditions for growth of each grafted polyester brushes from hydroxyl terminated surface via ring opening polymerization (ROP) was investigated. Unlike PCL brushes that grew the thickest at elevated temperatures PGA brushes grew better at room temperature. Degradation of grafted polyester brushes was found to be very distinct from both spin coated brushes and bulk polyesters. The degradation behavior of grafted polyester brushes and their copolymer brushes with poly (ethylene glycol) under protein buffer environment was also studied.

Stephen Hughes
Graduate Program: Marine, Earth, and Atmospheric Sciences
Advisor: Jim Hibbard
Poster Number: 70

The August 23, 2011 M5.8 Virginia earthquake: Do intraplate seismic events exploit weaknesses along relict fault systems?

The August 23, 2011 M5.8 earthquake in the Virginia Piedmont was felt by more people than any other in U.S. history. While the most intense shaking and destruction occurred in rural Virginia, metropolitan areas from Boston and New York to Raleigh and Atlanta also felt the quake. In Washington D.C., the shaking damaged national monuments and only some 20 km northeast of the epicenter, the North Anna Nuclear Generating Station was shut down for ~2.5 months after the event.

This renewed recognition of intraplate seismicity at damaging levels near the densely populated metropolitan areas of the east coast demands a focused examination of the cause, and geologic setting of the 2011 central Virginia earthquake. The Piedmont of Virginia is underlain by a complex system of faults, folds, fabrics, and intrusions in the bedrock that developed during the Paleozoic era during the multigenerational amalgamation of the Appalachian Mountains. My geologic mapping in the epicentral area, conducted and finalized before the 2011 event, provides an unbiased and detailed view of the local geology and can also be used to better understand the manifestation of modern intraplate seismicity.

Field investigations show that there exists a previously unidentified zone of strained rocks in the epicentral area related to the nearby Paleozoic Long Branch fault system. The orientation of the relict strained linear features (070°,35°) in this zone lie within the rupture plane (035°, 53°SE) for the 2011 event. The attitude of the modern fault plane was ascertained using a 3D analysis of 60+ aftershocks that occurred in the week immediately following the mainshock. I interpret the geographic and spatial agreement of relict Paleozoic features and modern seismicity to be more than chance coincidence. From this case study, it is clear that inherited fabrics in the bedrock geology act as guides to intraplate seismic activity.

Nacole B. King and Paul A. Maggard
Graduate Program: Chemistry
Advisor: Paul Maggard
Poster Number: 84

Flux Synthesis and Photoelectrochemical Properties of *p*-Type $CuNb_3O_8$ and $Cu_2Nb_8O_{21}$ Polycrystalline Films

The new flux synthesis of the Cu (I) niobates $CuNb_3O_8$ and $Cu_2Nb_8O_{21}$ were investigated. Photoelectrochemical properties of the polycrystalline films were annealed on FTO at 500 °C followed by a mild oxidation in air between 250°C and 550°C in aqueous 0.5 M Na_2SO_4 at a pH of 2 to 12. Indirect and direct bandgap sizes of $CuNb_3O_8$ at 1.28 eV and 1.47 eV, and of $Cu_2Nb_8O_{21}$ at 1.58 eV and 1.73eV respectively, were measured. The products were characterized by powder X-ray diffraction, UV-Visible diffuse reflectance, and scanning electron microscopy. The *p*-type polycrystalline films yielded strong cathodic photocurrents under visible light ($\lambda > 420$ nm) irradiation. Thus, $CuNb_3O_8$ and $Cu_2Nb_8O_{21}$ are promising *p*-type semiconductors for photoelectrode-mediated solar-fuels production.

Ashlee Lillis, David B. Eggleston, and DelWayne Bohnenstiehl
Graduate Program: Marine, Earth, and Atmospheric Sciences
Advisor: David B. Eggleston
Poster Number: 93

Tuning into the Marine Soundscape: Habitat-specific underwater sounds influence larval invertebrate settlement

Ambient underwater sound is emerging as an important orientation and settlement cue for marine fish and invertebrate larvae, but sound patterns and larval responses remain largely unknown. Auditory reception may be valuable for larvae when locating and selecting nursery grounds, since sound is transmitted relatively large distances and reflects the bio-physical characteristics of habitat, while other sensory cues (e.g. light, chemicals) are rapidly attenuated. In estuaries of the Southeastern U.S., sound characteristics of oyster reefs are of particular interest because reefs are patchily distributed productive habitats and harbor many sound-producing organisms (e.g. sciaenid fish, snapping shrimp). Using subtidal oyster reefs in Pamlico Sound, NC as a model system, hydrophone-recording surveys demonstrated that oyster reefs consistently produce distinct acoustic spectra, comprised of significantly more sound in the 2 – 20 kHz invertebrate-dominated frequency range, compared to nearby soft-bottom habitats. This study indicates that habitat-associated sound could provide useful sensory information for settling reef-dwellers. Recent laboratory and field-based experiments suggest that sound has a significant effect on oyster settlement rates: higher numbers of larvae settled in the presence of oyster reef sounds than in soft-bottom sound or no sound treatments. Ecological acoustics and soundscape orientation is a promising new field in need of exploratory studies to characterize ambient sound patterns at spatial and temporal scales relevant to larval settlers and to investigate larval responses to these sound patterns.

Kristin A. Linn, Eric B. Laber, and Leonard A. Stefanski
Graduate Program: Statistics
Advisors: Eric B. Laber and Leonard A. Stefanski
Poster Number: 96

Interactive *Q*-learning for Dynamic Treatment Regimes

In practice, clinicians treat patients with chronic disease by collecting and synthesizing information such as patient medical history, demographics, and past treatments, using their best judgment to recommend a treatment based on these factors. Treatments are commonly adjusted and tailored to the individual over time depending on disease progression and patient response. A dynamic treatment regime (DTR) is a collection of sequential decision rules that mimics clinical practice by recommending a particular treatment at each decision point based on accumulated information up to that time. Each decision rule is a function that incorporates patient history to personalize treatment to the individual. An optimal DTR is a policy that, when followed, maximizes a certain desirable clinical outcome. Estimating optimal DTRs from data can inform clinical practice by suggesting evidence-based treatment policies, enhancing clinician judgment. *Q*-learning is a popular framework used to estimate optimal DTRs from data. It is an approximate dynamic programming algorithm that involves a series of regression, maximization pairs. Although conceptually simple, in practice the *Q*-learning approach suffers from problems of nonregularity, difficult inference, and model misspecification due to the maximization step that follows each regression. Additionally, *Q*-learning requires building a regression model after the nonsmooth, nonmonotone maximization step, and familiar model building techniques are often less successful or inappropriate after nonsmooth, nonmonotone transformations have been applied to the data. We propose an alternative to *Q*-learning called *Interactive Q-learning* (*IQ*-learning) that addresses practical model building concerns by switching the order of modeling and maximization in the *Q*-learning algorithm. *IQ*-learning only requires models for smooth, monotone transformations of the data. We illustrate the relative performance of *IQ*-learning to *Q*-learning with Monte Carlo studies and demonstrate advantages of *IQ*-learning from a modeling perspective by analyzing data from the STAR*D study of major depressive disorder.

Leyda Z. Lugo-Morales
Graduate Program: Chemistry
Advisor: Leslie A. Sombers
Poster Number: 101

Enzyme-modified Carbon Fiber Microelectrode Based on the Voltammetric Detection of H_2O_2

Non-electroactive molecules can be electrochemically detected using sensors that exploit an enzyme for its unique substrate specificity. However, a sensor capable of quantifying rapidly fluctuating non-electroactive molecules in complex mixtures with high sensitivity, electrochemical selectivity and a rapid response time is lacking. In order to address this critical need, we have enabled the sensitive and selective real-time detection of dynamic fluctuations of non-electroactive molecules (glucose and choline) at a single, micrometer-scale recording site using background-subtracted fast-scan cyclic voltammetry (FSCV). This approach eliminates the need for complicated coatings or self-referencing subtraction schemes that are typically required with conventional amperometric detection using enzyme-modified electrodes. The biosensor consists of a carbon fiber surface modified with an electrodeposited biopolymer hydrogel (chitosan), which encapsulates enzyme molecules (glucose oxidase, GOx, or choline oxidase, ChOx). The enzyme selectively oxidizes its substrate (glucose or choline, respectively) generating electroactive hydrogen peroxide (H_2O_2) which can be quantified at the electrode using FSCV. The custom electrodes are inexpensive to fabricate (< 1 cent), and the strategy is widely applicable to the encapsulation of any H_2O_2 producing enzyme, enabling the detection of many non-electroactive enzyme substrates. GOx/chitosan-modified microelectrodes were characterized *in vitro* and were used in intact rat brain to detect rapid glucose fluctuations with unprecedented temporal and spatial resolution. The technique was adapted for the immobilization of ChOx. *In vitro* characterization of these electrodes demonstrated the ability to detect choline concentration changes. Further characterization experiments will be performed to assure ChOx-modified electrodes can be used in *in vivo* experiments for the real-time detection of choline fluctuations. These fundamental studies will ultimately lead to broadly applicable technologies for rapid molecular monitoring in multiple markets (healthcare, security, military biodefense, environmental monitoring and the process industry).

Doreen M. McVeigh[1], Jeanette Moss[2], Susan L. Carney[2], M. Drew Ferrier[2], and John F. Morrissey[3]
Graduate Programs: Marine, Earth, and Atmospheric Sciences, North Carolina State University[1]; Environmental Science, Hood College[2]; Biology, Sweet Briar College[3]
Advisor: Dave Eggleston
Poster Number: 111

Genetic Analysis of Populations of the Cownose Ray, *Rhinoptera bonasus*, in the Chesapeake Bay and Florida Coast

Cownose rays, *Rhinoptera bonasus*, are elasmobranchs found in the Western Atlantic from Brazil to Massachusetts. In the spring and early summer, large schools of rays migrate into the Chesapeake Bay to forage. The rays also utilize the Chesapeake Bay as a nursery for young-of-the-year pups and a breeding ground. During the summer, cownose rays migrate throughout the polyhaline and mesohaline portions of the Bay, but it is not currently known if these subgroups of animals are genetically isolated. In this study, we analyzed DNA sequence variation from portions of two variable mitochondrial genes, cytochrome b and cytochrome c oxidase I, in samples collected from three sites in the Chesapeake Bay (St. George Island, MD, Reedville, VA, and Mechanicsville, MD) and from Tampa Bay, FL. Results show statistically significant differences in haplotype distributions between all sites ($p < 0.05$) except Mechanicsville and Reedville ($p > 0.05$). The presence of haplotypes in the Chesapeake that are absent in the Tampa Bay population suggests that rays migrating from other regions contribute to the genetic diversity in the Chesapeake Bay. Moreover, the unique haplotype distribution of St. George Island when compared to the other Bay sites suggests that cownose rays may exhibit philopatry.

Alison E. Moyer[1], Wenxia Zheng[1], and Mary H. Schweitzer[1,2]
Graduate Programs: Marine, Earth, and Atmospheric Sciences, North Carolina State University[1]; North Carolina Museum of Natural Sciences[2]
Advisor: Mary H. Schweitzer
Poster Number: 121

Melanosomes…Microbes?

Elongate microbodies associated with feathers were originally attributed to microbial biofilms, but recently, in a series of papers, they have been reinterpreted as intracellular, pigment-containing organelles (melanosomes). Based upon this interpretation, coloration in non-avian and avian dinosaurs has been hypothesized. The only support presented for either hypothesis is morphological. Because melanosomes and microbes overlap in size, distribution and morphology, morphological data are insufficient to robustly support either claim. Here, we re-evaluate both hypotheses using actualistic experiments and electron microscopy. Melanin is highly resistant to degradation, with high preservation potential, but the intracellular organelles storing the melanin have not been shown to be equally resistant. Microbes, however, as well as the exopolymeric substance they secrete, are known to persist in the fossil record.

We have applied scanning electron microscopy (SEM) and transmission electron microscopy (TEM) to visualize melanosomes in extant feathers, and compare with microbial growth on pigmented feathers from chicken (*Gallus gallus*). Melanosomes are intracellular and limited to internal regions surrounded by and embedded in the keratinous matrix of the feather. Microbes, on the other hand, grow across the surface of feathers. We compare these data with published and unpublished results for fossil feathers.

Mahboubeh Nejati
Graduate Program: Chemistry
Adviser: Morteza G. Khaledi
Poster Number: 125

Alcohol-Induced PMA-CTAB Complex Coacervate System for Protein and Enzyme Extraction

Simple and complex coacervate phases have been used for extraction of proteins for the past three decades. Complex coacervate is formed in aqueous mixtures of two oppositely charged amphiphiles (e.g. surfactants and/or polyelectrolytes) that phase separates into two aqueous-based phases (a surfactant/polyion enriched and a surfactant/ polyion depleted phase). The coacervate systems are powerful media for solubilization, extraction, and enrichment of proteins. However, most of the reported coacervate systems are only stable over a limited range of concentrations. We have discovered that alcohols, especially perfluorinated alcohols, can induce complex coacervation in aqueous mixtures of oppositely charged polyelectrolyte and surfactant systems. This phenomenon seems to be is ubiquitous that occurs over a wide range of concentration and mole ratios. In addition, coacervate phases can be induced by various fluoroacids / fluoroalcohols or aliphatic alcohols. The flexibility of the system would allow optimization of the composition of the coacervates based on the types of the applications. For example, trypsin can be extracted by aliphatic alcohols-induced coacervates such as 2-propanol-PMA-CTAB since the enzyme is active in the coacervate phase while other types of the protein such as membrane proteins can be extracted by fluoroalcohols (such as HFIP/TFE) induced system in which high preconcentration factor is a great advantage. In case of the 2-propanol induced

PMA-CTAB system, trypsin enzyme activity has been measured in both aqueous and coacervate phases at 1:1 charge ratio. Cytochrom c has been extracted and digested as preliminary experiment for proteomics application.

Jacob Norton[1], Georgiy Bobashev[23], Wendee Wechsberg[2], and Olga Toussova[4]
Graduate Programs: Biomathematics Graduate Program, North Carolina State University[1]; Research Triangle Institute (RTI) International[2]; Statistics, North Carolina State University[3]; The Biomedical Center, St. Petersburg, Russia[4]
Advisor: Georgiy Bobashev
Poster Number: 127

Prediciting HIV seroconversion in discordant couples

Often the risk of disease acquisition from a single event, such as an unprotected sex act, is small and difficult to interpret. However, when risky behaviors are repeated it is possible to forecast disease acquisition. In our study we consider the development of HIV seroconversion trajectories based on risk-bearing events that can occur at different time scales. We consider existing estimates of HIV transmission risks through injecting and sexual contacts to develop a predictive seroconversion model for an individual who is exposed to HIV primarily through intimate relationships with a partner known to have HIV, known as a discordant couple or discordant pair. We simulate time-to-event curves for a number of behavioral scenarios and particularly focus on sources of simulated uncertainty. In particular, we consider uncertainty in estimates of transmission risk and uncertainty in study subject responses. We apply the model to a longitudinal study of HIV-discordant pairs and discuss model validation based on order statistics.

Terrance Pendleton[1], Alina Chertock[1], and Jian-Guo Liu[2]
Graduate Program: Mathematics, North Carolina State University[1]; Physics and Mathematics, Duke University[2]
Advisor: Alina Chertock
Poster Number: 139

Convergence of a Particle Method and Global Weak Solutions for a Family of Evolutionary PDEs

The purpose of this poster is to provide global existence and uniqueness results for a family of fluid transport equations by establishing convergence results for the particle method applied to these equations. The considered family of PDEs is a collection of strongly nonlinear equations which yield traveling wave solutions and can be used to model a variety of flows in fluid dynamics. We apply a particle method to the studied evolutionary equations and provide a new self-contained method for proving its convergence. The latter is accomplished by using the concept of space-time bounded variation and the associated compactness properties. From this result, we prove the existence of a unique global weak solution in some special cases and obtain stronger regularity properties of the solution than previously established.

Priya R. Pillai[1], John. T. Walker[2], Viney P. Aneja[1], and Ellen Cooter[2]
Graduate Programs: Marine, Earth, and Atmospheric Sciences[1]; U.S. Environmental Protection Agency[2]
Advisors: Viney P. Aneja and John. T. Walker
Poster Number: 143

Nitrogen Losses from Biofuel Crops and its Biogeochemical Modeling

One of the major challenges in the energy sector is to establish energy security while reducing the emissions of greenhouse gas emissions. Reduction in carbon dioxide (CO_2) emissions, accomplished by replacing fossil fuels with biofuels, may lead to increased nitrous oxide (N_2O) emission (Crutzen et al., 2008). The emission rate of N_2O depends on N- fertilizer uptake efficiency of commonly used biofuel crops. Crutzen et al. concluded that soil N_2O emissions from N-fertilizer application in biofuel production can be 3-5 times greater than current estimates. Perennial crops with less N demand, such as switch grass may have more favorable climate impacts when compared to crops with high N demands, such as corn. However, N_2O emissions from such crops are not yet fully characterized. In this study we compare the nitrogen losses from switchgrass and corn fields for different application rates of fertilizer (ammonium sulfate granular, $(NH_4)_2SO_4$) at a site in the southeast U.S. The effect of soil moisture, soil temperature etc. on nitrogen losses is being analyzed. *Erosion Productivity Impact Calculator* (EPIC) biogeochemical model is being used to parameterize the nitrogen losses from these biofuel crops under different fertilizer application rates. This will allow improvements in the climate models that focus on understanding the environmental effect of the climate change mitigation strategy of replacing fossil fuels. [Crutzen, P. J., Mosier, A. R., Smith, K. A., and Winiwarter, W.: N_2O release from agro-biofuel production negates global warming reduction by replacing fossil fuels, *Atmos. Chem. Phys*., 8, 2008.]

Megan Sawyer
Graduate Program: Applied Mathematics
Advisors: Hien Tran and Marina Evans
Poster Number: 155

Compartmentalizing the Sunlight Vitamin: PBPK Modeling and Vitamin D

Vitamin D sufficiency has far-reaching health implications in many different systems of the body, including calcium regulation and potential protection against autoimmune diseases such as diabetes or cancer. However, vitamin D is not the active compound in this process, but in fact, it is the second compound, 1,25(OH)2D, in the metabolic cascade. Levels of D and 1,25(OH)2D are hard to accurately measure, so predictions of sufficiency are made through measuring the first metabolite, 25(OH)D. Although vitamin D has been modeled in conjunction with a variety of different substances (primarily calcium), little work has been done to model the vitamin D cascade itself. However, the metabolism path yields itself well to analysis through physiologically based pharmacokinetic (PBPK) modeling. PBPK modeling is a compartmental-based technique accounting for various physical and physiological properties of substances and subjects, and allows for testing of various exposure schemes *in silico*. We are developing a PBPK model of the vitamin D metabolic cascade flexible enough to predict levels of 25(OH)D for a variety of dosing and exposure schemes. In addition, as an understanding of the sensitivity of parameters is essential to guiding future *in vivo* experiments, we have utilized methods to quantify the sensitivity of estimated parameters in the PBPK model.

Nataliia V. Shymanska
Graduate Program: Chemistry
Advisor: Joshua G. Pierce
Poster Number: 159

Total synthesis of novel antimicrobial agents: Synoxazolidinones A and B

The ongoing emergence of multidrug-resistant bacteria highlights the pressing need for the development of novel antimicrobial agents. Disturbingly, over the last five decades there have only been two new classes of antimicrobial compounds approved by the FDA. The synoxazolidinones are newly discovered, antimicrobial compounds isolated from the sub-Arctic ascidian *Synoicum pulmonaria* collected off the coast of Norway. They contain an unusual 4-oxazolidinone core only found in nature once before. We have developed a synthetic route that not only provides access to the synoxazolidinones, but also allows generation of libraries of modified analogues. Through the use of an acylimine intermediate we have mimicked the postulated biosynthetic pathway to the 4-oxazolidinone scaffold thereby providing a rapid and scalable approach to these bioactive natural products. Although the target molecules were the goal at the outset of the project, the synthetic work on these scaffolds has revealed key reactions that will enable the synthesis of other classes of molecules and raises intriguing questions relating to chemoselectivity and stereoselectivity. Going forward, various functional group replacements around the 4-oxazolidinone backbone may result in an enhanced biological activity/selectivity spectrum leading to understanding of the mechanism of action and future development as chemical probes. These studies will allow the small molecules isolated from the cold waters off of the coast of Norway to be developed into medicines for the treatment of resistant infections.

Daniel E. Stasiw
Graduate Program: Chemistry
Advisor: David A. Shultz
Poster Number: 166

Quantum Interference Effects in a Cross-Conjugated Donor-Bridge-Acceptor Biradical

In an effort to reduce the costs of metal-based semiconductors, many real world devices will rely on conjugated and conductive polymer semi-conductors to transfer electrons across a molecular wire. One of the most important aspects of molecular electronics is how efficiently electrons can be transmitted from one end of a system to the other. Fundamental information on the electron transfer capabilities of polymers can be obtained by determining the electronic coupling through a single repeat unit. One approach to study such electronic coupling is through mimicking charge-separated states of the donor and acceptor by studying magnetic interactions in a Donor-Bridge-Acceptor (D-B-A) biradical system. We have developed structure-property relationships using a valence bond configuration interaction (VBCI) model to determine the electronic coupling matrix element, $\boldsymbol{H_{ab}}$, in D-B-A biradical complexes featuring semiquinone (SQ) Donor and nitronyl-nitroxide (NN) Acceptor radicals. Through magnetometry and spectroscopic analysis of a cross-conjugated, *meta*-phenylene bridged biradical [$Tp^{Cum,Me}$Zn(SQ-*m*Ph-NN)], we have found a -32 cm^{-1} antiferromagnetic exchange coupling, ***J***, between the SQ Donor and NN Acceptor. To explain the sign of ***J***, we invoke a third-order interaction within the VBCI model involving a doubly excited configuration mixing – via an intermediate configuration – and stabilizing the ground singlet state. Our findings provide the molecular basis for understanding and future design of single-molecule devices such as quantum interference effect transistors.

Katarina Sucic[1], Elizabeth Mannshardt[1], Wan Jiao[2], Francesca Dominici[3], H. Christopher Frey[2], Brian Reich[1], and Montserrat Fuentes[1]
Graduate Programs: Statistics, North Carolina State University[1]; Civil, Construction, and Environmental Engineering, North Carolina State University[2]; Biostatistics, Harvard University[3]
Advisor: Montserrat Fuentes
Poster Number: 170

Comparing Exposure Metrics for the Effects of Fine Particulate Matter on Emergency Hospital Admissions

A crucial step in an epidemiological study of the effects of air pollution is to accurately quantify exposure of the population. We investigate the sensitivity of the health effects estimates associated with short-term exposure to fine particulate matter with respect to three potential metrics for daily exposure: ambient monitor data, estimated values from a deterministic atmospheric chemistry model, and stochastic daily average human exposure simulation output. Each of these metrics has strengths and weaknesses when estimating the association between daily changes in ambient exposure to fine particulate matter and daily emergency hospital admissions. Monitor data is readily available, but is incomplete over space and time. The atmospheric chemistry model output is spatially and temporally complete, but may be less accurate than monitor data. The stochastic human exposure estimates account for human activity patterns and variability in pollutant concentration across microenvironments, but requires extensive input information and computation time. To compare these metrics, we consider a case study of the association between fine particulate matter and emergency hospital admissions for respiratory cases for the Medicare population across three counties in New York. Of particular interest is to quantify the impact and/or benefit to using the stochastic human exposure output to measure health exposure to fine particulate matter. Results indicate that the stochastic human exposure simulation output indicates approximately the same increase in relative risk associated with emergency admissions as using a chemistry model or monitoring data as exposure metrics. However, the stochastic human exposure simulation output and the atmospheric chemistry model both bring additional information which helps to reduce the uncertainly in our estimated risk.

Sarah R. Suda, Markus D. Petters, and Sara I. Christensen
Graduate Program: Marine, Earth, and Atmospheric Sciences
Advisor: Markus D. Petters
Poster Number: 171

The role of dynamic surface tension in cloud droplet activation: are soapy clouds brighter than salty clouds?

Cloud condensation nuclei are essential for the formation of clouds. Their abundance, size, and chemical composition of can affect the cloud's microphysical properties, such as albedo. Ideally, a mixed particle's ability to nucleate a cloud droplet can be predicted from that of each chemical component according to its volume fraction in the particle. However, the addition of a surfactant may disproportionately alter a particle's droplet forming potential by reducing the droplet surface tension. Measurements may miss this effect if the surfactant is slow to partition to the droplet surface. Here we present new data on the cloud droplet forming ability of particles composed of the surfactant sodium dodecyl sulfate with either sodium chloride or ammonium sulfate. The experiments were designed to test specific predictions made by Köhler theory that account for surface tension reduction. We also tested for kinetic limitations to the partitioning process by introducing a humidification step and a time delay before the droplet activation measurement, allowing extra time for the surfactant to equilibrate within the solution droplet. Our results confirm those of previous studies, showing that surfactants do not enhance cloud droplet activation relative to the predictions made from measurements of water activity. The data obtained with and without time delay were indistinguishable within measurement uncertainty, suggesting that dynamic surface tension does not need to be considered in Köhler theory.

Amanda Traud
Graduate Program: Biomathematics
Advisors: Alun Lloyd and Rob Dunn
Poster Number: 178

What's the Queen Got to Do with it?: Testing the Effects of Queen Presence on Ant Social Network Structure

Social media sites like Facebook have recently brought social networks into the public consciousness. For example, recent analyses have found that networks of people with identified leaders, like business networks that include managers and CEOs, differ in structure from those composed entirely of people on the same level of hierarchy. *Formica subsericea* are ants and, like humans, have a predefined hierarchy in their interaction networks, namely a caste system that includes workers and queens. In the natural setting, queens are present with workers, and we hypothesize that social networks of these ants, in which a queen is a member, will have a significantly different structure from those that do not include a queen. To test this hypothesis, we observed interactions of small groups of ants that include a queen (queenright) and small groups that are simply made up of workers (queenless). We created both weighted and unweighted networks to test this hypothesis. We compared various sizes of queenright and queenless networks through calculating statistics for each size and category.

Bradley Turnbull, Subhashis Ghosal, and Hao Helen Zhang
Graduate Program: Statistics
Advisors: Subhashis Ghosal and Hao Helen Zhang
Poster Number: 179

Iterative Selection using Orthogonal Regression Techniques

High dimensional data are frequently encountered in various branches of science. Variable selection techniques play a key role in analyzing this challenging type of data. Two main approaches are forward selection methods and penalization methods. Recently, penalized forward selection has been introduced as a procedure, which selects sparser models than comparable methods without compromising predictive power. The motivation for this approach comes from the fact that penalization techniques like LASSO give rise to closed form expressions when used in one dimension, just like the least squares estimator. Hence, one can repeat such a procedure in a forward selection setting until it converges. However, when predictors are highly correlated, unnecessary duplication can occur in the selection step. We show it is possible to improve stability and computation efficiency by introducing an orthogonalization step. At each selection step, variables are screened on the basis of their correlation with variables already in the model, thus preventing unnecessary duplication. This new strategy, called the Selection Technique in Orthogonalized Regression Models (STORM), turns out to be extremely successful in further reducing the model dimension and also leads to improved predicting power. We carry out a detailed simulation study to compare the newly proposed method with existing ones and analyze a gene expression dataset.

Joseph L. Usset[1], Peter Huybers[2], Arnab Maity[1], Ana-Maria Staicu[1], and Armin Schwartzmann[1]
Graduate Programs: Statistics, North Carolina State University[1]; Planetary and Earth Sciences, Harvard University[2]
Advisors: Arnab Maity and Armin Schwartzmann
Poster Number: 182

Smooth Change Point Estimation for the Quantification of Mountain Glacier Retreat

Better tracking of glacial systems would help identify their relationships with climate change, and improve our ability to monitor and predict changes in water supply. While the retreat of mountain glaciers has been studied from the ground, there exists a need for automated methods to track glacial change with a wider scope. Numerous studies have made use of Landsat satellite images to investigate single glaciers of interest, but to broadly catalog temporal changes worldwide, a robust and automated methodology is needed. The objective of our work is to develop a semi-automated way to quantify the retreat of mountain glaciers from 2-D Landsat satellite images. The method we propose is to extract 1-D image profiles from the 2-D images, along inlets of the glaciers, where recession might be noticeable. Within each profile lies a single glacier terminus – a change point. To find them, we perform spline smoothing on each profile and focus on inflection points. The challenge is that many inflection points occur in each profile, and most are noise. But we have sampled these 1-D profiles over time. This has allowed us to find a penalization criterion that integrates information across time points, and estimate glacial recession as a smooth path of change points. We demonstrate the effectiveness of our method by application to image data collected on the Franz Josef, Gorner, Rhone, and Nigardsbreen glaciers.

Thomas Wentworth
Graduate Program: Applied Mathematics
Advisor: Ilse Ipsen
Poster Number: 193

The Affects of Coherence on Randomized Row Sampling

Coherence is a matrix property that is of particular interest to randomized methods for approximating least squares and other problems. In this poster, we present how coherence is related to other matrix properties and a randomized least squares solver called Blendenpik. We provide bounds for the condition number of the sampled matrix of orthonormal columns and use these bounds to examine the potential performance of the Blendenpik algorithm.

Halil I. Akyildiz[1,2], Gregory N. Parsons[2,3], and Jesse S. Jur[1]
Graduate Programs: Fiber and Polymer Science[1]; Materials Science and Engineering[2]; Chemical and Biomolecular Engineering[3]
Advisors: Jesse S. Jur and Gregory N. Parsons
Poster Number: 2

Organic–Inorganic Hybrid Growth Mechanisms on Polymers by Sequential Vapor Infiltration

Organic-inorganic hybrid materials are of interest for mechanical, optical, electronic and catalytic applications. Sequential vapor infiltration (SVI) is a new organic-inorganic hybrid materials formation technique resulting from the ability for organometallic vapors to directly diffuse and react with a polymeric material. SVI is inspired by atomic layer deposition (ALD), a thin film

deposition technique that utilizes self-limiting reactions between vapor phase organometallics and the surface of substrate in order to create nanoscale coatings. In comparison to ALD, SVI relies on a single elongated exposure of the reactive vapor to the polymer that results in the formation of a sub-surface organic-inorganic hybrid material. This research investigates the characteristic hybrid formation mechanism by analyzing the growth as a function of exposure temperature and duration. Specifically, the SVI process has been studied on polyamide 6 (PA6) and poly(ethylene terephthalate) (PET), two commonly used synthetic polymers in the textiles industry and trimethylaluminum (TMA) and H_2O used as precursors. Winged and round fibers were utilized and mass gain after reaction was measured. While both PA6 and PET a decrease in mass gain with increasing temperature, the saturation behaviors of the polymers is substantially faster for PA6 in comparison to PET, especially at lower temperatures. In addition, the PET shows saturation at much higher mass gains comparing to PA6 10 wt% vs. up to 54 wt%. Furthermore FTIR, XPS and TEM analysis were conducted.

Huseyin Avci
Graduate Programs: Fiber and Polymer Science
Advisor: Richard Kotek
Poster Number: 6

'Green' Engineering for Obtaining a New Class of High-Performance Fibers

A number of production methods have been developed for high performance fibers; however, most processes use toxic solvents or generate a lot of by-products. Our research resulted in the development of a new family of high performance polypropylene (PP) fibers by utilizing simple, cost effective, ecologically friendly bath (ECOB). Various commodity polymers can be used with ECOB melt spinning system at high throughputs and performance benefits. The treated as-spun PP fibers had highly oriented, but not crystalline precursor morphology with f_a up to 0.6 generating superior mechanical properties. After drawing at DR of 1.49 at 120°C highly oriented crystalline and amorphous phases were achieved for the drawn fibers with the f_c and f_a value of 0.95 and 0.87, respectively. This fine structure for the ECOB treated fibers resulted in the tenacity close to 12 g/d, initial modulus higher than 150 g/d, and ultimate elongation at break of 20%. The polymer melting point of new fibrillar PP fibers increased by 9°C.

Hui Cong
Graduate Program: Textile Engineering
Advisor: Martin W. King
Poster Number: 29

Fabrication and Tissue Anchoring performance of Nylon and Polypropylene Barbed Surgical Sutures

Barbed surgical sutures are approved by the Food & Drug Administration for use in plastic and cosmetic surgical procedures. The main advantage of this suture is that the barbs project out, penetrate, and anchor with surrounding tissue all along the suture's length, thus eliminating the need for tying a knot. While this barbed suture technology is widely accepted clinically for skin wound closure, its suitability in other applications, such as tendon repair, has yet to be proven. The objective of the current study was to evaluate the anchoring performance of barbed sutures in skin and tendon tissues. Nylon and polypropylene (PP) size "O" barbed monofilament sutures were fabricated using a special barb cutting instrument with two cut depths, namely 40% and 50% of the filament diameter for skin and tendon tissues. The target cut angle of 170° and frequency of 2.5barbs/cm were kept constant. The average barb cut angle and cut depth measurements were obtained from the microscopic images using an image analysis software. The tensile properties of both the unbarbed and barbed sutures were determined on a tensile tester. The anchoring performance of the prepared PP barbed sutures in skin and tendon tissues were determined by using the *in vitro* pullout test. Fresh porcine dermis and superficial distal flexor tendons were harvested from the NCSU pig farm. The reduction in ultimate tensile stress of the barbed sutures was not linearly related to the cut depth. The barbs on PP sutures stood out more prominently than those cut on the nylon sutures. Despite having a lower ultimate tensile stress the PP 50% cut depth barbed suture gave a superior tissue anchoring performance in tendon tissue than the "stronger" PP 40% cut depth barbed suture in skin tissue.

Kun Fu
Graduate Program: Fiber and Polymer Science
Advisor: Xiangwu Zhang
Poster Number: 45

Flexible and Binder-Free Design: Nonwoven structure based Si materials as Anodes for Lithium-Ion Batteries

Flexible and binder-free Silicon-Carbon (Si-C) based nanostructured materials were synthesized and studied as anodes for use in lithium-ion batteries (LIB). Si is a good active material candidate with the highest theoretical capacity (4200 mAh/g) and it can be used replace current commercialized graphite material (375mAh/g) to significantly increase the energy density of batteries.

However, the 400% volumetric change and low electrical conductivity of Si lead to the structural failure of electrode materials and limit the battery cycling performance. In order to overcome these limitations, carbon nanofibers (CNFs) were introduced to combine with Si to form Si-CNFs composites. Carbon fibers can build effective electron pathways for Si active material and at the same time provide a stable matrix to accommodate the large volume change of Si. Electrospinning method is an effective way to produce continuous CNFs with nonwoven structure. Nonwoven structure is an important textile structure for obtaining flexible isotropic structure. Hence, designing flexible nonwoven Si-CNFs mats as anode material is a promising way to meet the requirement of future light-weight and flexible portable electronics with high-energy density and capacity. In this paper, several strategies were developed: creating vacant space for Si within CNFs and coating Si-C nanofibers with amorphous carbon by chemical vapor deposition (CVD). For the vacant space created for Si within CNFs, a stable cycling performance was obtained with high coulombic efficiency (99%), high capacity retention (>99%), and high capacity (~1000 mAh/g) after 150 cycles. Meanwhile, it needs to be mentioned that in this work, all the nonwoven structures were used directly as electrodes without the presence of polymer binder or current collector. In the end, our designs provide promising ways to obtain flexible and binder-free electrode with high energy and capacity for lithium-ion batteries.

William J. Gabler
Graduate Program: Textile Engineering, Chemistry and Science
Advisors: Roger Barker and Bryan Ormond
Poster Number: 47

Implementation of NFPA 1994 Chemical Permeation Resistance Test: Applying Air Sampling Methods to Detect Chemicals Used to Evaluate Protective Clothing Materials

Chemical protective apparel must meet strict standards and perform reliably when people's lives depend on it. However, existing test standards for measuring the permeation of toxic industrial chemicals do not specify important details of implementation, which could negatively alter results. The objective of this study is to investigate various air sampling, detection, and analysis methods to achieve reliable and sensitive quantitation of the permeation of challenge chemicals according to the NFPA 1994 Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents. National Institute for Occupational Safety and Health (NIOSH) methods are adapted for use on the standard. Operational parameters such as air conditions and flow rate are assessed. And additional criteria are suggested to ensure the high standard required for analysis of trace levels of permeant, such as defining collection efficiencies and determining limits of detection. The resulting testing apparatus and methods can be used to better evaluate materials and components of personal protective equipment.

Chirag R. Gajjar[1], Tabitha Rush[1], Michael Jolly[1], Jeffery Owens[2], Martin Hubbe[3], and Marian McCord[1,4]
Graduate Programs: Textile Engineering, Chemistry and Science, North Carolina State University[1]; Air-Force Research Laboratory[2]; Forest Biomaterials, North Carolina State University[3]; Biomedical Engineering, North Carolina State University/University of North Carolina-Chapel Hill[4]
Advisor: Marian McCord
Poster Number: 48

Improving the Hemostatic Property of Common Textile Fibers for Wound Dressing Application

Uncontrolled bleeding from wounds is major cause of preventable deaths. Blood-clotting is influenced by nature of the surface with which it comes in contact. Surface-induced hemostasis has been correlated to properties like wettability, negative surface charge, chemical functionalities etc. General belief is that negatively charged hydrophilic materials give rapid clotting. However, not all negatively charged surfaces are thrombogenic and even some positively charged surfaces show hemostatic properties. Some hydrophobic materials are also the coagulants. Thus, the exact requisites for hemostasis-inducing surfaces are yet not clear. The objective of this study is to characterize the relationship between fiber properties and their hemostatic behavior in order to improve hemostatic property of fibers for low-cost and effective wound-dressings. We used cotton, rayon, polypropylene, polyester, nylon and fiberglass. Fiberglass is an active hemostatic agent. Our hypothesis is that if we can replicate the surface-chemistry of glass onto other fibers, we can enhance their hemostatic properties. Hence, fibers were coated with tetraethyl-orthosilicate (TEOS) which imparts glass-like surface. Thrombin assay was used to measure the hemostatic potential of human plasma, Streaming Potential Jar was used to measure surface charge of the fibers and single-fiber contact angle measurements were used to determine the hydrophilicity. Scanning Electron Microscopy and Energy Dispersive Spectroscopy were used to characterize changes in surface morphology and surface-chemistry respectively after TEOS treatment. Thrombin assay gives the time to thrombin formation, which corresponds to the hemostatic potential of fibers. As expected, fiberglass was the most potent hemostatic material. It reduced the time to thrombin formation for human plasma from 34.27 ± 2.42 minutes to 7.57 ± 1.13 minutes. While TEOS treatment highly improved the hemostatic property for other fibers, it actually increased time to thrombin formation for fiberglass. TEOS treatment normalized the hemostatic behavior of all treated samples, bringing them to almost same level.

Rashi Grewal
Graduate Program: Fiber and Polymer Science
Advisor: Julie A. Willoughby
Poster Number: 54

An Analysis of Moisture Vapor Transport through Highly Breathable Surface-modified Materials

This study involves observing the moisture vapor permeability (MVP) and surface chemistry of elastomeric polydimethysiloxane (PDMS) that has been coated with various chemical moieties. Using a mechanically-assisted stretching technique, it is possible to vary the packing density of these grafted moieties on the surface of a PDMS film, thereby changing the degree of hydrophobicity. It was originally hypothesized that an increase in packing density would result in a corresponding decrease in MVP. It has been found that while this is not the case, the surface stability does seem to increase with increased packing density, under varying environmental conditions. This phenomenon would be desirable for designing materials that are highly breathable, yet liquid repellent; such materials include wound dressings, athletic apparel, and military uniform ensembles.

Jonathan C. Halbur[1], Ankesh Madan[2], and Jesse Jur[1]
Graduate Program: Fiber and Polymer Science[1]; Materials Science and Engineering[2]
Advisor: Jesse Jur
Poster Number: 56

Photoremediation of Heavy Metal Ions by Nonwoven Fabrics Coated with Thin Films Deposited by Atomic Layer Deposition

The presence of elevated levels of heavy metals in drinking water supplies is a global issue affecting nations worldwide. Ceramic oxides such as TiO_2 and ZnO, which are common photocatalytic materials, can reduce heavy metal ions from solution, leaving insoluble compounds on the oxide surface. However, these photocatalysts are typically placed in solution in particle form, which necessitates materials removal after use by ultrafiltration or sedimentation. This research explores the means to produce nanoscale thin film coatings of TiO_2 and ZnO on nonwoven fabrics to promote the ease of metal ion removal. Atomic layer deposition, a self-limiting vapor phase inorganic deposition technique, is explored to produce nanoscale thin films of these materials on nonwoven polyamide fabrics. Initially, fabrics were coated with varying numbers of ZnO ALD and exposed UV illumination in the presence of 0.1M $AgNO_3$ to determine the number of ALD cycles required to induce photocatalytic properties. Then, TiO_2 and ZnO coated fabrics were submerged in Cr^{6+} or Ag^{+} aqueous solutions and subjected to UV illumination. The ALD-treated fabrics show the ability to reduce heavy metal ions from solution directly. The heavy metal ion reduction was analyzed via optical emission spectroscopy and scanning electron microscopy.

Jing Liang
Graduate Program: Textile Science and Engineering
Advisor: Martin W. King
Poster Number: 91

Micro-braided Double Layer Nerve Conduits for Peripheral Nerve Regeneration

Several 100,000 people are affected by peripheral nerve defects every year, and many patients remain disabled for the rest of their lives. Currently, artificial nerve conduits (NCs) are considered as a promising therapy. However, some known nerve conduits have a rigid structure or fail to maintain a mechanically stable architecture during the regeneration process, which result in a chronic inflammatory response and compression of the new nerve [1]. Some NCs fail to meet the preferred pore size, resulting in either infiltration of inflammatory cells into the conduit, or inhibition of nutrients and oxygen exchange [2]. Moreover, limited researches of incorporating filaments or fibers to give guidance of axons and to attach Schwann Cells were done in the past. This study aims to design and fabricate a micro-braided double layer nerve conduit (NC) with desired pore sizes, and incorporate the NC with longitudinally aligned grooved fibers (4DG) inside. Micro-braiding technology is a versatile approach to obtain a soft, flexible and semipermeable tubular structure, with improved mechanical performance. The incorporation of 4DG fibers can not only provide expanded surface area and deep grooves for cells attachment and migration, but also provide guidance for regenerated axons to grow into the distal nerve stump. The NC consists of two layers, a dense outer layer and a macro-porous inner layer, which were braided from 170-denier poly(l-lactic acid) (PLA) yarn on a 16-spindle braiding machine. The average pore sizes of the inner and outer layers were around 50μm and 20μm respectively. Compression resistance test was performed, the two layer NC with 4DG fibers in the core withstood largest loads at strains of 40, 50, 60%. Schwann Cells were seeded on the 4DG fibers and cultured for up to 7 days. At day 7, the Schwann cells were stained with DAPI and were observed to attach to the 4DG fibers.

Yanxue Ma
Graduate Program: Textile and Apparel, Technology and Management
Advisor: Traci Lamar
Poster Number: 102

An Integrated model for shaped knit garment design and development

Competition in the knitwear market and quick changes in fashion increase the need for an effective and efficient garment development process. Innovative knitting technologies, such as fully-fashioned and seamless knitting, combined with other computerized technologies expand potential in knit garment design and development. However, inadequate understanding of these advanced technologies and lack of a well-developed process impede design and development of shaped knit garments. This research aims to establish an integrated model for fully-fashioned and seamless knit garments that incorporates all aspects of design and development such as yarn selection, knitted structure selection, garment style development, CAD/CAM, knit production, finishing and evaluation. Another purpose is to explore the knowledge base needed to support the fully-fashioned and seamless knit garment development process. An integrated model of the design and development process including knowledge building and evaluation components was established based on collected data and documentation of four case studies. The model not only demonstrates an effective knit garment design and development process, but it also discusses in-detail the knowledge needed to support each step and information needed to make evaluations. To support the model, a database of yarn types, knitted structures, and machine settings was developed through investigating effects of different shaping techniques on knitted fabric dimensions. The database provides a reference for designers seeking to create unique knit garments. In future research, the established model will be validated through in-depth case studies and interviews with experts in knit garment development.

Mahsa Mohiti-Asli [1], Behnam Pourdeyhimi[1], and Elizabeth G. Loboa[2, 3]
Graduate Programs: Fiber and Polymer Science, North Carolina State University[1]; Biomedical Engineering, University of North Carolina at Chapel Hill and North Carolina State University[2]; Materials Science and Engineering, North Carolina State University[3]
Advisors: Behnam Pourdeyhimi and Elizabeth G. Loboa
Poster Number: 117

Antibacterial Nanofibrous Bandages for Wound Healing Applications

Modern skin substitutes are being designed to combat bacterial infection. However, the cytotoxicity of these products has remained a significant challenge. In this study, a silver based antimicrobial solution was used as a surface modification treatment to provide antimicrobial properties to electrospun poly (L-lactic acid) (PLA) nanofibers. The chemical composition of the coated fibers was analyzed using XPS, TOF-SIMS and NMR spectroscopy. The release rate of silver ions in deionized water was quantified using an atomic absorption spectrophotometer. The antimicrobial properties of the dressings were tested using both qualitative (AATCC 147) and quantitative (AATCC 100) methods with analyses of two different bacteria that included both gram negative and gram positive phenotypes: Staphylococcus aureus and Escherichia coli J53. AATCC 147 results exhibited a clear zone of inhibition of both bacteria by the antimicrobial bandages. Quantitatively, the constructs exhibited a 100% reduction for the two bacteria after 24 hr. Cytotoxicity of the antimicrobial nanofiber dressings was tested using human epidermal keratinocytes and human dermal fibroblasts. Cell viability and proliferation was analyzed at days 1, 4 and 7. Results indicated that human fibroblasts and keratinocytes remained viable on the antimicrobial dressings with a proliferation profile similar to non-coated PLA controls. Field emission SEM was used to characterize cell morphology on both treated and control nanofibers and showed that fibroblasts adhered to, and spread, throughout the surface of the antimicrobial bandages. The newly developed antimicrobial PLA nanofibers exhibit excellent antimicrobial properties while maintaining human skin cell viability and proliferation. The gradual release of silver ions from these synthetic dressings makes them a promising candidate for skin substitutes, especially in cases of chronic burn injuries with a high risk of infection.

Katherine Polston
Graduate Program: Textile Technology Management
Advisor: Lisa Parrillo-Chapman
Poster Number: 145

Assessing user skill levels and niche market identities of print-on-demand inkjet digitally printed textiles

The primary objective of this study was to determine user skill levels in 1) CAD Software; 2) Color Control; and 3) Creating Repeat Patterns. Study participants were asked to self identify as one of four niche market categories: a crafter, a designer, an artist/artisan or a small business owner/entrepreneur. The self-identified user types represent possible consumer identities of print-on-demand (POD) inkjet digitally printed textiles (IJDPT). A survey instrument was developed based on a comprehensive review of the literature and informal interviews with textile industry members from the print-on-demand, inkjet digital printing market. The 625 valid responses were analyzed to determine if skill level impacts a user's ability to effectively use textile POD IJDPT and to determine if there is a difference in self-assessed skill levels per self-identified user type. The research resulted in

the following; the demographics of users of POD-IJDPT, the distribution of self-identified user types in users of POD-IJDPT, and found a statistically significant difference in the skill levels of user types in CAD, Color Control and Creating Repeat Patterns. The information gathered from this study will contribute to the broader understanding of how to determine and assess new skill sets when adopting a new technology, and how a change in skill sets may hinder adoption. Results from this research may also be applicable in a practical sense as information tabulated from the technology user's may enable educators to understand which knowledge areas may need to be strengthened or added to a curriculum to meet the demands of a changing field. In addition, industry and academic members could use this instrument in order to assess user's skills prior to the implementation of inkjet printing or similar design technologies. Print-on-demand (POD) inkjet digitally printed textiles (IJDPT) is a relatively new market. This study is the first to access skill level of this new technology. This research greatly contributed to the knowledge base of this field by identifying the new skill set needed to effectively adopt inkjet printing, and building a skill assessment instrument. This study is the largest study of its kind on inkjet printing users.

Iurii Sas
Graduate Program: Textile Technology Management
Advisors: Jeff Joines and Kristin Thoney
Poster Number: 154

Logistics of Closed-Loop Textile Recycling

Post-consumer carpet accounts for more than quarter of all textiles discarded at municipal solid waste centers. Recycling of post-consumer carpet reduces pressure on the landfills and may direct secondary materials back into production. To make recycled materials competitive with virgin materials, the cost of recycled materials should be kept as low as possible. This research was focused on carpet reverse logistics that have significant impact on cost of recycled materials. Two aspects of carpet reverse logistics were considered in the study: design of collection and recycling networks. Well-designed collection network can provide sufficient volumes of carpet to take advantage of economies of scale at large recycling plants. Efficient location of reverse processing facilities in recycling network, as well as, identification of reverse activities performed at each layer of the network can significantly reduce transportation cost. For the collection network problem, the set-covering optimization model with partial coverage was formulated and the novel heuristic based on greedy randomized adaptive search procedure was developed to solve large problems. The heuristic was used to design a set of nation-wide collection networks with different levels of the target collection rate. For recycling network, the hierarchical facility location model was formulated and a heuristic method based on the alternative location-allocation procedure was developed to solve large instances of the problem. The heuristic was used to compare, three alternative designs of carpet recycling network in the US that differ by types of facilities involved and reverse activities performed at each layer. The results of this study can be used by organizations involved in carpet recycling in the US to establish reverse networks. The optimization models and the solution heuristics can be used for similar problems in forward or reverse logistics.

Ravikanth N. Vangala
Graduate Program: Textile Technology Management
Advisor: Moon W. Suh
Poster Number: 184

Design and Development of a Dynamic Quality Control System: Applications to Ring Spinning and Continuous Dyeing Processes

Real-time diagnosis of abnormal variations in processing has always been a challenging task for most manufacturers with continuous/contiguous processing sequences. Despite the rapid advancements in technology in quality monitoring systems, attaining quality as per customer requirements is still a predominant issue for these companies. Hence, there is an urgent need for development of a new and better method for modeling and monitoring of abnormal variations to optimize quality costs in production, and consequently improve profits. This research study is a part in response to this call.

This research study primarily involves the design and development of a *dynamic quality control system*, by integrating and enabling three key concepts, namely – *concept of bias separation and estimation through structural equations, concept of variance tolerancing*, and *concept of dynamic control limits*. According to this novel system, the changes observed in prior processes update process averages and control limits of the current process through structural relationships that link those two stages. By applying the concept of variance tolerancing, a new set of control limits are obtained, which are functions of dynamic process averages and variances.

$$C.L = f(\mu_x,\sigma_x) \pm kf(\mu_x,\sigma_x)$$

As a case study, this novel concept is applied to ring spinning and continuous dyeing processes that are serially connected with time lags. Structural equations based on key process parameters – *mass variation and amount of dye absorbed* for ring spinning, and continuous dyeing processes respectively have been scouted-out from literature. By consolidating and tolerancing these structural equations, a set of dynamic control limits are obtained. Using these accurate control limits, the root causes of the out

of control situations can be determined precisely, and unnecessary corrective actions that are detrimental to quality of the output product can be minimized.

Guan Wang
Graduate Program: Textile Chemistry
Advisor: David Hinks
Poster Number: 189

Synthesis of Bleach Activators with Varying Cationic Groups

Bleaching is a key method for preparing natural textile fibers for dyeing and finishing. The process removes colored and non-colored impurities in the fiber. It whitens the fiber and provides a more uniform base to enable high quality dyeing. Hydrogen peroxide is an abundant, low-cost and commonly used oxidizing agent that oxidizes a range of organic compounds by dissociation into perhydroxyl anion under alkaline conditions. Relatively high temperature and alkali conditions are necessary for rapid hydrogen peroxide bleaching. These conditions produce a loss of fabric strength, result in relatively high energy consumption, and generate large amounts of electrolyte upon neutralization of the bleach solution. Cationic bleach activators have been investigated as next generation bleach activators that exhibit inherent substantivity towards cellulosic fibers. N-[4-(triethylam-moniomethly)benzoyl] butyrolactam chloride) (TBBC) is a cationic bleach activator that has been shown to exhibit improved hydrogen peroxide bleaching in relative low temperature and under neutral conditions. However, the use of cationically charged compounds often leads to aquatic toxicity and other negative environmental concerns. The purpose of this thesis research was to investigate the effect of varying the type of cationic group used for synthesis of a butyrolactam- and caprolactam-based bleach activators. The new cationic bleach activators were synthesized and characterized by ^{1}H NMR, melting point, and via mass spectrometry. The new activators were then used in comparative bleaching experiments and their performance was compared to TBCC and TBBC. The bleaching experiment results showed that all of the new cationic bleach activators exhibited bleaching at relatively low temperature and neutral conditions. When 3-methylpyridine was employed as the cationizing amine the bleach performance was comparable to that of the current best bleach activator, TBBC. Importantly, the toxicity of 3-methyl pyridine is substantially lower than the triethylamine used for the synthesis of TBBC.

Tong Yao
Graduate Program: Textile Engineering
Advisor: Martin W. King
Poster Number: 197

The Development of In Vitro Abrasion Test Method for Textile and Metal Components of Endovascular Stent Grafts

Abdominal aortic aneurysms (AAA) and thoracic aortic aneurysms (TAA) are localized dilations of the abdominal aorta and thoracic aorta respectively. Implantable endovascular stent-grafts have become routine devices for the treatment of abdominal and thoracic aneurysms. Given that such devices are permanent implants, the question of long-term biostability needs to be addressed. The ultimate goal of this study is developing an abrasion test method for the graft fabric and the metallic stent of an endovascular stent-graft.

The modified abrasion tester enables a stent wire abradant to abrade against a strip of graft fabric material under either a wet or a dry environment to mimic in situ abrasive motion. Three endpoints were established to determine the fabric's abrasion resistance after a certain number of abrasion cycles. Two types of graft fabric materials, multifilament polyester fabric and monofilament polyester fabric, and two types of stent materials, laser cut nitinol stent and regular round section nitinol stent wire, were evaluated under dry and wet environments using the developed abrasion tester.

The results have shown that this test method is viable for testing the relative abrasion resistance of the components of endovascular stent grafts. The abrasion resistance of both fabrics was lower in a wet environment compared to being tested dry. Additionally, the multifilament polyester fabric had better abrasion resistance than the monofilament polyester fabric. The laser cut nitinol stent was more aggressive in creating holes and breaking yarns, while the regular nitinol stent wire caused a greater loss in fabric strength.

Wenwen Zhang
Graduate Program: Textile Engineering
Advisor: Stephen Michielsen
Poster Number: 199

The Study of the Synthesis of a Water Soluble Antimicrobial Polymer

In this study we have tried to synthesize a water soluble antimicrobial polymer in order to produce an effective, reusable and skin friendly antimicrobial fabric while also lowering the production cost. The soluble polymer is a copolymer of acrylic acid, vinyl

benzyl chloride, and 4-stryrene sulfonic acid. The antimicrobial agent, Rose Bengal, was expected to attach to the copolymer through a reaction with benzyl chloride, but it was found that this did not occur. Rather, a large amount of free dye was found at the completion of the reactions. To eliminate the free dye, the reaction conditions were adjusted. After testing several methods for quantitatively determining the amount of free dye in our samples, it was found that dialysis provided the best quantitation. The amount of free dye was measured at several points during the polymerization to understand the cause of residual free dye. We believe it is due to competition between –COOH groups on Rose Bengal and on acrylic acid. By modifying the polymerization conditions and the benzyl Rose Bengal monomer synthesis, water soluble and antimicrobial polymer was successfully polymerized with very little free dye remaining. This was accomplished by attaching Rose Bengal to vinyl benzyl chloride. Next this monomer was copolymerized with acrylic acid to enhance its water solubility. While the polymerization was occurring, the reaction mixture was added to an aqueous solution of 4-styrene sulfonic acid and the polymerization continued.

Shannon E. Duke Becker[1], Alexander S. Graphodatsky[2], and Matthew Breen[1,3,4]
Graduate Programs: Comparative Biomedical Sciences, North Carolina State University[1]; Department of Molecular and Cellular Biology, Institute of Chemical Biology and Fundamental Medicine, SB RAS, Novosibirsk, Russia[2]; Center for Comparative Medicine and Translational Research, North Carolina State University[3]; Cancer Genetics Program, UNC Lineberger Comprehensive Cancer Center, Chapel Hill, NC[4]
Advisor: Matthew Breen
Poster Number: 38

Canid B Chromosomes May Represent More Than Inert Elements Within the Cell

Since divergence from the last common ancestor ~10 million years ago, canid karyotypes rapidly evolved into a wide range of chromosome number and morphology. These gross karyotypic changes result from rearrangements of chromosome segments with the associated breakpoints common between species. An artifact of these karyotypic changes is the presence of supernumerary chromosomes, termed "B chromosomes", in four canids. The number and type of B chromosomes varies between individuals in a population and within cells of the same individual. Chromosome banding and early cross-species molecular cytogenetics work led to the assumption that canid B chromosomes are inert. However, we have shown that at least twelve regions of the dog genome are found on the canid B chromosomes, including at least four cancer-related genes, suggesting that canid B chromosomes are not entirely heterochromatic and may have functional significance. We further assessed the composition of B chromosomes of the red fox *Vulpes vulpes* by comparison to the domestic dog genome, identifying an additional forty regions of the dog genome found on the red fox B chromosomes. Understanding the sequence composition of the B chromosomes may clarify questions regarding their origin and development and globally, new chromosome structures in evolving karyotypes.

[This study was supported by a grant from the Morris Animal Foundation awarded to MB (D08ZO-022). SEDB was funded in part by the Comparative Biomedical Sciences Graduate Program at NCSU. ASG was supported by funds from the Program on Molecular and Cellular Biology (MCB) and Russian Foundation of Basic Research (RFBR).]

Shivaramu Keelara[1], Wondwossen A. Gebreyes[3], Morgan W. Morrow[2], H. Morgan Scott[4], Maria Correa[1], and Siddhartha Thakur[1]
Graduate Programs: Comparative Biomedical Sciences, North Carolina State University[1]; Animal Science, North Carolina State University[2]; Veterinary Preventive Medicine, The Ohio State University[3]; Epidemiology, Kansas State University[4]
Advisor: Siddhartha Thakur
Poster Number: 79

Inter Serovar Transmission of Resistance Determinants in *Salmonella* Isolated from Antimicrobial Free (ABF) and Conventional Pigs at Farm and Slaughter

The aim of this longitudinal study was to determine the prevalence and molecular characterization of *Salmonella* in ABF and conventional pigs at farm, slaughter and in their environment. A total of 2889 fecal and 2122 environmental samples were collected from 10 conventional and 8 ABF cohorts of pigs at different stages on farm. In addition, 1363 slaughter and 205 lairage and truck samples were collected at slaughter. A total of 1090 *Salmonella* were isolated. *Salmonella* were characterized for their antimicrobial resistance profile, resistance genes, class I integrons and plasmid profile. Genotypic relationships among *Salmonella* isolates were determined by Pulsed-field gel electrophoresis (PFGE). Conjugation, plasmid isolation and restriction analysis was done to determine the inter serovar exchange of resistance determinates. *Salmonella* prevalence on conventional farms was significantly higher in pigs (4%; n=66) and environment (11.7%; n=156) compared to the ABF pigs (0.2%; n=2) and environment (0.6%; n=5) ($P < 0.01$). At slaughter, *Salmonella* were isolated from all stages including post chill. Isolates exhibited the highest frequency of resistance to tetracycline including conventional farm environment (88%) and pigs (82%) followed by ABF pigs (60%) and their environment (21%). MDR (resistance to ≥ 3 antimicrobials) was detected in 23% (n=257) of the isolates. *Salmonella* isolates from pigs and environmental samples at farm and slaughter exhibited similar resistance and fingerprinting profiles by PFGE. We detected bla_{TEM}, bla_{PSE}, *cmlA*, *str(A/B)*, *tet A* and bla_{CMY-2} resistance genes by PCR. The MDR isolates carried class 1 integrons. Restriction analysis of plasmids evidenced inter serovar exchange of bla_{CMY-2}, confirmed using southern blotting. The phenotypic and genotypic results of our study indicate the role of environment and plasmids in the transmission

of AR *Salmonella* in the two production systems. The prevalence of AR *Salmonella* in ABF pigs in the absence of selection pressure is concerning.

Mary Katherine Sheats [1,3], Kenneth B. Adler [2,3], and Samuel L. Jones [1,3]
Graduate Program: Comparative Biomedical Sciences[1]; Molecular Biomedical Sciences[2]; Center for Comparative Medicine and Translational Research[3]
Advisor: Samuel Jones
Poster Number: 156

MARCKS is a Key Regulator of Equine Neutrophil β2-Integrin Dependent Functions

Neutrophils are white blood cells designed to destroy invading microorganisms that penetrate the body's defenses. In response to infection these innate immune cells migrate from the vasculature into injured tissues where they deploy an arsenal of reactive oxygen species and proteolytic enzymes via the processes of respiratory burst and degranulation, respectively. While these mechanisms of bacterial killing are essential to host defense, there are numerous pathologic conditions in which dysregulated neutrophil response causes chronic and/or severe damage to host tissue (i.e. recurrent airway obstruction, ischemic reperfusion injury). Individuals suffering from these conditions would likely benefit from therapies designed to inhibit neutrophil recruitment and activation. Therefore, our goal is to identify cell signaling components involved in neutrophil migration in order to develop targets for new anti-inflammatory therapies.

In order to migrate into tissue, neutrophils must interpret chemoattractant signals in their external environment with reorganization of their actin cytoskeleton and increased expression of adhesion molecules, such as β2-integrins. As an actin binding protein, Myristoylated Alanine-Rich C-Kinase Substrate, or MARCKS, has been shown to regulate reorganization of the actin cytoskeleton in numerous cell types, including fibroblasts, neurons and endothelial cells. In this study we hypothesize that MARCKS is a key regulator of equine neutrophil migration.

To conduct this study we isolated primary neutrophils from whole blood of healthy donor horses and stimulated migration, adhesion, and respiratory burst *in vitro* using a variety of stimulators and chemoattractants. MARCKS function was inhibited by treating cells with MANS, a myristoylated, cell permeant peptide identical to the 24 amino-acid N-terminus of MARCKS. We found that MARCKS inhibition with MANS peptide significantly attenuated equine neutrophil migration, adhesion, and respiratory burst in a manner consistent with β2-integrin inhibition. These findings warrant further investigation of MARCKS as a potential target for anti-inflammatory therapy.

Rachael E. Stebbing[1], Susan C. Irvin[1], Karl W. Boehme[2], Mine Ikizler[2], Jeffrey A. Yoder[1], Terence S. Dermody[2], and Barbara Sherry[1]
Graduate Programs: Comparative Biomedical Sciences, North Carolina State University[1]; Vanderbilt University School of Medicine[2]
Advisor: Barbara Sherry
Poster Number: 167

An ITAM in Reovirus Regulates Activation of NF-κB, Induction of Interferon-β, and Viral Spread

Immunoreceptor tyrosine-based activation motifs (ITAMs) are signaling domains present in the cytoplasmic tails of receptors and transmembrane adaptor proteins that mediate a variety of cellular responses. ITAMs have also been identified in enveloped viruses, where they use the same cell signaling intermediates as cellular ITAMs to participate in pathogenesis and oncogenesis. We identified putative ITAM sequences in three proteins of reovirus, a non-enveloped virus. ITAM-mediated cell signaling requires phosphorylation of two tyrosine residues within the motif. To determine the role of ITAMs in reovirus replication and pathogenesis, we used reverse genetics to generate mutant reoviruses in which the two critical tyrosines in each ITAM were replaced with phenylalanine to prevent ITAM phosphorylation. We found that the μ2 ITAM was required for maximal activation of NF-κB and induction of IFN-β in both a generic fibroblast cell line and in primary cardiac myocyte cultures. In the fibroblasts, where NF-κB is required for apoptosis, the μ2 ITAM enhanced viral fitness. In contrast, in cardiac myocytes, where NF-κB is not required for apoptosis but is required for induction of the critical antiviral cytokine IFN-β, the μ2 ITAM diminished viral fitness. It remained possible that the μ2 ITAM sequence was a fortuitous homology. We found that μ2 but not the μ2 ITAM mutant activated Syk, a signaling intermediate in the cellular ITAM pathway. Together, our results provide the first evidence for an ITAM in a non-enveloped virus, and suggest it has a cell type-specific role, likely reflecting the cell type-specific function of NF-κB and IFN-β.

Suliko Ayvazov, Alex Herrington, Jie Liu, Shweta Madhwani, and Adam Miller
Graduate Program: Analytics
Advisor: Sudipta Dasmohapatra
Poster Number: 7

Unclaimed Property: Returning to their Rightful Owners and Supporting Higher Education

The Department of State Treasurer (DST) administrates North Carolina's Escheat Fund, which holds $344 million in unclaimed property. DST has two primary goals as fiduciary of the Escheat Fund:

1. Return properties back to rightful owners (in equivalent cash value).
2. Invest fund principal and distribute interest earnings for student loans and scholarships.

The objective of our graduate project was to use analytics to help the Department of State Treasurer better achieve their two major goals. First, we identified significant factors that affect the likelihood of a property to be claimed, allowing DST to measure the claim-risk for any individual unclaimed property out of 7-million in the database. With unclaimed properties valued as high as $12 million, this model provides a mechanism to apply a probability score for each property. Next, we recommended a minimum Escheat Fund requirement. We used actuarial techniques in risk and simulation to model claim distributions and recommend a fund reserve based on DST's chosen risk level. Property claims have been trending upward while the fund has been increasingly subjected to principal withdrawals for education investments. Our model takes these trends into account in generating its reserve recommendation. Finally, we created data visualizations of unclaimed properties and claimant locations across North Carolina, allowing DST to target their marketing efforts toward underserved areas that could have high potential for unclaimed property. These visualizations will also help DST manage their holder compliance outreach.

Applying our analytics solutions will ensure that the North Carolina Department of State Treasurer can fulfill its duty to return unclaimed property to rightful owners and provide financial support to students.

Kate Davies, Lisa Kuhn, Betsy Matthews, John Papazian, and Matt Pledger
Graduate Program: Advanced Analytics
Advisor: Sudipta Dasmohapatra
Poster Number: 33

SNA - Building on Yesterday's Methods to Answer Tomorrow's Questions

While the field of Social Network Analysis (SNA) has experienced rapid development since the 1970's, the world we live in today demands insights from such data and answers to questions faster than ever before. However, this cannot be achieved by applying the same methodology used ten, five, or even one year ago. To that end, our research focused on the creation of graph reduction and visualization methods to support large graph mining in the time-sensitive world in which we live. We extended on the key concepts found in typical shortest path algorithms to subset and isolate the paths and cycles of interest from the noise commonly found in large datasets. We coupled that with our unique approach to network visualization, which produces results which are intuitive, explainable, and timely.

INDEX