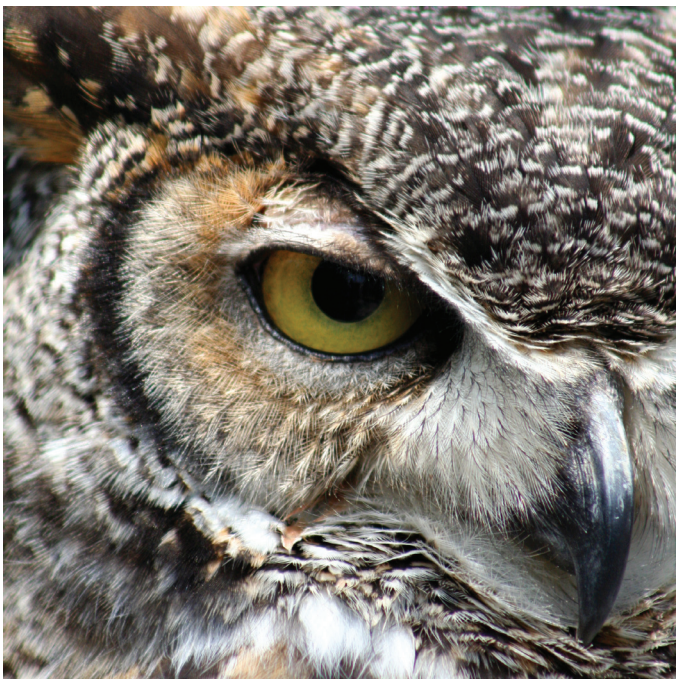
ABSTRACTS



6TH ANNUAL

NC STATE UNIVERSITY

GRADUATE STUDENT RESEARCH

.... SYMPOSIUM ....

March 21, 2011 • 1:00 - 5:30 pm • McKimmon Center

Sixth 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 (2010-2011)

Bryan Hoynacke, Public Administration (Chair)
David Rosero, Animal Science
Grant Brigham, Agricultural and Extension Education
Hakan Karagul, Industrial Engineering
Sen Li, Physics
Stacie Flood, Plant Biology

AGENDA

12:00 pm - 1:00 pm	Poster Set Up	Area 1
1:15 pm - 1:30 pm	Welcoming Remarks and Symposium Overview Ali Kefeli, University Graduate Student Association President Dr. Duane K. Larick, 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 Dr. Terri L. Lomax, Vice Chancellor for Research	Rooms 2A & 2B

TABLE OF CONTENTS

ABSTRACTS

Ayuub Ayoola[1], Peter Ferket[2], Russell J. Borski[3], and Charles R.Stark[2]
Graduate Programs: Food, Bioprocessing, and Nutrition Science[1]; Poultry Science[2]; Biology[3]
Advisors: Peter Ferket and Jonathan Allen
Poster Number: 4

Replacement of fishmeal by alternative protein ingredients in feeds for Nile tilapia (*Oreochromis niloticus*)

The declining availability and increasing demand of fishmeal is a major contributor to the rising feeds price. There are economic and environmental sustainability incentives to find lower cost protein sources to replace fishmeal in aquaculture feeds. Nile tilapia, an omnivorous species, is feasible specie to feed diets that contain proteins from alternative sources other than fishmeal. An experiment was conducted to evaluate the replacement of fishmeal at a dietary inclusion level of 6% with poultry by-product meal (PBM), fermented lactic acid stabilized deboned poultry meat residue (MDM), and yeast extract (YE), on growth performance of Nile Tilapia (*Oreochromis niloticus*). Four experimental diets were manufactured, fed twice daily at 3% of average body weight (BW) per day. Each treatment was replicated in three 1000L recirculation tanks containing 35fish per tank. The trial continued for 105 days, with initial average BW of 91 g. BW were measured at 34, 72, and 105 days, and specific growth rate (SGR) was calculated. Blood samples for plasma IGF-1(IGF-1) measurements were collected at day 0 and 105. At 105 days, 3 fish per tank were randomly sampled for proximate composition analysis. Feed conversion ratio (FCR) and protein efficiency ratio (PER) from 1-105 days were calculated. There were significant treatment effects on final average BW, SGR, FCR and PER. The final average BW, SGR and FCR of the fish fed with FM was significantly greater than fish fed diets containing MDM, but neither different from YE and PBM ($p<.05$) . In contrast, PBM resulted in significantly lower PER than FM, but neither of these treatments were significantly different from YE or MDM ($p<.05$). There were no significant treatment effects on the IGF-1 and proximate composition. The results demonstrated that YE, MDM and PBM are feasible low cost alternatives for FM in diets for Nile tilapia.

Renee A. Beardslee and Scott D. McCulloch
Graduate Program: Environmental and Molecular Toxicology
Advisor: Scott D. McCulloch
Poster Number: 9

Analysis of Molecular Split Mutants of Human DNA pol eta and Their Effect on Polymerase Properties

DNA polymerase eta (pol eta) is responsible for the bypass of cyclobutane pyrimidine dimers (CPDs) during DNA replication as well as other lesions such as 8-oxoguanine (oxoG). Both are ubiquitous lesions; the former is produced by exposure to UV radiation, while the latter is generated by reactive oxygen species (ROS) yielded during xenobiotic metabolism in addition to normal cellular function. It follows that pol eta is indispensable to successful completion of DNA replication and organism survival. It has been recently reported that a beta-strand (amino acids 316-324) in the little finger region of pol eta appears important to correctly align the template strand with the catalytic core of the enzyme. We hypothesized that modification of these residues would interfere with correct enzyme-DNA alignment and alter pol eta activity and fidelity. To study the role of these mutations, we expressed catalytic core amino acids 1-511 of human pol eta in *E. coli*. We generated both wild type enzyme as well as enzyme with single amino acid substitutions at residues Pro-316, Thr-318, Gly-320, Ser-322 and Asn-324. Overexpressed protein was purified by chromatography using HiTrap™ Chelating HP (GE) with subsequent application of pol eta rich fractions to Mono S™ (GE). Purified protein fractions and DNA oligomers synthesized with both CPD and oxoG lesions were then used in *in vitro* assays to evaluate both polymerase activity and fidelity during replication of undamaged and damaged DNA. We anticipate that some or all of these beta-strand mutations will alter the activity and fidelity of pol eta compared to wild-type and that the results from these studies will suggest that these amino acids provide an important structural component to the enzyme necessary for the successful bypass of DNA lesions during replication as well as organism survival.

Yang Bian[1], Archana Natarajan Raja[1,2], and Allan Brown[1]
Graduate Programs: Horticultural Science, North Carolina State University, Kannapolis, NC[1]; David H. Murdock Research Institute, Kannapolis, NC[2]
Advisor: Allan Brown
Poster Number: 11

Identification and utilization of novel genomic SSR markers in blueberry

The health benefits and economic value of blueberry (*Vaccinium* spp. section *Cyanococcus*) are widely recognized. Genetic improvement of complex traits in blueberry, however, has been hindered by the limited understanding of the genetic resources and genomic structure. With the considerable amount of data currently available in the next-generation genomic sequencing of

a diploid *V. corymbosum* ("W8520"), we have been developing novel genomic microsatellite markers to use in genetic studies and breeding.

A subset of 10% largest contigs (4817) was chosen from the assembled unique contigs. 3098 to 4155 contigs were found to contain microsatellites using various SSR-detecting software (MISA, Sputnik, SciRoKo, and TRF). While there were 1603 (25.7%) compound repeats identified using MISA, we found 4645 (74.3%) perfect repeats, which distributed as 3724(59.6%) di-, 734(11.7%) tri-, 114(1.8%) tetra-, 54(0.9%) penta-, and 19(0.3%) hexa-nucleotides. Forty genomic SSRs present in 40 separate contigs were designed primers.

These novel genomic SSR markers will be used to assess genetic diversity and population structure in the USDA Blueberry Core Collection of diverse cultivars and selections. The abundance, distribution and diversity of SSRs in blueberry will also be discussed. These markers and genetic studies will provide information that will ultimately contribute to the dissection of complex traits in blueberry and the development of new improved varieties.

Tracy E. Borneman and Theodore R. Simons
Graduate Program: Biology
Advisor: Theodore R. Simons
Poster Number: 13

Effects of Disturbance on American Oystercatchers Breeding at Cape Lookout National Seashore

As human populations and associated development increase, human-wildlife conflicts are occurring with greater frequency. Anthropogenic noise is an often overlooked and poorly understood source of wildlife disturbance. In this study we seek to assess the effects of noise disturbance on American Oystercatchers (*Haematopus palliates*) nesting at Cape Lookout National Seashore. The species is listed as a "Species of High Concern" by the U.S. Shorebird Conservation Plan and a "Special Concern" species by the State of North Carolina. Sources of disturbance at Cape Lookout include military jet overflights, vehicles, and park visitors. Our study is focused on the effects of various forms of disturbance on the behavior, physiology, reproductive success, and survival of American Oystercatchers at Cape Lookout. We employ a variety of technologies including; audio recorders to monitor sound levels, video cameras to monitor oystercatcher behavior, microphones to monitor the heart rates of incubating birds. We are applying new software tools to automate the analysis of both audio and video recordings. We are quantifying the flushing behavior, nest attendance, and heart rate of the incubating birds to assess the relative effects of different forms of disturbance. We are also comparing measures of productivity, such as the number of nesting attempts, clutch size, nest survival, number of eggs hatched, chick survival, and chicks fledged per pair to assess the effects of different types of disturbance on reproductive success. Preliminary results show a minimal behavioral response to aircraft and a potential behavioral response to vehicles.

Ahmet Bozdag[1] and Michael C. Flickinger[1,2,3]
Graduate Programs: Microbiology[1]; Chemical and Biomolecular Engineering[2]; Golden LEAF Biomanufacturing and Training Education Center, North Carolina State University[3]
Advisor: Michael C. Flickinger
Poster Number: 16

Formaldehyde Tolerance and Carbon Dissimilation by Thermotolerant Methylotrophic Strains of *Bacillus methanolicus* strains MGA3 and PB1

Bacillus methanolicus is a gram-positive aerobic methylotroph growing optimally at 50-53 °C. Wild-type strains of *B. methanolicus* have been reported to secrete 58 g/l of L-glutamate in fed-batch cultures while classical mutants can secrete 37 g/l of L-lysine, at 50 °C. Methylotrophy in *B. methanolicus* is encoded by an endogenous plasmid, pBM19 in strain MGA3, except for hexulose phosphate synthase (*hps*) and phosphohexuloisomerase (*phi*). It is a promising candidate for industrial production of chemical intermediates or amino acids from methanol (MeOH). *B. methanolicus* employs the ribulose monophospate (RuMP) pathway to assimilate the carbon derived from MeOH but enzymes that dissimilate carbon have not been identified. Formaldehyde and formate were identified as intermediates of MeOH dissimilation by ^{13}C NMR. This study aims to elucidate and compare the carbon dissimilation pathways of *B. methanolicus* strains MGA3 and PB1. Formaldehyde tolerance of *B. methanolicus* strains MGA3 and PB1 were determined by growth inhibition studies using formaldehyde with 0.5, 1 and 2 mM final concentrations. Fed-batch fermentations of *B. methanolicus* strains MGA3 and PB1 were conducted in 2-liter fermentation vessels and dissimilated MeOH carbon was detected in exhaust gas by CO_2 sensor. The proportion of dissimilated MeOH carbon was calculated by mass balance. Southern blot analysis was used to show the presence of *formaldehyde* (*faldh*) and *formate dehydrogenase* (*fdh*) genes by using *B. licheniformis, B. kaustophilus* and *B. subtilis faldh* and *fdh* genes as probes. Growth inhibition studies demonstrate that *B. methanolicus* PB1 can tolerate higher concentration of formaldehyde compared to MGA3. MeOH fed-batch fermentations show that ~40% of the methanol carbon is dissimilated as carbon dioxide and that strain PB1 dissimilates more carbon than MGA3. Southern blot experiments demonstrated the presence of the *faldh* and *fdh* in strain PB1 but not in MGA3. These results and genome analysis suggest that *B. methanolicus* strains MGA3 and PB1 are different in terms of formaldehyde metabolism and favor strain MGA3 over PB1 as a candidate for production of intermediates and amino acids from MeOH.

Christine M. Bradish
Graduate Program: Horticultural Science
Advisors: Penelope Perkins-Veazie and Gina Fernandez
Poster Number: 17

Metabolomic Variation in North Carolina Red Raspberry

Raspberries and other berry crops have received increased consumer and research attention due to their wide range of human health benefits. Berry polyphenols have powerful antioxidant capacity, anti-inflammatory and anti-cancer properties, and regular consumption of these compounds may help prevent and manage chronic diseases. Additionally, raspberries are a high-value crop with growth potential in North Carolina and an increasing consumer market in the Eastern United States. Metabolomic methods that allow for compositional analysis of fruit samples have applications for human health and breeding programs. These methods can help determine genetic versus environmental effects on polyphenol content, allowing for the development of nutritionally enhanced varieties. This study examines metabolomic variation among three fall-fruiting red raspberry cultivars (Autumn Britten, Caroline, and Nantahala) grown in three climactic regions of North Carolina. A metabolite profile quantifying major flavonoid compounds in 27 freeze-dried fruit samples from the 2010 growing season was assembled using liquid-chromatography-time-of-flight-mass-spectrometry (LC-TOF-MS) technology. Additionally, assays analyzing total anthocyanins, total phenolics, and Ferric Reducing Antioxidant Power (FRAP) of raspberry samples were used to determine correlations between antioxidant capacity and levels of specific and total polyphenolic compounds. Multivariate statistical analysis tools were used to determine significant differences among metabolite levels due to genetic and environmental differences, and to group samples based on qualitative and quantitative variation of specific metabolites. Results indicate highest levels of specific polyphenolic compounds in Caroline and Autumn Britten, and increased levels of these compounds in climates at higher temperature and lower elevation. These methods and results can be utilized in breeding programs to identify key metabolites contributing to antioxidant properties and health benefits for humans, and further tailoring for functional foods.

Marybeth K. Brey
Graduate Program: Biology
Advisors: James A. Rice and D. Derek Aday
Poster Number: 18

Quantifying the effects of introduced species on a reservoir food web

Introduced species have the potential to alter aquatic systems through habitat destruction, declines in populations of native species, and modification of community structure. Unraveling the impacts of introduced species on aquatic food webs, however, can be exceedingly difficult. Frequently used approaches include direct diet analysis, diet overlap indices, stable isotope analysis (SIA), and ecosystem modeling. This poster highlights attempts to combine these approaches to quantitatively assess the impact of introduced species on reservoir systems in North Carolina. As a simple assessment, stomach content analysis was used to determine the potential for white perch (a recent fish introduction) to compete for food resources with established species. Because stomach content analysis provides only a snapshot of direct consumption, I also combined the use of SIA to provide a more integrated assessment of long term (~6 month) prey assimilation, thereby measuring both potential competition and providing insight into trophic niche overlap between native and introduced species. Finally, I combined diet data with estimates of fish biomass and modeled estimates of energy use to parameterize a powerful ecosystem model, Ecopath with Ecosim (EwE). This synthetic approach allows me to predict how introduced species will impact the overall trophic structure of Lake Norman. To date, I have found that fish invaders tend to be either trophic generalists (e.g., white perch), exploiting a large range of resources and, therefore, having a potentially significant influence on community structure, or that they exploit a currently unoccupied niche (e.g., alewife), allowing them to become established in the community with perhaps fewer consequences to native species. With future modeling (EwE) efforts I will attempt to assimilate these data to predict the synergistic and compensatory impacts of multiple invaders. In sum, diet overlap, SIA, and EwE modeling appear to be effective ways to elucidate the effects of introduced species in reservoirs.

Kathleen M. Burchhardt
Graduate Program: Plant Pathology
Advisor: Marc A. Cubeta
Poster Number: 22

Population genetic analyses, microsatellite marker development, and implications for management of mummy berry disease on blueberry (*Vaccinium* spp.) caused by the fungal pathogen *Monilinia vaccinii-corymbosi*

Monilinia vaccinii-corymbosi (Mvc) is an economically important fungal pathogen that can reduce the health and fruit yield of blueberry (*Vaccinium* spp.). The fungus causes mummy berry disease, which is characterized by blighting of stems and leaves

followed by desiccation and premature drop-off of infected fruit. The main method for managing this disease is multiple applications of fungicides from bud break to fruit set. With increased interest in organic products and environmental concern for fungicide toxicity, disease management methods involving reduced fungicide usage are desirable. Information about the population genetics of Mvc is not currently known, but is imperative for developing more effective and integrated strategies to manage mummy berry disease. The primary objective of this study was to develop and identify genetic markers from informative sequence loci and microsatellite regions of the genome for use in subsequent population genetic analyses. To address this objective, a geographically diverse collection of 228 Mvc isolates was generated by sampling infected blueberry stems from eight fields; one field in Oregon, Washington, and Michigan, and five fields in North Carolina. Preliminary results from sequencing the elongation factor-1α (EF-1α), RNA polymerase II subunits RPB1 and RPB2, and internal transcribed spacer (ITS) regions of a subsample of 21 Mvc isolates suggest that intraspecific genetic diversity is low. Within field genetic variability was found at locus EF-1α, suggesting that this locus may be useful for sequence-based population genetic analyses. Microsatellite loci were identified by 454 pyrosequencing an isolate of Mvc to generate 135,661 reads with an average length of 355.6 bp. Sequence reads were screened for microsatellite repeats suitable for primer design. Marker development and screening is ongoing and will be reported. Future research will utilize markers from polymorphic microsatellite and sequence loci to examine the population genetics of Mvc.

Rachel Clark
Graduate Program: Plant Biology
Advisor: Alexander Krings
Poster Number: 25

The Vascular Flora of Kitty Hawk Woods (Dare County, North Carolina)

One of ten reserves in the North Carolina Coastal Reserve system, Kitty Hawk Woods (Dare County, North Carolina) is a nationally significant natural area that is comprised of 760 ha of forested wetlands, sandy wooded ridges, and brackish marshes. It contains one of the last remaining examples of the rare Maritime Deciduous Forest (S1 G1) community type and the most extensive example of Maritime Swamp Forest (S1S2 G2) in North Carolina. Topographically, Kitty Hawk is unique along North Carolina's Outer Banks by being situated on a series of north to south running, parallel, relict beach ridges, which are evidence of the seaward development of the island. These relict dunes and intervening swales provide the framework on which the plant communities have developed. In order to effectively manage and preserve the biodiversity of Kitty Hawk Woods, comprehensive resource inventory and monitoring were identified as top priority management goals in the Kitty Hawk Woods management plan. The objectives of the present work were to contribute to these goals by developing: (1) a checklist of the vascular flora of Kitty Hawk Woods based on a thorough floristic inventory and survey of historic collections and (2) an illustrated guide based on the checklist to facilitate monitoring, research, and precision management. Over 420 plant species in 110 families have been reported for the site, including two county records (*Psilotum nudum* (L.) P. Beauv. S1 G5, W4; *Solidago villosicarpa* LeBlond S1 G1, E). Keys are provided to all reported species and genera. Habitat, phenology, relative abundance, illustrations, and synonymy in Radford et al. (1968) are also provided. In addition, relevant herbarium vouchers from Kitty Hawks Woods and Bodie Island housed in the main depositories of Outer Banks collections are cited after each species.

Lauren M. Dembeck
Graduate Program: Genetics
Advisor: Trudy F.C. Mackay
Poster Number: 29

Natural variation of abdominal pigmentation in *Drosophila melanogaster* females

Body melanization is a conspicuous trait that varies within and between species. It plays a role in many important physiological functions and behavioral paradigms such as camouflage, thermoregulation, and mate selection. *Drosophila melanogaster* females generally have light to medium stripes of melanization on the posterior end of each sternite. We measured natural variation in female abdominal pigmentation within the *Drosophila* Genetic Reference Panel, a wild derived population of 192 inbred lines. Live females were scored for melanization on sternites 4, 5, and 6 on a scale from 0 (no melanization) to 5 (total melanization). Our results show that there is significant variation in melanization for each sternite. We will use a genome-wide association analysis to identify DNA polymorphisms associated with sternite melanization. Such a study will allow us to understand the genetic architecture that underlies this trait and also provide a basis to address if genes underlying within species variation are the same as those involved in trait divergence between species.

Rebecca Fisher and Joseph Long
Graduate Program: Agricultural Education
Advisor: Gary Moore
Poster Number: 39

The Role of Rosenwald Schools in Agricultural Education for African Americans in the South

At the turn of the twentieth century in the segregated South, schools for African American students were deplorable. The schools were often dilapidated buildings with no new equipment, only tattered books and scratched-up desks handed down from white schools. The decision on what to teach was even a source of discussion and disagreement. To remedy the facilities and curriculum conundrum, a Northern Philanthropist, Julius Rosenwald, established a fund to build elementary schools in the South for African American students. The Fund recommended that the schools be built on at least two acres, securing enough land for school buildings, industrial work-shops, teachers' homes, sufficient sized privies and viable agricultural land for demonstration work and school gardens. In fact, one condition of receiving funds from Rosenwald's rural school building program was acceptance of a curriculum that included elementary agricultural education (and home economics).

The primary purpose of this study was to document the establishment and organization of Rosenwald Schools paying attention to the agricultural literacy and agricultural education components of the schools. The specific objectives of the study were to answer the following questions: Who was Julius Rosenwald, how did the Rosenwald Schools come into being, what was a Rosenwald School, and how did it address agricultural education.

Although historical research methods were used for this study, the underlying rational for the research revolves around the concept of agricultural literacy. Both the existence and impact of Rosenwald schools has largely gone unnoticed in the agricultural education community. This paper is intended to add to the "agricultural education literacy" of the profession.

Rosenwald Schools provided educational opportunities to generations of African-American children who otherwise may have been neglected. They also awakened a sense of responsibility of many public school officials to the education of all children – rich and poor alike.

Megan E. Garlapow
Graduate Program: Genetics
Advisors: Trudy Mackay and David Threadgill
Poster Number: 44

Comparative Systems Genetics of the Insulin Signaling Pathway

The insulin signaling pathway is an evolutionarily conserved pathway essential for maintaining normal body glucose levels. Although numerous genetic modifiers have been described that modulate the activity of the insulin signaling pathway, the evolutionary conservation of the genetic modifiers of the insulin signaling pathway remains unknown. To examine genetic modifiers of the insulin signaling pathway and their interaction with environmental factors such as diet, we will use a comparative approach consisting of the eight parental strains of the mouse Collaborative Cross (CC) and the 192 sequenced lines of the Drosophila Genetic Reference Panel (DGRP). First, we will identify high and low extreme-feeding lines of the DGRP using a capillary feeding assay for further targeted assays using dietary perturbations to affect the insulin signaling pathway and its modifiers. We will place the mice and *Drosophila melanogaster* on either high fat, high sucrose (*D. melanogaster* only), high yeast (*D. melanogaster* only), or standard diets to identify perturbations of the insulin signaling pathway and its modifiers. Perturbations will be identified with phenotypic measures such as a glucose tolerance test in mice and mass spectrometry glucose determination in *D. melanogaster* as well as whole genome transcript abundance, which can be compared to measurements taken from the standard diet condition. We will use differential phenotypic measurements in mice and association analysis in *D. melanogaster* to further understand the variation in phenotypic responses to diet. Organismal level phenotypes combined with whole genome transcript abundance will allow identification of molecular correlates of the environmental perturbations. This comparative genomic approach will elucidate how the insulin signaling pathway responds to environmental perturbations and the conservation of genetic networks modulating insulin-dependent metabolic parameters.

Charlotte D. Glen[1], Gary E. Moore[1], Koralalage S. U. Jayaratne[1], and Lucy K. Bradley[2]
Graduate Programs: Agriculture and Extension Education[1]; Horticultural Science[2]
Advisor: Gary E. Moore
Poster Number: 46

Demonstration Gardens as Teaching Tools in Extension Horticulture Programs: Their characteristics, utilization, target audiences, benefits, and challenges as implemented by horticulture Extension agents in North Carolina

Cooperative Extension's non formal education programs seek to provide effective lifelong learning experiences that improve the land, economies, and lives of North Carolina's residents and communities. Extension horticulture agents often incorporate demonstration gardens into their programming, yet little research has been conducted into how demonstration gardens can

best be utilized or their challenges and benefits to Extension programming. Employing a two part survey, this descriptive study investigated how North Carolina horticulture Extension agents utilize demonstration gardens in their programs, the characteristics of these gardens, and the perceived benefits and challenges of utilizing gardens for Extension programming. It was determined that agents develop gardens primarily to enhance their non-formal education efforts, enable self-directed learning, engage volunteers, and build partnerships. The majority of gardens developed by North Carolina agents are less than one half acre in size, include both edible and ornamental plantings, and are heavily supported by volunteers. Though many agents were found to be fully utilizing gardens to enhance non-formal education, few were fully employing practices that enable self-directed learning, or evaluating the garden's outcomes and impacts. Agents perceived the greatest benefits of gardens to be their effectiveness as an educational delivery method, their ability to enhance the overall program, and their capacity to provide opportunities for meaningful volunteer service and to facilitate the development of partnerships. The greatest challenges of incorporating gardens into Extension programming were perceived to be availability of time, money, and volunteer support. It was concluded that demonstration gardens are an appropriate and effective educational delivery method for Extension programming. When developing gardens, special emphasis should be given to involving and investing volunteers. Additional recommendations are to integrate the garden into the entire Extension program, to employ multiple practices to enhance self-directed learning, and to develop a framework for evaluation that captures the garden's full impact.

Stephen Holland
Graduate Program: Soil Science
Advisor: Joshua Heitman
Poster Number: 64

Measuring the Influence of an Inter-row Fescue Crop on the Below-Canopy Humidity in a North Carolina Vineyard

Growing European grape varieties for wine making is an expanding industry in the southeastern U.S. However, the southeastern climate differs from climates where European grapes are traditionally grown. The southeast has high precipitation and soils with poor internal drainage, which lead to high humidity. High humidity, in turn, creates ideal conditions for fungal diseases. Without adaptations to management practices to reduce canopy humidity, fungal diseases will continue to limit the local wine grape industry. Altering inter-row management practices may offer a solution. We hypothesize that inter-row crops, typically fescue, serve as a pump extracting water from the soil, which increases below canopy humidity. The following objectives seek to test this hypothesis; 1) estimate and compare surface water vapor flux under (i.) bare soil conditions and (ii.) fescue cover crop conditions in the inter-row and in the vine row and 2) characterize and compare the humidity profile from the ground surface to the upper canopy for bare soil conditions and fescue cover crop conditions. Research will be conducted at a commercial vineyard in the Yadkin Valley Appellation. Measurements of below canopy water vapor flux will be collected with a micro-Bowen ratio system. To support this calculation, soil heat flux density, net radiation, and an air temperature gradient will be measured. We will also use microlysimeters and profile water content measurements to monitor soil water dynamics within the vineyard. Below-canopy humidity will be monitored at several heights. Together, these data will be used to compare the inter-row water balance between treatments. Measurements will be collected starting in March 2011.

Jessica Houle and George Kennedy
Graduate Program: Entomology
Advisor: George Kennedy
Poster Number: 66

Just can't resist: Virus gains access to resistant host through reproductive tissue

The control of diseases in crops through host plant resistance can be compromised by differential expression of resistance across plant tissue types. *Tomato spotted wilt virus* (TSWV) infects tomatoes (*Solanum lycopersicum*) causing serious economic losses worldwide. Thrips (Family: Thripidae) transmit the virus to young tomato plants by feeding on vegetative tissue. As hosts mature, they become more resistant to TSWV. To provide early season protection, growers use tomatoes with the *Sw-5* resistance gene, which enables the plant to mount a hypersensitive response against TSWV. However, early season infections of tomatoes carrying the *Sw-5* gene can result from TSWV isolates that break resistance through novel mutations. Another problem with host resistance occurs when tomato plants reach the reproductive stage and new infections emerge in the fruit. We hypothesized that, unlike the vegetative tissue, reproductive tissue in mature tomato plants may not have the ability to resist infection even if the plant has the *Sw-5* gene. Non-resistance breaking isolates of TSWV were inoculated into the reproductive tissue of mature tomato plants with and without the *Sw-5* gene using western flower thrips (*Frankliniella occidentalis*) as the vector. Surprisingly, these inoculations resulted in local and systemic infections in both host types. The reproductive tissue provides an entry point for TSWV to infect tomatoes with *Sw-5* mediated resistance and mature plant resistance. Feeding by viruliferous thrips on the reproductive tissue of tomato plants can result in substantial late season losses in marketable fruit.

John S. House[1], Songyun Zhu[1], Rakesh Ranjan[1], Keith Linder[2], and Robert C. Smart[1]
Graduate Programs: Environmental and Molecular Toxicology[1]; Population Health and Pathobiology[2]
Advisor: Robert C. Smart
Poster Number: 67

C/EBPα and C/EBPβ are Required for Sebocyte Differentiation and Stratified Squamous Differentiation in Adult Mouse Skin

C/EBPα and C/EBPβ are bZIP transcription factors that are highly expressed in the interfollicular epidermis and sebaceous glands of skin and yet germ line deletion of either family member alone has only a mild or no effect on keratinocyte biology and their role in sebocyte biology has never examined. To address possible functional redundancies and reveal functional roles of C/EBPα and C/EBPβ in postnatal skin, mouse models were developed in which either family member could be acutely ablated alone or together in the epidermis and sebaceous glands of adult mice. Acute removal of either C/EBPα or C/EBPβ alone in adult mouse skin revealed modest to no discernable changes in epidermis or sebaceous glands. In contrast, co-ablation of C/EBPα and C/EBPβ in postnatal epidermis resulted in disruption of stratified squamous differentiation characterized by hyperproliferation of basal and suprabasal keratinocytes and a defective basal to spinous keratinocyte transition involving an expanded basal compartment and a diminished and delayed spinous compartment. Acute co-ablation of C/EBPα and C/EBPβ in sebaceous glands resulted in severe morphological defects, and sebocyte differentiation was blocked as determined by lack of sebum production and reduced expression of stearoyl-CoA desaturase (SCD3) and melanocortin 5 receptor (MC5R), two markers of terminal sebocyte differentiation. Specialized sebocytes of Meibomian glands and preputial glands were also affected. Our results indicate that in adult mouse skin, C/EBPα and C/EBPβ are critically involved in regulating sebocyte differentiation and epidermal homeostasis involving the basal to spinous keratinocyte transition and basal cell cycle withdrawal.

Samanthi S. Kottegoda and Michael R.Hyman
Graduate Program: Microbiology
Advisor: Michael R. Hyman
Poster Number: 94

Metabolism of Isobutane by *Mycobacterium austroafricanum* JOB5

Isobutane, the simplest branched alkane, is an important component of gasoline, liquefied petroleum gas and natural gas. Few isobutane-oxidizing organisms have been identified and little is known about either the pathway or the enzyme responsible for initiating isobutane oxidation. The only previous study of the aerobic microbial isobutane oxidation suggested that propane and isobutane are oxidized by two different oxygenase enzymes. In this study, we have compared oxidation of propane and isobutane by *Mycobacterium austroafricanum* JOB5. The initial steps of oxygenase-dependent alkane-oxidations, as well as the further metabolites generated from the alcohol products of these reactions were compared at the physiological level. The isobutane-dependent induction of isobutane-oxidizing activity in fructose-grown cells was also examined using *tert*-butyl alcohol production as an indicator. Finally, changes in the proteins produced by whole cells during induction of isobutane-oxidizing activity, as well as the proteins produced by cells grown on propane, isobutane and their respective primary alcohol products were examined.

Cells grown on either propane or isobutane were able to oxidize both of these alkanes at high rates without any delay and were fully and consistently inhibited by acetylene. Oxidation of primary alcohol products of these reactions by both cell types was also very similar. *De novo* synthesis of a single 53kDa polypeptide was observed during the induction of isobutane-oxidizing activity in fructose grown cells. This polypeptide and another major 38kDa polypeptide were present at varying levels in cells grown on propane, isobutane, 1-propanol or 2-methyl-1-propanol and neither polypeptide was present in fructose-grown cells. Based on these results we conclude that propane- and isobutane-grown cells are very similar both in terms of their catalytic capabilities and whole cell protein expression. We further conclude that both 53 and 38kDa polypeptides are likely to be important structural components of the oxygenase enzyme responsible for initiating both propane and isobutane oxidation.

Kestrel R. Lannon, Ramsey S. Lewis, and H. David Shew
Graduate Program: Plant Pathology
Advisor: H. David Shew
Poster Number: 97

Components of Resistance to *Phytophthora nicotianae* in Doubled-Haploid Lines of Tobacco Possessing a Novel Source of Resistance

Black shank of tobacco, caused by the oomycete *Phytophthora nicotianae*, is an important disease primarily managed by the deployment of partial and complete resistance genes. Following the widespread occurrence of race 1, and the loss of the only effective source of single gene resistance, new sources of resistance are needed. Tobacco variety Florida 301 (Fla 301) served as the primary source of partial resistance prior to incorporation of complete resistance from *Nicotiana plumbaginifolia*. However, reduced quality and yield are associated with this resistance, so other sources of partial resistance are being investigated.

Beinhart 1000 (BH 1000) is highly resistant to all races of *P. nicotianae*. In previous work, 118 doubled-haploid lines from BH 1000 and the susceptible variety Hicks were evaluated for black shank resistance and a genetic linkage map with 24 linkage groups was created. Six QTLs on linkage groups (LG) 2, 4, 8, 9, 11, and 14 were associated with black shank resistance. QTLs on LG 4 and 8 accounted for 43% of the phenotypic variation for end percent survival, with the QTL on LG 4 representing a novel source of resistance. Forty three doubled-haploid lines with genomic regions from BH 1000 or Hicks on LG 4 and/or LG 8 were selected and evaluated in greenhouse tests along with both parents for incubation period, percent root rot, and secondary inoculum production. Genotypes with LGs 4 and 8 from BH 1000 had increased incubation periods and decreased root rot compared to genotypes with LGs 4 and 8 from Hicks. The effects of the two LGs were additive and genotypes with both QTLs were significantly different from genotypes with only one QTL for all measured components of resistance. The previously unidentified QTL on LG 4 may provide growers with a new source of resistance to the black shank disease.

Veronica Mbaneme
Graduate Program: Biological and Agricultural Engineering
Advisor: Praveen Kolar
Poster Number: 109

Synthesis, characterization, and testing of Ni-olivine catalysts for oxidation of biomass-derived tars

To decrease US dependency on fossil fuels and improve environmental and economic sustainability, significant research efforts are focused on producing affordable and reliable energy from renewable resources such as biomass. Biomass gasification under oxygen-limited conditions produces synthesis gas (SG), a fuel that can also be used to synthesize other valuable chemicals such as hydrogen, methanol and ethanol. However, a mixture of aromatic hydrocarbons present within SG, termed tars, prevents commercialization of this technology due to these impurities condensing and inactivating engine machinery. Hence, tar removal is necessary to improve the quality of SG. The present research contributes to this effort by investigating Ni-olivine, as a tar oxidizing catalyst. Specifically, the objectives are to 1) synthesize Ni-olivine catalysts using electroless plating (ELP) (350°C) and thermal impregnation (TI) (1400°C) techniques; 2) characterize the catalysts using microscopic and spectroscopic techniques; and 3) determine the catalytic oxidation efficiencies. Testing will be performed in a heated (200-300°C) integrated plug flow stainless steel reactor (1-in dia.) packed with 3 grams of the catalyst. Vapors of toluene are injected into the heated reactor, while inlet and outlet concentrations are measured via gas chromatographs equipped with mass selective and thermal conductivity detectors. Preliminary results obtained with electroless plated Ni-olivine, indicated a toluene oxidization efficiency of 87%. In addition, scanning electron microscopy and energy dispersive spectroscopy analyses depicted porous structures and a nickel film coating 90% of the catalyst surface, which is believed to have contributed to the electroless plated Ni-olivine catalytic activity. Synthesis of Ni-Olivine catalysts via TI are currently in progress. Upon completion, this work will provide new knowledge on toluene oxidation mechanisms and kinetics as well as tar oxidation efficiencies of TI and ELP catalysts. If successful, these catalysts have the potential to improve the quality of SG for production of biofuels and value added products.

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Graduate Programs: Animal Science, North Carolina State University[1]; Anthropology, University of Texas at San Antonio[2]
Advisors: Vivek Fellner and Melissa Ashwell
Poster Number: 110

Microbial fermentation and ecology in Primate and Carnivore species

Nutrition, as a form of preventative medicine and a foundation for good health, has great importance for health in zoo settings. Microbial populations play a key role in the process of digestion for nutrient use by the animal. Differences in the diversity and fermentation activity of microbial populations associated with specific animal hosts arise from dissimilar diets and divergent phylogenies. This project aims to compare the community composition and fermentation activity of gastrointestinal bacteria found in *Gorilla gorilla* (n=3), *Pan troglodytes* (n=12), *Papio hamadryas* (n=17), and *Arctictis binturong* (n=*10*). All animals within each species were fed a different fixed diet for two weeks prior to sample collection. Fecal specimens were collected within two hours of defecation and placed into pre-warmed vacuum Thermos® flasks and immediately transported to the lab. Fresh pooled fecal inoculums were added to pre-weighed diet substrate and incubated at 37°C for 24h. Fermentation products were measured and analyzed using the proc mixed procedure in SAS (Cary, NC). DNA was extracted from frozen fecal samples and pooled across individuals. A region of the *cpn60* gene from the bacterial species was sequenced for species identification. Phylogenetic trees were compiled using the PHYlogeny Inference Package (PHYLIP), and biodiversity indices were used to quantitatively compare the microbial population compositions. Significant differences were observed across species for volatile fatty acid ($P<0.0001$) and methane ($P<0.001$) production, as well as neutral detergent fiber ($P<0.05$) and dry matter ($P=0.0001$) digestibility. Preliminary data suggests dissimilar microbial communities across species. While the composition of diets offered may contribute to differences in fermentation, the trends seen in our microbial diversity data suggest inherent microbial patterns are associated with energy requirements of the host. This link between patterns of energy usage and host-specific endosymbionts is consistent with previous findings in humans and non-human primate species.

Tiffany Messer
Graduate Program: Biological and Agricultural Engineering
Advisor: Michael R. Burchell II
Poster Number: 113

Groundwater Nitrate Reductions within Upstream and Downstream Sections of a Riparian Buffer

Riparian buffer systems have gained much interest over the past 25 years for their ability to reduce groundwater nitrate through denitrification. However, buffer ability to reduce NO_3^--N has been variable and does not always work as effectively as desired. Defining ideal buffer placements that maximize denitrification could protect more stream miles improving overall water quality. Over the past five years a detailed evaluation of the hydrology and attenuation of groundwater nitrate was conducted on two sections of buffer along the same stream enrolled in the North Carolina Conservation Reserve Enhancement Program. These sections had two distinct widths and topographic locations. Project research objectives included to conduct a hydrologic evaluation, evaluate changes in nitrate concentrations through the buffer, identify contributions of denitrification and dilution, and make recommendations for future buffer enrollments. The average buffer widths were 60 m (Section 1) and 43 m (Section 2). Groundwater monitoring well nests were installed in three transects within each buffer zone. Each nest consisted of a shallow (1.5-2.3 m) and deep (2.7-3.6 m) groundwater monitoring well.

Groundwater nitrate levels significantly decreased through the buffer sections (α=0.05). Water table measurements, nitrate to chloride ratios, deep well water quality analyses, topography, and redox measurements were used to determine whether denitrification or dilution was the primary mechanism for nitrate reductions. Hydrology and water quality results supported denitrification was the predominant nitrate reduction mechanism in both sections. The buffers relative wetness, low redox readings and high DOC concentrations further indicated the sections were suitable for denitrification to proceed at high rates. However, groundwater contributing areas had a major impact on the efficiency of nitrate reduction in Section 1 due to nitrate limitations. Findings from this project provide an advanced understanding of biogeochemical factors that could lead to design recommendations that will enhance pollutant reductions in riparian buffers.

Trisha Moore
Graduate Program: Biological and Agricultural Engineering
Advisor: William F. Hunt
Poster Number: 117

Ecosystem Services: are stormwater wet ponds and wetlands created equal?

Ecosystem services, defined as the benefits provided to society by ecosystems, generally diminish under the pressures of urban development. Among the services diminished in urban and suburban areas is the ability of the landscape to regulate runoff volume and quality, a loss that engineered stormwater wet ponds and wetlands are designed to mitigate. While runoff treatment and hydrologic benefits are of prime importance for regulatory purposes, these systems have the potential to provide many other ecosystem services. There is a need to both recognize and assess this suite of potential services in order to provide a more holistic evaluation of stormwater system performance. The objective of this work was to develop an assessment tool to assess a suite of ecosystem services, including carbon sequestration, biodiversity maintenance, habitat provision, food and raw material production, and recreational and educational opportunities. The assessment was conducted at 20 wet ponds and 23 wetlands. Soil cores were collected from each and analyzed for soil organic carbon over the age gradient of wetland and pond systems to examine rates of carbon accumulation. System biodiversity was quantified in terms of both vegetation and aquatic macroinvertebrates. Habitat value was qualified in terms of vegetation structure and species while recreation and education services were assessed based upon public proximity, accessibility, and the presence of recreational infrastructure. While both wet ponds and wetlands provided all of the assessed services to some extent, statistical analysis indicated that stormwater wetlands generally outperformed wet ponds in all categories, particularly biodiversity. These results indicate that stormwater ponds and wetlands are not equal with regard to the full suite of ecosystem services they provide and that an ecosystem service-based assessment can be used to supplement traditional water quality and hydraulic analysis of stormwater practices as we move toward engineering more sustainable urban landscapes.

Nape Mothapo
Graduate Program: Soil Science
Advisor: Julie Grossman
Poster Number: 120

Hairy Vetch Use History Affects Nodulation and Diversity of *Rhizobium leguminosarum*

Contribution of biological nitrogen fixation to soil fertility can be improved through functional knowledge of nodulation and rhizobia diversity associated with popular legume cover crops, such as hairy vetch (HV; *Vicia villosa* Roth). The objective of this study was to evaluate nodulation effectiveness and diversity of rhizobia isolated from soils with and without history of HV

cultivation with distinct HV genotypes. Soils from six paired fields, three with 10-yr HV history and three with no history, were collected from three organic farms across North Carolina. Five distinct HV genotypes were inoculated with soil dilutions from the six fields and used to trap rhizobia over a 6-wk period in a growth chamber. Nodulation efficacy was equated to nodule number and mass, and nitrogen-fixation efficiency to legume growth and development. Rhizobia diversity was evaluated through DNA analysis using repetitive element polymerase chain reaction (rep-PCR). Plant biomass was linearly correlated to nodule mass (r^2 = 0.79). The rep-PCR analysis showed that fields with HV history exhibit higher rhizobia diversity than fields without HV history. Nonetheless, strains isolated from one of the fields with HV history had surprisingly lower rhizobia diversity than the other two, possibly due to strain domination from prior inoculant. Rhizobia grouping based on cluster analysis indicated five genetic groups and suggested rhizobia diversity to be most impacted by site, followed by hairy vetch field history. Overall, results suggest that HV use provides an environment that enhances diversity of rhizobia populations capable of high nodulation.

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Advisors: Steven P. Washburn and Kevin L. Anderson
Poster Number: 123

Comparisons of udder health and milk quality in North Carolina organic and conventional pasture-based dairy herds

This observational study compared milk quality and herd health management of 7 organic and 7 conventional dairies in North Carolina. Published comparisons between organic and conventional dairy systems with regard to milk quality are sparse for the southeastern region of the United States. Management practices vary between organic and conventional dairies because of differences in farming philosophy and in government regulations. Organic dairies are prohibited from using certain drugs and antibiotics that are commonly used on conventional dairies. The objective of this study was to elucidate the relationship between management type and milk quality. Each dairy owner filled out a questionnaire regarding specific management practices. To assess milk quality, milk samples were aseptically collected from each quarter of each cow in the milking herd at the time of sampling and somatic cell scores were obtained for individual cows. A total of 4988 quarter milk samples (2608 conventional, 2380 organic) were collected from 1247 cows (652 conventional, 595 organic). Milk samples were cultured and bacterial growth was identified using protocols consistent with those of the National Mastitis Council. The proportion of cows with positive microbiological results did not differ ($p>0.10$) between organic (56.1%) and conventional (52.9%) dairies. However, differences in species present in positive cultures were observed: conventional herds had significantly more ($p<0.01$) coagulase-negative staphylococci infections per cow whereas organic herds had more *Corynebacterium sp.* ($p<0.01$) and *Staphylococcus aureus* ($p<0.01$) infections per cow. Conventional herds did have a lower proportion of infected quarters (27.0% versus 36.3%, $p<0.001$). Somatic cell scores did not differ between organic (3.0 ± 0.1) and conventional (3.0 ± 0.1) herds. Despite differences in herd management, milk culture results and SCS measurements were remarkably similar between organic and conventional NC dairies compared for this study.

Rodrigo A. Olarte[1], Bruce W. Horn[2], James T. Monacell[1,3], Rakhi Singh[1], Eric A. Stone[3,4], and Ignazio Carbone[1]
Graduate Programs: Plant Pathology, North Carolina State University[1]; National Peanut Research Laboratory, Agricultural Research Service, U.S. Department of Agriculture, Dawson, GA[2]; Bioinformatics Research Center, North Carolina State University[3]; Genetics, North Carolina State University[4]
Advisor: Ignazio Carbone
Poster Number: 129

Ramifications of sex in the usage of biocontrol as management of aflatoxigenic *Aspergillus flavus*

Aspergillus flavus contaminates many important crops worldwide and is the major producer of aflatoxins (AFs), which are cancer-causing secondary metabolites. A unique feature of this fungus is that it is able to infect and cause disease in both plants and animals, including humans. In the US, mycotoxins have been estimated to cause agricultural losses totaling upwards of $1.4 billion annually, with AF contamination in peanut export worldwide potentially accounting for as much as $450 million. Costs for AF testing in the US alone have been calculated to be roughly $30-$50 million, and the cost grows exponentially when management regimes are implemented. Biological control is the most effective means of reducing inoculum levels of detrimental AF-producing fungal pathogens in agricultural systems; however, the long-term efficacy of such methods may face scrutiny with the recent discovery of the sexual cycle in these fungi. We crossed strains of opposite mating type in *A. flavus* to produce offspring, which were genetically and phenotypically analyzed to quantify gene flow and determine the heritability of AF and cyclopiazonic acid (CPA). We found that a single generation of sexual reproduction between a non-aflatoxigenic parent containing a single mutation in the AF cluster and an aflatoxigenic parent can restore AF production. The recombinant F1 progeny regained aflatoxigenicity through a crossover event within the AF gene cluster. Other F1 progeny in crosses between either a partial AF cluster strain or a strain missing the entire cluster and an aflatoxigenic parent regained toxicity via independent assortment of chromosomes. We also found that genetic exchange and recombination are associated with

significant heritability of AF and CPA in progeny. These results suggest that a single round of sexual reproduction in *A. flavus* can have a substantial influence on genetic and mycotoxin diversity.

Akinbolade O. Oyegunwa, Michael L. Sikes, Jason Ray Wilson, Frank Scholle, and Scott M. Laster
Graduate Program: Microbiology
Advisor: Scott M. Laster
Poster Number: 130

Tetra-O-methyl nordihydroguaiaretic acid (Terameprocol) inhibits the NF-κB-dependent transcription of TNF-α and MCP-1/CCL2 genes by preventing RelA from binding its cognate sites on DNA

Tetra-O-methyl nordihydroguaiaretic acid also known as Terameprocol (TMP), is a naturally occurring phenolic compound found in the resin of the creosote bush. We have shown previously that TMP will suppress production of certain inflammatory cytokines, chemokines and lipids from macrophages following stimulation with LPS or infection with H1N1 influenza virus. In this study our goal was to elucidate the mechanism underlying TMP-mediated suppression of cytokine and chemokine production. We focused our investigations on the response to LPS and the NF-κB protein RelA a transcription factor whose activity is critical to LPS responsiveness. Reporter assays were performed with HEK293 cells overexpressing either TLR-3, -4, or -8 and a plasmid containing the luciferase gene under control of an NF-κB response element. Cells were then treated with LPS, poly(I:C), or resiquimod, and/or TMP, and lysates were measured for luciferase activity. ChIP assays using RelA specific antibodies showed TMP caused virtually complete inhibition of RelA binding in vivo to promoters for the genes TNF-α, MCP-1/CCL2, and RANTES/CCL5 although the LPS-dependent synthesis of IκB-α was not inhibited. EMSA assays did not reveal an effect of TMP on the binding of RelA to naked DNA templates in vitro. Furthermore, TMP did not inhibit the nuclear translocation of NF-κB RelA nor the phosphorylation of IκB-α. Our results strongly suggest that TMP acts indirectly as an inhibitor of NF-κB-dependent transcription by preventing RelA from binding the promoters of certain key cytokine and chemokine genes.

Monica D. Poteat and David Buchwalter
Graduate Program: Environmental and Molecular Toxicology
Advisor: David Buchwalter
Poster Number: 138

Comparative Fluxes of Zinc, Cadmium, and Calcium in Aquatic Insects

Aquatic insects typically comprise 70-95% of the invertebrate species pool in freshwater ecosystems and are extensively used in biomonitoring programs worldwide. Because there are over 6,500 aquatic insect species described to date in North America, making experimental work relevant to community ecologists who commonly work with insects is a daunting task. We are attempting to overcome this limitation by putting fundamental physiology, central to trace metal bioaccumulation and toxicity, into an evolutionary context. Initial experiments were conducted to analyze comparative uptake and efflux kinetics of essential (Zn) and non-essential (Cd) metals in two species-rich insect families (Trichoptera: Hydropsychidae and Ephemeroptera: Ephemerellidae) using radiotracers. Dissolved co-exposures of four *environmentally-relevant* concentrations of Zn (1, 3, 9, and 27 µg/L) and Cd (0.1, 0.3, 0.9, and 2.7 µg/L) were used to determine the influx of metals. Radioactivity was measured at 3, 6, 9, and 24 hours during exposure. Efflux was determined by measuring radioactivity daily for 10 days after an exposure period of at least 4 days. Results have shown drastic variations in the uptake and efflux kinetics of 6 species. Future work will populate phylogenies with experimental data from at least 20 species and test for a phylogenetic signal. It will then be determined if the physiologies of novel species can be predicted based on their phylogenetic position. Other work has focused on determining the uptake pathways for Zn and Cd. Both metals are purported to use calcium transport systems as routes of aqueous bioconcentration, but even Ca transport systems in stream insects are poorly understood. Verapamil, nifedipine, and lanthanum, all inhibitors that block various Ca channels, are currently being tested for effects on Cd and Zn uptake.

Joshua K. Raabe
Graduate Program: Fisheries, Wildlife, and Conservation Biology
Advisor: Joseph E. Hightower
Poster Number: 140

Evaluation of restored habitat use by migratory fishes following dam removals

Dam removals are contentious processes that are increasing for both economic and ecological reasons. Migratory fish species may benefit most from eliminating barriers and restoring access to upstream habitat, but limited evaluations exist. We conducted a study from 2007-2010 on the Little River, North Carolina, a tributary to the Neuse River, to assess migratory fish responses to removal of three dams since 1998. We used a resistance board weir near the river mouth to capture and tag migratory fishes with passive integrated transponders (PIT). PIT antennas were installed upstream, including at former dam sites, to determine the extent of migrations, identify migratory timing and cues, and to evaluate passage efficiency of a notched

dam. Extensive migrations, and subsequently increased usage of upstream habitat, occurred during freshets of increased river flow that also aided in notched dam passage. Overall, we found that a relatively high percentage of fish migrated past former dam sites. For example, 24-31% of anadromous American shad *Alosa sapidissima* and 45-49% of resident gizzard shad *Dorosoma cepedianum* migrated past the most recently removed dam located at river kilometer (rkm) 56. In addition, 8-15% of American shad and 31-43% of gizzard shad utilized restored habitat to the farthest upstream extent, an impassable dam at rkm 82. Although it was low (<1%), we documented PIT-tagged American shad returning from the ocean to spawn in the river in subsequent years; annual survival rates for resident species were much higher. Cases of predation on American shad by invasive flathead catfish *Pylodictis olivaris* were concerning, especially since flathead catfish abundance and migrations increased substantially over the study period. Nevertheless, the results provide strong support for further efforts to restore currently inaccessible habitat through removal of derelict dams.

Jose Santa-Cruz[1], Araby Belcher[2], John Zwonitzer[3], Consuelo Arellano[4], Matt Krakowsky[5], and Peter Balint-Kurti[1,6]
Graduate Programs: Plant Pathology, North Carolina State University[1]; Research and Extension Center, University of Idaho, Aberdeen, ID[2]; Dow Agrosciences, Huxley, IA[3]; Statistics, North Carolina State University[4]; Crop Science, North Carolina State University[5]; USDA-ARS, Plant Science Research Unit[6]
Advisors: Peter Balint-Kurti and Matt Krakowsky
Poster Number: 147

Fine Mapping and Field Evaluation of a Quantitative Trait Locus conferring Resistance to Southern Corn Leaf Blight

Southern leaf blight (SLB) caused by the fungal pathogen *Cochliobolus heterostrophus* (anamorph = *Bipolaris maydis*), is a common disease of maize in southeastern US, as well as many hot and humid tropical and subtropical areas in the world. Most of the disease resistance used in maize is quantitative in nature; however, quantitative disease resistance remains poorly understood. We have identified a strong QTL for SLB resistance at the tip of the short arm of chromosome 6 in maize. Specific objectives of this research include fine-mapping the region where this QTL is located (namely 6A), cloning the gene that accounts for this effect, and evaluating its yield and fitness effects under both high and low disease pressure for possible future use of this resistance. Preliminary growth chamber phenotyping experiments showed that 6A segregates as a single recessive resistance gene, and can be scored in growth chamber experiments on a single plant basis. 168 F_2 individuals and over 500 $F_{2:3}$ families were phenotyped, and genotyped with SNPs markers. We narrowed down the region of interest to approximately 0.3 Mb, encompassing 15 genes. Currently, candidate genes are being analyzed. To evaluate the effect of the genes on fitness and yield, we have developed isohybrid pairs by crossing B73 with/without locus 6A to several inbred lines (testers). We have found significant differences in disease resistance between the isohybrid pairs in some pedigrees. Yield trials are in process to study the influence of the presence or absence of 6A locus on agronomic traits and disease.

Kathryn K. Schweri[1], Guozhong Huang[2], Bingye Xue[1], Melissa G. Mitchum[3], Thomas J. Baum,[4] Richard S. Hussey[2], Ramsey Lewis[5], and Eric L. Davis[1]
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Advisor: Eric L. Davis
Poster Number: 149

Host-derived RNAi targeted to a novel root-knot parasitism gene in tobacco

Root-knot nematodes (RKN), members of the genus Meloidogyne, have multiple crop host species and cause severe economic losses worldwide. These nematodes are particularly important as they have a very wide host range (more than 2000 plant species) and can damage many different crops, including tobacco. Proteins encoded by RKN parasitism genes are secreted into host plant root cells to form elaborate and essential feeding cells. To identify the proteins in the RKN secretome, Huang et al. (2003) microaspirated RKN gland cells to create gland cell libraries. After EST analysis 37 putative parasitism genes were identified, and one of these genes, *16D10*, was investigated in more detail. The 16D10 gene is conserved in all four major species of RKN and encodes a 13aa protein that interacts with the SAW domain of a plant SCARECROW-like transcription factor. Previous studies (Huang et al., 2003) have shown that silencing the novel 16D10 RKN parasitism gene transcript using host-derived RNA interference (RNAi) makes Arabidopsis thaliana plants highly resistant to all four major RKN species. The 16D10-RNAi construct that was used in the study by Huang et al. was used to transform two haploid lines of Nicotiana tabacum, TN90, a burley tobacco, and Hicks, a flue-cured tobacco. Double-haploids were recovered through midvein tissue culture of mature leaves, and T1 progeny were produced through self-fertilization. Nematode infection assays of T1 plants have shown a significant reduction in the number of eggs produced by females of M. arenaria when compared with wild-type. No off-target effects of 16D10-RNAi have been observed in the regenerated tobacco lines and attempts to correlate the severity of the nematode infection with RNA expression are underway.

Brantley Snipes
Graduate Programs: Landscape Architecture and Horticultural Science
Advisors: Kofi Boone and Anne Spafford
Poster Number: 152

Retrofitting Suburbia with Health in Mind

Retrofitting, or the modification of existing places to meet contemporary needs, is a critical practice in landscape design. However, the trend is just now becoming relevant in America's suburbs. From 1945-1970, the United States committed to decentralizing communities through low interest loans for low density development and extensive investment in infrastructure. Now, sixty years later with the majority of the American population residing in the suburbs, these areas are faced with a wide range of crises, from auto dependence to infrastructure decay to ecological degradation. The Center for Disease Control recognizes the health of suburban populations to be a growing epidemic in our society and a direct result of the low density, auto-dependent infrastructure. Yet demographic trends suggest that suburban areas will increasingly become the homes of more diverse populations with need for increased mobility, access to services, walkability, and housing choices. The objectives of this project were to consider the growth trends, evaluate existing conditions, and create a suburban retrofit designed to promote both human and environmental health along the Blue Ridge Corridor in Raleigh. The process started through the creation of a health metric to determine the spaces within suburban areas that exacerbate the problems of health and to create design solutions to amend these issues. It was determined that by designing for ecological health first, developmental needs of the suburban population, such as higher density, walkability and mixed use, could ensue. The result was an area of rich environmental quality, unique character, and a promoter of the health and well being of a suburban population.

Jessica J. Stocking and Theodore R. Simons
Graduate Program: Biology
Advisor: Theodore R. Simons
Poster Number: 155

Comparison of oystercatcher nesting sites: habitat plasticity, and implications for coastal change

Between increased human use and rising seas, America's coastline is changing at unprecedented rates – barrier beaches are disappearing for those species who call it home. As an obligate coastal species exhibiting high visibility and site fidelity, the American oystercatcher is an ideal species through which to consider those changes. Evidence suggests that the proportion of oystercatchers nesting on dredge spoil islands has increased but that success is reduced in these locations. The primary tradeoff for birds nesting on these islands is that there are no mammalian predators, but food acquisition requires leaving the nesting territory. Oystercatcher chicks are dependent upon their parents for food until after fledging. Therefore, one adult is forced to fly to a distant food source, leaving the second adult alone to defend the brood. This is energetically taxing on all members of the family group and may explain reduced nesting success of pairs on the dredge-spoil islands, as compared to barrier islands. We evaluate reproductive success by two metrics: the condition of chicks prior to fledging and the daily survival rate of nests. Chicks are handled multiple times prior to fledging, in order to determine condition growth rates. This will be combined with several years of productivity data to compare the overall success in the two types of site (barrier and dredge). Our hypothesis is that oystercatchers on dredge islands exhibit reduced success compared to those on barrier islands. If no difference in success is demonstrated, this may be an illustration of adaptive plasticity in the face of disappearing traditional habitat.

Shilpa Swarup,[1,2] Taufika Islam Williams[3], and Robert R. H. Anholt[1,2,4]
Graduate Programs: Genetics[1]; W.M. Keck Center for Behavioral Biology[2]; Chemistry[3]; Biology[4]
Advisor: Robert R.H. Anholt
Poster Number: 162

Functional Dissection of Odorant Binding Protein Genes in *Drosophila melanogaster*

Most organisms rely on olfaction for survival and reproduction. The olfactory system of *Drosophila melanogaster* is one of the best characterized chemosensory systems and serves as a prototype for understanding insect olfaction. Olfaction in Drosophila is mediated by multigene families of odorant receptors and odorant binding proteins (OBPs). Whereas molecular response profiles of odorant receptors have been well documented, the contributions of OBPs to olfactory behavior remain largely unknown. Here, we used RNAi-mediated suppression of *Obp* gene expression and measurements of behavioral responses to 16 ecologically relevant odorants to systematically dissect the functions of 17 OBPs. We quantified the effectiveness of RNAi-mediated suppression by quantitative RT-PCR and used a proteomic LC/MS/MS procedure to demonstrate target-specific suppression of OBPs expressed in the antennae. Our results show that OBPs are essential for mediating olfactory behavioral responses and that targeted interference with OBP expression generates aberrant behavioral phenotypes that are sex-dependent. Behavioral analyses of flies in which expression of specific OBPs is systematically suppressed indicate that OBP-dependent odorant recognition is combinatorial. (Supported by NIH grant GM059496).

Jacob Thomas
Graduate Program: Physiology
Advisor: Scott Whisnant
Poster Number: 164

The Mechanical Regulation of GSK3β in Mesenchymal Stem Cells is Dependent on AKT Activation

GSK3β is emerging as a critical mediator of mechanical responses in mesenchymal stem cells (MSC). Mechanical strain causes inactivation of GSK3β, resulting in stabilization of β-catenin levels and indirectly increasing COX2 expression via NFATc1. Importantly, both β-catenin and COX2 influence MSC differentiation. The signaling molecules required for mechanical inhibition of GSK3β activity are unknown. AKT, known to decrease GSK3β activity in response to insulin, may also participate in mechanical effects as strain rapidly activates this molecule via phosphorylation at both Thr 308 and Ser 473. Here we wished to define proximal events whereby mechanical stimulation regulates both AKT and GSK3β activity in marrow-derived MSC. Blocking of strain activation of AKT, via pharmacological inhibition using AKT1/2 or knockdown of AKT expression using siRNA, resulted in a loss of GSK3β Ser9~P in response to mechanical strain (2%, 0.17Hz). We then compared the mechanical response to treatment with insulin, which is known to activate AKT downstream of PI3K. In the presence of the PI3K inhibitor LY294002, strain induction of T308~P was inhibited, but S473~P was unimpaired. Importantly, mechanical inactivation of GSK3β was not blocked by PI3K inhibition. This contrasts with effects of insulin, in which inhibition of T308~P with LY294002 ablated GSK3β phosphorylation. Possible involvement of integrin-linked kinase (ILK) in the mechanical response to strain was evaluated, as ILK can inhibit GSK3β activity. siRNA was used to decrease ILK expression by ~70%. However, strain still induced AKT T308~P and S473~P in conjunction with GSK3β inactivation in MSC. Protein kinase C (PKC) was also considered because of its proximity to the membrane and previous work that demonstrated activation of PKC by mechanical stimulation. Use of the global PKC inhibitor Calphostin C resulted in a loss of AKT activation by strain. In further work we will determine the specific PKC isoform responsible for mechanical activation of AKT, thus identifying a critical signaling molecule upstream of GSK3β.

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Advisor: Michael R. Burchell II
Poster Number: 166

Simulating the Long Term Hydrology and Nitrate-Nitrogen Dynamics of a Riparian Buffer located in Eastern North Carolina using Riparian Ecosystem Management Model (REMM)

Riparian buffers are stream-side vegetated corridors located in the landscape down-slope from upland/agricultural fields and upslope from adjacent streams. Conservation practices such as the installation of riparian buffers along streams are known to attenuate agricultural non-point source pollutants such as nitrogen and phosphorus. A riparian buffer located in the Tar-Pamlico basin in North Carolina was enrolled in the Conservation Reserve Enhancement Program (CREP) and monitored for its hydrology and water quality since 2005. This buffer site received nitrogen and phosphorus loads from an upland source of inorganic fertilizer application for crops such as cotton, peanut and soybeans. Results from field studies (2005-2009) have shown the buffer to decrease the incoming nitrate-nitrogen load from field to the stream. Riparian Ecosystem Management Model (REMM), a computer simulation tool was designed to simulate riparian buffer performance for nitrate-nitrogen attenuation. REMM model was used as a tool to calibrate/validate the surface water, groundwater hydrology and nitrate-nitrogen using 5 year (2005-2009) field measured data. This calibrated model was then used to forecast long term riparian buffer performance (2010-2042) for hydrology and nitrate-nitrogen using the historic weather data. The model predictions showed the riparian buffer acting as nitrate-nitrogen sink by decreasing the incoming loads from agricultural fields before being discharged into streams. The long term simulations showed the nitrate-nitrogen concentrations entering the buffer were 13 mg/L (average) and were reduced to 1.7 mg/L (average) before entering the stream. These model predictions were based on current application rates of inorganic fertilizers at the buffer site. The calibrated model was also used to simulate application rates similar to swine/dairy manure application rates and effects of differing buffer widths on nitrate-nitrogen loads. This study demonstrated that the REMM model is an effective tool to simulate riparian buffers under different field conditions, if properly calibrated and validated.

Nash E. Turley, Walter C. Odell, and Marc T.J. Johnson
Graduate Program: Plant Biology
Advisor: Marc T.J. Johnson
Poster Number: 171

Rapid evolution in plants following experimental removal of herbivores

Herbivores are a potent agent of natural selection and are credited with driving the evolution and diversification of plant defensive traits. Despite an abundance of circumstantial evidence, no experiment has demonstrated that natural selection by

herbivores maintains or causes directional changes in plant defensive traits – the hallmark of adaptive evolution. We tested this hypothesis using a field experiment where 22 local plant populations were protected from natural rabbit herbivory for <1 to 26 years. We then compared each population's tolerance to herbivory, individual plant growth rate, tolerance to competitors, and the concentration of defensive chemicals in a common environment. In 26 years without rabbit herbivory, plant growth rate decreased by 30%. Thus, increased plant growth rate is adaptive in the presence of intense and frequent herbivory but not in the environmental condition created in its absence. This suggests that rabbits influence the evolution of plants directly through consumption and indirectly by altering the environment. Surprisingly, we found no evolution in tolerance to herbivory, competitive ability, or abundance of defensive chemicals (tannins and oxalate). In conclusion, intense herbivory caused evolution in a morphological trait (plant growth rate), but not it traits not traditionally thought of as defenses against herbivory (tolerance and chemical defenses).

Rich Tuttle[1], Niki Robertson[1], Candace H. Haigler[1,2], Ali M. Idris[3], and Judith K. Brown[3]
Graduate Programs: Plant Biology, North Carolina State University[1]; Crop Science, North Carolina State University[2]; Plant Sciences, University of Arizona, Tucson, AZ[3]
Advisor: Niki Robertson
Poster Number: 173

Development of a Virus-induced Gene Silencing (VIGS) System for Cotton

Cotton is an economically important crop grown worldwide for the long spinnable fibers that derive from the surface of the cottonseed. The large genome of cultivated cotton has complicated both traditional breeding and genome assembly. Biotechnological improvements have been hampered by recalcitrance to transformation. An improved understanding of the function of genes unique to the cotton fiber could guide transformation-based initiatives leading to further improvements in fiber qualities. Virus-induced gene silencing (VIGS) is a reverse-genetics technique that can be used to investigate gene function by producing a rapid, sequence-specific knock-down (silenced) phenotype for a target gene without transformation or a complete gene sequence. Here we describe the development of a cotton VIGS vector.

The objectives of this work were to: 1) develop a VIGS vector from the geminivirus *Cotton leaf crumple virus* (CLCrV) and 2) characterize its ability to silence genes in cotton fiber. Standard molecular cloning techniques were used to replace the coat protein of CLCrV with a poly-linker for insertion of approximately 750-bp of targeting sequence. The chlorophyll biosynthetic gene Magnesium Chelatase (*ChlI*) was used as a visible marker for vegetative gene silencing. Both silencing of *ChlI* and accumulation of vector DNA were increased at lower growth temperatures. When a full-length Green Fluorescent Protein (GFP) was cloned into the poly-linker, expression from the vector was observed in vascular tissue as well as the seed coat. This proximity to the site of fiber initiation suggested the vector would be useful for silencing fiber genes. Subsequently we have used VIGS to silence the transgenic reporters *GFP* and beta-glucuronidase (*GUS*) in fiber. Silencing of the endogenous cell elongation-related gene Expansin1 (*Exp1*) resulted in a 10% reduction in the length of mature fibers. These results verify the usefulness of VIGS for investigating gene function in cotton fiber.

Steven Vensko
Graduate Program: Genetics
Advisor: Eric Stone
Poster Number: 180

Constructing common transcriptional units in an experimental Drosophila melanogaster population

It is well established that protein assembly, conditional upon genomic and environmental factors through RNA synthesis, is a requirement for maintenance of both cell and organism. With such complex machinery dictating phenotype, even the most subtle genomic or environmental variation can have profound effects on transcript abundance. If we are to understand these complex systems found in biology then we must uncover the causal relationships among genetic variation, environmental variation, transcriptomic variation and organismal phenotypic variation. Resources that have been developed, such as the extensive DGRP (Drosophila Genetic Reference Panel), created and maintained by the Mackay Lab, provide unprecedented amounts of genomic, transcriptomic and phenotypic data for 192 wild-derived inbred lines which allows for unraveling of some of Drosophila melanogaster's most complex molecular systems. I will be presenting computational methods to make use of the DGRP's natural variation to overcome confounded genetic and transcript variation identify transcriptional units common to all DGRP lines in unannotated regions of the Drosophila melanogaster genome. The construction of these transcriptional unit sets will serve as a springboard to a variety of future studies that aim to better understand the interrelationship among genomic variation, expression variation, environmental variation and organismal phenotypic variation.

Ziyu Wang[1], Jay J. Cheng[1], Ruyu Li[2], and Rongda Qu[2]
Graduate Programs: Biological and Agricultural Engineering[1]; Crop Science[2]
Advisor: Jay J. Cheng
Poster Number: 181

Alkaline Pretreatment of Genetically-Engineered Switchgrass for Improved Carbohydrates Conversion Efficiency

The world-wide increased energy demand and the limited supply of fossil fuels prompt exploration of alternative renewable energy sources for sustainable economic development. Switchgrass is considered as a promising bioenergy crop for ethanol production due to its high biomass yield, low agricultural inputs, and environmental benefits. With the help of genetic technology, conventional switchgrass can be modified to reduce its lignin content and increase its carbohydrates content for effortless conversion of biomass to fermentable sugars during pretreatment and enzymatic hydrolysis. The objectives of this study are to investigate the effects of sodium hydroxide (NaOH) and lime ($Ca(OH)_2$) pretreatments on improved production of total reducing sugar as well as glucose and xylose from transgenic switchgrass, and examine the impact of lignin modification on facilitating biomass saccharification. For sodium hydroxide pretreatment, the conditions being studied are 121°C, 0.5-2% NaOH, and a range of residence times from 15 min to 60 min. To make an easy comparison with the impact of sodium hydroxide pretreatment on biomass digestibility, the conditions examined for lime pretreatment include 121°C, lime loadings of 0.05-0.15 g lime/g dry biomass, and a set of residence times of 15-90 min. Preliminary results show that under the same pretreatment condition (1% NaOH, 30 min and 121°C) total reducing sugar production from transgenic switchgrass after enzymatic hydrolysis was improved by approximately 22% as compared to conventional switchgrass. The effects of these alkaline pretreatments at other conditions (as stated above) on sugar yield from both conventional and transgenic switchgrass are being explored, followed by optimization of the proposed pretreatment conditions. Finally the entire conversion process involving pretreatment and enzymatic hydrolysis will be simulated using three different models including statistical model, kinetic model, and non-kinetic model.

Qian Wu, Heike Sederoff, and Imara Y. Perera
Graduate Program: Plant Biology
Advisors: Heike Sederoff and Imara Y. Perera
Poster Number: 189

Regulation of phosphate sensing by the inositol phosphate signaling pathway in tomato

Growth and productivity of plants depends on the availability of phosphate. Plants grow in soils that often contain very low concentrations of phosphate. To adapt in phosphate-deprived environments, plants must sense external changes and adjust their growth to match the resource availability. Downstream responses to phosphate (Pi) deprivation are fairly well described, but the initial molecular events that monitor and transmit information on external and internal phosphate status are poorly understood.

Our project specifically addresses how inositol phosphate metabolism in plants is involved in sensing and response to phosphate limitation. The Inositoltriphosphate ($InsP_3$)-mediated signaling pathway is an important regulator of plant stress responses. We have generated tomato plants constitutively expressing the mammalian type I inositol polyphosphate 5-phosphatase (InsP 5-ptase). These transgenic plants have greatly reduced levels of basal $InsP_3$. The transgenic plants have altered responses and/or sensitivity to low Pi. In order to unravel the relationship between $InsP_3$ signaling and phosphate signaling transduction, we generated reciprocal grafted wild type and transgenic tomato plants. Pi starvation time course experiments were also carried out to elucidate when the $InsP_3$-mediated signaling pathway may be involved in regulating Pi signal transduction. Following Pi starvation, root and shoot samples were analyzed for Pi content and expression of Pi responsive genes.

We anticipate that this work will generate fundamental knowledge on the molecular basis of plant phosphate sensing mechanisms with applications for crop improvement. [This research is funded by USDA and NASA.]

Yan Zhao
Graduate Program: Animal Science
Advisor: Sung Woo Kim
Poster Number: 193

Effect of gestational housing systems on reproductive performance and oxidative stress status of sows during gestation and lactation

Gestational housing system of sows has received increasing criticism from the public in the USA. However, few studies did integrated evaluations of gestational crates and pens. In this study, two types of gestational housings were used to evaluate the effects on reproductive performance, physiological status, and behavior of sows during gestation and lactation. Ninety six multiparous sows were randomly assigned either to group pen (PEN) or individual crate (CON) on d 35 of gestation. Behaviors of sows were recorded and observed for the first 4 d after treatment assignment. One week before farrowing, sows were

moved to individual farrowing crates. Sows were weighted on d 35 and 109 of gestation, and d 1 and 18 of lactation. Jugular blood was collected from each sow on d 35, 60, 90, and 109 of gestation, and d 3 and 18 of lactation. Plasma malonedialdehyde, protein carbonyls, 8-hydroxy-deoxyguanosine, immunoglobulin G, and immunoglobulin M were quantified. Litter size and piglet weight were recorded on d 1 and 18 of lactation. Sows in PEN gained less BW ($P < 0.05$) than sows in CON during gestation. Sows in PEN tended to have smaller ($P = 0.069$, 0.096) litter size than sows in CON on d 1 and 18 of lactation. Sows in PEN tended to have less ($P = 0.089$) litter weight than sows in CON on d 1 of lactation. Plasma concentration of protein carbonyl of sows on d 90 of gestation in PEN tended to be greater ($P = 0.098$) than sows in CON. The eating time of sows in PEN tended to be less ($P = 0.060$) than sows in CON. In conclusion, sows had reduced reproductive performance when housed in pens during gestation, and sows housed in pens had increased protein oxidative damage during late gestation than sows housed in crates.

Eric Goldman, Christoph Konradi, and Matteo Rapallini
Graduate Program: Architecture
Advisor: Wayne Place
Poster Number: 48

Dynamic Building Facades: A Study on the Mediation Between Double Skin Construction, Daylighting, and Design

Buildings accounted for 38.9% of the United States' total energy consumption in 2005 and by 2025 buildings are projected to be liable for 75% of the nation's electrical consumption. Integration of 'green' building technologies into design can have a vast impact on limiting energy consumption. More than ever, an integrated, holistic design process needs to account for all building functions to work in harmony for an efficient, cost-effective built form. Between architectural design and building technologies, there is a need to recognize the positive result that can occur from a productive synthesis. The first step for such mediation is data collection to inform integrated building system design.

The George Matsumoto building on the North Carolina State University's College of Design Campus was chosen as the subject. The overall goal was to retrofit the existing building with a proposed floor addition, the challenge was to develop a system to respond to technology, design, and human comfort. To this end, a dynamic building facade can react to exterior site conditions, internal spatial desires by the occupant, and reduce the life-cycle costs of the building. The proposal includes a double skin for a layer of air to be heated or cooled, providing both radiant and convective assistance to lower the buildings energy loads. Motorized sunshade panels react to sun angles and internal light levels to optimize their location along the facade. Integrated early into design and passive heating, cooling, and daylighting strategies fosters a synthesized whole.

Through digital modeling, computer simulations, environmental data collection, and physical scale model testing designers can better inform and verify design implications. The logic behind architectural design stems from precedent studies on past works and an intuitive understanding of desired spatial qualities. The future of architectural design coincides with both creative and scientific reflection for an efficient built form.

Kathryn Hanser
Graduate Program: Landscape Architecture
Advisor: Celen Pasalar
Poster Number: 59

North Carolina Zoo's Honey Bee Garden: A Case Study and Post-Occupancy Evaluation

Zoo exhibit conceptualization, design and implementation represents a particularly complex design challenge that involves balancing animal and human requirements in the context of overarching zoo missions – conservation, research, education and recreation – that can themselves create inherent conflicts, especially with the financial necessity of maintaining gate receipts. The Honey Bee Garden at the North Carolina Zoo in Asheboro, North Carolina, represents a unique opportunity to assess the effectiveness of a zoo exhibit in meeting its educational goals.

In design assessment, post-occupancy evaluation techniques such as behavior mapping and user questionnaires are used to identify physical use patterns and user attitudes which are essential in evaluating realization of design intent: are people doing and learning what was intended in particular spaces? An initial pilot study phase suggests that the more interactive portions of the exhibit, as well as the presence and location of volunteers, drive usage of exhibit space. A single-site case study approach will be applied to document the design process and implementation, while post-occupancy evaluation techniques will be used to identify specific design qualities of target areas.

Continuing research intends to: (1) articulate specific design goals for the exhibit; (2) evaluate the success of the site in meeting these goals, and (3) identify key design qualities that promote intended uses such that underutilized areas may be improved. The main questions are whether design elements result in their intended uses, what design qualities are present in high- or low-use areas, and how these might be manipulated. It is hoped that this study will generate strategies to further the ability of the exhibit – and those working in it – to communicate its intended message, as well as add to the limited literature on zoo exhibit evaluation.

Meghan Holliday
Graduate Program: Design
Advisor: Susan Brandeis
Poster Number: 65

The Blending of Binary Systems: Interweaving Jacquard Textile Design and Computer Generated Art

This research challenges the premise of woven pictures typical of Jacquard fabrics, static textile patterns, and expected repetition of textile design through the interaction of hybrid media. My explorations combine a tangible woven backdrop with ephemeral projections that together narrate a concept of more amplified meaning because of the history of the Jacquard loom. My studies include hand-woven textile samples that are illuminated with computer generated video and animation. The significance of the research is the ancient Jacquard process, which led to the birth of the modern computer. My research endeavors introduce a new technology – kinetic Jacquard motifs through computerized projection – to their predecessor bringing full circle the direct relationship between both binary systems.

Leslie Morefield
Graduate Program: Landscape Architecture
Advisor: Andrew Fox
Poster Number: 119

Narrative strategies in Low Impact Development stormwater management along greenways

With ever-increasing fragmentation of both ecological and cultural systems, improved connectivity between ecosystem and human community hubs is essential to enhanced sustainability and future land stewardship. Increased interaction between humans and the ecosystems that support them can lead to a deeper understanding and respect for the processes that underlie these systems.

Low Impact Development (LID) stormwater management strategies, utilized in linear park systems such as greenways situated along waterways in urban settings, are an ideal opportunity to reconnect a variety of users with the processes of water conveyance and filtration and the relationship between clean water and ecosystem and human health.

LID strategies, through explicit human-ecosystem interaction, inherently promote participatory education via the revelation of ecological processes that lead to healthy water systems and land stewardship. However, the educational communication is not necessarily effective through a top-down designer intervention. Rather, an integration of user-driven participation in the landscape with professional design influence, that can allow the user flexibility regarding comprehension and input, more effectively ensures user understanding and appreciation of ecological processes occurring on a site.

Integration of designer-imposed stormwater management strategies and a user-based participation approach of LID storytelling in the landscape is tested through the design of a section of greenway in Raleigh, NC.

Tylila Pinkham
Graduate Program: Landscape Architecture
Advisor: Andrew Fox
Poster Number: 133

Research Strategies for Future Campus Rain Gardens: Implications of Stormwater Management and the Design/Build Process

In November 2010, the Landscape Architecture Department at the College of Design received a grant from the North Carolina State University (NCSU) Housing Department to select, design and construct a series of stormwater runoff management rain gardens to mitigate a variety of ecological, functional and aesthetic problems adjacent to student housing facilities. The grant funds a series of 10-week landscape architecture design/build studio courses scheduled to take place during the summer terms of 2011-2015. Commensurate with these design/build course offerings, the department will employ a number of quantitative and qualitative research strategies to collect data relating to the social, environmental and financial implications of the design/build studios and the resulting impacts the implemented rain gardens will have on NCSU facilities, students and environs. First, the social research foci seek in part to augment limited bodies of data on the efficacy of the design/build studio format as a tool for design education and the subject of user preference as it pertains to landscape design. Second, the environmental focus examines the impact the resulting rain gardens have on surrounding structures and environments. Third, a cost analysis of the financial implications of student-driven construction on campus compared with equivalent costs associated with the employment of the professional community for the same services will be completed to determine the return on investment for the Housing Department. The results of these research strategies are intended to inform future design/build studio formats, contribute to existing data on the social, environmental and financial implications of stormwater runoff management and provide the basis for future departmental exploration and research on related topics.

Michele L. Proctor
Graduate Program: Industrial Design
Advisors: Brian Laffitte and Percy Hooper
Poster Number: 139

fArmor: A case Study in Design and Agriculture

Modern agricultural science and technology has made it possible to house thousands of commercial chickens in a protected enclosure at optimal lighting, feeding, and temperature for best growth rates. However, the consequences of these facilities include extremely high levels of organic dust, especially airborne particulates, which can create unhealthy respiratory conditions for poultry farmers and workers. This research investigates the respiratory hazards commercial poultry producers are exposed to, existing technology and solutions, and proposes a new type of respiratory protection for agricultural applications. It has been discovered that after five years of unprotected, daily exposure to a confined livestock environment, a worker is at high risk for respiratory illness or disease. This information has not been widely published, nor are farmers educated on respiratory risks. Given the rate of urban growth and food demand, as well as a predominantly aging farming population, it may be more important now than ever to protect farmers. Methods used in this study include farm observations, interviews with poultry farmers, health professionals, and industry representatives. Data was then collected through a survey of the user groups. In summary of the data collected, common reasons for not using existing respiratory protection included level of education on the issue, uncomfortable to wear, and personal image. The data collected was then used in the design of an innovative alternative to existing technology in the form of a powered helmet that provides eye, hearing, and respiratory protection. The fArmor Agricultural respirator features power-filtered air directed over the face for easier breathing, prevents fogging, and creates a cooling effect for the wearer. The unit is also BlueTooth enabled for hands-free communication without removing the helmet. The unit is battery powered and rechargeable via a wireless charging station in the form of a wall-mounted, sealed storage case.

Robert E. Sturk
Graduate Program: Industrial Design
Advisor: Bryan Laffitte
Poster Number: 159

Entertainment Design: First Person Virtual Game Development

The days of video games being viewed as a source of entertainment just for children has long since past. Just in the past decade video games have come to be revered with much enthusiasm, not just by children, but by adults as well. The days of PacMan and Donkey Kong are no more. Video games have become multi-million dollar productions with multi-million dollar returns. The industry employs tens of thousands of passionate and talented professionals ranging from computer scientist, animators, designers and writers. The sophistication of story development, environment development, personal interaction and social interaction are just a few underlying support structures for the incredible success the video game industry is having. Due to this success of video games the world culture has developed a healthy and respectful attitude towards the powerful influence this form of entertainment has on our daily lives. The video game industry is aware of this influence and capitalizes on it with the development of various genres, including but not limited to, education, cognitive development, security and job training. The research investigates the phenomenon of video games on today's culture, the key elements of developing a successful and memorable video game experience for the end user as well as the design of all pertinent assets within the game. Through reading articles, reviewing feedback from the end user to the video game industry as well as an awareness of popular trends in the industry the decision was made to apply all efforts to designing a "First Person Virtual Game". The First Person gaming genre is one of the more popular gaming experiences on the market. Giving the end user the illusion of complete control and freedom has lead to the success of this particular form of video game. The result of this research is to develop a First Person video game that will enhance the end users experience in the virtual gaming environment.

D. Kelvin Bullock
Graduate Program: Curriculum and Instruction
Advisor: Meghan Manfra
Poster Number: 21

PBL: A Bridge for the Achievement Gap?

The achievement gap is generally defined as the disparity between the achievement of white students and minority students. For many years educators have sought ways of closing this gap and boosting the overall academic successes of American students. Despite these efforts, white students continue to outperform minorities on standardized tests and have lower representation in dropout and suspension statistics. Many of the current attempts to close the gap have been through various school reform measures, some of which utilize project-based learning (PBL). In this qualitative case study I investigated the effectiveness of PBL in closing the achievement gap in two urban, secondary social studies classrooms. The primary methods of data collection included interviews, field observations, and analysis of student work. The chief finding was the idea that PBL led

to a notable increase in student engagement. Furthermore, teachers felt PBL supported students who would possibly fail in other settings due to a lack of teacher flexibility and assistance. Finally, student engagement was likely increased because of the real-world applicability of PBL. Thus, it was concluded that if PBL were going to be replicated elsewhere to boost the academic achievement of minority students and close the achievement gap, it would be important to ensure that the curriculum was relevant to the real world and provided extensive student support.

Robert Coven and Meghan Manfra
Graduate Program: Curriculum and Instruction
Advisor: Meghan Manfra
Poster Number: 26

History is Not a Spectator Sport: Reengaging Students through Modeling

An understanding of history is essential for democratic citizenship. Modeling pedagogy, a teaching method drawn from the sciences and newly introduced to the humanities, holds considerable promise of providing students with an understanding of the process and structure of historical analysis. Through modeling students can learn to form their own historical frameworks—i.e. they engage in historical theory making (VanSledright, 2011). According to Burenheide (2007), when students are given the opportunity to construct their own conceptual framework--e.g. through modeling--they become engaged participants, internalizing "the historical facts that are often the goal of other [pedagogical] methods" (p. 57), and are able to perceive patterns and transfer their knowledge to novel situations (McDermott, 1993).

In order to determine whether this teaching strategy can engage students in concept formation in the history classroom, I conducted an action research to evaluate modeling. The action research cycle focused on the enacted curriculum in an ancient world history course for high school freshmen and a US history course for juniors. Qualitative data were collected through formal and informal means. Students were interviewed, by an outside participant-observer, and asked for their insights regarding the teaching method. In addition, more informal observations—by students and the teacher—were recorded. The study also focused on student work, including a series of conceptual models constructed by students, in response to prompts developed by the teacher. Observations and evaluations were made for each set of models. After each iteration, modifications were made by the teacher in order to improve the teaching method.

The study reports on the findings of the action research. Specifically, it demonstrates that as students engage in inquiry elicited by modeling, they develop comfort with ambiguity and complexity, enhance their critical thinking skills, learn to negotiate group dynamics, overcome significant historical misconceptions, and learn to visualize patterns and connections within and among broad historical phenomena.

Morgan Early
Graduate Program: Mathematics Education
Advisor: Karen A. Keene
Poster Number: 34

Engineering Professors' Preferences for the Learning of Differential Equations

A first semester course in ordinary differential equations is often described as a service course to engineering and hard science majors; how engineering professors envision the course content and tools is important. Additionally, reform efforts in differential equations courses have focused on enhancing students' relational understanding of the material, which seeks to enhance students' abilities to connect procedures with conceptual ideas. This mixed-method research study reports the results of a nationwide survey of engineering professors who articulate their opinions of the important topics of the differential equations curricula, the relational understanding of differential equations students, and how technological advances have impacted the study of differential equations for engineers. Follow-up interviews were also conducted to provide extra insight into the reasoning for some of the engineering professors' opinions of the differential equations course. Item analysis as well as open-coding showed many common threads in preferences, the most significant being a concern for relational understanding in the curricula.

Valerie N. Faulkner
Graduate Program: Curriculum and Instruction
Advisor: Cathy Crossland
Poster Number: 37

Analyzing the effects of fifth grade teacher impressions of student mathematics ability on students' eventual placement in eighth grade algebra or above

In our educational system it is expected, when different levels (or 'tracks') of an academic topic are in effect, that students be placed in academic classes primarily based on demonstrated performance and ability levels. There is limited research on the classroom factors that may affect these placement decisions. The purpose of this study was to identify whether elementary school teacher impressions of student mathematical ability affected middle school mathematics placement differently for students with different background characteristics. The sample was drawn from the fifth and eighth grade rounds of a national data set (Early Childhood Longitudinal Study – Kindergarten Class of 1998-1999). The effects of fifth grade teacher rating of student mathematical ability, actual student mathematical performance, and student background characteristics (specifically race and disability status) were investigated using logistic regression to determine the impact of these variables on eighth grade mathematics placement. A ratio of the effect sizes was created to determine relative impact of teacher rating versus actual mathematical performance for different student groups. While socioeconomic status, disability status, and actual mathematical performance is held constant, teacher rating has a larger relative impact on student placement for Black/African American students (.77), Asian students (1.18) and students with disabilities (.96) than for white students (.49) or all students combined (.48). Interactions indicate some difference in this effect for higher and lower performing students. Teacher impressions of student performance seem to differentially impact placement decisions for students and this differential application appears to diminish odds of placement for some students (B/AA and SWD) and increase odds of placement for other students (Asian).

Christina Gomez
Graduate Program: Special Education
Advisor: Douglas Cullinan
Poster Number: 49

Using Direct Instruction Techniques to Increase Basic Addition Fluency of a Student with Concomitant Disabilities

Students with concomitant disabilities frequently have difficulty learning basic facts and require urgent, intensive and explicit interventions. Without an individualized focus, these students do not make meaningful academic progress. The research in this study is based on Applied Behavior Analysis (ABA), a scientific approach that investigates the functional relationship between the environment and behavior. This paper explores the impact of repeated practice, immediate feedback and positive reinforcement on the one-digit addition fluency rate in a one-minute timed interval of a 9 year-old, second grade female student. A changing criterion design was utilized to create sub-criterion levels based on previous performance. This approach allowed the researcher to systematically and effectively increase one-digit addition fluency and automaticity. Correct written responses increased from a mean of 4 during the baseline phase to a mean of 14 in the final phase of intervention. Interobserver reliability checks indicated a reliability rate of 100% in all phases. The study demonstrated maintenance and generalization, but insufficient time prevented further analysis of both.

Lisa Hervey
Graduate Program: Curriculum and Instruction
Advisor: Hiller A. Spires
Poster Number: 63

Between the Notion and the Act: Distinctions Between Veteran Teachers' TPACK and Practice in 1:1 Settings

Veteran teachers have found it daunting to efficaciously weave educational technologies into their established instructional practices (Bebell & Kay, 2010). A surge in 1:1 initiatives, where every teacher and student has access to a mobile, Internet-connected device for 24-hour use, further adds to the complexity of the educational landscape for veteran teachers. Despite the increase in 1:1 initiatives, there is a lack of clarity about the kind of professional knowledge veteran teachers must have to create and implement instructional practices and activities to effectively support student learning within these environments. The technological pedagogical content knowledge (TPACK) framework is a nuanced lens to study teachers' 21st century professional knowledge and practice (Mishra & Koehler, 2006), and has been applied in a variety of settings. Veteran teachers practicing in 1:1 settings, however, are not targeted in current TPACK research. In this mixed-methods study, veteran secondary education teachers (N = 85) were first surveyed to determine their self-reported technological content knowledge (TCK), technological pedagogical knowledge (TPK) and technological pedagogical content knowledge (TPACK) while practicing in 1:1 settings. Information rich teacher cases (N = 6) were identified for the subsequent qualitative phase. Qualitative data included teachers' videotaped lessons, simulated recall and semi-structured transcripts and field notes. TPACK *a priori* codes were used during within-case analysis. Open coding analysis was conducted to discover emerging themes across cases. Findings suggest that

most veteran teachers had lower self-perceptions of their TPACK then their practices indicated. TCK, TPK and TPACK *a priori* coding resulted in observational findings that significantly added to this under-theorized aspect of the TPACK framework. Cross-case results indicated that veteran teachers' want: (a) autonomy in selecting technology related professional development; (b) freedom to choose technologies to use with their students; and (c) opportunities to practice with technology with their peers.

Donna Hucul
Graduate Program: Adult and Community College Education
Advisor: Carol Kasworm
Poster Number: 68

An Exploration of Factors that Predict the Financial Literacy of Undergraduate College Students in North Carolina

In the aftermath of one of this country's most serious financial crises, the topic of financial literacy has come to the forefront for education practitioners. A decade ago, the Excellence in Economic Education Act of 2001 put the onus on researchers and educators to develop and measure the impact of financial literacy programs. To date, results from studies among college students are less than encouraging, indicating low levels of financial literacy ranging from 30%-60%. While a number of studies have measured financial literacy levels of college students, few provide predictive models which associate specific learner attributes with this ability. The intent of this study, anchored in self-efficacy theory and principles of andragogy, is to examine the predictive ability that factors of self-confidence, motivation, anxiety/stress and financial experiences have on the financial literacy of college undergraduate students. A survey questionnaire measuring these factors was distributed to a randomly selected sample of NCSU undergraduate students to capture data for both descriptive and inferential statistical analysis. It is hoped this predictive model will reveal significance in the association of self-confidence, motivation, anxiety/stress and financial experiences with financial literacy levels among college undergraduates. Insight into drivers of the learning process through the examination of the relationships between learners' attributes and financial literacy levels can benefit educators and curriculum planners by highlighting factors that correlate with higher financial literacy levels. Education practitioners can then use this deeper understanding of learner attributes to adapt and refine financial education programs with a goal toward achieving higher levels of financial literacy among college students.

Alex Kaulfuss
Graduate Program: Curriculum and Instruction
Advisor: Ruie J. Pritchard
Poster Number: 85

Visualizing Literacy: Determining the impact the utilization of graphic novels in the English classroom has on student learning

Sometimes considered a means of wasting time and fueling youthful fantasies, graphic novels do not often come to mind when discussing strategies for literacy success; however, graphic novels have myriad benefits to offer the English / Language Arts (ELA) classroom. To date much of the documentation on the effectiveness of graphic novels has been anecdotal, investigations into the responses students have to reading graphic novels; however, no studies have addressed student performance on assessments or their comprehension of the material. The enjoyment students garner from reading graphic novels does not, in and of itself, make them sound pedagogical tools; after all, students enjoy a great many things (e.g., sleeping or playing cards) which we would generally not consider pedagogically beneficial. This study, therefore, empirically investigated the impact of the utilization of graphic novels on the ELA classroom using William Shakespeare's *The Tragedy of Macbeth*, focusing on the activation of schema appropriate to the subject being explored, comprehension of complex speaker / listener interaction, and performance on assessments. Results indicated that there is a statistically significant difference between the performance and comprehension of students presented with the play in graphic novel form and students presented with the play in traditional form. Discussion centers on supporting anecdotal evidence with empirical evidence and encouraging educators to utilize graphic novels in their classrooms. Further research opportunities include investigation of taxonomic rank of discussions, of applications at varying class levels (e.g., academic, honors, AP, etc.), and of students' perceptions of textual accessibility when utilizing a graphic novel versus a text-only version of a text.

Naomi Kraut
Graduate Program: Curriculum and Instruction
Advisor: Carl A. Young
Poster Number: 95

Repurposing Social Networking Tools for the Classroom: An Examination of Twitter's Potential for Enhancing Preservice Teachers' Language Awareness

Research on language instruction indicates that the traditional approach to teaching grammar is ineffective. But how do teachers break away from the decontextualized grammar worksheets, from replicating the ways that they themselves were taught language? Re-envisioning language instruction begins with reflecting on how we authentically use and interact with language on a daily basis. The microblogging social network site Twitter has the potential to serve as a tool for such an exploration of language. In this study, I investigate how Twitter can be used as a tool for language exploration in the English language arts (ELA) methods classroom by examining the use of Twitter in two ELA methods classrooms in the fall 2010 semester. As part of their coursework, students were required to post seven to ten tweets during the semester under the instructor's Language_Today Twitter account. This account serves as "an ongoing effort to seek out, make observations about, and highlight contemporary examples of language, literacy, and culture in action in global media." At the conclusion of the semester, students completed a Likert scale survey and open-ended questionnaire about their experience with Language_Today, and students' tweets were coded and categorized. In addition, several students were interviewed after the semester to get further insight into their Twitter experience. Findings indicate that Twitter does have the potential to enrich students' content knowledge, with high numbers of students reporting that posting to the Language_Today site enhanced their knowledge about language in the real world and impacted their thinking about language instruction. Further analysis of the open-ended questions and interviews indicate that while Twitter is a viable tool for enhancing content knowledge, it needs to be firmly and broadly integrated into the course so that students can form enough Twitter habits to approach the tool's full potential for content learning.

Erin Krupa
Graduate Program: Mathematics Education
Advisor: Jere Confrey
Poster Number: 96

Evaluating the Impact of Professional Development and Curricular Implementation on Student Achievement

In this era of high-stakes testing and accountability, curricula are viewed as catalysts to improve high school students' mathematics performances. Districts across the United States are making decisions on curricular materials with consideration of their impact on student achievement. These decisions should be made as a result of evidence gathered from high quality curricular evaluation studies. However, it is an arduous task to link a curriculum directly to student learning when other confounding variables are involved in the complex setting of a classroom. Students and teachers interact with curricula in unique ways in creating the classroom milieu, complicating the determination of curricular effectiveness.

This mixed methods research examines the impact of the reform based *Core-Plus Mathematics* (CPMP) curricular materials on student achievement using hierarchical linear modeling to account for variation in student achievement. It relates research on the use of the curricula and student outcomes to teachers' participation in a state-funded professional development and their levels of implementation of the curricula. The professional development model, including a summer program and classroom coaching, was developed to build and support a community of teachers using the CPMP curricular materials, particularly in high needs schools. Data indicate there are differences in teachers' implementation of the curricular materials based on their participation in different components of the professional development and that these implementation indices can impact student achievement. Preliminary results also point to differences in student achievement based on the curriculum type to which students were exposed.

Carrie Amanda Mae Lineberry
Graduate Program: Mathematics, Science, Technology, and Education
Advisor: Karen Allen Keene
Poster Number: 103

Using Dynamic Geometry Software to Develop Students' Conceptual Understanding of Angle

Angle is a complex topic defined in a variety of contexts; some define angle to be as a pair of rays coming from a single point, as a rotation about a single point, or in a curve. Due to the multiple definitions of angle students get confused as to what an angle truly consists of. This study paid close attention to the misconceptions high school geometry students' hold about the concept of angle and how to help them gain a more conceptual understanding of this essential concept with the use of technology. There are multiple varieties of technologies that can be used to help students learn the concept of angle, or any geometry related concept, the one used in this study was The Geometer's Sketchpad, which is one version of Dynamic Geometry Software

in which students can create a figure and manipulate its shape to discover properties of the shape they created. The study hypothesizes that angle can be learned using interactive software. The students can move the dynamic diagrams around and see what changes with different types of angles. By connecting the following two research areas, student understanding of angle and DGS as a tool for instruction, this study was designed to expand upon the research on incorporating technology into the geometry classroom by concentrating on how the technology is incorporated and if the method has any affect on students' conceptual understanding. The primary purpose is to discover whether it would be beneficial for students to create their own constructions with DGS given definitions or discover definitions using teacher-constructed diagrams while learning the concept of angle. The results of this study showed that software was shown to be more beneficial for the students who used teacher-constructed diagrams to investigate the definitions of important geometric terms.

Lauren Madden
Graduate Program: Science Education
Advisor: Eric N. Wiebe
Poster Number: 105

Examining Elementary Teachers' Identities from Multiple perspectives

The purpose of this study is to understand how teacher identity influences elementary teachers' science practices from multiple perspectives—the teacher's self-reported identity, the researcher's perspective, and the students' perspectives. Two frameworks on identity were synthesized and used in this research. The first, developed by Gee (2000-01) examines *who a teacher is* with respect to four areas: nature, institution, discourse, and affinity group belonging. The second, developed by Beijaard and colleagues (2000) examines factors that drive *what a teacher does* in his/her practice through examining teachers' expertise divided among three areas: content, pedagogy, and didactics. These frameworks were used together to examine the identities of three second grade teachers in a year-long case study. The study took place over the course of the 2009-10 school year in one second grade classroom where science was taught by three different teachers. Classroom observations, teacher interviews, teacher questionnaires, student interviews, and photographs of students' notebook entries served as data sources. These data sources were triangulated to reveal differences in both the identities and practices among the three teachers. For two of the three teachers, their self-described identities were different from how they were viewed by their students and the researcher. These findings highlight the importance of incorporating multiple perspectives, including those of students, when describing teachers' practices and identities. The study revealed that the three experienced teachers at the same grade level had vastly different science needs, underscoring the utility of identity theory for the design of future professional development efforts.

Lauren Bricker Myers
Graduate Program: Curriculum, Instruction, and Counselor Education
Advisor: Edward Sabornie
Poster Number: 125

The Effect of Choral Repeated Readings to Increase Oral Reading Fluency

Current pressures from state and national legislations are causing school districts to re-evaluate their reading programs with the hopes that students will achieve reading levels on grade level. Reading fluency has often been used to predict word recognition and comprehension of students' reading level. Research indicates the success of many different reading strategies to increase students' reading fluency. This study examined the efficacy of one reading intervention, choral repeated reading, for increasing reading fluency. A changing criterion design was implemented to monitor student progress as the researcher and student set interim goals within the reading program. Oral reading fluency increased from a mean of 14 words per minute during baseline to 53 words per minute during the final intervention phase. Interobserver reliability was found to average 95% across all checks. While a functional relationship was established between the choral repeated reading intervention and increasing oral reading fluency, the student's reading levels were not able to be maintained without the use of the intervention.

Tom Warren
Graduate Program: Educational Research and Policy Analysis
Advisors: Matt Militello and Lance Fusarelli
Poster Number: 184

How Q-Methodology Reveals Early College High School Philosophy, Policy, Process, and Outcomes

Problems confront the US high school: national demographic and global achievement gaps; drop-out rates; gang involvement; 21st century skill sets development; and preparing graduates for the work-force or continued education. Secondary school reform in the US has a long, cyclic history. A successful secondary public school reform model, the Early College High School, has gained greater national attention since funding by the Bill and Melinda Gates ECHS Initiative in 2001. This qualitative

research study examines the educational philosophy, policies, infrastructures, processes, and outcomes of three ECHs in a rural and metropolitan area of a mid-Atlantic state in order to fulfill the overarching descriptive research goal: *investigate what policies and philosophy shape the form, process, and outcomes of local ECH organizations*. Phase One, Stage One of the study examines ECH policies as set forth by national and state organizations vis-a-vis semi-structured interviews of these organization leaders to answer research sub-question one: *How are ECHs designed differently from traditional high schools?* Phase One, Stage Two utilizes semi-structured interviews to investigate ECH administrator input about policies and processes at the school level that address research sub-question two, *How is school leadership in ECHs different from traditional public high schools?* Phase Two utilizes Q-Methodology to define participant ECH teachers' perceptions of most and least effective processes at work in ECHs and why school personnel view them as successful, in order to answer research sub-question three, *How do local ECH teachers perceive their school process to align with state- and national-level process, policies and philosophy?* The study's theoretic underpinnings are based on a perspective that aims to reveal alignment between national ECH policies and local ECH high school process set against a conceptual paradigm backdrop that includes select qualitative and quantitative inquiry methods.

Kemah Eugene Paul Washington
Graduate Program: Higher Education Administration
Advisor: Audrey J. Jaeger
Poster Number: 185

Towards a Deeper Understanding of Community College Part-Time Faculty: Perceptions of Roles and Expectations

The employment of part-time faculty (PTF) continues to ensue debate among educators, policymakers, and state officials. Recent debate has focused on the impact of employment of PTF on student outcomes, but misses a critical element -- the experiences of part-time faculty. This study explores community college PTF members' perceptions of their roles and expectations, along with their perceptions of the institutional environment. Offering insight into the lived experiences of part-time faculty -- as they are critical to the ongoing practices of community colleges this study informs discussion of faculty identity development. Drawing on PTF typology research, as well as theories of faculty role performance and achievement, faculty socialization, and faculty identity, this instrumental case study explored the experiences of twelve PTF at a North Carolina community college. Classroom observations and document analysis were used to triangulate primary data yielding three key findings: 1) PTF come to understand what it means to be a faculty member largely as a result of graduate school experiences, as well as interactions with community college faculty and department-heads; 2) PTF perceive themselves as educators as opposed to adjunct or PTF; 3) When discussed as adjunct faculty, PTF view their roles as less than those of full-time faculty; and 4) PTF list professional development, personal aspirations, and faculty/department-head interactions as factors that facilitate role performance, and note lack of pay/reward structures, lack of training and orientation, lack of resources, and lack of acknowledgment as factors which hinder the fulfillment of roles.

Rhonda M. Welfare
Graduate Program: Leadership, Policy and Adult and Higher Education
Advisor: Diane Chapman
Poster Number: 187

Alternate-Route Career and Technical Education Teachers' Professional Development Experiences

In recent years there has been a dramatic increase in the number of alternative routes to K-12 teacher certification. Issues related to preparation and ongoing professional development of these teachers are critical and have application to Human Resource Development (HRD) as well as in K-12 education. This exploratory narrative study, currently in the proposal stage, examines the impact of professional development on alternate-route teachers through extensive interviews with successful Career and Technical Education teachers now at various stages in their careers who originally entered the profession through alternate routes. Much of these teachers' preparation takes place outside of traditional, university-based teacher education. The objective of this study is to explore what professional development for alternatively certified teachers looks like; how these teachers acquire the knowledge, skills, and attitudes they need to be successful and to transfer that learning to the classroom; and reported gaps in what teachers know and what they need to know. The findings of this research will contribute to the ongoing debate on how to improve the quality of teachers, particularly significant given the current focus on education at the state, national and international levels. In addition, increased knowledge about the effectiveness of professional development can be applied by HRD practitioners in business and industry, resulting in overall improvements to performance across numerous clusters.

Youngsuk Bang and Hany S. Abdel-Khalik
Graduate Program: Nuclear Engineering
Advisor: Hany S. Abdel-Khalik
Poster Number: 5

Efficient Hessian Matrix Construction Algorithm for Large Dimensional Systems

Sensitivity Analysis is a mathematical tool that estimates the changes in model's responses resulting from input data variations. This method is useful especially for computationally expensive problems, e.g., long computation time or large storage requirements, because once the sensitivity information is given, actual code executions become unnecessary. However, for typical reactor analysis problems with many input data (e.g., 10^4-10^5 data values), calculating the sensitivity information itself becomes computationally prohibitive. For this reason, nuclear engineers have been considering only first derivatives to approximate the relationship between the response of interest and input data within a small range around the reference input data. However, when input data variations are large, first order derivatives may not be accurate enough to characterize responses' variations, thus creating the need for estimating higher order derivatives. This study focuses on constructing approximations for the 2^{nd} order effect, i.e., the Hessian matrix. Because the number of unknowns in the Hessian matrix increases exponentially as the number of input parameters increases, constructing whole matrix is computationally challenging for large dimensional systems. Exploiting mathematical tools, i.e., Reduced Order Model (ROM), Efficient Subspace Method (ESM), Tikhonov Regularization and Rank revealing decomposition, the algorithm to build the Hessian matrix with reduced computational costs and storage demands is suggested. Numerical experiments showed that only 300 code executions are sufficient to build the Hessian matrix $\mathbf{R}^{1584\times1584}$ and the estimation discrepancy from the actual response variation could be reduced from 12% to less than 1%.

Bjorn Berg[1], Brian Denton[1], S. Ayca Erdogan[2], Thomas Rohleder[3], and Todd Huschka[3]
Graduate Programs: Industrial and Systems Engineering[1]; Operations Research[2]; Health Sciences Research, Mayo Clinic[3]
Advisor: Brian Denton
Poster Number: 10

Optimal Design of Overbooking Schedules for an Outpatient Procedure Center

Patient appointment scheduling for cancer screening and other preventive health services is challenging for several reasons including uncertainty about patients attending their appointments. Typical endoscopy practices have no-show rates ranging from 20-40%. This leads to poor resource utilization and ultimately high costs and poor access to patient care. While overbooking strategies are well developed and commonly used in other industries such as airline scheduling, healthcare applications pose a unique challenge since reserving a discrete physical asset (a seat on an airplane) is not directly analogous to reserving time with a physician. Thus, healthcare managers require new models to develop optimal patient scheduling and overbooking policies. We developed a two-stage stochastic program to design optimal overbooking schedules. Decision variables in the model include the number of patients to book on a particular day, the patient sequence, and appointment times. The objective of the model trades off the benefits of overbooking (increased revenues) with the cost of congestion (patient waiting costs). The model is computationally challenging to solve because the scheduling decisions are combinatorial in nature. We discuss analytical insights that provide sufficient conditions for sequencing procedures in increasing order of no-show probability, and special cases in which double booking of customers is optimal. We discuss the underlying structure of the problem and compare several ways to adapt advanced decomposition methods to solve the resulting stochastic integer programming problem. Data from an endoscopy suite are used to generate practical problem instances. The value of the stochastic solution is shown to be high, 14-67%, in experimental instances, indicating substantial opportunity for cost reduction using the optimal solutions based on our proposed model.

William Cox, Kory Gray, Jim Simpson, Brandon Cochenour , Brian Hughes, and John Muth
Graduate Program: Electrical Engineering
Advisor: John Muth
Poster Number: 27

A MEMS Blue/Green Retroreflecting Modulator for Underwater Optical Communications

We propose the use of a MEMS retroreflecting modulator for optical communicating between underwater systems. This method allows for extremely low power communication between underwater vehicles or sensor nodes. Our modulator is a MEMS Fabry-Perot cavity made from an aluminum patterned silicon nitride membrane suspended above an aluminum patterned glass substrate. Indium bump-bonds provide the cavity spacing. By applying a voltage across the two plates, the cavity distance can be changed, thereby changing the reflectivity of the cavity. A QPSK modulated signal was applied to the modulator and data was transmitted 3.66 meters at 250 kbps, 500 kbps, and 1 Mbps at attenuation lengths up to 6.5 m/m in the laboratory water tank.

David Edson and Thomas Ward
Graduate Program: Mechanical Engineering
Advisor: Thomas Ward
Poster Number: 35

Experimental study of viscous rivulet coating of a trench: Wetting vs. non-wetting fluids

The dynamic interfacial behavior of a rivulet flowing over a trench is studied experimentally. The trenches are of square dimensions with depths that vary from slightly smaller than the capillary length to slightly larger. The problem is parameterized using capillary, Reynolds and Bond numbers. The fluids used in the experiments are a glycerol glycerol/water mixture and a silicone oil with the former two fluids representing a partially wetting and the latter a nearly complete wetting fluid, respectively. Images of the rivulet front, and downstream steady film thickness, are analyzed for the local film height as a function of time and compared with the theory of C. M. Gramlich et al. for dynamic trench coating behavior. A rich variety of phenomenon is observed within these two trench depths using the two fluids, suggesting that trench coating behavior is greatly affected by a combination of geometry and fluid wetting behavior.

Garrett Foster
Graduate Program: Mechanical and Aerospace Engineering
Advisor: Scott M. Ferguson
Poster Number: 40

Expansion of alternative generation techniques

Designing a system for a specific scenario can be a challenge in of itself. However, changes in model fidelity, customer preferences, and desired system architecture further complicate the design process. To respond to this challenge we must change our perspective of looking for the single "best" design and develop multiple solutions that can account for - or address - specification changes that arise throughout a system's design cycle. This research investigates the expansion of existing design techniques to assist a designer locate and explore design alternatives. Such alternatives exist within a specified threshold of an originally specified design. Further, this research will explore both the procedure of finding these alternatives, as well as the insight that can be gained through their discovery. Within these objectives, the previously explored designs of a genetic algorithm are used as a means of increasing computational efficiency. Additionally, comparisons of various distance metrics and scaling techniques are performed to understand the significance of each. Beyond this, it is theorized that the alternatives themselves can illuminate information about the freedom or sensitivity near the original design that can then be used by the designer to make appropriate design decisions.

Benjamin E. Gaddy and Elizabeth A. Paisley
Graduate Program: Materials Science and Engineering
Advisors: Douglas L. Irving and Jon-Paul Maria
Poster Number: 41

Surfactant Stabilization of Rocksalt Oxides (CaO) on GaN

We demonstrate that surfactant-assisted epitaxy is a useful method for stabilizing the growth of {111} CaO films on (0001) GaN. *Ab initio* thermodynamic calculations of surface free energies for configurations of CaO surfaces with varying surfactant coverages explain the experimental observation that incorporating water vapor during CaO deposition produces a protonated surface that changes the habit of CaO from (001) to (111) enabling layer-by-layer growth. Density Functional Theory calculations are extended to real temperature and pressure conditions to interpret the experimental findings and verify that hydrogen enables two-dimensional film growth. Dramatic changes in physical properties accompany this morphology control. For instance, smooth CaO films exhibit a 100 to 1000 times reduction of leakage current density. The experiments demonstrate a new approach, applicable to numerous materials systems, where chemical boundary conditions are engineered to regulate growth mode. Unique opportunities to integrate highly heterogeneous materials and to explore property coupling unencumbered by the defects of conventionally grown thin films are consequently available.

Jennifer Gamble
Graduate Program: Electrical Engineering
Advisor: Hamid Krim
Poster Number: 43

Computational Topology in Sensor Networks

A sensor network consists of nodes which are spatially distributed over an area of interest, where each node is a sensor that can detect information about its local environment, and can communicate with other sensors that are within its communication radius. Such networks are used in diverse areas of application, such as environmental or ecological monitoring, industrial control, military surveillance, or in wastewater industries.

In many practical applications power is at a premium, and because GPS or localization algorithms can be expensive, it is useful to model a network where nodes have no location information. Each sensor has its own unique identification number, and it can obtain information from other nodes within some communication radius (including their identification numbers). Given such a setup where only local information is available, we would like to make statements about global properties of the network. For example, are there any 'coverage holes', or regions which are not observed by any sensor in the network?

Within mathematics, the field of algebraic topology uses tools from abstract algebra to combine information defined locally over points of a topological space to calculate corresponding global topological features, such as the number of connected components, holes or voids in the space. The recently developed field of computational topology uses these tools to help analyze discrete data sets, and has been applied to the analysis of sensor networks.

Here, we will discuss the ways in which computational topology can be used to glean global features of a sensor network, using only local information in a coordinate-free environment.

Brian Gonzales
Graduate Program: Biomedical Engineering
Advisor: David S. Lalush
Poster Number: 50

Performance of Reconstruction and Processing Techniques For Dense Full-Spectrum X-ray Computed Tomography

We have recently developed a novel x-ray computed tomography (CT) system capable of dense spectral measurements along the energy axis using a photon-counting single-pixel detector. The reconstructions have high energy axis resolution but suffer from high noise resulting from the nature of photon counting. We have recently developed two methods to suppress the noise along the energy axis: a Penalized Weighted Least Squares Algorithm (PWLS) for iterative reconstruction along the energy axis and an Eigenvector Filtering Algorithm for noise suppression in the energy domain using a set of basis functions. The two methods are briefly presented and initial assumptions, rate of convergence, and mathematical relevance are compared. We investigate the relationship between energy resolution and noise and the corresponding change in noise for the conventional reconstructions and both algorithms. We present a detailed comparison of the two algorithms focusing on the noise-energy resolution relationship in both methods: comparing the signal-to-noise ratio (SNR) ratio for both methods. Results show that the SNR is distributed differently across the energy spectrum for the two methods. The two methods are also investigated to see how both retain key energy-axis information, specifically absorption edges for contrast agents. We investigate combining the two methods forming a hybrid PWLS-Eigenvector method. The hybrid method is shown to take advantage of both methods' SNR improvements. We conclude that both algorithms offer significant noise suppression while preserving key energy axis data; the PWLS algorithm is shown to be more dependent on the incident x-ray spectrum, whereas the Eigenvector algorithm is more dependent on prior knowledge of materials in the imaged object.

Austin S. Hampton, Dominic J. Farris, and Gregory S. Sawicki
Graduate Program: Biomedical Engineering, North Carolina State University and University of North Carolina-Chapel Hill
Advisor: Gregory S. Sawicki
Poster Number: 57

Mechanics and Energetics of Ankle Propulsion During Hemiparetic Walking

Hemiparetic walking requires ~30-40% more metabolic energy when compared to age and size matched healthy controls. Despite this significant energetic penalty, few studies have examined the links between the mechanics and energetics of hemiparetic gait - especially at the single joint level. At the ankle joint, the spring-like stretch and recoil of the Achilles' tendon helps propel the body forward in a 'catapult' action while allowing the muscles to remain isometric – a cheap mode of operation metabolically speaking.

It is possible that impaired magnitude and timing of ankle muscle force following a stroke disrupts the normal 'catapult' mechanism and leads to inefficient contraction. This may help explain the elevated metabolic cost of hemiparetic walking. We combined standard inverse dynamics to assess ankle joint mechanical performance and indirect calorimetry to assess metabolic

energy expenditure in both control and post-stroke subjects. We hypothesized that the positive mechanical power (W/kg) generated by the ankle plantarflexor muscle-tendons would be greater in the non-paretic and control limbs when compared with the paretic limb.

As expected, data from a single hemiparetic subject walking at 0.75 m/s indicated a large increase in net metabolic power (3.0 W/kg vs. 1.5 W/kg) over a size matched healthy control. Peak mechanical power for the ankle plantarflexors was more than 3 times greater (1.6 W/kg vs. 0.5 W/kg) in the control versus paretic limb. Interestingly, we found that the non-paretic limb delivered peak ankle mechanical power of 3.3 W/kg, approximately double that of the control limb. These data indicate that hemiparetic subjects compensate for lack of paretic ankle power output by modulating non-paretic power output to levels above normal. As a result, the combined effort of the paretic+non-paretic ankles is greater than the combined effort of the control ankles during walking. Thus, the asymmetry in ankle joint peak power in hemiparetic gait increases the overall mechanical and metabolic demands of walking.

Ranga Nikhil Hulluru
Graduate Program: Integrated Manufacturing and Systems Engineering
Advisor: Timothy Clapp
Poster Number: 69

Optimizing Factory Processes – A Six Sigma and Computer Simulation Approach

The systems and concepts driving an apparel industry have not changed much in the past two decades. Production is still a labor intensive process with semi automated machinery. Moreover, strong market competition has demanded quick fashion adaptability at the smallest cost. Both of these factors have strongly contributed to the decline of apparel manufacturing industries in USA. Garland Shirt Company, Garland - NC (A Brooks Brother's Manufacturing Facility), has been manufacturing dress shirts for the past five decades and has realized the advantages of doing so. However, to be profitable, such large scale manufacturing should have the most efficient processes. The major objective of this project was to reduce the manufacturing lead time and thus catalyze an improvement in the overall factory process. To achieve this, Six Sigma - a widely used process improvement technique - was applied. Simio - an advanced discreet-event simulation software - was also adopted to study the effectiveness of various improvements and to visualize them. The project started off with the problem definition and a detailed process map. Based on data collection, a computer simulation model ('As-Is') was developed. Various improvement techniques were studied and applied to this model resulting in an optimal 'Proposed' state model. Based on the data of the 'proposed' model, changes were made to the factory processes. At the end of the project timeline of one year, the factory had reduced its lead time by 21%

Mahmud Hussain[1], Nimish Gera[1], Andrew Hill[1], Dustin Lockney[2], Megan Smithmyer[1], Stefan Franzen[2], and Balaji Rao[1]
Graduate Programs: Chemical and Biomolecular Engineering[1]; Chemistry[2]
Advisor: Balaji Rao
Poster Number: 71

Alternate Protein Scaffolds from Hyperthermophilic Organisms for Engineering Biomolecular Recognition

We describe an ensemble of scaffold proteins derived from hyperthermophilic bacteria and archaea to generate stable binding proteins for a wide spectrum of targets. Based on structural data, we randomized 10-15 residues on surface accessible regions of each scaffold to create a "super-library" of ~ $4x10^8$ mutant proteins. Binding proteins for a wide spectrum of targets has been isolated from this "super-library" and hence these protein scaffolds are good candidates for use in biomolecular recognition. Traditionally, antibodies are used as biomolecular-recognition-reagents in biotechnology as well as in biomedicine. However, large multi-domain structure secured by disulfide bonds, multi-step generation and manufacturing process, limited tissue penetration, reduced bioavailability limit the use of antibodies. On the contrary, protein scaffolds can circumvent some of these key issues associated with antibodies and antibody-based molecules. Such a protein scaffold is analogous to the Complementarity Determining Regions (CDR) of an antibody and owing to their small size (7 to 10 KDa) and lack of disulfide bonds, these protein scaffolds serve as excellent alternatives to antibodies.

We also discuss the use of binding proteins derived from the super-library in the context of three different applications: generation of multi-subunit binding proteins through "stitching together" individual scaffold protein mutants, development of engineered proteins for culture and differentiation of human embryonic stem cells, and design of adaptor proteins to facilitate virus-mediated drug delivery.

Janelle Hygh
Graduate Program: Environmental Engineering
Advisor: Joseph F. DeCarolis
Poster Number: 73

Energy Simulation as a Decision Support Tool in Conceptual Building Design

This research focuses on the development of methods to effectively analyze and communicate insights drawn from building energy simulation to designers at the conceptual stage of the building design when design decisions have the greatest impact on building energy performance. Integrated Project Delivery (IPD), where a well-coordinated team works together sharing the same digital building information model (BIM), provides the theoretical framework for sharing building energy performance information. However, the lack of interoperability between BIM and analysis tools severely limits this practice. The time required to translate models creates a lag between design and analysis, which is not amenable to the iterative nature of building design. Hence, building energy simulations are generally used to validate designs (e.g., documentation of LEED points for energy efficiency) and not as a decision support tool. Additional technical barriers to building energy simulation include the difficulty of model implementation when many design decisions have not been made yet, the corresponding uncertainty in the energy simulation results, and the translation of results into useful insight regarding building design. Sensitivity analysis can provide useful feedback to designers at this early stage by identifying the design parameters that have the largest effect on building energy usage. Some design decisions can be represented by a single parameter (e.g., insulation R-value), but others (e.g., building form) require substantial changes to the building representation. In an effort to capture both types of decisions, three feasible building forms are constructed for a 15,000 square foot office building. The sensitivity to orientation, window area, shading, wall, roof, and floor insulation, window type, and building form are then computed and compared between forms. To ensure effectiveness, model insights are communicated in a manner that is consistent with the design-related thought process and workflow of the intended user.

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Graduate Programs: Civil Engineering, North Carolina State University[1]; HNTB Corporation, Arlington, VA[2]
Advisor: Y. Richard Kim
Poster Number: 76

Local Calibration of the Mechanistic-Empirical Pavement Design Guide for North Carolina

For decades, our roadway pavement structures in the United States were designed using empirical-based procedures developed using performance data measured in the 1950s at the AASHO road test in Illinois. Because of the significant changes in truck axle loads and configurations, truck tire pressure, construction practices and construction materials, in addition to weather and subgrade soil changes between one location and another, these empirical design procedures became outdated and unsuitable for the design of new and rehabilitated pavement structures in different locations across the country.

Due to the limitations of the aforementioned AASHO road test and its inherent empirical design procedures, the AASHTO Joint Task Force on Pavements (JTFP) initiated an effort in 1996 to develop an improved AASHTO pavement design guide by the year 2002. The project called for the development of a design guide that employs existing state-of-the-practice mechanistic-based models and design procedures. The product of the NCHRP 1-37A project first became available in 2004 in a software format called; the Mechanistic Empirical Pavement Design Guide (MEPDG). The mechanistic component of the MEPDG calculates pavement critical responses (i.e., stresses, strains, and deflections) based on layer material properties and climatic conditions. The empirical side of the design method bridges the gap between laboratory and field performance, which, in turn, reflects local construction practices and other field-related variables.

The performance prediction models in the MEPDG were calibrated and validated using pavement performance data measured on hundreds of pavement sections across the US.

The nationally calibrated performance models in the MEPDG do not necessarily reflect local materials, construction practices, and NC traffic stream characteristics. Therefore, the main goal of the work performed under this research project was to re-calibrate the performance prediction models in the MEPDG to reflect local conditions and materials. The re-calibrated models allow for the design of the cheapest, yet reliable asphalt concrete pavements that can satisfactorily serve the intended design life at a desired performance level. Results show that the local calibration effort was successful and that North Carolina Department of Transportation can now use the MEPDG with the developed local calibration factors for future pavement design work.

Reza Jafari
Graduate Program: Civil Engineering
Advisor: Joseph Hummer
Poster Number: 77

Safety Effects of the Access Points near Signalized Intersections

North Carolina has too many motor vehicles crashes each year. More than half of these crashes are intersection and driveway-related. Driveways provide transition between a site and the adjacent roadway and their design should minimize the negative impact on traffic to provide a safe movement. To investigate and ultimately reduce the driveway-related crashes, we focused on traffic volume, land use type, median type, number of lanes, lane configurations, speed limit, and corner clearance. Corner clearance, or the distance from the driveway to the nearest intersection, is one of the important factors to be considered in reducing the crashes near intersections. Because of the visibility and easy access of the drivers, developers are interested in the lands close to the intersections. When a driveway is requested, traffic engineers are responsible for making a decision and issuing or withholding this permit. This raises the question of what criteria they should consider to make a proper decision. In the State of North Carolina, new and expanded driveways should be permitted by the North Carolina Department of Transportation (NCDOT) through the permit application process. The permit application is in the "Policy on Street and Driveway Access to North Carolina Highways" known as the "Driveway Manual". Data from the Traffic Engineering Accident Analysis System (TEAAS) and individual collision reports have been used for this study. By analyzing the collected data and fitting good collision models, the outcome of this study will be a validated model predicting the number of collisions at driveways near intersections. As a result, a recommendation will be provided for a safe corner clearance. This will improve the recommendations of the NCDOT by helping policy makers suggest proper spacing and safe driveways for new and expanded developments.

Vilas V. Jangale and Alexei Saveliev
Graduate Program: Mechanical Engineering
Advisor: Alexei Saveliev
Poster Number: 78

Real-Time Monitoring of the Properties of Opportunity Fuels Using NIR Absorption Spectroscopy

For the past few decades, the sector-wise energy consumption pattern in the US shows a significant potential for using several opportunity fuels in electricity generation and process industries. The energy content of these fuels varies widely depending on their source and other factors specific to their production process. For efficient utilization and to prevent damage to heat and power generating systems, it becomes necessary to characterize these fuels in real-time. Conventional methods used for fuel characterization are gas chromatography and calorimetry. However, these techniques are not capable of providing real-time information. This research investigates the applicability of absorption spectroscopy as a potential alternative to conventional methods. Optical signatures in the near-infrared region (900 to 1700 nm) of the electromagnetic spectrum are representative of the number and nature of chemical bonds, and hence, the fuel chemical composition and heating value. A NIR spectroscopic system is utilized to measure the absorption spectra of the fuel under continuous, flow-through conditions. The spectral data is processed using the principal components regression or partial least squares to correlate absorption features to the fuel composition and heating value. The spectra of hydrocarbons and carbon dioxide are studied at elevated pressures. The spectral variation associated with the pressure and thermal Doppler broadening has been analyzed. The accuracy and repeatability of the method has been addressed. The method has been validated for natural gas and landfill gas; and can be extended to other opportunity fuels, such as, coalbed methane, biogas, and producer gas.

Aaron C. Johnston-Peck[1], Giovanna Scarel[2], Junwei Wang[1], Gregory N. Parsons[2], and Joseph B. Tracy[1]
Graduate Programs: Materials Science and Engineering[1]; Chemical and Biomolecular Engineering[2]
Advisor: Joseph B. Tracy
Poster Number: 83

Phase Conversion of Thermally-Stable FePt Nanoparticle Monolayers

Increasing the storage density of magnetic recording media necessitates the consideration of novel designs and material types. Using monolayers of monodisperse ferromagnetic nanoparticles (NPs) that can potentially extend the storage limit beyond 15 TBit/in^2. Thermally-robust monolayers of FePt nanoparticles (NPs) were synthesized by combining chemical synthesis and atomic layer deposition. Spin cast monolayers of FePt NPs were coated with Al_2O_3, followed by annealing to convert the FePt NPs from an alloy (A1) to intermetallic ($L1_0$ and $L1_2$) phases. The layer of Al_2O_3 serves as a barrier that prevents sintering between NPs during annealing. High-angle annular dark-field scanning transmission electron microscopy (HAADF STEM) imaging of single NPs reveals that as-synthesized A1 FePt NPs converted to $L1_0$ and $L1_2$ phase NPs after annealing. HAADF STEM also allowed determination of the ordering of the NPs, which was imperfect and mixed across individual NPs. Compositional limitations and surface effects inhibit formation of perfectly-ordered (S=1) intermetallic NPs.

Rohan Kapoor[1] and Chad Bieber[2]
Graduate Programs: Mechanical Engineering[1]; Aerospace Engineering[2]
Advisor: Larry Silverberg
Poster Number: 12

Robust Precision 3D Trilateration using Distributed Ultra-Sound Beacons

Navigation is a critical part of developing an autonomous vehicle system. We develop a trilateration algorithm and sensor grid using distributed 40KHz ultrasonic transmitters as the basis for a precise 3-D positioning system. A vehicle measures arrival time of incoming ultrasonic signals and calculates position without broadcasting to the grid. This system allows for silent, or covert, operation and for simultaneous navigation by a large number of vehicles. We begin by characterizing the transmitters and receivers used. Transmission lobe patterns and receiver directionality determine the geometry of transmitter clusters and the need for acoustic lenses on receivers. Range and accuracy of measurement dictate the number of sensors needed to navigate a given volume. A small array of transmitters are set up in the lab and the system tested for accuracy, speed and reliability. This prototype system will help future development of a large formation simulation and large scale group navigation.

Chris Kennedy
Graduate Program: Nuclear Engineering
Advisor: Hany Abdel-Khalik
Poster Number: 87

On the Effects of Cross Section Perturbations to Monte Carlo Criticality Sensitivities

Nuclear data have been shown to be a major contributor of nuclear simulation uncertainties. Typical sensitivity analyses of state-of-the-art codes can quickly become intractable due to the magnitude of the input/output (I/O) data streams typical for nuclear simulations. A sensitivity analysis provides insight into the behavior of these complex nuclear systems, relating the input and output responses. The sensitivity coefficients can be used for uncertainty quantification, data assimilation, or general improvement of an engineering design. Subspace methods introduce perturbations in the cross sections (input space) to determine correlation and model order reduction opportunities. Prior works have suggested that the sensitivity vectors generated as a result of perturbations in the cross sections are correlated, allowing for reduced order modeling (ROM) and thus making calculations computationally feasible. Monte Carlo methods rather than deterministic methods are selected due to the capability of accurately reproducing real-world systems at the cost of additional computational resources. Any ROM for a Monte Carlo method would be desirable in making more accurate and robust models competitive against the faster deterministic codes.

The sensitivity in the system eigenvalue k_{eff} (criticality) was selected for this study as it represents a nonlinear response computed from linear combinations of input parameters with an additional leakage term. Additionally, the system eigenvalue is a common benchmark in criticality integral experiments used to test both cross section evaluations and new neutronics methods to real-world data. Cross section perturbations are introduced into the SCALE6 multi-group libraries and processed using the TSUNAMI-3D sequence for a critical sphere configuration. Region-independent cross section sensitivities are then arranged in a matrix and the singular value decomposition is computed to determine correlation via the normalized singular value spectrum. Any correlations in these sensitivities would suggest ROM opportunities that may be applicable for future research opportunities in uncertainty quantification and data assimilation.

Hyung-Jun Koo[1], Suk Tai Chang[2], Joseph M. Slocik[3], Rajesh R. Naik[3], and Orlin D. Velev[1]
Graduate Programs: Chemical and Biomolecular Engineering, North Carolina State University[1]; School of Chemical Engineering and Materials Science, Chung-Ang University, Republic of Korea[2]; Materials and Manufacturing Directorate, Air Force Research Laboratory, Wright-Patterson AFB[3]
Advisor: Orlin D. Velev
Poster Number: 92

A New Class of Aqueous Soft Matter Based Photovoltaic Devices

This presentation describes a new class of biomimetic photovoltaic systems, inspired by the materials and structures found in natural leaves. For our first approach inspired by hydrated, soft materials of leaves, photovoltaic devices based on aqueous soft gel will be presented [H.-J. Koo *et al.*, *J. Mater. Chem.* (2011), 21, 72]. Agarose gel, used as a biomimetic medium of the devices, contains 98% of water and 2% of polysaccharides derived from natural seaweed. Two photosensitive ions, DAS^- and $[Ru(bpy)_3]^{2+}$, were used as photoactive molecules embedded in a matrix of water-based agarose. The provisional mechanism of the operation of the hydrogel photovoltaics (HGPVs) suggests that the dye ions cooperatively work and contribute to the photocurrent generating process both on the surface of the working electrode and in the bulk of the gel. To reduce the cost of HGPVs without efficiency loss, we found an efficient replacement of the expensive Pt counter electrode with inexpensive copper coated with

carbon materials. Biologically derived photoactive molecules, such as Chlorophyll and Photosystem II, were successfully operated in the aqueous gel media of HGPVs. For the second strategy, we will discuss how channels can be embedded in such gel photovoltaic systems to mimic the microvascular network of leaf venation. The channel structures could enable efficient and continuous supply of the reagents necessary for photovoltaic operation. We developed modeling tools to numerically estimate the rapidity and efficiency of the reagent supply through the various gel-network structures, thereby optimizing the channel design embedded in hydrogel cells. The concept of the channel embedded PV systems has been demonstrated in the dye-sensitized solar cell devices (DSSCs), where dyes and electrolytes can be continuously supplied. Such gel based and microvascular channel embedded PV concepts could allow constructing biomimetic photovoltaic systems with unprecedented functionality.

James W. Levis and Morton A. Barlaz
Graduate Program: Civil Engineering
Advisors: Morton A. Barlaz and Ranji Ranjithan
Poster Number: 99

Cost Effective Solid Waste Management Decision Making in Consideration of Climate Change Policy

In 2007, U.S. solid waste management (SWM) resulted in 157 Tg of CO2e emissions (from landfills, composting and waste-to-energy), representing 2% of national greenhouse gas (GHG) emissions. Landfills, which received 54% of municipal waste in 2007, represent the 2nd largest source of anthropogenic methane in the U.S. Potential national GHG mitigation policies—based on a cap and trade system or carbon tax—would place a price on GHG emissions and drive significant changes in energy supply and prices, which will in turn influence the SWM system. Proactively altering SWM process technology choices and integrated SWM programs provides an opportunity for cost-effective GHG mitigation, while potentially reducing other environmental impacts, increasing material recovery, and reducing net energy use. The objective of this research was to investigate the effects of carbon pricing schemes on solid waste management operations, costs, and GHG emissions. A life-cycle assessment model was developed to analyze how a price on carbon would affect optimal SWM process choices. A base case scenario was analyzed as well as a scenario using the U.S. Environmental Protection Agency's default parameters for landfills found in the AP-42 database. Based on an objective to minimize cost, the base case results indicate that mixed waste should be processed in landfill gas to energy (LFGTE) facilities up to a price of carbon of $31 per mtCO2e at which point metals and paper should be recycled and the remaining waste should be processed via LFGTE. In the AP-42 scenario, mixed waste is sent to LFGTE up to a carbon price of $21 per mtCO2e. From $22 per mtCO2e to $146 per mtCO2e, paper and metals are most economically recycled and the remaining waste is sent to LFGTE. Above $146 per mtCO2e the remaining waste is sent to waste-to-energy (WTE).

Zeyu Liu
Graduate Program: Computer Science
Advisor: George N. Rouskas
Poster Number: 104

Fast Exact ILP Decompositions for Routing and Wavelength Assignment in Rings

With the help of advanced technology, wavelength division multiplexing (WDM) networks nowadays can support up to more than 100 wavelengths on a single fiber. This new feature brings new challenges to routing and wavelength assignment (RWA) problem, which is a key design problem in optical networks. Conventional link and path formulations for the RWA problem are inefficient due to the inherent symmetry in wavelength assignment and the fact that the problem size increases fast with the number of wavelengths. Although a formulation based on maximal independent sets (MIS) does not have these drawbacks, it suffers from the exponential growth in the number of variables with the increasing network size. We develop a new ILP formulation based on the key idea of partitioning the path set and representing the maximal independent sets in the original network using the independent sets calculated in each of these partitions. This exact decomposition trades off the number of variables with the number of constraints and, as a result, achieves a much better scalability in terms of network dimension. Numerical results on ring networks of various sizes demonstrate that this new ILP decomposition achieves several orders of magnitude decrease in running time compared to existing formulations. Our main contribution is a novel and extremely fast technique to obtain, in a few seconds using off-the-self CPUs, optimal solutions to instances of maximum size SONET rings with any number of wavelengths; such instances cannot be tackled with classical formulations without vast investments in computational resources and time. This work will also speed up several optical network design problems that includes RWA as a sub-problem, such as traffic grooming, survivability design and traffic scheduling.

Jennifer E. Mason[1], Brian T. Denton[1,2], Nilay D. Shah[2], and Steven A. Smith[2,3]
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Advisor: Brian T. Denton
Poster Number: 107

Optimal Management of Blood Pressure and Cholesterol for Patients with Type 2 Diabetes

Approximately 25.8 million people in the U.S. have diabetes, and two out of three will die from stroke or heart disease. While glycemic control is important for patients with diabetes, managing blood pressure and cholesterol levels is more important for preventing cardiovascular events such as heart attack and stroke. Current U.S. guidelines for blood pressure control and cholesterol control are "one size fits all" and independent. However, the goals of treatment, such as prevention of cardiovascular events, are correlated since blood pressure and cholesterol both influence a patient's risk of events.

We present a Markov decision process (MDP) model to determine optimal plans for the treatment of cardiovascular risk in patients with diabetes. Our model determines the optimal sequence and timing for initiation of blood pressure and cholesterol medications over the course of a patient's lifetime, taking into account the patient's risk of cardiovascular events, cost of treatment and adverse events, the patient's quality of life, and other patient factors such as gender, age, and metabolic levels.

We present results comparing our optimal model-based treatment plans to U.S. and other international treatment guidelines on the basis of cost and life years to first event. We conclude there is the potential for improving efficiency of treatment through the redesign of treatment guidelines.

Samson Melamed[1], Thorlindur Thorolfsson[1], Adi Srinivasan[2], Edmund Cheng[2], Paul Franzon[1], and W. Rhett Davis[1]
Graduate Programs: Electrical and Computer Engineering, North Carolina State University[1]; Gradient Design Automation, Santa Clara, CA[2]
Advisor: W. Rhett Davis
Poster Number: 111

Device-level Thermal Simulation of Three Dimensional Integrated Circuits

Moore's Law famously predicted that the number of transistors on a computer chip would double approximately every two years. For decades, the electronics industry has been able to both meet this challenge and improve performance by reducing transistor sizes and increasing operating speeds. Unfortunately, this approach has resulted in increased power densities, which now threaten to prevent further advancement. In order to keep the industry on track with its predicted roadmap, additional techniques must be considered. The use of three dimensional integrated circuits (3DICs) is one such technique. 3DICs provide increased performance by vertically stacking chips. The increased transistor density of such circuits helps to maintain Moore's Law, but also increases power density. Vertical stacking also makes it harder to physically remove heat from the chip. Care must be taken as this new vertical environment can have a profound and unexpected impact on transistor temperature. Increased temperatures are detrimental to circuit performance, and in some cases can completely prevent a circuit from operating. For non-traditional chips (such as 3DICs) with increased power densities, the ability to accurately predict temperature becomes a critical component for cutting-edge circuit design. The goal of this research is to develop 3DIC-appropriate methods for accurately and efficiently calculating the temperature of on-chip devices. The focus is on determining individual transistor temperatures, which can be considerably higher than average temperature. An extraction method was developed to accurately determine the power profile of a 3DIC. Gradient HeatWave-3DIC was then used to simulate the temperature profile for various model fidelities. Low resolution simulations failed to locate areas of concern. Medium resolution simulations were found to be ideal, as they were able to locate areas of concern while also providing a 36x reduction in runtime and a 7.5x reduction in memory usage as compared to high resolution simulations.

Amirhosein Norouzi[1] and Reha Uzsoy[2]
Graduate Programs: Operations Research[1]; Industrial and System Engineering[2]
Advisor: Reha Uzsoy
Poster Number: 127

Modeling the Evolution of Demand Forecasts in a Production System under Congestion

A key objective for every manufacturing facility is to better match supply with demand over time to reduce the costs of inventory and stock out. However, demand uncertainty leads to disparities in supply and demand and thus, the quality of demand forecasts has a direct impact on production planning, and inventory control of every manufacturing facility. This research introduces a general approach for integrating a probabilistic model of forecast updates with an analytical model of production planning under congestion. We study a multi-period production system where the nonlinear operational dynamics of the lead times is captured through clearing functions. We model the evolution of demand forecasts as an additive Martingale Model of Forecast Evolution (MMFE) and propose a mathematical programming formulation based on chance constraints to

take into account the stochastic demand. The model gives us forecast-corrected safety stock levels and release schedules that allows manufacturer to be flexible to react to evolving business conditions. This evolution-based inventory management acts more effectively compared to conventional distribution-based inventory management. Computational investigations demonstrate how the manufacturer benefits through considering information updates coming from the forecast evolution.

Elizabeth A. Paisley, Mark D. Losego, Benjamin Gaddy, Anthony Rice, Ramon Collazo, James Tweedie, Douglas Irving, Zlatko Sitar, and Jon-Paul Maria
Graduate Program: Materials Science and Engineering
Advisor: Jon-Paul Maria
Poster Number: 131

2-D Growth of Smooth Cubic Epitaxial Oxides on GaN

Epitaxial integration of polar oxides with GaN presents the possibility of 2D charge carriers at polar interfaces and access to non-linear dielectric properties. However, to realize such devices, defect densities must be low, interfaces smooth, and the microstructure featureless. Conventional synthesis techniques generally fail to achieve this when materials have highly dissimilar structure, symmetry, and bond type - precisely when the potential for property engineering is most pronounced. Previously, we have demonstrated growth of high-quality polar oxides, MgO (111) and CaO (111) films on polar semiconductor, GaN by MBE. However, the terminal 3D rocksalt surface is determined by the tendency for polar (111) surfaces to form (100)-oriented low-energy facets. Therefore, realizing smooth oxide films on GaN requires overcoming the rocksalt (001) faceting tendency. In this presentation we will discuss a newly developed general synthesis methodology, involving systematic control of the chemical boundary conditions in situ, by which the crystal habit, and thus growth mode, can be actively engineered. Although our method should be generic to any material class or PVD growth, we demonstrate it for the difficult prototype of cubic (111) CaO on (0001) GaN by MBE, which presents the challenge of polar growth directions as well as heteroepitaxy in one system. In so doing, we establish the capability for layer-by-layer deposition in systems that otherwise default to island formation and grainy morphology. RHEED oscillations and AFM images of these films show 2D growth, suggesting that altering the surface chemistry during growth plays a critical role in determining the surface orientation. The operative surfactant-based mechanism is verified by temperature dependent predictions from ab initio thermodynamic calculations. Further, CaO films with smooth morphology exhibit a three order of magnitude enhancement of insulation resistance.

Benjamin Robertson
Graduate Program: Biomedical Engineering
Advisor: Gregory S. Sawicki
Poster Number: 143

Muscle Stimulation Frequency Influences Elastic Mechanisms in Steady-State Locomotion

Years of research on the mechanics and energetics of locomotion have established the role of tendons in shaping efficient and stable locomotion. A coupled muscle-tendon system can significantly reduce energy costs with little effect on overall power output by minimizing muscular length change, and maximizing elastic energy storage and return in series elastic tissues. Though the benefits of optimally 'tuned' muscle-tendon interaction are clear, the role of the nervous system in coordinating the timing and magnitude of muscle activation to exploit elastic mechanisms is poorly understood.

To investigate the effect that neural control has on locomotion stability, power production, and energy cost we developed a simple mathematical model of a compliant muscle-tendon. The model includes a Hill-type muscle model in series with a Hookean tendon-spring operating across a lever on a mass; reflecting the muscle-tendon dynamics at distal joints of the lower-limb (e.g. ankle). To drive muscle force generation we used a feed-forward neural control signal to activate the muscle at a given frequency and amplitude. Then we asked: How does the frequency of muscle stimulation influence overall muscle-tendon power production and elastic energy storage in tendon? We studied a range of stimulation frequencies about the resonant frequency of the passive mechanical system. We found that while muscle-tendon unit power output is relatively stable about the resonant frequency, the amount of elastic energy stored and returned by the series elastic tendon varied greatly. The largest amount of elastic energy storage and return (and the least muscular length change/energy consumption) occurred when stimulation was at the resonant frequency of the underlying tendon spring-mass system. These results accurately reflect observations from direct measurements of muscle-tendon dynamics in both humans and animals during walking and running. The model provides an excellent theoretical framework that can be used to uncover fundamental neuromuscular control strategies that can exploit elastic mechanisms for efficient energy production and robust system stability.

Kristen E. Roskov[1], Joseph B. Tracy[2], Lyudmila M. Bronstein[3], Amy Oldenburg[4], and Richard J. Spontak[1,2]
Graduate Programs: Chemical and Biomolecular Engineering, North Carolina State University[1]; Materials Science and Engineering, North Carolina State University[2]; Chemistry, Indiana University[3]; Physics and Astronomy, University of North Carolina-Chapel Hill[4]
Advisor: Richard J. Spontak
Poster Number: 144

Alignment and Spatial Positioning of Ligand-Functionalized Nanoparticles in Electrospun Polymer Nano/Microfibers

Formation of polymer nanocomposites is becoming an increasingly attractive means by which to combine the highly desirable properties of metals and metal oxides (e.g., electrical, magnetic and thermal) with those of polymers (e.g., flexible, lightweight and tough). Incorporation of either nanoparticles or nanorods into electrospun polymer nano/microfibers measuring 50 nm to 1 μm in diameter yields functional materials that can be used in various applications such as data storage, conductive nanowires, nonwoven sensors, magnetic filters, and drug delivery patches. Metallic nanomaterials tend to aggregate because of the driving force to decease the total surface energy. By aligning such nanomaterials in one-dimensional constructs, we hypothesize that favorable attributes such as electronic, optical, thermal, magnetic, and catalytic properties can be realized. The objective of this study is to gain a better fundamental understanding of how to controllably align and position nanoparticles and nanorods within polymer fibers to maximize such attributes. Alignment of superparamagnetic iron oxide nanoparticles has been achieved through magnetic field-assisted electrospinning. In this case, a magnetic field is applied perpendicular to the electric field. Transmission electron microscopy (TEM) is utilized to ascertain the morphology of the resultant nanocomposite fibers, and magnetic properties have been tested on a superconducting quantum interference device. The effect of shear encountered during electrospinning has also been found by TEM to align gold nanorods parallel to the fiber surface. Aligned nanorods are capable of absorbing light in the near-infrared spectrum due to the enhanced longitudinal surface plasmon resonance arising from their orientation over large length scales. Blends of hydrophobic and hydrophilic polymers have likewise been prepared to discern the feasibility of controlling the spatial location of nanoparticles within electrospun fibers on the basis of thermodynamic compatibility. In this case, a core-sheath structure naturally forms with the hydrophobic nanoparticles sequestered in one preferential phase.

Fatemeh Sayyady[1], John R. Stone[2], Fadi M. Jadoun[2], and Y. Richard Kim[2]
Graduate Programs: Operations Research[1]; Civil Engineering[1,2]
Advisor: John R. Stone
Poster Number: 148

Effects of Sampled Weigh-In-Motion Data on Axle Load Distribution for Mechanistic-Empirical Pavement Design in North Carolina

Resource and budget constraints may restrict departments of transportation (DOTs) from collecting and reporting complete data. Also, technical and/or equipment problems may lead to incomplete or intermittent weigh-in-motion (WIM) data. To address these issues, DOTs have begun to investigate WIM data sampling procedures, focusing on axle load distribution factors (ALDFs) and the effectiveness of the sampling procedures for estimating the ALDF accurately. This paper proposes sampling schemes using two dimensions: frequency (annual, semiannual, quarterly, and monthly) and duration (two consecutive weekdays and five consecutive weekdays). The effectiveness of the sampling schemes is evaluated using the sum of the relative error (SRE) in estimating the ALDF derived from sampled WIM data compared to ALDF derived from annual WIM data. In addition, the paper investigates the relationship between data sampling and seasonal variations for traffic data in circumstances where annual WIM data are not available. The three regions in North Carolina, which have different climatic characteristics, are studied for this purpose. Findings show that a direct correlation between seasonal variations and the accuracy of the sampling schemes exists for truck traffic. When truck traffic is fairly stable, the annual sampling schemes for two or five consecutive weekdays generate encouraging results. In locations with high seasonal variability, semiannual and quarterly sampling schemes are required to capture the seasonal variations in terms of the axle load distribution. The results of this paper will provide guidance to DOTs in situations where annual WIM data that are incomplete or intermittent and must be sampled in order to produce ALDF inputs for the Mechanistic-Empirical Pavement Design Guide (MEPDG).

Jeffrey C. Stanley
Graduate Program: Computer Science
Advisor: Robert Rodman
Poster Number: 154

To Read Images Not Words: Computer-Aided Analysis of the Handwriting in the *Codex Seraphinianus*

The study of undeciphered scripts promises benefits of two kinds. Ancient scripts like the Indus script of India and the Rongo script of Easter Island could provide a window into history. Cryptic scripts like that in the Voynich Manuscript could provide a window into the mind. While most work today on mysterious scripts recognizes the importance of computers for statistical inference, scholars must painstakingly transcribe the writing into input data, usually alphanumeric. This practice is prone to

ambiguity and error, and the original forms of the glyphs are lost. Furthermore, it potentially alienates non-technical scholars. The purpose of this project is to demonstrate that computers can help to explore mysterious scripts graphically, avoiding the problems of transcription and allowing examination of the writing in its original form. Using as a corpus the *Codex Seraphinianus*, a fanciful tome similar to the Voynich Manuscript, applications were developed to perform two primary tasks in decipherment: identifying recurring sequences of glyphs and classifying the glyphs into types. Through their ability to show and compare the glyphs graphically, these applications facilitate human judgment in accomplishing their tasks of comparison and typology and reveal patterns in the codex in a way that would be useful to apply to other undeciphered scripts. While fundamentally successful, the process demonstrated here should be polished with the latest advances in image processing technology to reach its full potential.

Danielle E. Touma, Ranji Ranjithan, Sankar Arumugam, and E. Downey Brill
Graduate Program: Civil Engineering
Advisor: Ranji Ranjithan
Poster Number: 168

Effects of climate and land use change on streamflow in the Northeast Cape Fear Basin

The objective of the research is to assess how a river's flow can be affected by both climate and land use change. The changes in a river's flow beyond its natural variability can harm the ecology in the channel. The study strives to combine climate, land use, and hydrological models in a framework to provide assessments about the possible future of the ecosystem of the Northeast Cape Fear River, NC. The A2 and B1 storylines from the Intergovernmental Panel on Climate Change Fourth Assessment Report (IPCC AR4) are used to model both the climate and land use data. The study uses precipitation and temperature data from the Parallel Climate Model and ECHAM5 for 30 years in the future (2010-2040) on a monthly scale. The data available has been downscaled and bias corrected from a 2 degree longitude by latitude to 1/8 degree longitude by latitude scale. The data is then temporally disaggregated to a daily scale using a k-nearest neighbor algorithm to allow for streamflow modeling in the Soil and Water Assessment Tool (SWAT). Along with land use data that has been modeled by the EPA, the streamflow is modeled on a daily basis for the future in SWAT for realistic combinations of climate and land use scenarios. Indicators of hydrologic alteration (IHA parameters) are used to analyze the changes in the streamflow from past years (1980-2010) to future years and take into account daily, monthly and annual flows. The IHA parameters are assessed based on the Range of Variability and the Sum of Mis-hits approach. The research is expected to illustrate a framework that can be used for similar studies and to provide insight into the changes in the watershed to aid in future planning and policy making.

Callaway Turner
Graduate Program: Mechanical Engineering
Advisor: Scott Ferguson
Poster Number: 172

Exploring the Impact of Heterogeneous Market Model Form on Market Segmentation and Product Line Optimization

While product proliferation and extreme product variety may appear to be successful means toward achieving breadth of market coverage, optimal market coverage may be better obtained by introducing a limited number of products. IT has been determined that embracing commonality and creating product variants strategically designed toward specific customer preferences offers a significant reduction in build complexity with minimal loss of market share. By applying both discrete and continuous models of customer preference, this research advanced beyond ad hoc representations of market demand and integrates product design with the identification of market opportunities. In a problem starting with over 1 billion possible build combinations, this work has shown that five products require 27 million build combinations to capture 71.5% of the market. When a common product architecture is enforced, a 99.99% reduction in build combinations (down to 144) results in a 5.8% loss in market share (down to 65.7%). A further analysis of the cost savings associated with this reduction in build combinations with a relatively small loss in market share will reveal the true benefits of this research. In order to reduce the computational time and expense required in determining the optimal product family, top down platforming methods are being employed which should improve upon bottom up platforming methods typically utilized.

A. Burak Uçar[1], Suk Tai Chang[2], Frederick J. Renk[3], and Orlin D. Velev[1]
Graduate Programs: Chemical and Biomolecular Engineering, North Carolina State University[1]; Chemical Engineering and Materials Science, Chung-Ang University, Seoul, Republic of Korea[2]; Center for Packaging Innovation, MeadWestvaco, Raleigh, NC[3]
Advisor: Orlin D. Velev
Poster Number: 174

Multifunctional Microfluidic Materials: Photocurable Microfluidic Endoskeleton & 'Chameleon' Materials

Microfluidic systems have been widely investigated for bioanalysis, as well as organic and nanoparticle synthesis. The potential of microfluidics for different uses, such as making materials with self-healing properties, extraordinary adhesiveness and other functionalities has been recently explored. In our research, we have focused on designing new multifunctional microfluidic materials in the form of flexible sheets. These materials are based on microfluidic channel networks embedded into a matrix of thin sheets of polydimethylsiloxane (PDMS). They can be solidified by light or repeatedly change color on demand. The macroscopic properties of the composites are determined by the stiffness or color of the material in the microchannels. The microfluidic materials filled with liquid photocurable polymer possess the unique ability to "memorize" and retain user-defined shapes upon illumination. When the microchannel networks are deformed and exposed to UV light, the photoresist inside the channels is solidified and subsequently acts as an endoskeleton within the PDMS layer. This endoskeleton increases the bending and stretching moduli of the materials drastically. These composites could be used in making instant containers, creating "exoskeletons" for delicate devices, rapid prototyping and multiple other applications. We also present microfluidic materials that can controllably switch their color and transmittance in the visible and near-infrared range by pumping refractive index-matched liquids into the channels. The optical transmittance of these materials changes when colored solutions with different compositions displace each other by virtue of laminar flow in the microchannel networks. Such "chameleon" microfluidic sheets with the capability of absorbing near-infrared light could potentially allow or block solar radiation coming through the material on demand and can find applications in smart windows/energy management.

B. Shane Underwood
Graduate Program: Civil Engineering
Advisor: Y. Richard Kim
Poster Number: 175

Multiscale Constitutive Modeling of Asphalt Concrete

Multiscale modeling of asphalt concrete has become a popular technique for gaining improved insight into the physical mechanisms which affect the material's behavior and ultimately its performance. This type of modeling considers asphalt concrete, not as a homogeneous mass, but rather as an assemblage of materials at different characteristic length scales. For proper modeling these characteristic scales should be functionally definable and should have known properties. Thus far, research in this area has not focused significant attention on functionally defining what the characteristic scales within asphalt concrete should be. Instead many have made assumptions on the characteristic scales and even the characteristic behaviors of these scales with little to no support. The primary goals of this research are to; 1) better define and understand the microstructural configuration of asphalt concrete, 2) constitutively model the behaviors of these different characteristic scales, and 3) formulate a microstructure association model for asphalt concrete. Mechanical experimentation, analytical study, microscopy, and microsampling techniques have been utilized to accomplish these goals. The work completed thus far has focused on: 1) the development of models for asphalt concrete linear viscoelastic and damage behaviors, 2) the development of practical mixture fatigue analysis methodology, 3) understanding the constitutive linear viscoelastic behaviors of asphalt fine aggregate matrix (FAM), 4) understanding the constitutive linear viscoelastic behaviors of asphalt mastic, 5) developing simplified models for describing the major linear viscoelastic behavior trends in asphalt FAM and mastic, and 6) understanding the microstructural configuration of the various characteristic scales within an asphalt concrete mixture. The existence of a distinct mastic phase within asphalt concrete mixture has been identified and the interaction between this phase and the particulate phase of the FAM and mixture scales is currently under investigation.

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Graduate Programs: Chemical and Biomolecular Engineering[1]; Textile Engineering, Chemistry and Science[2]; and Materials Science and Engineering[3]
Advisors: Richard Spontak and Tushar Ghosh
Poster Number: 176

Solvated Block Copolymer Networks as Versatile Electroactive Polymers

As mechatronic devices become increasingly important in our daily lives, energy-efficient, inexpensive and lightweight actuators are needed to meet this growing demand. Electroactive polymers (EAPs) satisfy these requirements and are capable of replacing bulky pneumatic and hydraulic actuators. In this work, we demonstrate that block copolymers capable of self-organizing into nanostructured soft materials possessing an elastic network and remarkable shape-memory attributes can be in

conjunction with selective solvents emerge as the most versatile materials platform for high-performance EAPs. This versatility is evidenced by their ability to be used as dielectric elastomers (DEs) and ionic polymer metal composites (IPMCs) — two types of EAPs that actuate by distinctly different mechanisms. Robust DEs prepared by selectively swelling the midblock of an acrylic triblock copolymer are capable of generating high actuation strains (~110%), energy densities (~50 kJ/m^3) and electromechanical coupling efficiencies (~80%). Moreover, these materials actuate without mechanical prestrain prior to actuation, which eliminates the need for bulky frameworks used with conventional DEs and material problems associated with stress relaxation over long times. Existing copolymer nanostructures are characterized by dynamic rheology, small-angle x-ray scattering and electromechanical actuation. In the case of the IPMCs, we retain the same design paradigm by selectively solvating the ionic midblock of a pentablock copolymer. After plating with Pt and Ag, the resultant IPMCs exhibit superior performance compared to contemporary Nafion®-based analogs by (*i*) retaining their mechanical integrity when highly solvated with polar solvents, (*ii*) undergoing a high degree of actuation when tested in a cantilever configuration, and (*iii*) avoiding the shortcoming of back-relaxation under routine test conditions. The extent and dynamics of actuator motion can be controlled by varying the applied potential, and the actuation behavior can be explained in terms of the ion inflation model, which permits determination of solvent diffusion coefficients during actuation.

Linda J. Vasil, Ranji S. Ranjithan, Sankar Arumugam, and E. Downey Brill, Jr.
Graduate Program: Civil Engineering
Advisor: Ranji S. Ranjithan
Poster Number: 177

Exploring the Relationships between Ecological Flow Regimes and Changes in Land Use

Land use changes alter flows within a watershed which may be detrimental to the ecology of streams and rivers. One of the ways to assess how changes land use affects the ecological flow regimes is to use the 33 parameters set forth by the Indicators of Hydrological Alterations (IHA) method developed by the Nature Conservancy. The 33 parameters encompass 5 main groups that are relevant to a waterway's ecological health. These five groups are: Magnitude, Duration, Timing, Frequency, and Rate of Change. The Range of Variability Approach (RVA) was developed to establish the natural flow variability for each of the 33 parameters. RVA establishes a low, median, and high range of flows based on the 33 percentile (low boundary) and 67 percentile (high boundary). The RVA can be used as an acceptable variability in ecological flow regimes when studying the effects of land use categories. This study uses correlations between the number of "mis-hits" for each the 33 parameters to land use categories as defined by the National Land Cover Database (NLCD) 1992-2001 Land Cover Retrofit Change Product. Mis-hits are the absolute difference between expected flows within a RVA range from the pre-land conversion period to the observed flow from the post-land conversion period. The pre-land conversion period is set from 1980-1994 and the post-land conversion period is from 1995-2009. Land use conversions will also be studied using the ArcSWAT model (SWAT: Soil and Water Assessment Tool). Land use will be systemically altered using cellular automata procedures and the resulting simulated flow will be analyzed using the IHA software. All other parameters such as precipitation, evaporation, soil type, topography will remain unchanged and therefore only land changes will be affecting the simulated flow. By modifying land use and studying the effects on the ecological flow regimes, land use planners can make informed decisions of the best locations for development.

Xin Wang[1], Haibo Zhao[2], and Yuntian Zhu[1]
Graduate Programs: Materials Science and Engineering[1]; Mechanical Engineering[2]
Advisor: Yuntian Zhu
Poster Number: 182

Enhanced Mechanical Properties of CNT Composites

Carbon nanotubes (CNTs) have highly desirable mechanical, thermal and electrical properties. They are promising candidates as reinforcement for the next generation of high performance composites. Conventional fiber-reinforced composites provide insight into critical structural features for synthesizing ultrastrong and lightweight CNT composites: high aspect ratio, good fiber alignment, and high fiber volume fraction. So far significant effort has been focused on developing CNT composites through incorporating CNTs with polymer matrix. Methods for fabricating CNT composites include dispersing short CNTs in polymer matrix, infiltrating CNT buckypaper with polymer solutions, and reinforcing with CNT fiber assemblies. However, they fail to address the major characteristics effectively. Here we report a strategy to conveniently produce macroscopic CNT composites that overcome these limitations. Super spinnable CNT arrays were synthesized using a one-step chemical vapor deposition (CVD) method. Uniform CNT sheets were drawn from free-standing CNT arrays and CNT/Nylon 6,6 composites were fabricated using an infusion-stretching approach. Stretching the composites after fabrication greatly improved the mechanical and electrical properties. The tensile strength of the CNT/nylon 6,6 composites with stretch ratios of 2, 4 and 7% were improved by 50, 150, and 190%, respectively and the Young's modulus were improved by 50, 200, and 290%, respectively, over those of the non-stretched composites. Improvement of the electrical conductivities exhibited a similar trend. In this work, long CNTs, good CNT alignment, high volume fraction and fast processing speed have been achieved simultaneously. The results of this work may point to a direction of maximizing mechanical properties of CNT composites.

Yixu Wang and Hsiao-Ying Shadow Huang
Graduate Program: Mechanical and Aerospace Engineering
Advisor: Hsiao-Ying Shadow Huang
Poster Number: 183

An Overview of Lithium-Iron-Phosphate (LiFePO4) as Cathode Materials for Rechargeable Batteries

The need for development and deployment of reliable and efficient energy storage devices, such as lithium-ion rechargeable batteries, is becoming increasingly important due to the scarcity of petroleum. Lithium-ion batteries operate via an electrochemical process in which lithium ions are shuttled between cathode and anode while electrons flowing through an external wire to form an electrical circuit. In this work, we provided an overview of commercially available cathode materials for Li-ion rechargeable batteries and focused on characteristics that give rise to optimal energy storage systems for future transportations. The study showed that the development of lithium-iron-phosphate ($LiFePO_4$) batteries promises an alternative to conventional lithium-ion batteries, with their potential for high energy capacity and power density, improved safety, and reduced cost. However, current prototype $LiFePO_4$ batteries have been reported to lose capacity over ~3000 charge/discharge cycles or degrade rapidly under high discharging rate. In this study, we hypothesized that the mechanical and structural failures were attributed to dislocations formations. Numerical models and crystal visualizations were provided to further understand the stress development due to lithium movements during charging or discharging. This work will contribute to the fundamental understanding of the mechanisms of capacity loss in lithium-ion battery materials and help the designing of better rechargeable batteries, and thus leads to economic and environmental benefits.

Bruce Wiggin[1], Steven H. Collins[2], and Gregory S. Sawicki[1]
Graduate Programs: Biomedical Engineering, North Carolina State University and University of North Carolina-Chapel Hill[1]; Mechanical Engineering, Carnegie Mellon University, Pittsburgh, PA[2]
Advisor: Gregory S. Sawicki
Poster Number: 188

A Passive-Elastic Ankle Exoskeleton to Aid Plantar Flexion During Walking

Human walkers exploit a key passive dynamic principle of locomotion, controlled energy storage and return. We hypothesize that a passive wearable device using parallel elastic elements during the walking cycle is capable of recycling a significant portion of the ankle joint mechanical work. By taking a lightweight, portable approach we aim to reduce the metabolic cost of walking by up to 18% in unimpaired populations, and up to 30% in clinical populations.

The main objective of our research is to build a passive elastic ankle exoskeleton using controlled energy storage and release that can reduce the metabolic cost of human walking.

To generate torque in parallel with the ankle joint center and match the normal ankle joint moment we centered our design around a single commercially available linear tension spring. The maximum k_{eff} was initially calculated based on inverse dynamics and mathematical modeling of the system. In order to properly store and release the spring's energy at key intervals a mechanical control system was needed. We designed a system of springs, pins, and motion constraints to control the latch and release of a ratchet and pawl, engaging and disengaging the parallel springs during walking (i.e. controlled energy storage and release). This novel, adjustable 'smart-clutch' is advantageous because it uses the linear motion of the spring linkage, transmitted by changes in ankle joint angle, rather than electro-mechanical switching to set the timing of pawl latch and release. These components were then attached to a custom carbon fiber exoskeleton.

The current design configuration yields a maximum exoskeleton torque of ~109 N-m and ~20.7 J of cycled spring energy. Future directions include device fabrication and human testing to determine whether an 'energy-neutral' passive elastic ankle exoskeleton using controlled energy storage and release can reduce metabolic cost during walking.

Kelly Abrams
Graduate Program: English
Advisor: Walt Wolfram
Poster Number: 1

Comparing Codes: Dialect Density Measurements of Oral and Written Codes in Developing African American English

Although sociolinguistic studies have examined the degree to which school-aged children conform to phonological community norms (Eckert 2000, Trudgill 2004) and how they shift their speech styles (Renn 2007), as well as studies of dialect influence on writing (Wolfram & Whiteman 1970; Farr & Daniels 1986), there is limited research comparing the relative use of dialect in oral and written styles based on dialect density measures (Craig & Washington 2003, 2006; Renn 2007). To what extent do oral and written uses of dialect, as measured in dialect density measures differ for African American school-age children? How do these

systems change throughout childhood? Are certain vernacular features more likely to appear in written and/or oral systems? Data collected at the Frank Porter Graham Child Development Institute for 67 African American children from infancy through age 17 (Van Hofwegen & Wolfram 2010) allow the opportunity to analyze the relative dialect densities of school-age children longitudinally through the school years. This research examines longitudinally the oral and written codes of developing African American English speakers; specifically, the interface between the speaking and writing of school-aged AAE speakers and identifies how certain linguistic measures change across time. Using writing samples from the Woodcock Johns Test of Achievement, the oral and written dialect density measures will be measured and analyzed for ten African American English speakers across three time points—third grade, seventh grade, and tenth grade. This research will determine the extent to which oral and written dialect densities differ for African American school-aged children across time, and which features are more prominent in the different registers at different points through the elementary and secondary school developmental trajectory.

Kathryn Bove
Graduate Program: Spanish Foreign Languages and Literature
Advisor: Mark Darhower
Poster Number: 14

Complexity: How to create quality discourse with meaningful questions in the Foreign Language Classroom

Bridging the gap between language and content courses has been an ongoing challenge and has sparked debate in the university setting. While the two are unquestionably intertwined within a language department, literature courses are sometimes scrutinized as pedagogically lacking in their development of students' oral proficiency skills. While many literature professors are very knowledgeable in their area of expertise, the best ways to share that knowledge are sometimes unknown.

The present study concluded that simply having literary discussion does not ensure that students will be pushed to use language in advanced ways. In this study, three professors were recorded for a total of thirteen recorded major level Spanish courses. I transcribed the recordings, and the findings were analyzed for teacher versus student talk, student verb usage, and the complexity of teacher questions.

Using the data found in the recordings, I have drawn several conclusions in regards to teaching literature classes. Analyses of teacher versus student talk show that there is a strong contrast between the amount and level of discourse between teachers and students. In the comparison of three different teachers, I was able to conclude that while there are several factors that may help increase student length of talk time and level of advance speech according the ACTFL scale. Most notably, questions posed to the class by teachers can have a large effect on the length and quality of student discourse. Additionally, I found a correlation between complexities of thought according to Bloom's Taxonomy and complexities of student responses.

By incorporating questioning guidelines suggested by this study, instructors can help students to advance in their speaking skills according to the ACFL proficiency scale. I will also present an eight-step approach to forming effective questions derived from the research that allows student to analyze literature while advancing their discursive abilities.

Jennifer L. Buchan
Graduate Program: Sociology
Advisors: Margaret Zahn and Brett Clark
Poster Number: 20

Child Homicide in the Southern United States: The Role of Religion in the Subculture of Violence

This study of child homicide in the Southern United States compares child homicide rates in the Southern U.S. to the other Census-defined regions of the continental United States. It is hypothesized that religious fundamentalism in the South leads to higher rates of child homicide than in other parts of the country. Child homicide is defined as the killing of those aged 0-11. Region parallels the U.S. Census defined regions. GSS data from 1976-2006 is used to measure religious fundamentalism and region variables, also using income variables to control for low economic levels. The FBI's Supplemental Homicide Reports, ranging from 1976-2006 are used to measure child homicide rates by state and region. Results detail how religious fundamentalism affects the killing of children in the United States.

Jennifer Caputo, Frances Fu, Joann Keyton**,** Paromita Ghosh, Samantha Leibowitz, and Chaofan Wu
Graduate Program: Communication

Advisor: Joann Keyton
Poster Number: 23

Efficacy and Intentionality: How We Communicate at Work

The change in the balance of blue-collar to white-collar employment, and increases in temporary and contingent employment, globalization, and use of technology has put greater emphasis on employees' "interpersonal skills and the ability to collaborate" in teams (Barley & Kunda, 2001, p. 77). As a result, few, if any, jobs can be conducted without communicating, and it is not uncommon for communication skills to appear on lists of skills employers seek. Employees are now expected to be good communicators, and oftentimes they are evaluated for their performance. Interestingly, a review of research (Corman, 2006) over the past two decades demonstrates consistent scholarly focus on talk *about* work rather than talk *as* work. This multi-study project with working adults examines which communication behaviors occur at *work* and how these communication behaviors are evaluated. Through an analysis of organizational communication publications, Study 1 identified 166 communication behaviors; participants confirmed which they had observed at work. Through participants' effectiveness evaluations, Study 2 reduced that list to 41 communication behaviors. Two subscales emerged: work-related communication behaviors and workplace-related communication behaviors. Examples of items in the first subscale include making decisions, listening, and discussing; items in the second subscale include joking, expressing frustration, and making small talk. The Communication Work Efficacy scale is presented.

Christopher L. Cummings[1], Mary E. Lavelle[3], David M. Berube[3], and Andrew R. Binder[3]
Graduate Programs: Communication, Rhetoric, and Digital Media[1]; Communication[3]
Advisors: David M. Berube and Steven B. Crofts Wiley
Poster Number: 28

Implications of Socioeconomic Indicators on Environmental Health and Safety Risk Perceptions

Predicting how the public forms attitudes and opinions about environmental health and safety risks is a complex matter with potential to improve policy and communication guidelines related to public health and wellbeing. Previous work in the fields of Risk Assessment and Risk Communication notes that attitudes toward environmental health and safety issues are likely to be based on ideological worldviews and religious predispositions, but there is little empirical evidence that demonstrates these factors are adequate and reliable predictors of an individual's risk perceptions. Funded by a National Science Foundation Grant (#0809470) investigating how the public makes sense of toxicological information concerning nanoparticles, this study evaluates predictors of risk perceptions by isolating multiple personal and demographic characteristics in conjunction with individuals risk perceptions of various hazards in hopes of improving the predictive capability of how the public perceives risks of various types. Data are analyzed from a probability sample collected in 2009 of 307 households in the continental United States that completed a pen and paper survey asking respondents to rank risks associated with a set of 24 hazards ranging from obesity to cell phone use to nanoparticles. The battery of questions contextualizes risk perceptions and this study analyzed responses using Ordinary Least Squares regression modeling to quantitatively establish which personal characteristics are the best predictors of risk perceptions. Interestingly, findings note that socioeconomic indicators including "age," "education," and "income" hold significantly greater predictive capability in explaining risk perceptions than do ideological worldviews and religiosity. Efforts to inform the public— like government programs, risk messages, and public engagement events— should note that while issues like ideological worldviews and religious predispositions influence risk perceptions, they are not likely to be the principal force in predicting individuals risk perceptions.

Kendra Erickson
Graduate Program: Public History
Advisor: Craig Friend
Poster Number: 36

Preserving Homes Through Historic Preservation Agreements

Historic Preservation Agreements allow private homeowners to engage the assistance and resources of historic and preservation organizations to preserve and protect their historic homes in perpetuity, or for as long as the homeowners desire. The agreements act as contracts between homeowners and the preservation or historical organization of the homeowners' choice. Homeowners retain ownership and responsibility for the restoration and care of their home, while the organization collaborates with the owner to ensure the covenants are followed. Historic Preservation Agreements contain easements that restrict the use of the property to protect its historic character. Easements detail through covenants the actions that can and cannot be committed on interior or exterior elements of the home and property. To complete North Carolina State University's Public History program practicum requirement, I interned with the Preservation Society of Chapel Hill over the summer of 2010. The Preservation Society of Chapel Hill is legally committed to ensuring the continued preservation of eight homes and properties. I created inspection forms for the covenanted properties, conducted inspections of the covenanted elements, and documented the present preservation state of the properties through photography to assist future inspections. The results of

six property inspections revealed the continued success of Historic Preservation Agreements of the Preservation Society of Chapel Hill and educated both the homeowners and the society as to the current preservation state of the properties. The Preservation Society of Chapel Hill plans to complete the last two inspections and develop a plan for future inspections of all the properties on a one or two-year schedule.

Kristen M. Gossett, Mary E. Lavelle, Tingting Liu, and Katarina Pantic
Graduate Program: Communication
Advisor: Melissa Johnson
Poster Number: 52

Student Sociocultural Adaptation: A Study of Self-Esteem, Intercultural Communication Apprehension, and Geographic Origin

The purpose of this study was to examine how geographic origin, self-esteem and intercultural communication apprehension (ICA) influence the process of sociocultural adaptation in a new environment. The participants in this study were 266 students from a large southeastern university in the U.S. In addition to 160 US students, there were 101 international student participants. Students identified where they grew up as a rural, urban or neither a rural nor urban area. A sociocultural measurement of adaptation was used in order to account for the adaptation process all students go through, regardless of geographic origin. No significant difference was found between rural and urban students for sociocultural adaptation to university life, yet a significant difference was found between international students and U.S. students in their levels of sociocultural adaptation. Both self-esteem and ICA functioned as predictors of a student's sociocultural adaptation.

Joshua Hager
Graduate Program: Public History
Advisor: Craig Friend
Poster Number: 55

Contributing to a Community's Collective Memory Through Archives: Three Practical Approaches

The creation of archives, or manuscripts and other primary materials arranged and described in such a manner as to allow for enduring preservation and as much public access as possible, is one of the central tasks of the public historian. Furthermore, according to archival scholar Kenneth Foote, the transfer of information from generation to generation embodied in archival institutions is one of the most essential components of the formation of a society's collective memory. Yet understanding that archives have a role in forming a community's consciousness of the past is not sufficient for the practicing public historian; he or she must become aware of how that process occurs in order to best encourage an integral role of archives in community life. The aim of this project is to analyze three different methods of outreach and reference services that best serve to connect the public to its past and thereby assist in the formation and strengthening of collective memory. A summer internship at Duke University provided the venue for the testing of the following methods: First, archival materials provided the basis for an exhibit concerning Duke's institutional history. Second, rare books became the subject for an audio-visual tour to allow the public to have digital encounters with the most important works of modern society. Finally, a personalized reference service connected individuals with historical works relevant to their personal projects. In all three cases, members of the public both at Duke and farther afield attested to a personal link established to the past through interactions with specific archival materials. Therefore, each method proved effective as a means for strengthening the link between the general public and a collective memory derived from archives. Public historians should therefore consider more broadly enacting similar outreach methods at their respective institutions to achieve equally beneficial results.

Rebecca S. Hahn
Graduate Program: Spanish Language and Literature
Advisor: Jim Michnowicz
Poster Number: 56

Mood Selection in Spanish: The Variation in Native and Heritage Speakers of Spanish in the United States

According to Spanish textbooks and grammar books (Borrás et al. 2008, Dozier and Iguina 1995), there are distinct prescriptive rules for the selection of mood in Spanish. In this study, mood selection is measured in both heritage and native speakers of Spanish in the United States to determine the variation of these prescriptive rules. There are two goals for this study: 1) determine if there is a difference in the prescriptive mood selection rules and the actual guidelines native and heritage speakers use for this aspect of the language; and 2) determine if there is a difference in the mood selection between native and heritage speakers of Spanish in the United States, and if so, find the factors that affect this difference. The tool is a written survey composed of sixteen phrase completions, and twelve of the phrases contain subjunctive mood prompts according to the prescriptive grammar rules. The study examines sociolinguistic factors such as length of residency in the United States, and if participants are heritage or native speakers. I also examine linguistic factors such as the verb in the prompt, the tense of the

prompt, and the polarity of the prompt. Thus far, the frequencies show that heritage speakers use more of the indicative where subjunctive is necessary (71%), whereas native speakers favor the indicative 40%. However, the prescriptive rules govern the use of indicative in this survey 0%, so both of these groups are varying in their mood selection. There are prescriptive rules in the textbooks, but the native and heritage speakers do not always follow those rules, and this study will relay the factors that govern the "real world" mood selection.

Dayne Hamrick
Graduate Program: International Studies
Advisor: Mark Nance
Poster Number: 58

Rejecting Transplant Capitalism: The Institutional Embeddedness of the Russian Market

Russia continues to struggle to develop its market system since its transition to a market economy at the end of the 20th Century. From the failures of shock therapy to the rise of the oligarchs and the current surge in state control, Russia continually finds it difficult to establish itself as a stable business environment. This research examines the struggles of Russian capitalism from an institutional perspective, arguing that the market system is embedded into malformed institutions, which hinder rather than promote stabilization. Through a qualitative case study of two business scandals: the Yukos affair and the Media Most scandal, this research shows what happens when strong institutions are not present. While a well established body of work in sociology argues that the embeddedness of the market into local institutions results in positive outcomes, this research expands our understanding of "embeddedness" by testing its impacts in a negative case. If the institutions supporting the market, both formal and informal, do not compliment market behavior the results can be more devastating than a self regulating form of capitalism. This is the case for Russia today as it continues to struggle to establish itself as a stable economy with transparent institutions.

Molly Hartzog Storment
Graduate Program: English
Advisor: David Rieder
Poster Number: 61

Spatializing Composition: An Argument for the Use of Drawing Tools as an Aid to Invention

The cultural tendency of considering writing as an extension of speech causes severe organizational issues with many writing students. Writers often forget that a reader treats the text, either print or electronic, as a tangible, manipulatable object while holding a visual schematic of the content in their working memory. In the information age where text, image, mathematics, music, art, and code converge, writing is a performance: putting ideas in dynamic interplay with one another. In this way, texts and text production carry a greater spatial quality to them. This research devises a pedagogical approach to composition that foregrounds the importance of the visual elements of the content of a text through spatial outlining methods.

This research takes a historical approach, examining development of writing as an extension of drawing. This historical account is then applied to contemporary research on writing and cognition, and placed in the context of current pedagogical practices which incorporate visual rhetoric into the writing process. However, where many of these pedagogies attend to visualization on a surface level, this research assesses visualization on a cognitive level. This research will ultimately culminate in the creation of a software program that will allow writers to build an outline, using it as an artist uses a sketchbook: to externalize what may begin as vague ideas, then to use the "sketches" of these ideas to extrapolate further relationships and possibilities for the text.

Ashley L. Humphries
Graduate Program: Anthropology
Advisor: Ann Ross
Poster Number: 70

Craniometric Variation in the Caribbean and Latin America as Influenced by the Trans-Atlantic Slave Trade

As the application of forensic anthropology increases worldwide, especially in cases of mass disasters and genocide, the need for population specific methods and research has become more important, particularly those concerned with ancestry. Until recently, ancestral categories have been very broad. For example, the term Hispanic is a broad category which assigns a missing person to one of many Spanish speaking countries. Increasingly, investigations have shown that humans are far more diverse than these broad categories account for and have shown that modern statistical methods can more narrowly identify intra-regional variation as well as answer broader questions concerning human migration and expansion.

Between the 16th and 19th centuries, nearly 10 million African slaves were transported to the Americas. This event brought together Europeans, indigenous Americans, and various African groups that drastically changed the cultural and biological composition of the region.

To investigate the diversity found within the Caribbean and Latin America, samples from different African groups, Mexican, Cuban, Panamanian, and Ecuadorian samples were compared using traditional craniometrics. To evaluate group similarities and differences, Mahalanobis D^2 were calculated using SAS 9.13.

Results show that all Africa groups significantly differ from one another. Interestingly, Panamanians are not significantly different from Angolans or São Toméan. While the Mexican sample was significantly different from all African samples, Mexicans were not significantly different from the Panamanians, possibly suggesting similar indigenous and/or African origin. These results indicate that the various African populations significantly differ from one another and that this diversity has contributed to the heterogeneity in the Caribbean and Latin America. This research highlights the importance of investigating biological diversity in regional samples, which would allow forensic anthropologists to determine ancestry more accurately and aid in narrowing the pool of missing persons. In addition, this research helps to fill a void in African diaspora studies.

Felysha L. Jenkins
Graduate Program: Psychology
Advisor: Mary Wyer
Poster Number: 79

African American Women in Science, Technology, Engineering, and Mathematics (STEM): How They Choose Success through the Examination of Science Self-Efficacy, Department Climate, and Career Commitment

African American women are underrepresented in most STEM majors, a fact amply documented by the National Science Foundation (NSF, 2010). Why this is so is less clear. A patchwork of research suggests that African-American women must be especially motivated if they are to become scientists. Some posit that African American women are as interested in STEM majors as other students are but that they have higher attrition rates in comparison to European Americans and Asian Americans (Daempfle, 2003). Others posit that African American women are not obtaining degrees in STEM in greater numbers because they do not have the necessary aptitude or interest in science (Ceci & Williams, 2010). Many approaches rely on a 'deficit model' of African-American talent that overlooks social and institutional contexts. However, the university, department, and individual make unique contributions that help explain the patterns that are observed when examining the persistence and attrition rates of African American women in STEM. Despite the odds, African American women are achieving some success in the sciences. In 2008, African American women represented 4% of bachelor's degrees conferred in the physical sciences and 5% in of degrees conferred in all the science and engineering fields combined. These numbers demonstrate that African American women are making strides in the STEM fields even with the obstacles they face.

The proposed study will investigate why African American women are able to persist in the sciences in spite of the barriers they face. Specifically, through surveying students from multiple institutions of higher education, including Historically Black Colleges and Universities (HBCUs) and Predominately White Institutions (PWIs), the study will examine how African American undergraduate women's self-efficacy, gender, ethnicity, and college climate interact to promote career commitment. Substantial information exists on the circumstances of women in STEM and on increasing minority representation in STEM. However, there is a paucity of research at the crossroads of race and gender in STEM. This project will focus on a population at that crossroads: African American women obtaining STEM degrees.

Multiple regression analyses will be used to examine the data. The results can be used to create and improve interventions designed to increase the number of African American women who pursue degrees in science, technology, engineering, and mathematics.

Evan T. Johnson
Graduate Program: International Studies
Advisor: Michael Struett
Poster Number: 82

Debating Disparities in the United States and Canadian Health Care Systems: A Closer Look at Administrative Costs

For several years, scholars have questioned the efficiency of the heath care system in the United States due to the fact that Americans pay more for health care services than anyone else in the world, yet the system ranks poorly when compared to other nations by the World Health Organization. While many studies examine the differences in quality of care, training, and medical technology, this debate concentrates on the administrative costs involved with the American health care system as a latent variable contributing to significantly higher costs than the world standard. In addition, a comparison is drawn between the United States and Canadian health care systems to evaluate the costs involved in a country that is similar in terms of population, demographics and level of development. After a thorough review of existing scholarly literature as well as state and federal laws, the analysis indicates that health care administrative costs represent an overwhelming majority of total health care

cost and that these costs can be considerably reduced through policy reform. The resulting discussion recommends that policy adjustments be made to promote competition among the insurance industry by removing state barriers to coverage and secondly to streamline the claims filing process in a manner similar to that of the Canadian system to reduce administrative costs. This study furthers the interest of reducing health care administration costs that translate to lower costs for the average American through intelligent policy design.

Madeeha Khan
Graduate Program: International Studies
Advisor: James Kiwanuka-Tondo
Poster Number: 88

Navigating Through Two Worlds: South Asian American Views of Gender Roles

The Immigration and Nationality Act of 1965 significantly altered the diversity of the American population as individuals from non-Western countries immigrated to the US in large numbers. Many South Asians, with Indians and Pakistanis representing the majority of this group, came during the 1970s-1980s. These individuals came to start a new life for themselves and their families while also desiring to maintain ties with their culture of origin. This study examines how these immigrants have managed to weave their homeland's cultural values with mainstream American society. In particular, comparing how foreign-born South Asian Americans and US-born South Asian Americans view gender roles illustrates how immigrant communities make sense of being a part of two different societies, and provides a better understanding of the similarities and differences between immigrants and their subsequent generations. A qualitative study was employed through an online open-ended questionnaire that surveyed a pool of South Asian individuals to obtain pertinent information in regards to their experiences living in US society. Their viewpoints on male and female gender roles concerning marriage, career, education, housework, and child-rearing were explored. An analysis of the results shows that a multitude of factors are at play in shaping how South Asian individuals view gender roles.

Paul Y. Kim
Graduate Program: Human Factors and Ergonomics
Advisor: Christopher B. Mayhorn
Poster Number: 89

Exploring Age-Related Differences in Prospective Memory Inside and Outside of the Lab

Much of the memory literature investigated the topic of retrospective memory which referred to remembering past information such as telephone numbers or addresses. By contrast, the present research was on prospective memory. Prospective memory is essential because it refers to one's ability to remember and execute intentions in the future. Age differences in the performance of two prospective memory tasks (activity-based and event-based) were investigated both in laboratory and naturalistic settings. Forty young and 40 older adults participated. First, the participants came to the lab and answered ninety trivia questions with embedded prospective memory tasks. Second, they were required to come to a local mall (naturalistic setting) a few days later to complete various prospective memory tasks. Results indicated that both age groups performed the event-based task followed by activity-based task better in the lab than in the naturalistic setting. The young performed the tasks better than their older counterparts in both contexts, though the effects failed to reach statistical significance. An interesting finding was that older participants performed the naturalistic event-based task better than the young participants. These findings suggest that converting activity-based tasks into event-based tasks may help people accomplish their daily prospective memory tasks more successfully.

Melinda M. Leonardo[1], Jessica Jameson[2], and Barbara Metelsky[3]
Graduate Programs: Communication, Rhetoric, and Digital Media[1]; Communication[2]; Adult and Higher Education Communication[3]
Advisor: Jessica Jameson
Poster Number: 98

Discourse Patterns within Small Group Decision-Making

The study examines discourse patterns present in small group decision-making in the context of nonprofit boards of directors. The board meetings of two social service nonprofit organizations were observed and audio-recorded for a full year. Eight decision- making episodes that resulted in group agreement were identified and selected for analysis. The goal of the study was to identify discourse patterns that describe collaborative or competitive communication within each decision-making episode. The author coded each episode at the clause level, examining pronoun use ("I" or "we") and the presence of direct requests for participation. A second coding at the exchange level examined the presence of agreement or disagreement, elaboration, acknowledgment, topic change, or an incomplete exchange (often a result of interruption). The study found that the use of "I" and "we" were distributed over the course of the decision-making episodes and very few disagreements occurred. No specific

pattern of elaboration or acknowledgment was found to precede the disagreements. The paper concludes with implications for theory, practice, and future research in collaborative small group decision-making.

Sarah Merritt
Graduate Program: Communication
Advisor: Melissa Johnson
Poster Number: 112

Framing Franco: Editorializing *Time* Newsmagazine Cover Art Through Switching to Illustration

Visual media used in mass communication serve as unique and powerful components in the framing used by mainstream media outlets to guide perception and interpretation of foreign events. Still powerful and influential today, *Time* newsmagazine is one of the oldest mainstream news outlets in the U.S. that has consistently guided public perception of foreign events through editorialized illustration of foreign leaders. During the Spanish Civil War, the late dictator Franco became the first foreign leader to be portrayed through editorialized illustration on *Time* cover art, and this qualitative content analysis aimed to identify and interpret historical presence and utility of visual framing in *Time's* coverage of Franco from 1937 to 1966. The five solo portraitures of Franco appearing on *Time* cover art were analyzed across a four-tier methodology, beginning with the identification of manifest content and visual metaphor and ending with ideological interpretation. According to each image, the analysis interpreted which U.S. interests were served, as well as the nature of Franco's inner character in terms of interactivity with the viewer. Through qualitatively interpreting how illustrated foreground and background content in each image were used to convey specific messages, findings revealed that the use of visual framing in these images consistently presented a causal narrative over time through visual metaphors. Findings strongly supported that consistent ideology and vision of a news media organization are an indicator and predictor of consistent visual framing demonstrated repeatedly over media and time.

Charlotte Mick
Graduate Program: Anthropology
Advisor: D. Troy Case
Poster Number: 115

Status and Health at the Mississippian Period Site of Averbuch

Social organization has been determined to influence nutritional health in a variety of different archaeological populations. The reconstruction of social organization utilizing mortuary analysis may be further substantiated by corresponding biological data. Theoretical principles guiding this goal of mortuary analysis emphasize a combination of structural and social traits. For Mississippian chiefdoms, these are largely based on Peebles and Kus' (1977) prescriptions. A test of these prescriptions is performed on the Tennessee Averbuch population, combining burial good mortuary data and the following nutritional health indicators: linear enamel hypoplasia frequencies, and the presence or absence of porotic hyperostosis and cribra orbitalia. Applying Goodenough's (1965) social role theory, burial good data are reconfigured into "diversity scores" which represent the variety of types of goods present. Diversity scores are evaluated to consider if higher social status afforded individuals any protection against nutritional stress under a Mississippian redistributive system. Some nutritional stress was observed across all diversity scores, but the highest social status individuals did not appear affected by the greatest stress levels. The Averbuch population appears to have been in poor health in general, but social status may have offered some defense against extreme nutritional stress. Social and structural organization at Averbuch does not conform to a Mississippian chiefdom designation as it is commonly assessed.

Matt Morain
Graduate Program: Communication, Rhetoric, and Digital Media
Advisor: Carolyn Miller
Poster Number: 118

Know Your Genre: A Case Study of Genre Classification Strategies within a Discourse Community of Internet Meme Culture

Internet phenomena are a parent category of online cultural artifacts comprising viral videos, memes, image macros and other classifications of digital media, and are best understood by the online users who create, share, and remix them. These users form tightly knit Internet sub-communities with their own heavily intertextual discourse replete with idiosyncratic jargon that may be difficult for outsiders to understand and use. As a result, many scholars may view this rich and culturally diverse collection of digital media as inaccessible to academic research. Many of these artifacts have crossed virtual borders from the inner circles of Internet culture (e.g., 4chan or 7chan) to more mainstream web locales (e.g., Digg, Twitter or the NY Times Online). With this spillover, more attention is turning toward what makes these artifacts compelling enough to share and distribute. But how do sub-communities of Internet users talk about genres of memes?

To answer this, I conduct a case study of knowyourmeme.com, a site of active users who are particularly interested in tracking, researching, and cataloging Internet phenomena as they appear. The site's discussion forum is a rich source of archived negotiations among users and administrators alike, providing an historical record of a discourse community's attempts to codify genre classification strategies. I analyze key forum threads that reflect the vernacular genre practices of Internet users and classification strategies, showing how discourse communities attempt to define emerging and fuzzy digital genres.

Brandi Moyer
Graduate Program: Communication
Advisor: Kelly Albada
Poster Number: 121

Married Couples Perceptions of Physical Appearance through Social Interaction

Research has established that physical attractiveness (PA) is an important component for relationships. However, studies mainly focus on couples that are less established and open to more fluctuation in evaluation. Those that focus on more established relationships have found mixed results suggesting that PA is either very important to the husband or it impacts both husband and wife equally, but to a lesser extent than personality. In this study, the Interaction Appearance Theory (IAT) developed by Albada, Knapp, and Theune (2002) is applied, which provides an explanation for how physical attractiveness (PA) perceptions can be altered by social interaction. Although IAT has been tested with early daters, its applicability to a married population remains in question. This study surveyed married individuals regarding their positive and negative conversations with their spouses and the impact of those interactions on PA perceptions and marital satisfaction. Facebook was used as a research tool to reach participants. The main goal is to isolate age as a variable that can impact PA. The research will work to determine if the definition of PA changes with relationship length, age, or both.

Caroline O. Muglia
Graduate Program: Public History
Advisor: Craig Thompson Friend
Poster Number: 122

The Evolution of the Modern Archival Movement and North Carolina's Role in Preserving State History

We produce archival materials everyday. Historical excavation allows us to retrieve archives; archivists arrange and describe archives, shaping them into a collection; repositories democratize the information by providing access to the public; and the public digests the information for purposes of scholarship, analysis, and research. The records, manuscripts, audio-visual materials, photographs, paintings, and artifacts that make up archival collections represent the tangible history of society, the evidence of cultural beliefs and social values. So, what are the roots of the modern archival movement? In 1789, during the start of the French Revolution, thousands of historical documents had been burned as monuments of the newly overthrown feudal regime of the country. This episode in the destruction of national history led to new standards for archival administration including a nation-wide public archival system; State responsibility for *all* archives as "documentary heritage of the past;" and accessibility of archives to the public. Over one hundred years later, in 1905, the North Carolina State Archives became the third-oldest state archival institution in the United States. Later, in 1934, R.D.W. Connors, a native of Wilson, NC, became the first United States Archivist for the National Archives and Records Administration (NARA). Decades later, NCSU became one of the first archival programs in the United States and has contributed greatly to the professionalization and standardization of archival practice. Archival processing has transformed since its modern roots especially in the arenas of acquisition, arrangement and description. In a growing digital environment, the shape of archives has also transformed from paper to born-digital materials marking a significant departure from 1789 in reassessing conservation standards along with the life cycle of materials and the way in which the public can access archival materials.

Adrianne M. Offenbecker
Graduate Program: Anthropology
Advisor: D. Troy Case
Poster Number: 128

Examining the Role of Environmental Stress in the Etiology of Skeletal Defects

Frequencies of skeletal defects within families are noticeably elevated when compared with frequencies found in the general population, which indicates a strong genetic component in the etiology of these traits. Clinical studies, however, have demonstrated that certain environmental factors, particularly dietary deficiency and disease, may trigger or enhance the genetic predisposition for developmental defects. While it is likely that both genetic and environmental factors contribute to the etiology of skeletal defects, it is unclear which specific traits are most sensitive to environmental stress. The primary objective of this study is to examine whether environmental stress causes elevated levels of developmental defects within a population. To

test this hypothesis, a total of 415 individuals from three archaeological cemeteries were examined for the presence of 45 skeletal defects. The samples are derived from temporally distinct Arikara sites whose inhabitants experienced varying levels of environmental stress over several centuries. Defect frequencies were calculated for each of the three sites and interpopulation differences were analyzed using Fisher's exact test. The only defects that varied significantly between samples were the os styloideum and vertebral shifting, which were more prevalent in the Mobridge sample, and the asterion bone, which occurred most frequently in the Leavenworth sample. These findings suggest that environmental stress has minimal influence in the etiology of developmental anomalies since the majority of skeletal defect frequencies were similar among the three samples examined for this study.

Daniel S. Stanhope and Ruchi K. Patel
Graduate Program: Industrial/Organizational Psychology
Advisors: Bob Pond and Bart Craig
Poster Number: 132

Transformational Leadership in the Midst of Technological Innovation

Transformational leadership is said to be important during times of change because of the leader's ability to engage followers, motivate them, and align their values and interests with those of the organization. Due to the increasing pervasiveness of technology-related change initiatives that are associated with educational and organizational innovation, it is important to understand the role that leadership plays in soliciting stakeholder commitment. Accordingly, this study employs multilevel modeling to examine the impact of transformational leadership on followers' attitudinal and behavioral reactions to a large-scale organizational change initiative in multiple schools across North Carolina. The change initiative consists of providing laptops to every student and teacher with the objective of incorporating the technology into teaching practices for the ultimate goal of enhanced student learning. Survey data—both quantitative and qualitative—were collected from schools (i.e., students, teachers, and administrators) at multiple time points during the initiative. Among the outcomes studied herein were (a) teachers' perceptions of the adequacy of the technological infrastructure, (b) teachers' attitudes toward teaching and learning with the laptops, (c) teachers' use of the technology for planning and instruction, and (d) teachers' technology-related self-efficacies. Overall, findings indicate that teachers' perceptions of their principal as a transformational leader significantly relate to both their attitudinal and behavioral commitment to the initiative, such that higher ratings of transformational leadership were associated with followers demonstrating more favorable affective reactions and increased engagement in technology-related behaviors. However, despite the aforementioned individual-level results, the multilevel analysis did not indicate substantial between-school variance, hence, no group-level effects. This inability to detect group-level effects may have been largely due to deficiencies in statistical power—namely, low sample size at the school level. The implications of these findings are discussed, including their value for theory and practice.

Zachary Rash
Graduate Program: Communication, Rhetoric, and Digital Media
Advisor: Carolyn Miller
Poster Number: 141

Bridging Identities through Digital Genres: The Case of Sports Fan Revolution Websites

The internet has caused significant changes in the relationship between fans and the entertainment industry, providing new ways for fans to shape their objects of fandom, such as through online fan communities. Little rhetorical scholarship has examined how online sports fan communities use the internet to discuss and interact with their object of fandom, despite a considerable body of sociological research on offline sports fan communities. Sports fan-created websites warrant critical examination, particularly a growing number of sites created by passionate fans for the express purpose of voicing displeasure with their favorite teams' poor performance; fans using these sites can challenge the unfaltering loyalty to their teams that the norms of sports culture demand and can organize grassroots efforts to voice their displeasure in physical space. The present study explores one particular type of disgruntled sports fan website, the sports fan revolution website (SFRWs), through genre analysis. I perform a case study on these SFRWs to examine the relationship between sports fan identities, genres, and technology. I begin by describing SFRWs' antecedent genres—sports fan blogs and gripe sites—describing these online genres' conventions of content, form, and social action, or function. I then analyze several SFRWs, each devoted to a particular National Football League team. I explore the textual and social conventions of SFRWs in light of conventions operating in sports fan blogs and gripe sites. From this analysis I argue that SFRWs provide forums for constructing new fan identities, a hybridization of traditional and consumer fan identities facilitated by social media's technological affordances and consumer fans' rising numbers in sports culture. Correspondingly, these sites' conventions invite site visitors to embrace a loyal, though skeptical and hostile fan identity.

Bindiya I. Shajith and William P. Erchul
Graduate Program: School Psychology
Advisor: William P. Erchul
Poster Number: 150

Bringing Parents to School: The Effect of Invitations from School, Teacher, and Child on Parental Involvement in Schools

Parental involvement in children's school and education has been found to be beneficial for children's academic and social competence. However, parental involvement tends to decrease as children grow older and move from elementary to secondary school. It is therefore important to devise ways to promote parental involvement at the secondary level, especially in middle schools. Research has shown parental perceptions of invitations for participation in school activities to be positively associated with parental involvement. The differential effect of three types of invitation (general school invitation, specific teacher invitation, and specific child invitation) on middle school parents' decisions to become involved in their children's school activities was studied. It was hypothesized that specific invitations from teachers for participation would be a better predictor of parental involvement than general invitations from the school, and that specific invitations from a child would be a better predictor of parental involvement than specific invitations from a teacher. Unfortunately, low parent attendance at the event provided insufficient data to formally support or reject the hypotheses. Parents who agreed to come to the event were found to be more likely to attend the event. Parents of eighth graders were less likely to attend the event than parents of sixth and seventh grade students. Limitations and implications are also discussed.

Rebecca Y. Sutphin
Graduate Program: Anthropology
Advisor: Ann Ross
Poster Number: 161

Juvenile stature estimation of the Arikara Plains Indians

Limited analysis has been conducted for estimating stature derived from the long bone lengths of juvenile skeletons. While juvenile stature estimation may be particularly beneficial in the forensic setting, it may have applications for use as a proxy for nutritional health of past populations like adult stature.

Stature equations developed by Ruff (2007) and Smith (2007) were used to predict juvenile stature from long bone measurements of 1-17 year old Arikara Plains Indians from three temporally distinct burial sites spanning 1600-1832 C.E. (Extended Coalescent (EC), Postcontact Coalescent (PC), and Disorganized Coalescent (DC) time periods). Ages were collapsed into three year age ranges: 1-3, 4-6, 7-9, 10-12, 13-15, and 16-17 year olds. *T*-test results revealed a significant difference in the 4-6 age range for the femoral derived statures between EC and DC (*p-value* = 0.0005) and PC and DC (*p-value* = 0.013) sites. The tibia and combined femur and tibia stature estimates also showed a significant difference during the 4-6 range for the EC and PC sites (tibia *p-value* = 0.03; femur and tibia *p-value* = 0.05) and EC and DC sites (tibia *p-value* = 0.01; femur and tibia *p-value* = 0.002).

Changes in femoral length were noted in the DC site, while tibial changes were noted in the EC site. Interestingly, results of the combined femur and tibia stature estimates suggest a shift in bone length proportions, while juveniles maintained the same relative stature possibly reflecting the presence of environmental stressors for the Arikara juveniles in this age category.

Anne-Lise Knox Velez
Graduate Program: Public Administration
Advisor: Branda L. Nowell
Poster Number: 179

Regional Differences in Historic Preservation Nonprofits: Three Regions Compared

In the United States regional designations are often used in order to better understand differences in the policies and actions of government and nonprofit organizations. The National Trust for Historic Preservation (NTHP) designates six regions for their Partner organizations, providing technical assistance and leadership to each region through a regional field office. Because of this, NTHP Partners within the same region have more opportunity to interact with one another than with organizations outside their region. It is therefore important to examine whether the regional designation used by NTHP really offers a good fit in describing common characteristics and differences among partner organizations. In order to obtain data for a comparison of three of these regions, telephone interviews with leaders at over 70 NTHP partners in the Southern, Midwest, and Southwest regions were conducted. Interviews solicited feedback about which programs nonprofit leaders consider most important to their organization's work, how programming decisions are made, whether and how the organization solicits public opinion, and changes that they may have observed within their organization or the field as a whole. The interviews also collected quantitative data about the age, size, and other characteristics of each organization in order to allow for statistical comparisons. Initial findings suggest that NTHP regional designations are a good fit for several organizational characteristics, at least among the three regions examined to date.

Neveen Ahmed and Denis Pelletier
Graduate Program: Economics
Advisor: Denis Pelletier
Poster Number: 2

Portfolio Choice: An Empirical Investigation

Individuals differs in their investment motivation, some invest in order to finance higher consumption in the short-run, some make longer term investment to secure higher income at retirement, other invest for the goal of paying for kids tuition in the future. Choosing the optimal combination of stocks given the enormous number of stocks available becomes a critical decision.

I estimate a single and multi-period portfolio choice of an infinitely-lived investor where the agent can invest in N risky assets and one risk-free asset. I use the first-order conditions "Euler Equations" from the investor maximization problem to estimate optimal portfolio weights. I utilize two sets of preference representation: Epstein-Zin (EZ) recursive utility function and habit formation (HF) utility. I apply Monte-Carlo simulation to simulate returns and consumption from their conditional distribution Then I use Generalized method of Moments to estimate the optimal portfolio weights when the information set contains lagged values of returns, and consumption.

I test the models using different set of preferences parameters, as an example the risk aversion parameter in the EZ utility, and habit persistent parameter in HF utility function. I found that the optimal portfolio weights differ greatly across time and across utilities. Moreover as expected I found that more risk-averse investors tend to hold fewer stocks than less risk-averse ones.

Aycan Koksal and Michael Wohlgenant
Graduate Program: Agricultural and Resource Economics
Advisor: Michael Wohlgenant
Poster Number: 91

Cigarettes and Alcohol: Complements or Substitutes?

It has long been recognized that cigarette and alcohol not only have adverse health effects, but also negative externalities imposed on third parties. If cigarettes and alcoholic beverages are related in consumption, the information about how they are related may permit better coordination of public policies (e.g., excise taxation) concerning these goods. For this purpose, we analyze the relation between cigarette and alcoholic beverage consumption within the rational addiction framework. We use pseudo panel data approach which has many advantages compared to aggregate and panel data models. We found that alcohol is a complement for cigarette, and smokers respond to rising alcohol prices, while it is not the same the other way around. We believe that drinking works as a trigger for smoking especially in social setting like bars, etc. In addition we found that alcohol is a gateway for cigarette. Because alcoholic beverages are complements for cigarettes, increasing only alcoholic beverages prices would decrease the demand for both goods. However considering that alcohol demand is pretty elastic, policy makers face a trade-off between reducing the consumption of these goods and maximizing tax revenues. Moreover, although cigarette taxation has been cited as an effective public policy tool for cigarette control, our results suggest that increasing cigarette prices might lead to increased alcohol consumption. A possible resolution of this conflict is to use public policy tools other than excise taxation. As we believe that cigarettes and alcohol are complements in social settings, policies such as smoking bans in bars, etc might be more effective in achieving the desired outcomes.

Sofia Kotsiri
Graduate Program: Agricultural and Resource Economics
Advisor: Roderick Rejesus
Poster Number: 93

Farmers' Optimism about their Spatial Yield Variability and its Impact on Precision Technology Adoption

This paper examines how cotton farmers' perceptions about their spatial yield variability influence their decision to adopt precision farming technologies. To the best of our knowledge, no previous study has focused on the role of farmers' optimism about future yield risk on adoption. Utilizing cross-section survey data from 12 Southeastern states and a two-step econometric modeling approach (Least Squares and Multinomial Logit Model), we find that farmers who perceive their yields as more spatially heterogeneous will more likely use site specific information gathering technologies (i.e., yield monitors with GPS, aerial photography, grid sampling, etc.) and apply their inputs at a variable rate. This is consistent with the theoretical insights of the overconfidence literature that indicate a positive impact of actual yield variability on technology adoption. In addition, our empirical analysis shows that perceptions about future profitability and importance of precision farming, along with socio-economic factors, also drive the adoption decision. These results have implications for producers contemplating the variable rate management decisions, as well as dealers selling these precision farming technologies.

Shannon A. Bowling[1], Christopher E. Moorman[1], Christopher S. DePerno[1], and Ted R. Simons[2]
Graduate Programs: Fisheries, Wildlife, and Conservation Biology[1], NC Cooperative Fish and Wildlife Research Unit[2]
Advisors: Christopher E. Moorman and Christopher S. DePerno
Poster Number: 15

Influence of landscape factors on northern bobwhite densities on croplands in the Carolinas

Since the 1970's, northern bobwhite (*Colinus virginianus*) populations have declined across most of their range. Landscape changes resulting from fire suppression, intensive siviculture practices, cleaner farming, and habitat fragmentation are believed to be important causes for this decline. We examined how landscape-level habitat factors influenced bobwhite densities adjacent to cropland in North Carolina and South Carolina. In the summers of 2006-2010, we conducted10-minute unlimited-radius distance sampling counts on 148 sites, sampling each site twice during each year. We analyzed point count data using program DISTANCE and calculated density estimates for male bobwhite at each site. Using the Southeastern GAP land-cover database, we determined estimates of shape complexity, average patch size, edge density, and percentage of row crop, pasture, early successional, forest, and developed lands within a 500-m, 1-km, 2-km, and 3-km buffer (buffer areas = 78, 314, 1256, 2827 ha) surrounding all point count locations. We calculated correlation coefficients between density estimates and predictor variables (GAP landscape statistics as well as the presence/absence of a field border). Bobwhite density was negatively correlated with edge density at the 500-m, 1-km, and 2-km scales, median patch size at the 3-km scale and percentage developed at the 1-km and 2-km scales but positively correlated with shape complexity at the 1-km and 2-km scales. However, the strengths of the relationships were weak for all correlations (r^2 <0.25).

Candice Bruton, Myron F. Floyd, Jason N. Bocarro, Karla A. Henderson, Jonathan Casper, and Michael Kanters
Graduate Program: Parks, Recreation, and Tourism Management
Advisor: Myron F. Floyd
Poster Number: 19

Factors Associated with Partnership Participation to Increase Physical Activity: An Examination of North Carolina Park and Recreation Agencies

Multi-sectoral partnerships are key strategies for promoting and implementing environmental and policy changes to increase physical activity. Increasing evidence suggests that parks and recreation agencies are essential partners in this effort. Yet few studies have examined factors associated with physical activity partnerships involving park and recreation agencies. This study examined the extent of personal characteristics of agency administrators and organizational characteristics of their agencies that were associated with formal partnership participation to promote physical activity. A web-based survey was administered to 216 directors from all NC municipal and county park and recreation agencies in May 2007. Partnership participation was measured by asking whether an agency participated in formal partnerships with a county health department and other community organizations (e.g., YMCAs, faith-based organizations, schools, and others) to promote physical activity. Organizational characteristics measures were operating budget, capital budget, size of population served, staff size, and target populations for physical activity programs. Personal characteristics of agency administrators were total years of experience, gender, professional certification status, and tenure in their current position. Results indicated that agencies most frequently participated in formal partnerships with community organizations (56%), schools (46%), and health departments (30%). Chi square tests revealed that agencies that served larger populations and had larger operating budgets were more likely to partner with a health department. Professional certification status of administrators was positively associated with community organization partnership participation. Departments focusing efforts on ethnic minorities and obesity among teens were more likely to engage in partnerships with schools and community organizations. Staff size was related to school partnerships. Findings have implications for policy makers and park and recreation administrators. Agencies serving smaller populations may need assistance in identifying and sustaining partnerships. Additionally, professional certification of agency administrators may be beneficial to relationship building between the recreation and parks profession and community partners.

Laurie Gharis
Graduate Program: Forestry and Environmental Resources
Advisor: Joseph Roise
Poster Number: 45

The Effect of Optimal Stand Level Management Regimes on Volumes of Wood and Carbon

Environmental policy makers need research based decision analysis models that include carbon sequestration and forest products in order to make economically viable policies and effective carbon sequestration policies for foresters to follow. Forests have been identified as an important mechanism for removal of carbon dioxide and storage of carbon. Additionally, forest products have been recognized for their long term carbon storage abilities. Policies often cover carbon sequestration but

not carbon storage in products. Furthermore, many researchers have developed and published models on global carbon management. However, these models do not provide guidance at an operational level. We develop a model to investigate optimal stand level management with the competing objectives of maximizing carbon sequestration, carbon storage, and net present value. Our purpose is to produce an accurate and useable analytical product for Southeastern United States foresters growing *Pinus taeda* in the presence of a carbon market. The decision variables are the traditional stand level management variables of planting density, thinning timing and intensity, and rotation length. Over time these variables influence the proportion of wood going into pulp, chip-n-saw, and sawtimber products where each of these classes have expected use (carbon storage) lives. The optimal management regime is dependent on the relationship between the volumes of pulp-wood, chip-n-saw, and sawtimber over multiple rotations. The relationship between pulp-wood, chip-n-saw, and sawtimber volumes determines the amounts of above and below ground tree carbon and carbon in wood products. Two graphs are developed which summarize the decision model for use by both foresters and policy makers to compare different policies. The result of this paper is a methodology to increase knowledge of how forest management practices and time impact commercial volumes of wood and carbon sequestration at an operational level. This practical knowledge can lead to economically viable policies for foresters and effective carbon sequestration policies for the environment. [This paper was funded through an EPA P3 (People, Prosperity, and Planet) grant.]

Nathan Irby
Graduate Program: Forest Biomaterials
Advisors: Sudipta Dasmohapatra and Phil Mitchell
Poster Number: 75

Assessing Consumer Purchase Perceptions of Wood Household Furniture

The global marketplace coupled with changing customer needs and the economic downturn has altered the dynamics of the traditional wood household furniture industry in the U.S. This project examined consumer perceptions and motivations toward wood household furniture purchase with a focus on implications of branding of furniture products (geographical: U.S. and North Carolina), local sourcing of materials and local production, the green marketing potential of furniture (i.e. the environmentally-friendliness of wood as a raw material), and furniture customization. By conducting surveys at home shows in the southeastern U.S., we sought to identify whether the aforementioned attributes are helpful in assisting furniture businesses in the U.S. to become more competitive and profitable. Results of the study may be used by the furniture suppliers, manufacturers and affiliated industries to improve their marketing and environmental objectives.

Lisa Hausfather Jennings
Graduate Program: Forestry
Advisor: Gary B. Blank
Poster Number: 80

Assessing Restoration Success: The NCSU Harris Research Tract's Piedmont Longleaf Pine Forest

Primarily a coastal plain species, a few fringe communities of *P. palustris* (longleaf pine) occur in the North Carolina Piedmont. These remnant piedmont stands offer unique communities, with a mix of coastal and piedmont species classified by Schafale and Weakley (1990) as the globally rare "Piedmont Transitional Longleaf Pine Forests." The possible existence of one such community type was identified in the NCSU Harris Research Tract in Wake County by forestry students surveying the tract, and later confirmed by a master's study in 1998 using the Carolina Vegetation Survey methodology. The result of said master's project was an intensive, guided restoration of the northern half of the research tract. Following these efforts, our current study has provided the first formal look at the post-restoration site. There were two main goals of this study: (i) to relocate plots used in the 1998 master's study and add additional plots to set up a statistically-stable monitoring system for use in subsequent studies, and (ii) to perform a woody-stem inventory on all plots to present a current picture of forest dynamics and focus future management efforts. Lessons from the plot set-up show an interesting picture of how forest monitoring and GPS capabilities have changed over the last two decades, and provide detailed maps of the northern half of the site. Preliminary results from the woody-stem inventory show a dominance of *P. taeda* (loblolly pine) and hardwoods in fringe areas, as well as a dominance of *P. palustris* in interior areas. Final results of woody-stem dynamics will be visualized using ArcGIS interpolation techniques, and areas to focus burning and herbicide use will be delineated. It is our hope that the results will guide NCSU's future management of the forest to allow the Harris Tract to reach its highest ecological and educational potential.

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Graduate Programs: Parks, Recreation, and Tourism Management, North Carolina State University[1]; Parks, Recreation, and Tourism, University of Utah[2]; Department of Golf Industry, Daegu University, South Korea[3]
Advisor: Jonathan Casper
Poster Number: 81

Examining Golfer Typology Based on Destination Choice Motivation: The Case of Korean Recreational Golfers

Korean golfers have various place options including both domestic and overseas golf clubs, in/outdoor driving ranges, and virtual golf clubs. As a result, competition over consumers has increased among golf service providers. Therefore, the purpose of this study is to examine the motivation factors associated with golfers based on preferred golf destination. The survey included Destination Choice Motivation (DCM) and Preference Golf Clubs (PGC). In PGC, there were four choices of golf destination types: 1) overseas golf clubs (OGC), 2) domestic golf clubs (DGC), 3) in/outdoor driving ranges (RANGE), and 4) a virtual golf club (VGC). A total of 249 questionnaires were collected from the southeast part of Korea. Based on Exploratory Factor Analysis (EFA), five DCM factors were selected as Socialization, Facility Convenience, Game itself, Dignity/Deviation, and Price. The results of MANOVA analysis revealed that the four groups of PGC have different Destination Choice Motivation factors. In addition, post hoc tests revealed 1) an in/outdoor driving range group had a significantly lower mean score on Socialization and Facility Convenience than the other three comparison groups, 2) both an in/outdoor driving range and the virtual golf club groups had a significantly lower mean score on Dignity/Deviation than both domestic and overseas golf club groups and 3) a virtual golf club group had significantly higher mean score for Price than the other three comparison groups. Overall the results showed that there were significant Destination Choice Motivation differences among four golfer groups based on their preference for golf destination choices. Implications for destination marketing will be suggested as well as the limitations of this research will be discussed.

Ryan Law Klimstra and Christopher E. Moorman
Graduate Program: Fisheries, Wildlife, and Conservation Biology
Advisor: Christopher E. Moorman
Poster Number: 90

Small Mammal Use of Native Warm-season and Exotic Cool-season Forage Fields

Grassland-dependent wildlife have suffered population declines throughout the United States, mostly from habitat loss. Converting exotic cool-season grass (ecsg) pastures to native warm-season grass (nwsg) fields may improve habitat quality for wildlife while still allowing forage production for cattle. However, nwsg monocultures likely do not provide the same quality of habitat as more diverse grasslands. In 2009 and 2010, we compared small mammal populations among 5 nwsg, 4 ecsg, and 4 wildlife fields (i.e., nwsg and forbs planted specifically for wildlife) located in the western piedmont of North Carolina. We captured small mammals using Sherman live traps during spring and summer on the 13 privately owned fields. In 2009, small mammal captures differed among the three field types ($p=0.002$). We captured more small mammals in wildlife fields ($\bar{x}$=50.3±10.0/1000 trap nights) than in ecsg ($\bar{x}$=4.5±2.9/1000 trap nights) and nwsg ($\bar{x}$=20.6±4.0/1000 trap nights) fields. Although captures were higher in nwsg fields than in ecsg fields, differences were not statistically significant. Based on preliminary data, ecsg and nwsg forage production fields do not provide the same habitat quality as florally diverse fields managed for wildlife.

Liwei Lin
Graduate Program: Forestry and Environmental Resources
Advisor: Erin Sills
Poster Number: 102

Sub-national Geography of REDD+ Projects

Reduce Emissions from Deforestation and forest Degradation (REDD+) has gained momentum as a climate mitigation strategy that can be implemented at multiple scales. In developing countries, the most advanced initiatives are projects that aim to capture carbon funding from the voluntary market, bilateral initiatives, or a future compliance-based fund or market. The expectation is that these projects will provide important lessons and guidance for incorporating REDD+ into future international agreements on climate change. In this context, it is important to examine the spatial distribution of projects, as that both provides insight on where REDD+ is most viable and influences the lessons that we can expect to learn from these projects. In this study, we examine the determinants of REDD+ project site-selection with a focus on forest cover. We consider the three countries in Latin America, Africa, and Asia with the most REDD+ projects: Brazil, Indonesia and Tanzania. These all rank high in both forest carbon emissions and forest carbon stocks, and are therefore logical sites for REDD+ projects. We consider the count of REDD+ projects in each administrative unit as our dependent variable, drawing on a global catalog of REDD+ projects developed in collaboration with the Center for International Forestry Research (CIFOR). Potential site-selection criteria were identified from literature review and interviews with projects. We then estimated probit and poisson models to test the

influence of these criteria. The results suggest some common drivers of site-selection in Brazil and Indonesia. In both countries, forest cover, percent of protected area, and population are statistically significant factors determining the location of REDD+ projects. In Brazil, road density and poverty index are also significant. None of the determinants are significant in Tanzania, perhaps because of the smaller sample size, or perhaps because different and unobserved criteria are at play. This study increases understanding of REDD+ project site-selection in different parts of the world, which provides input for future funding and research initiatives.

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Graduate Program: Forestry and Environmental Resources
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Poster Number: 114

Hydrology Controls Soil Respiration and its Isotopic Composition from Different Soil Types in a Forested Wetland in Southeast US

Recent evidence suggests that old soil carbon may become mobilized with climate change, contributing to a decadal increasing trend in soil respiration (SR) rates. If true, the high carbon densities in the organic soils of forested wetlands may be particularly sensitive when subject to changing temperature and hydrology. Here we report on soil CO_2 efflux and its isotopic signature at a *Taxodium-Nyssa* forested wetland in the Southeast U.S.A. The wetland spans three soil types – Pungo, Belhaven and Hyde series (PuA, BvA and HyA, respectively) with the first two being Histosols, and the latter an Ultisol. Using monthly measurements of net CO_2 efflux and isotopic composition of the respired CO_2, we have detected significant differences in the magnitude and seasonality of old and new carbon sources among these soil types. Summer SR was higher in HyA (15.0±1.3 μmol CO_2 m^{-2} s^{-1}, mean±SE) than BvA (9.2±0.9) and PuA (8.3±1.0) soils, and was associated with deeper aerated soil depth. No differences were detected in spring (mean SR=1.4±0.7 μmol CO_2 m^{-2} s^{-1}). PuA respired more enriched CO_2 (-28.32±0.81‰, n=8) in summer than in spring (-29.36±0.93‰, n=6), suggesting that the contribution from old carbon increases with temperature. BvA displayed the opposite pattern, with the composition of -28.06±0.55‰ (n=10) in summer and -27.06±0.50‰ (n=8) in spring. As a whole, the CO_2 from PuA which has higher organic matter content is more depleted than the ones from BvA and HyA. The differences in partitioning among soil types are attributable to differences in the flooding regime and soil aeration, whereas the timing and rate of input of new carbon through litter does not significantly differ.

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Advisor: Sudipta Dasmohapatra
Poster Number: 134

Social perceptions of the biofuel industry in the Southeastern United States

Biofuel production has the ability to be both ecologically sustainable and economically attractive. As a result, plans for expanding this industry in the Southeastern US are steadily increasing. An abundance of research about biofuel production focus on the technical components. While these areas of research are critical to the feasibility of the industry, social acceptance and use of biofuels are likely to affect the volume and ultimate success of this industry. The purpose of this study is to assess the perceptions of various stakeholder groups (consumers, forest landowners, government, non-government, industry professionals, and researchers) in the Southeastern US concerning energy and biofuels for transportation. Electronic survey data was collected from stakeholders in Spring/Summer of 2010 resulting in 605 responses. Results from our study indicate widespread support for biofuels amongst respondents (57.5% indicating they would purchase biofuel over gasoline). Respondents were most willing to purchase biofuels produced from crop, wood, and landfill wastes (with 81%, 78.9%, and 75.3% of respondents willing to purchase, respectively). Respondents were least willing to purchase biofuels produced from food items (soybeans, corn, and potatoes), trees, and genetically modified trees (with 68.6%, 67.3%, 62.9%, 57.3%, and 50.4% of respondents willing to purchase, respectively). Although support for biofuels is strong amongst our respondents, there are still large gaps in consumer understanding about the biofuel topic in general. Data from this study should be used to guide industry professionals and policymakers in making informed decisions about expanding the use and production of biofuels in the Southeastern US.

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Graduate Programs: Fisheries, Wildlife, and Conservation Biology[1]; Entomology[2]; Crop Sciences[3]
Advisor: Christopher Moorman
Poster Number: 136

Do beneficial insect habitats also provide quality brood-habitat for northern bobwhite: A comparison between planted and fallow field borders?

Strips of fallow vegetation along cropland borders are an effective strategy for providing northern bobwhite (*Colinus virginianus*) habitat. However, a limitation of fallow borders is the lack of nectar-producing vegetation needed to sustain many beneficial insect populations. Planted borders that contain mixes of prairie flowers and grasses may harbor more diverse arthropod communities, but the relative value of these borders compared to fallow borders is unknown. We used groups of six human-imprinted bobwhite chicks as a bioassay for comparing four different border treatments (planted native grass and prairie flowers, planted prairie flowers only, fallow vegetation, or mowed vegetation) as bobwhite brood habitat from June-August 2009 and 2010. All field border treatments (0.33 ha each) were established around each of nine organic crop fields. Groups of chicks were led through borders for 30-minute foraging trials and immediately euthanized. Quail chick crops and gizzards were later dissected and eaten arthropods were identified, measured, counted. We used allometric equations to estimate live weight of arthropods consumed. A modified leaf blower was used to sample arthropod availability in the borders. The mass of arthropods consumed per chick did not differ among treatments in 2009 ($F=0.60$, $p=0.617$) or in 2010 ($F=1.34$, $p=0.28$). Similarly, there was no difference in the number of arthropods consumed by chicks across treatments in 2009 ($F=0.60$, $p=0.620$) or in 2010 ($F=2.05$, $p=0.12$). Number of arthropods collected from leaf blower samples did not differ among treatments in 2009 ($F=0.73$, $p=0.54$) or 2010 ($F=0.17$, $p=0.92$). Our results suggest that the planted field borders may provide quail brood habitat equivalent to fallow borders while also promoting beneficial insects.

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Poster Number: 145

Assessing the Movement of Canada Geese around an Airport in Urban North Carolina

As the number of resident Canada geese (*Branta canadensis*) rises, there is increased concern about the risk to human safety associated with goose-aircraft collisions near airports. Due to their large size, flocking behavior, and use of critical airspace, Canada geese pose the greatest threat to aircraft at take-off and landing. Our primary objective was to track the movement of Canada geese around Piedmont Triad International (PTI) Airport and adjacent areas of Greensboro, North Carolina using PTT-100 70-gram Argos/GPS satellite transmitters and auxiliary neck bands. During June 2008, 764 Canada geese were neck and leg banded at 14 sites within a 5-mile radius of PTI Airport, and in August 2008, 15 Argos/GPS satellite telemetry units were attached to geese randomly distributed within this area. The Argos/GPS satellite telemetry units collected 19 locations/goose/day and provided the direction, speed, and altitude for each data point. Canada goose movement data was used to evaluate the risk to human safety (i.e., sites with high levels of goose use on or adjacent to the airport). Information on Canada goose movement direction, the number of movements, and the time of day of each movement was used to identify which individuals or populations of Canada geese pose a threat to PTI Airport. We strategically removed Canada geese at one site to lower the risk of goose-aircraft collisions and to evaluate future goose recolonization of removal sites. Study results will assist state and federal agencies with effective management of resident Canada goose populations around airports and educate the public about geese in urban areas.

Carlos Salas, Orlando J. Rojas, and Lucian Lucia
Graduate Program: Forest Biomaterials
Advisors: Orlando Rojas and Lucian Lucia
Poster Number: 146

Adsorption of soy proteins on silica and ultrathin films of cellulose studied by quartz crystal microgravimetry

Use of biopolymers as substitutes or in combination with synthetic polymers have become of prime interest in a variety of applications, especially those involving green chemistries. Soybean proteins comprise a large fraction of the beans weight (>50%) and have found use in many areas. In this work we studied the adsorption of soy globulins (glycinin and β conglycinin) onto smooth films of cellulose as well as on silica surface. Globulins were fractionated from soy flour, and different aqueous solution concentrations in pH 7 phosphate buffer were used. We used quartz crystal microbalnce with dissipation (QCM-D) technique to study the effect on the adsorbed amount of solution ionic strength as well as the presence of molecules (mercaptoethanol) known to break the disulfide linkages in proteins. In the case of glycinin it was found that adsorption increased and was cooperative in the presence of salt, as the concentration of protein was increased. This highlighted the

importance of electrostatic interactions in solution as well as between the protein molecules and the surface. On the other hand reduction of glycinin with mercaptoethanol resulted in lower adsorption due probably to the unfolding of protein structure that exposed their hydrophobic groups, thereby reducing the affinity with the surface. Adsorption isotherms of glycinin on ultrathin films of cellulose were similar to those for silica; however, the adsorbed amount was lower and the effect of salt was found to be more critical. It is hypothesized that this effect is due to the screening of electrostatic interactions between soy glycinin and the negatively charged cellulose. Beta conglycinin adsorption on silica and cellulose was lower than that observed in the case of glycinin, owing to the difference in molecular weight. However, the effect of salt highlighted the differences in the structure of the adsorbing proteins.

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Advisor: John S. King
Poster Number: 157

Ecophysiology and productivity of transgenic decreased-lignin *Populus* for use in short-rotation bioenergy cropping systems

Development of a wood-based liquid fuels industry holds promise of an abundant, sustainable, low-cost energy supply. Yet, current cellulosic feedstocks, such as wood from forest trees, have several barriers to cost-effective conversion to liquid fuels. Among them, the nature of lignin limits enzyme accessibility for cellulose saccharification. Bench-scale studies have shown that transgenic modification of *Populus trichocarpa* for decreased lignin enhances biomass production and saccharification efficiency. Twelve lines of transgenic *P. trichocarpa* trees modified for decreased lignin (22 to 11 %) and altered S/G ratios were planted at field sites in the coastal plain, piedmont, and mountain regions of North Carolina and monitored for growth and physiology for two growing seasons. Growth was greatest at the cooler mountain site, consistent with growth requirements of *Populus*. Five transgenic lines displayed growth similar to the control. Our results show that decreases in lignin of up to eight percent are possible without compromising productivity, which has large implications for the economics of cellulosic liquid fuels production. Wide variation in the performance of individual transgenic lines indicates that more research is needed to produce and identify the genotypes with the most potential to benefit the cellulosic biofuels industry.

Tyler Strayhorn
Graduate Program: Forest Biomaterials
Advisors: Dave Tilotta and Sudipta Dasmohapatra
Poster Number: 158

Evaluating Oriented Strand Board Under Flood Conditions

According to the Federal Emergency Management Agency (FEMA, 2008), there are currently no test procedures that can be used to identify and rank flood resistant construction materials. Rather, FEMA uses the guidance developed by the National Flood Insurance Program (NFIP) for the repair of flood damaged homes. The result of this is a set of guidelines which lack quantifiable scientific validation.

There is very little understanding of what Oriented Strand Board (OSB) will do under flood conditions. Therefore, the objective of this study is to evaluate OSB (engineered wood panel common in home construction) under different flooding conditions and time intervals. In order to do this, three different brands of exterior OSB were used to represent all producers. Fresh water, salt water, and diesel contaminated water were each utilized to simulate isolated contaminants present in common flood water. Full sheets of OSB were submerged in the various water types according to ASTM D1037 over different time intervals (0 to 336 hours). Panels were then dried within 10% of their initial weight and cut into bending samples in accordance to ASTM D3043. The samples were conditioned to 9% equilibrium moisture content then tested in flexure (ASTM D3043).

Although this work is ongoing, significant progress has been made. It has been found that after 24 hours in any water type that OSB may lose up to 50% of its mechanical properties. As a general trend, edge samples are significantly weaker than those samples taken from the interior of the panel regardless of water type or soak duration. In addition there is not a statistically significant difference (95%) between MOR and MOE of salt and fresh water samples, although fresh water samples show a trend of approximately 50 psi and 50 ksi higher MOR and MOE respectively after eight hours of submersion.

Stacy Supak
Graduate Program: Parks, Recreation, and Tourism Management
Advisors: Hugh Devine and Gene Brothers
Poster Number: 160

Insights into Recreation Demand: A Spatial Interpretation of Users and Federal Facilities

The great outdoors entice millions of American tourists each year. In 2003, the Travel Industry Association reported that 40% of all U.S. adults visited a national park at least once while on a trip of 50 miles or more, one-way, away from home in the preceding five years. Understanding demand for recreation on federal lands can improve management decisions affecting both natural preservation and visitor enjoyment. For management planning efforts, it is critical to gain insight related to the use of each facility and the populations who are using the facilities. Since 1999, the National Recreation Reservation Service has provided reservation services for participating partner agencies (e.g. NPS, BLM, USDAFS.) At a single web-presence, users can browse, query and reserve over 60,000 facilities (campsites, cabins and group facilities) at over 2,500 locations. In addition to the facilitating reservation making, the service maintains a customer database with approximately 7.5 million reservations between 1999 and 2007. After several stages of data cleaning, the remaining reservation's origin and destination zip codes were matched with the geographic coordinates for the centroid of that respective zip code. Summarized information for each origin and destination zip code as well as each state were used to elucidate the demand for recreation on federal lands. Descriptive statistics and visualizations investigate the spatial relationships between populations (on the state and zip code scale) and distances traveled, group sizes and participation per capita. Additionally, the relationships between facilities and customers' travel distances, group sizes and cumulative participation are investigated.

Wei-Lun Tsai
Graduate Program: Parks, Recreation, and Tourism Management
Advisor: Yu-Fai Leung
Poster Number: 170

A GIS-based methodology to generate trail information for promoting physical activity

A trail system is the basic recreational infrastructure in most forests, protected areas and parks where visitors experience the nature and engage in physical activities. As governments and health organizations are increasingly concerned about physical activity of their populations and associated with chronic disease and health cost, they are collaborating with researchers in finding ways to promote physical activity. Providing trail information directly relevant to physical activity is therefore a step toward the goal of promoting physical activity. The increasing use of GIS and availability of spatial data such as digital elevation model (DEMs) offers a utile way to generate variety of trail information relevant to physical activity such as time and energy cost. This study aims to apply and evaluate a GIS-based methodology to generate physical activity-related information for trail users. The method was applied to a network of sixteen trails in a well-visited forest recreation area in Taiwan. The time and energy costs information are generated from DEMs and integrated into trail information system to help visitors plan optimal trail routes based on different purposes such as the shortest time or the maximum physical activity. The results indicate that integrating multiple spatial datasets and deriving advanced trail information by GIS-based methods is feasible and efficient. Trail route selection based on time or energy costs provides an effective way of communicating benefits of physical activity to visitors. The information can be presented in more general ways that converting the energy consumption into food quantity. Therefore, it can be a very helpful tool for achieving the physical activity objective of park and recreation agencies.

Guillermo Velarde
Graduate Program: Forest Biomaterials
Advisors: Daniel Saloni and Richard Lemaster
Poster Number: 178

Housing Elements Research Chamber: A new testing facility – A crawl space study

Housing issues have been a growing research area due to the modifications of the living conditions. These modifications were originated from changes of building features and the utilization of technologically advanced material and devices present in modern homes.

The reality is that additional research needs to be conducted in order to improve the living conditions in houses. For instance, moisture related problems in houses have been reported to cause more than $1 billion in damages annually. Furthermore, in terms of health issues, humidity and mold exposure in homes have been estimated to cause asthma problems that cost $3.5 billion a year.

This research proposes the design, development, and verification of a Housing Elements Research Chamber (HERC) by means of a monitoring and control system to study the interactions of contiguous housing environments to evaluate and analyze some common housing problems. The monitoring and control system was based on temperature and relative humidity wired sensors

located in all the areas of the research chamber (indoor, simulated outdoor, and crawl space). Additionally, a case study of the interactions of moisture, relative humidity and temperature between the housing environment and its crawl space was included as part of this research.

The results proved the capability of the design and development of the HERC to test different environmental conditions within the different areas (indoor, simulated outdoor and crawl space). Results also showed the different temperature and relative humidity levels than can be achieved in the HERC with the current equipment.

Additionally, results showed that the utilization of multiple drying methods controlled by a monitoring and control system based on the real time conditions of the crawl space is the desired solution to improve the conditions of a highly variable environment inside the crawl space.

Zhouyang Xiang
Graduate Program: Forest Biomaterials
Advisors: Ilona Peszlen and Perry Peralta
Poster Number: 190

A novel approach to mitigating defects due to wood shrinkage anisotropy

Lumber drying is a very time-consuming and energy-intensive unit operation that is complicated by shrinkage that occurs when wood moisture content falls below the fiber saturation point. Differential shrinkage between the radial and tangential directions results in cross-sectional strains that cost the wood industry a substantial amount of money. A novel approach that uses the concept of drying stresses has the potential to mitigate this problem. This study investigated the feasibility of applying an impervious coating to a lumber surface to induce stresses that minimize a drying distortion called cupping. Flatsawn and quartersawn southern red oak (Quercus falcata) lumber from different trees were analyzed. The specimens from the same lumber were randomly assigned to three treatments. For flatsawn specimens, the treatments were uncoated, pith-side coated and bark-side coated; while for quartersawn specimens, the treatments were uncoated, upper-side coated and bottom-side coated. The specimens were dried in a kiln for a month. The quartersawn specimens had very limited distortion. Flatsawn bark-side coated specimens had the most severe cupping, while flatsawn pith-side coated specimens had little cupping or even cupping to the opposite side. The experimental strains for the flatsawn uncoated specimens were in agreement with those predicted using a numerical model. Those for the bark-side coated and pith-side coated specimens will have to be modeled using a scheme that incorporates stresses induced by moisture content gradients.

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Advisor: Samantha Rozier Rich
Poster Number: 191

Motivations and Sensation Seeking Characteristics of Recreational Storm Chasers

Storm chasing is considered a new form of risk tourism and recreational activity that is increasing in popularity. Previous studies have examined risky outdoor recreational activities, including scuba diving, whitewater rafting, and mountain climbing and examined motivations or personality traits (i.e., sensation seeking attributes) associated with their participants. However, research on either motivations or sensation seeking attributes pertaining to recreational storm chasers is lacking.

This study examined the factors associated with participation in recreational storm chasing in the United States, specifically, the motivations and sensation seeking attributes of recreational storm chasers. Five storm chasing tour agencies participated in the study, and helped distribute self-administered questionnaires to their customers at the end of each of their tours. The survey inquired about motivations, sensation seeking, storm chasing experience, and socio-demographic characteristics. A modified Recreation Experience Preference scale (Driver, 1987) was used to measure 21 motivations representing six dimensions: Enjoying nature, Learning, Stimulation, Similar People, Achievement, and Risk Taking. A modified Sensation Seeking Scale (Zuckerman, 1979) was used to measure 16 sensation seeking attributes representing four dimensions: Thrill and Adventure Seeking, Experience Seeking, Boredom Susceptibility, and Disinhibition. A total of 50 responses were obtained.

Respondents were primarily white, male with a mean age of 42, and have no children. Nearly half of the storm chasers took the tour alone. Enjoying Nature and Learning were the most important motivations driving recreational storm chasing. Achievement was the least important motivation. Experience Seeking and Disinhibition were the sensation seeking dimensions with the highest average levels while Boredom Susceptibility was the one with the lowest average. This study enhanced our understanding of recreational storm chasing and participants in this activity, filling a gap in the risk-outdoor activities literature. Research findings are also useful for tour agencies in designing their future marketing strategies and management operations.

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Graduate Program: Forestry and Environmental Resources
Advisors: John S. King and Asko Noormets
Poster Number: 192

Investigation on Environmental Drivers of Soil Organic Matter (SOM) Decomposition-- A Lab Incubation Study on Soil Respiration from Lower Coastal Plain Forested Wetland

Lower coastal plain (LCP) ecosystems store and cycle a large amount of carbon. Soils from LCP ecosystems are high in organic carbon, and the large amounts of carbon are prone to be lost due to modified temperature and water properties caused by climate change. To understand the mechanism of soil carbon loss and to quantify "new carbon" and "old carbon" turnover under different climatic scenarios, we conduct a soil incubation study with controlled temperature (T) and soil volumetric water content (VWC) for 8 months. Soils from two depth levels (0-30cm & 45-75cm) were collected form LCP Loblolly Pine plantation site. Samples were incubated at three temperature levels with 2°C apart, and VWC were maintained at 20%, 30% and 40% for shallow soil and 10%, 20%, and 30% for deep soil. Weekly data of CO2 flux measurements shows both temperature and VWC significantly affect carbon loss, and the flux differences caused by T by VWC factors become less at the later time phase (5th month – 8th month). Three identical sets of samples were incubated and prepared for three time harvests. Each sample unit was fractionated into light (F≤1.0g/cm3), medium (1.0g/cm3<F2≤1.6g/cm3), and heavy fractions (F3>1.6g/cm3). 13C signatures examined for these fractions show lighter fractions have larger 13C signature, indicating lighter fractions from "younger" soil carbon pool. Changes in 13C signatures between first and second harvest suggest greater 13C signature increase happens in lighter fraction, and shallower soil. These facts indicate lighter fractions, as well as shallower soils turn over faster. The significant effect of temperature on the change of the 13C signature implies warming effect potentially accelerates soil decomposition.

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Graduate Programs: U.S. EPA Office of Research and Development, National Center for Computational Toxicology[1]; Statistics, North Carolina State University[2]
Advisor: Alison Motsinger-Reif
Poster Number: 8

A Bayesian Framework for the Analysis of Biological Signaling Pathways with Applications to Chemical Risk Assessment

The US EPA's ToxCast™ program seeks to combine advances in high-throughput chemical screening technology with methodologies from statistics and computer science to develop high-throughput decision support tools for assessing chemical hazard and risk. Of growing interest is how compounds perturb or affect biological pathways known to be associated with adverse outcomes. Traditionally, pathway perturbation has been studied by measuring a single biomarker at the apex or end of the pathway. However, we incorporated multiple biological endpoints available from the ToxCast data set to form a Bayesian network reflective of the known biological structure using the peroxisome proliferator-activated receptor (PPAR) pathway. PPAR has been shown to be associated with diabetes, obesity, atherosclerosis, and hepatotoxicity. This formulation integrates multiple sources of evidence about a chemical's PPAR activity with the well studied network structure to form a more robust inference framework that is less susceptible to assay failures, false positives, and false negatives. We demonstrate that this method is more able to reliably assess PPAR perturbation than a single endpoint can, and show further that quantities such as assay variance are able to be estimated where as previously they were not. This abstract does not necessarily reflect Agency policy.

Jennifer L. Dickson Brown
Graduate Program: Marine, Earth, and Atmospheric Sciences
Advisor: Christopher L. Osburn
Poster Number: 31

Optical Analysis of Chromophoric Dissolved Organic Matter as a Tracer of Organic Material in the Neuse River Estuary, Eastern North Carolina

This study presents the first extensive examination of the optical properties of chromophoric dissolved organic matter (CDOM) including spectral slope ratios (S_R) and fluorescence spectroscopy excitation emission matrices (EEM), in the Neuse River & Neuse River estuary. Samples from the Neuse River were collected from the MODMON sampling cruises which are conducted by the University of North Carolina at Chapel Hill-Center for Marine Science from February 2010 to February 2011. All samples were shipped to NC State University and filtered directly through 0.22 mm GF/F filters. Until the time of filtration samples were stored in coolers with ice packs. After filtrations DOC samples were immediately acidified to pH 2-3 with 85% H_3PO_4. CDOM samples were filtered into amber bottles and kept at 4 °C until absorption and fluorescence were measured on Varian Cary 300 and Eclipse instruments, respectively, using standard methods. In-lab mixing experiments were conducted after sample filtration had taken place. DOC and CDOM samples were processed with the same methods as mentioned above. In situ

samples, laboratory mixing experiments, & mathematical mixing models were performed to determine the conservative or non-conservative behavior of CDOM in the Neuse River. Further analysis on the compositional differences and peak ratios will also be examined to determine further trends seen in Neuse River. It is apparent that the composition and source of the CDOM is being altered; possibly by means of a hydrological, photochemical or microbial processes. EEM's and S_R values have proved useful in detecting different processing mechanisms of dissolved organic matter (DOM) occurring for estuarine systems like the Neuse River. S_R values and EEM's have revealed vital information on the chemistry and source of CDOM as it progresses down the river into the coastal ocean.

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Graduate Program: Chemistry
Advisor: Reza Ghiladi
Poster Number: 33

Spectroscopic Characterization of Protein Radicals in Dehaloperoxidase: The First Globin Peroxidase

Dehaloperoxidase (DHP) is the oxygen-transport heme protein found in the coelom of *Amphitrite ornata*, a terebellid polychaete that inhabits coastal environments contaminated with halophenols. In the presence of hydrogen peroxide (H_2O_2), both isoenzymes of DHP (A and B) have been shown to oxidize trihalophenols to less toxic dihaloquinones. As such, DHP is the first known globin that is also enzymatically active as a peroxidase. Our goal is to understand the mechanism of DHP as an important step towards using it for bioremediation purposes. In a theoretical study conducted by Thompson et al.[1] where electron-paramagnetic resonance (EPR) spectra were simulated for the reaction of wild-type (wt) DHP A with H_2O_2, it was concluded that Tyr^{34} (Y34) is the primary site of radical formation at pH 7. In order to explore that hypothesis experimentally, we report here the expression, activity assays, and spectroscopic characterization (stopped-flow UV-visible and EPR) of the following DHP mutants: DHPA (Y34F), DHPA (Y38F), DHPA (Y34F/Y38F), DHPB (Y38F), DHPB (Y28F/Y38F), and DHPB (Y28F). We found that all mutants formed the high-valent species Compound ES (Fe=O, AA•) except DHPB (Y28F/Y38F). Our results also suggested that when Y34 and Y38 were mutated, the intermediate Compound I (Fe=O, $Por^{+\bullet}$) was observed. Interestingly, mutants that formed Compound I exhibited improved catalytic efficiency when compared to the wild-type enzyme. For example, DHPA (Y34F/Y38F) was 3 times more efficient (k_{cat}/K_M=0.090 vs. 0.027 for wt DHPA) and DHP B (Y28F/Y38F) was 16 times more efficient (k_{cat}/K_M=0.114 vs. 0.070 for wt DHPA). Taken together, our results confirm the hypothesis from the theoretical study that Tyr^{34}, as well as Tyr^{38}, play an important role in the catalytic turnover of dehaloperoxidase.

[[1]Thompson et al. Compound ES of Dehaloperoxidase Decays via Two Alternative Pathways Depending on the Conformation of the Distal Histidine. *J. Am. Chem. Soc*. 2010. 132, 17501-17510.]

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Graduate Programs: Marine, Earth, and Atmospheric Sciences, North Carolina State University[1]; School of Earth and Atmospheric Sciences, Georgia Institute of Technology[2]
Advisor: Karl W. Wegmann
Poster Number: 42

Hillslope Response to Knickpoint Migration in the Southern Appalachians: Implications for the Evolution of Post-Orogenic Landscapes

The southern Appalachians represent an active landscape characterized by locally high topographic relief, steep slopes, and frequent mass wasting in the absence of significant tectonic forcing for at least the last 200 Ma. The fundamental processes responsible for such activity in a post-orogenic landscape remain enigmatic. The non-glaciated Cullasaja River basin of southwestern North Carolina, with uniform lithology, frequent debris flows, and the availability of high-resolution airborne lidar DEMs, is an ideal natural setting to study landscape evolution in a post-orogenic landscape through the lens of hillslope-channel coupling. We limit our investigation to channels with upstream drainage areas > 2.7 km^2, a conservative estimate of the transition from fluvial to debris-flow dominated channel processes. We utilize values of normalized hypsometry, hypsometric integral, and mean slope vs. elevation for 14 tributary basins and the Cullasaja basin as a whole to characterize landscape evolution following upstream knickpoint migration. Our results highlight the existence of a transient spatial relationship between knickpoints present along the fluvial network of the Cullasaja basin and adjacent hillslopes. Metrics of topography (relief, slope gradient) and hillslope activity (landslide frequency) exhibit significant downstream increases below the current position of major knickpoints. We capture the transient effect of knickpoint-driven channel incision on basin hillslopes by measuring the relief, mean slope steepness, and mass wasting frequency of tributary basins and comparing these results to the distance from major knickpoints along the Cullasaja River. We present a conceptual model of area-elevation and slope distributions that may be representative of post-orogenic landscape evolution in analogous geologic settings. Importantly, our model explains how knickpoint migration and channel-hillslope coupling is an important factor in tectonically-inactive orogens for the maintenance of significant relief, steep slopes, and weathering-limited hillslopes.

Timothy Glotfelty, Yao-Sheng Chen, and Yang Zhang
Graduate Program: Marine, Earth, and Atmospheric Sciences
Advisor: Yang Zhang
Poster Number: 47

Impact of Future Climate and Emissions on Air Quality

Tropospheric ozone (O_3) and particulate matter with aerodynamic diameter ≤ 2.5 μm ($PM_{2.5}$) are two major pollutants that impact our environment. They impact human health by penetrating deeply into the lungs and cardiovascular system, reducing lung function, and increasing the chance of heart attacks. O_3 is formed via chemical reactions involving nitrogen oxides (NO_x) and volatile organic compounds (VOCs). $PM_{2.5}$ is generated via primary emissions from wildfires, automobiles, and industry and reactions involving NO_x, sulfur dioxide (SO_2), ammonia, and VOCs. The purposes of this study are to understand the impacts of future climate and emissions on O_3 and $PM_{2.5}$, and to provide policy makers scientific information for the development of future emission control and climate mitigation strategies. To accomplish these goals, simulations are conducted for one current year (2001) and 5 future years (2010, 2020, 2030, 2040, and 2050) using the Global-through-Urban Weather Research and Forecasting model with Chemistry (GU-WRF/ Chem). The preliminary analysis indicates an increase of 10-20 ppbv in the maximum 8-hr average mixing ratios of O_3 over India, Indonesia, and South East Asia across all seasons. This is most likely resulted from increasing temperatures of 1-4°C and increasing emissions of NO_x and VOCs by factors of 1.4 and 1.5, respectively, in this region. $PM_{2.5}$ levels increase by 4 – 14 μg m^{-3} in India and Indonesia in all seasons. This appears to be driven by a factor of 2.1 increase in SO_2 emissions in all seasons and decreased precipitation in summer. In contrast, there is a decrease of 2 - 6 μg m^{-3} in $PM_{2.5}$ levels in most of Europe. This is due in part to a 20% decrease in $PM_{2.5}$ emissions. These results indicate that future climate and emissions will have a sizeable impact on global and regional air quality.

Megan Gore
Graduate Program: Marine, Earth, and Atmospheric Sciences
Advisor: Viney P. Aneja
Poster Number: 51

Assessing the impact of bi-directional ammonia transport on nitrogen fertilizer emissions and fate in the Eastern U.S.

Atmospheric ammonia (NH_3) plays a role in the formation of fine particulate matter and, at elevated concentrations, can have adverse effects on terrestrial and aquatic ecosystems *via* wet and dry deposition. Large uncertainties exist in quantifying NH_3 emissions, particularly from the agricultural sector, and modeling subsequent environmental processes. A pilot study assessing bi-directional NH_3 transport using the Community Multi-scale Air Quality (CMAQ) Model was completed to develop and test bi-directional flux algorithms, explore methods of providing agricultural fertilizer information (accounting for up to 40% of total agricultural NH_3 emissions) into CMAQ using a dynamic soil emission potential component, and clarify possible NH_3 and overall one-atmosphere chemical budget changes. The soil emission potential was calculated offline using commercial fertilizer application survey data and was then input to CMAQ for computation of the NH_3 air-soil compensation point and subsequent NH_3 flux. Two annual simulations for 2002, a bi-directional and a base (i.e., uni-directional) CMAQ v4.7.1 simulation, were run over the Eastern Continental United States. Results from the pilot study indicate that the soil and canopy flux in the bi-directional simulation have a spatial pattern similar to that of the base fertilizer emissions with a domain-wide increase in net NH_3 surface flux, decrease in dry deposition, and increase in wet deposition annually. With fertilizer use expected to increase, and the potential shifts in NH_3 emissions patterns due to an increased focus on bio-fuels production, accurate representation of NH_3 emissions and atmospheric processes will be essential to assessing regulation needs and abatement strategies in the future.

David Kendellen
Graduate Program: Physics
Advisors: Paul Huffman and David Haase
Poster Number: 86

Cryogenic Design for the nEDM Experiment

NC State Physics faculty and students are part of a collaboration that seeks to measure the electric dipole moment of the neutron (nEDM). A nEDM is an extremely small separation of positive and negative charge in the neutron's charge distribution. A measurement of the nEDM is a precision test of time reversal symmetry, probing the same physics believed to be responsible for the matter-antimatter imbalance in the universe. The proposed experiment at the Spallation Neutron Source at Oak Ridge National Laboratory will measure the nEDM in a three-component fluid composed of ultracold neutrons and polarized ^{3}He dissolved in liquid ^{4}He at 0.4 kelvin. A large ^{3}He-^{4}He dilution refrigerator will cool the measurement cells, as well as over 1000 liters of liquid helium.

At NC State we are conducting a supporting experiment to investigate cooling and thermal flows in liquid helium. At very low temperatures, liquid helium is a superfluid which flows with zero viscosity and creeps up the walls of containers. As the superfluid flows to warmer places and evaporates, it creates temperature and pressure gradients that drive large heat flows

back to the cold parts of the apparatus. In our test apparatus, we condense liquid helium in tubes of various sizes and geometries, measure heat flows and temperature gradients, and compare them with current models of superfluid films. The results will be applied in the final design of the experiment at ORNL.

Somsubhra Maity, Jason R. Bochinski, and Laura I. Clarke
Graduate Program: Physics
Advisor: Laura I. Clarke
Poster Number: 106

Use of embedded metal nanoparticles as photothermal heaters in polymer nanocomposites

Polymer composite materials (particles doped into a plastic matrix) have a wide variety of applications, ranging from common household items like clothing, appliances, and tires to highly specialized products such as space suit linings. Particularly for new "nanoscaled" structures where the polymeric material has features of nanoscale dimensions, the ubiquitous use of these materials requires development of novel processing strategies. Such applications address pertinent social needs such as development of new biomedical technologies or the refinement of materials needed for more efficient batteries. This research investigates the use of a particular type of composite, where metallic nanoparticles are embedded in a polymer. These nanoparticles exhibit the unusual property of producing significant heat when irradiated with visible light (at intensity similar to that of a laser pointer), even to the point that the surrounding matrix can be melted. This process can thus be utilized to process an existing polymer structure by softening, melting or bonding the plastic; such heating from within is particularly important for nanoscaled applications. Ultimately, this technique might be used to repair, strengthen or intentionally thermally degrade plastic objects while in service. We discuss our recent results, which demonstrate significant morphological changes due to melting and internal temperature rise (measured through a non-contact fluorescence-based technique) when utilizing photothermal heating by embedded metallic nanoparticles. These results indicate that temperature increases of ~100° C are possible in a variety of polymeric systems. The efficacy of plasmonic heating in different morphologies (nanofibers/films) as well as its effect on material mechanical properties when heated between T_g and T_m is discussed. The spatial specificity of the photothermal process determined by the nanoparticle location, alongside the capability to monitor and control the temperature variation using fluorescent probes, represents a unique nanoprocessing and nanothermometry tool.

Danny Modlin, Montse Fuentes, and Brian Reich
Graduate Program: Statistics
Advisor: Montse Fuentes
Poster Number: 116

Circular Conditional Autoregressive Modeling of Vector Fields

As hurricanes approach landfall, there are several hazards for which coastal populations must be prepared. Damaging winds, torrential rains, and tornadoes play havoc with both the coast and inland areas; but, the biggest seaside menace to life and property is the storm surge. Wind fields are used as the primary forcing for the numerical forecasts of the coastal ocean response to hurricane force winds, such as the height of the storm surge and the degree of coastal flooding. Unfortunately, developments in deterministic modeling of these forcings have been hindered by computational expenses. In this paper, we present a multivariate spatial model for vector fields that we apply to hurricane winds. We parameterize the wind vector at each site in polar coordinates and specify a circular conditional autoregressive (CCAR) model for the vector direction, and a spatial CAR model for speed. We apply our framework for vector fields to hurricane surface wind fields for Hurricane Floyd of 1999 and compare our CCAR model to prior methods that decompose wind speed and direction into its N-S and W-E cardinal components.

Rebecca Pirtle-Levy[1], Carrie Thomas[1], Laura Belicka[2], Rudolf Jaffe[2], and Dave DeMaster[1]
Graduate Programs: Marine, Earth, and Atmospheric Sciences, North Carolina State University[1]; Chemistry and Biochemistry, Florida International University, Miami, FL[2]
Advisor: Carrie Thomas
Poster Number: 135

Trophic Ecology of Antarctic Benthic Megafauna: A Lipid Biomarker Approach

Fatty acid biomarkers were used to examine the diet of dominant benthic megafauna along a latitudinal gradient (63°S-68°S) on the deep (500-600m) continental shelf of the western Antarctic Peninsula as part of the project FOODBANCS2. Samples of surface plankton, surface sediment, and body wall tissue from two dominant holothurian species (*Protelpidia* sp. and *Molpadia* sp.) were collected during July 2008 (winter) and February-March 2009 (summer) to assess biochemical responses to seasonal inputs of particulate organic matter (POM) to the benthos. Preliminary results indicate relative distributions of fatty acids in surface sediments and holothurian tissues are similar between seasons and along the latitudinal gradient. Polyunsaturated fatty

acids indicative of diatoms [16:1(n-7) and 20:5(n-3)] are prevalent in all sample types suggesting a source of labile POM to the benthos regardless of season or location. Bacterial markers (branched-chain 15:0 and 17:0) present in surface sediment and holothurian tissue suggest bacterial reworking might be an important factor in the trophic ecology of benthic deposit-feeders. The prevalence of diatom and bacterial markers is consistent with the presence of a year-round "food bank" for benthic deposit-feeders.

Monnat Pongpanich[1], Patrick F. Sullivan[2], and Jung-Ying Tzeng[1,3]
Graduate Programs: Bioinformatics, North Carolina State University[1]; Genetics, University of North Carolina at Chapel Hill[2]; Statistics, North Carolina State University[3]
Advisor: Jung-Ying Tzeng
Poster Number: 137

A quality control algorithm for filtering SNPs in genome-wide association studies

The quality control (QC) filtering of single nucleotide polymorphisms (SNPs) is an important step in genome-wide association studies (GWAS) to minimize potential false findings. SNP QC commonly uses expert-guided filters based on QC variables (e.g., Hardy-Weinberg equilibrium, missing proportion, and minor allele frequency) to remove SNPs with insufficient genotyping quality. The rationale of the expert filters is sensible and concrete, but its implementation requires arbitrary thresholds and does not jointly consider all QC features. We propose an algorithm that is based on principal component analysis and clustering analysis to identify low-quality SNPs. The method minimizes the use of arbitrary cutoff values, allows a collective consideration of the QC features, and provides conditional thresholds contingent on other QC variables (e.g., different missing proportion thresholds for different minor allele frequencies). We apply our method to the seven studies from the Wellcome Trust Case Control Consortium (WTCCC) and the major depressive disorder study from the Genetic Association Information Network (GAIN). We measured the performance of our method compared to the expert filters based on the following criteria: (a) percentage of SNPs excluded due to low quality, (b) inflation factor of the test statistics (λ), (c) number of false associations found in the filtered dataset, and (d) number of true associations missed in the filtered dataset. The results suggest that with the same or fewer SNPs excluded, the proposed algorithm tends to give a similar or lower value of λ, a reduced number of false associations, and retains all true associations.

Michael A. Robert[1], Mathieu Legros[2], Luca Facchinelli[3], Laura Valerio[3,4], Janine M. Ramsey[5,], Thomas W. Scott[3,6], Fred Gould[2,6], and Alun L. Lloyd[1,6]
Graduate Programs: Mathematics and Biomathematics, North Carolina State University[1]; Entomology, North Carolina State University[2]; Entomology, University of California, Davis[3]; Pasteur Institute-Cenci Bolognetti Foundation, University of Rome "Sapienza", Rome, Italy[4]; Centro Regional de Investigación en Salud, Instituto Nacional de Salud Pública, Cuernavaca, México[5]; Fogarty International Center, National Institutes of Health[6]
Advisors: Alun L. Lloyd and Fred Gould
Poster Number: 142

A Mathematical Model for Guiding Field Cage Experiments for Testing Transgenic Mosquitoes

Mathematical models have frequently been used as tools in pest management, primarily to utilize existing data to predict future field population dynamics and population genetics of insect pests. We demonstrate the further utility of models as aids in the design and assessment of experiments aimed at measuring the effects of proposed population control strategies. To emphasize the utility of models in designing economically efficient experiments for addressing specific questions, we describe the development and numerical exploration of a stochastic, age-structured model that simulates field cage experiments that test the ability of a transgenic female-killing (FK) strain of the primary vector of dengue fever, *Aedes aegypti,* to suppress a wild type population. Results show that choices of release ratio and population size can impact the mean extinction time and the variability in extinction time among experiments. We find that unless fitness costs are greater than 60% they will not be detectable in experiments with high release ratios. At lower release ratios the predicted length of the experiment increases significantly for fitness costs greater than 20-40%. We explore field cage designs that specifically aim to study the impact of density dependence and immigration; in some cases, predictions indicate that population eradication may not be obtainable in a realistic time frame. We propose a method to predict the extinction time of a population based on the rate of population reduction, with the goal of shortening the overall duration of the experiment. Our results highlight the utility of the model in designing future experiments as well as the role of the model in understanding the implications that the simulated cage experiments have for field releases.

Jessica L. Smeltz and Elon A. Ison
Graduate Program: Chemistry
Advisor: Elon A. Ison
Poster Number: 151

Experimental and Computational Investigation of the Mechanism for the Activation of CO by Metal Oxo Complexes

Activation of CO by the rhenium (V) oxo complex [((N(R)CH2CH2)2N(CH3))Re(O)(CH3)] (R = (a) C6F5, (b) 2, 4, 6 – trimethylphenyl), resulted in isolation of the rhenium (III) acetate complex [((N(R)CH2CH2)2N(CH3))Re(C(O)2(CH3))(CO)]. The mechanistic details of this reaction were explored experimentally and computationally. The novel oxorhenium (V) acyl intermediate, [((N(R)CH2CH2)2N(CH3))Re(O)(C(O)CH3)], was isolated in this reaction, and its reactivity with CO was investigated. An unprecedented mechanism is proposed: CO is activated by a metal oxo complex and is inserted into the rhenium methyl bond to yield the acyl complex; then, the acyl ligand migrates to the metal oxo to yield the acetate complex.

Kimberly Spayd
Graduate Program: Mathematics
Advisor: Michael Shearer
Poster Number: 153

Two-Phase Flow in Porous Media with Dynamic Capillary Pressure

The Buckley-Leverett equation for two-phase flow in a porous medium was formulated in the 1940s to model the dynamics of water and oil in porous rock or compacted sand. In its original form, the equation is a scalar conservation law expressing the unidirectional nonlinear transport of the two phases through a medium with uniform porosity. Buckley and Leverett effectively use the method of characteristics to solve initial value problems and deduce the breakdown of smooth solutions, giving rise to sharp interfaces or shock waves smoothed by the effect of capillary pressure. This pressure has typically been treated as though interfacial forces equilibrate on a fast time scale, an assumption brought into question by Gray and Hassanizadeh, who formulated a dynamic capillary pressure law, which includes a dependence on the rate of change of saturation. In this research, we study solutions of the Buckley-Leverett equation with unidirectional nonlinear transport and dynamic capillary pressure. The resulting pseudo-parabolic partial differential equation includes dissipative and dispersive terms. We analyze traveling wave solutions in the case in which relative permeabilities are quadratic functions of saturation. Phase plane analysis, including a separation function to measure the distance between invariant manifolds, is used to determine when the equation supports traveling waves corresponding to undercompressive shocks. The Riemann problem for the underlying conservation law is solved using this information about traveling waves to identify admissible shocks. To verify the structures of these solutions, numerical simulations of the full partial differential equation are generated with an implicit finite difference scheme.

Chuan Tian[1], Changhoon Lee[1], Hongjun Xiang[2], Yuemei Zhang[1], Christophe Payen[3], Stéphane Jobic[3], and Myung-Hwan Whangbo[1]
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Advisor: Myung-Hwan Whangbo
Poster Number: 165

Investigation of the magnetic structure and ferroelectric polarization of the multiferroic compound $MnWO_4$ by first principles Density Functional Theory calculations

The coexistence of the ordered magnetism and ferroelectric polarization in multiferroics makes it potential for applications such as magnetic field sensors or new types of electronic memory devices. In this work, we find the cause of the magnetic ordered ground state of the multiferroic compound $MnWO_4$ on the basis of first principles density functional calculations. We also explain its ferroelectric polarization in the spiral spin state. We construct ten ordered magnetic states of $MnWO_4$ at low temperatures, and evaluate the spin exchange interactions between the Mn^{2+} ions of $MnWO_4$ by mapping analysis. Our spin exchange parameters show that the intrachain spin exchange interactions along the c-direction are frustrated, and so are the interchain spin exchange interactions along the a-direction, which explains the experimental observation that a spiral-spin propagates along the c- and the a-directions in the incommensurately ordered magnetic state AF2, and a $\uparrow\uparrow\downarrow\downarrow$ spin arrangement occurs along the c- and a-directions in the ordered magnetic state AF1. The Berry phase calculations for a model superstructure with spiral-spin order simulating the spiral-spin state AF2 show ferroelectric polarization along the b-direction, in agreement with experiment.

Yukihisa Tokunaga
Graduate Program: Physics
Advisor: Chueng R. Ji
Poster Number: 167

Relativistic Two-Body Bound States on the Light-Front

Nucleons inside the subatomic nucleus are bound themselves interacting strongly within the short distance far smaller than the angstrom size of an atom. The particles with such a short wavelength cannot but experience the ultra high momentum or move as fast as the speed of light according to their subatomic quantum nature. Thus, the bound nucleons in nuclear physics provide a paramount testing ground for the practice of Einstein's special relativity. Since Albert Einstein published his seminal paper on the special relativity in 1905, Paul Dirac proposed a few different forms of relativistic Hamiltonian dynamics in 1949. One of the proposed forms, known as the light-front form of the relativistic Hamiltonian dynamics, or briefly light-front dynamics (LFD), carries distinguishing features such as the clean vacuum structure as well as the invariance of the simultaneity since it utilizes the light-front coordinate t+z/c (instead of the ordinary time t) as the evolution parameter. Thus, one may have high hopes on the LFD in solving the relativistic bound-state problem of the nuclear physics as well as in dealing with the strong force and interactions for any other areas of science. In this presentation, we report our recent findings in the simplest possible relativistic two-body bound-state problem that can be applicable in the realistic nucleus such as the deuteron as well as any other nuclei that may be effectively modeled as a two-body bound state. We will discuss the energy shifts and the corresponding wave-function deformation due to the multi-quanta mediating the strong force and interactions.

Amanda L. Traud
Graduate Program: Biomathematics
Advisors: Robert Dunn and Alun Lloyd
Poster Number: 169

Brown-ANT-ian Motion: Ant Social Structure

Communication is an integral part of living in a group, especially for animals that need to complete large tasks like ants. Studying the interaction of ants within a single colony can help us to understand the both the social structure of these small creatures and how this structure may affect disease and information flow. Here we focus on interactions of individuals within colonies, in small groups of comparable size to other social animals, like wolves, giraffes, and prairie dogs. We studied the interactions among individuals by observing one communication type, antennation. As a first step towards understanding the nature of interactions between ants, we compared their motion to a null model, namely Brownian motion, for which meetings between individuals have no impact on their movements. Future work will involve developing a description of how movement of an ant is affected by encounters with other ants.

Katherine Weaver[1], Helena Mitasova[1], Margery Overton[2], and Laura Tateosian[3]
Graduate Programs: Marine, Earth & Atmospheric Sciences[1]; Civil, Construction, and Environmental Engineering[2]; Center for Earth Observation[3]
Advisor: Helena Mitasova
Poster Number: 186

Investigating the Evolution of Jockey's Ridge Sand Dune Using Modern Geospatial Techniques

Jockey's Ridge State Park, located along the Outer Banks of North Carolina, is home to the largest active sand dune on the Eastern coast of the United States. LiDAR surveys and aerial photographs have provided high resolution data enabling accurate analysis of its complex evolution. Previous studies indicated that this dune evolved over a short time period, growing from 1900-1950 and losing half its elevation from 1950-2001, while annually migrating 3-6 meters south. Recent LiDAR surveys allowed for further analysis and quantification of the dune evolution using geospatial techniques which verified the predicted deflation, stabilization and southerly migration of the dune. In addition, aerial photography was used to extract land use and land classes to determine how vegetation and urbanization have affected its evolution. The increase in vegetation and urbanization may play a role in the evolution by limiting the sand source which originally fed the dunes. Ongoing studies combine LiDAR, aerial photography, historical elevations, and climatological data to further investigate the relationships between dune evolution and the increase of vegetation and urbanization, storms, and climate change.

As part of our dune evolution analysis, we are investigating the impact of changes in dune topography on storm surge flooding using a tangible geospatial modeling system (TanGeoMS). TanGeoMS integrates a 3D laboratory laser scanner, a scaled physical model, and a projector with GRASS GIS. We manipulated the model's clay surface by hand to simulate land management and natural impacts such as sand relocation and foredune breaches. Then we rescanned and calculated flood simulations on the modified landscape. We projected the results of simulations over the model, providing feedback on the impact of the manipulations and guiding further exploration. LiDAR-based geospatial analysis and TanGeoMS provides valuable results that coastal managers and researchers can use for land-use planning, coastline protection, and emergency response.

Aasim Ahmed Atiq[1] and Maqbool Hussain[2]
Graduate Programs: Textile Chemistry[1]; Fiber and Polymer Science[2]
Advisor: Ahmed El-Shafei
Poster Number: 3

Influence of Anchoring Group Location in Ru-based Polypyridyl Sensitizers on the HOMO/LUMO Gap and Total Solar-to-electric Conversion Efficiency for Dye-sensitized Solar Cells

Two novel isomers of heterolyptic Ru(II) bistilbazole-based sensitizers were synthesized to study the effect of isomerization of anchoring group (COOH) on the excited state life time, incident-photon-to-current conversion efficiency (IPCE) curve and total solar-to-electric conversion (η) of sensitizers for dye-sensitized solar cells (DSSCs), and their performances were compared to the state-of-the-art **N-719**. The sensitizers were purified to obtain the N-bonded isomers and were characterized using FT-IR, $^{-}$ESI-MS, UV-Vis, ^{1}H-NMR, emission spectroscopy, Time-correlated Single Photon Counting (TCSPC), for measuring the lowest-excited state life time, and electrochemical techniques. To gain more insight and deep understanding of the effect of degree of protonation of the anchoring group (COOH) on the Fermi level of TiO_2, open-circuit potential and short-circuit photocurrent density of the device, the monoprotonated and diprotonated forms of each sensitizer was loaded on a TiO_2 film, and its IPCE and total solar-to-electric conversion (η%) were measured and compared to **N-719**.

Jiaxing Bao[1], Laura I. Clarke[2], and Russell E. Gorga[1]
Graduate Programs: Textile Engineering, Chemistry, and Science[1]; Physics[2]
Advisors: Russell E. Gorga and Laura I. Clarke
Poster Number: 6

Role of fiber mat morphology on electrical properties of composite nanofibers

It is well established that the addition of multiwall carbon nanotubes (MWNTs) can enhance the mechanical and conductive properties of nanostructured polymeric fibrous webs. For instance, electrospun polymer/nanoparticle composite-fiber structures have been reported as potential light-weight strain sensors in filters, where the electrical current through the web is proportional to the strain. However, most electrical measurements on these materials have utilized relatively short length scales, which would not be the case in an application setting. We report conductance measurements on reasonable length scales using a reliable and sensitive testing method. Thermal bonding is utilized to slightly modify the web morphology and improve inter-fiber connection for electron transfer. The specific objective of this work is to study conductivity as a function of multiwall nanotube loading and annealing temperature, observing how the system transitions from nonconductive to conductive as a network of conductive nanotubes forms within the insulating polymer matrix. Multiwall nanotubes were dispersed with the help of dispensing agent Gum Arabic and ultrasonication. Poly (ethylene-oxide) composite webs of varying loadings of MWNTs were synthesized by electrospinning for an extended time to produce a sufficiently thick porous web. Conductance and conductivity of composite webs have been studied and their reliability and reproducibility have been investigated, for instance, by observing a linear increase in conductance with thickness when holding other parameters constant. The effect of annealing on conductivity has been studied by heating to slightly below the polymer melting temperature. Furthermore, morphology and tensile properties of composite webs have been characterized to better understand the possible mechanisms associated with conductance changes. At a MWNT concentration of 3wt%, conductivity is nearly six orders of magnitude higher than the un-doped polymer.

Hammad A. Cheema
Graduate Program: Textile Engineering, Chemistry and Science
Advisors: Ahmed El-Shafei and Peter J. Hauser
Poster Number: 24

Synthesis, Characterization, and Application of Novel Bi-functional Halogen-Free Phosphorus-based Flame Retardant Monomers

Flame retardants for textiles are required because of the critical advantages they can offer to safe life and property losses. In United Sates only fire has killed more people than all natural disasters combined. According to the National Fire Protection Association (NFPA) statistics for 2009 of fires happened in USA, 28% of total fires were happened in residential structures. These fires resulted in 86% of total deaths out of 3017, 77% of total injuries out of 17,050 people and 62% of total value for property losses of 12.5 billion. The NFPA has identified upholstered furniture, curtains, mattresses and bedding material as the major cause of fire in residential structures after electrical cables and flammable liquids.

The most common flame retardant systems for rendering textiles flame retardant are halogen containing compounds. Halogen-based compounds are not environmentally friendly because they generate toxic gases, which are endocrine disruptive. Recently, phosphorus-nitrogen-based flame retardant systems have attracted more attention in the academia and industry

because of their good thermal stability, low toxicity, and superior performance owing to the synergistic effect of nitrogen and phosphorous. Two of the widely used phosphorus based- flame retardants are Tetrakis(hydroxy methyl phosphonium chloride (THPC) and Pyrovatex. However, THPC requires a very special ammonia-based application method and equipment where Pyrovatex does not have good wash fastness properties. Hence, flame retardants that are durable to washing, halogen-free, efficient in performance, easy to apply and benign to the environment are in high demand. Hence, the main thrust of this work is two-fold, the synthesis of novel phosphorous-nitrogen containing monomers and their applications on cotton via atmospheric plasma-induced graft polymerization. Two novel phosphorous-nitrogen flame retardant monomers were synthesized and characterized in our laboratory. The synthetic routes and the application process, using atmospheric plasma on cotton, for these monomers will be presented.

Alper Gurarslan
Graduate Program: Textile Chemistry
Advisor: Alan E. Tonelli
Poster Number: 54

Polymers Nano-structured with Cyclodextrins are Telling Us Something

Cyclodextrins (CD) are cyclic polysaccharides with nano-size cavities. Threading through and filling their cavities with polymer chains produces non-covalently bonded inclusion compounds (ICs). In this study, we formed fully covered, stoichiometric poly(L-lactic acid): and Nylon-6: α-CD-ICs. Coalesced samples of both polymers were obtained after appropriately removing the stacked α-CD host channels from their α-CD-ICs. Distinct DSC thermograms were observed for as-received and coalesced samples of both polymers, with the coalesced samples crystallizing faster at higher temperatures, and this distinction was maintained even after extensive [long-time (hours,days)] melt-annealing. We believe this is due to the un-entangled and extended conformations of chains in the coalesced samples. When small amounts (2-2.5 wt%) of the coalesced polymers are employed as self-nucleating agents for their as-received samples, the self-nucleated polymers show DSC thermograms similar to those of the neat coalesced polymers, including their stability to melt-annealing. Coalesced polymers and the samples they self-nucleate conserve their organization (extended and un-entangled chains) in the melt for long periods, because the process of entangling the many chains influenced by a single initially coalesced chain, after it has randomly-coiled, is extremely sluggish. By contrast, in melt-crystallized or solution-cast samples, polymer chains generally become fully randomly-coiled and entangled after being heated and held in their melts for short times. We have recently observed (DSC) that Ultra high MW gel-spun Spectra-PE fibers did not conserve or retain their as-spun and drawn semi-crystalline morphology even after spending just 2 minutes in the melt. As a consequence, we believe that PE chains in Spectra fibers must be at least partially coiled and entangled, thereby facilitating the rapid formation of a full entanglement network in the melt.

Ting He
Graduate Program: Textile Management and Technology
Advisors: Martin W. King and Nancy B. Powell
Poster Number: 62

3D Textile Scaffolds for Tissue Engineering Applications Using Warp Knitting Technology

The success of regenerative medicine requires the design of tissue engineering (TE) scaffolds, which promote cell growth and cellular regeneration of viable tissues and organs by harnessing the body's inherent natural capacity to repair injured tissues. This calls for a 3D macrostructure that is highly porous and a microstructure that induces cells to attach, proliferate and regenerate complex tissues. In this study, the latest textile warp knitting technology has been used to create these 3D macrostructure scaffolds, which have appropriate mechanical properties and support the adhesion and proliferation of cells for use in a wide range of TE applications. The objectives were to design and produce biocompatible porous spacer fabrics and to evaluate the architecture, mechanical properties, cell viability and functionality of these textile structures. Four 3D spacer fabric prototypes using a multifilament 150 denier polyester yarn have been knitted on a Karl Mayer double needle bed warp knitting machine with different gauges (12 and 24 needles per inch) and guide bar numbers (4 and 6) so as to knit scaffolds with diverse properties. The spacer fabrics have a sandwich construction with surface and filling layers providing ideal 3D pores for cell growth. The morphology and architectural geometry have been visualized by optical microscopy and scanning electron microscopy (SEM). The scaffold's performance has been studied in terms of porosity, compression and recovery, thickness, stiffness and bursting strength, and has been found to change according to the knitting parameters. The results of cell viability and proliferation studies using MTT assays, laser scanning confocal microscopy (LSCM) and SEM have confirmed active cell growth and proliferation throughout the thickness of the scaffolds. This study has shown an effective and novel application of knitted porous spacer fabrics as tissue engineering scaffolds with the advantage of promoting the attachment and proliferation of cells in three dimensions.

Maqbool Hussain
Graduate Program: Fiber and Polymer Science
Advisor: Ahmed El-Shafei
Poster Number: 72

Molecular Engineering and Synthesis of Novel and Highly Efficient Light Harvesting Ru-based Sensitizers for Dye-Sensitized Solar Cells

Two novel heterolyptic Ruthenium (II) bipyridyl-based sensitizers (NCSU 5a-b) were synthesized in 85-91% yield. The sensitizers were purified to obtain the N-bonded isomers and were characterized using FT-IR, ESI-MS, UV-Vis, ^{1}H-NMR, and emission spectroscopy. The effect of different auxochromes (RO) on the excited state life time, incident-photon-to-current conversion efficiency (IPCE) curve and total solar-to-electric conversion (η) of sensitizers for dye-sensitized solar cells (DSSCs) were studied, and their performances were compared to the state-of-the-art N-719 dye under the same conditions. The NCSU 5a-b showed better molar absorptivity, stronger emission and more red shift than that of N-719. Moreover, comparison between the incident-photon-to-current efficiency (IPCE) conversion curves of N-719 and NCSU 5a-b sensitizers showed that both sensitizers (NCSU 5a-b) harvest more photons and inject more electrons into the conductions band of titanium dioxide than the benchmark N-719 dye.

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Poster Number: 84

Design, Characterization and Processing of Carbon Nanofiber-modified PVC as Fabric Sensor Composite

Increasing demand of mobile devices and recent innovations in functional fibers and polymers have lead to an entirely new field of research and product development referred to as electronic textiles or e-textiles. E-textiles offer one or more electronic functionality with commonly desired attributes such as flexibility, conformability, etc. Although electronic textiles have many potential applications including sensing, data processing, actuation, and energy storage or generation; integrated sensing capability with flexibility and environmental stability are the key elements for future e-textile products. Textile based sensors can be used to provide an interface between the user and the electronic system by converting any type of physiological or environmental signal into electrical signals. Common applications include health monitoring, rehabilitation, multimedia, and surveillance.

In this research we demonstrate fabrication of piezoresistive sensors on textile fabrics through application of a screen-printed conductive nanocomposite layer of plasticized poly(vinyl chloride) (PVC), and carbon nanofiber (CNF). The PVC/CNF nanocomposite exhibits significant sensitivity to applied strain. The effect of nanocomposite structure on the sensor response is also evaluated. [Supported by National Science Foundation, #CMMI-0700700, Program Name: Materials Processing and Manufacturing]

Ying Li
Graduate Program: Fiber and Polymer Science
Advisor: Xiangwu Zhang
Poster Number: 100

Si/C nanofiber composite anodes for new-generation rechargeable lithium-ion batteries

To reduce the gaseous emissions from the burning of fossil fuels and meet the ever-growing need for high energy and high power, rechargeable lithium-ion batteries have attracted more and more attention. Lithium-ion batteries are one of the most promising energy storage devices due to their high energy density, long cycle life, high voltage, and excellent rate capability. However, commercial lithium-ion batteries are using graphite as anodes, and graphite only has a theoretical capacity of 372 mAh/g. To increase energy density and performance of lithium-ion batteries, alternative anode materials with higher capacities are needed.

Si is a promising anode material due to its extremely large theoretical capacity of 4200 mAh/g. However, the practical use of Si anodes is hindered by the structural failure of the material during charge/discharge cycling caused by the large volume changes. In our group, we have developed a new type of nanofiber composite anode formed by embedding Si nanoparticles in electrospun carbon nanofibers. Electrospinning is a convenient and low-cost technology to make nano-scale materials. Embedding Si nanoparticles in electrospun carbon nanofibers allow them to withstand large volume changes during cycling.

In this presentation, we discuss the effect of particle dispersion and carbonization temperature on the electrochemical performance of Si/C nanofiber composite anodes made from electrospun 10, 15 and 20 wt % Si/polyacrylonitrile (PAN) precursors. The carbonization temperatures used were 700, 800 and 900 °C, respectively. The morphologies of Si/C nanofiber

composite anodes were examined by scanning electron microscope. The structure of Si/C nanofiber composite anodes was also investigated by X-ray diffraction. Si/C nanofiber composite anodes have been assembled into laboratory-scale coin-type cells and their electrochemical performance has been investigated by carrying out galvanostatic charge-discharge experiments at different current densities. These nanofiber composite anodes exhibited good electrochemical performance in terms of large reversible capacity and relatively good capacity retention.

In summary, Si/C nanofiber composite anodes made from electrospun Si/polyacrylonitrile (PAN) precursors are promising anode candidate for practical lithium-ion batteries.

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Poster Number: 108

Durable Plasma-Induced Graft Polymerization of C6-Fluorocarbo Monomers on Nonwoven Substrates for Fuel Filtration Applications

C6-fluorocarbon monomers plasma induced graft polymerization were performed on nonwoven poly(ethylene terephthalate) (PET) webs for high-performance fuel filtration media. Different nanolayer thicknesses (80-350nm) of the grafted polymer were furnished to generate surfaces with different wettabilities for water/fuel separation of different fuel compositions. The effect of different plasma conditions and device parameters including the flow rate of monomers, power of the device, and time of plasma exposure on the repellency performance of the webs was studied and characterized by measuring the surface energy of the treated substrates against liquids having different surface tensions. The surface chemistry and morphology of the treated samples were characterized using XPS, SEM, TOF-SIMS and the hydrophobic performance was evaluated by measuring the dynamic and static contact angles and water intrusion pressure resistance of the webs.

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Advisor: Russell E. Gorga
Poster Number: 124

Development and optimization of an alternative electrospinning process for high throughput

Nanofibrous materials, such as those fabricated through electrospinning, have diverse applications including filtration, tissue scaffolding, autonomous sensors within textiles (smart textiles), and fuel cells. In the traditional electrospinning process, fiber growth originates from a confined geometry and the fabrication rate is very slow (0.01 – 0.1 g/hr). This small material throughput limits widespread industrial implementation, despite the high commercial potential for fibers of this size (~100 nm). Approaches to scale-up the nanofiber production rate can be categorized as confined or unconfined based on the feed system. In addition to innate complexity present in both systems, confined systems typically have potential clogging problems while unconfined systems often require higher electric fields and produce larger diameter nanofibers. In this present work, we demonstrate a simple edge-plate electrospinning geometry, which represents an easily implemented unconfined system to produce fibers that are of similar high quality to a confined system but offers great potential for scaling-up the production rate without clogging the feed apparatus. We compare the electric field distribution, polymer jet profiles, and fiber diameter distribution of traditional and edge-plate electrospinning geometries and show that they work in a remarkably similar manner. We extend the edge-plate fundamentals and design a novel configuration, namely bowl electrospinning. Our bowl electrospinning experiments with polyethylene oxide (PEO) produce fibers of ~250 nm in diameter having the same quality as fibers from the traditional single needle technique while demonstrating a ~40 times higher production rate.

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Poster Number: 163

Modeling the Interfacial Phenomena of Polymer-SWCNT Interactions Via Molecular Dynamics Simulations

Polymer nanocomposites are novel materials that possess the reinforcements of size less than 10 nm in at least one of the dimensions. Nanocomposites containing single walled carbon nanotubes (SWCNTs) also possess excellent directional properties due to high aspect ratios of the reinforcement particles. Polymer nanocomposites can be multi-functional materials with significant strength and conductivity improvements with very low addition of SWCNTs. The synergy of the properties, however, heavily depends upon the interfacial phenomenon of the polymer-SWCNT structures. Molecular dynamics studies on these systems match the length and time scale of many of the events that occur during interfacial ordering and adhesion. The studies

presented detail the behavior of several polymer chains composed of a variety of chemical compositions in the vicinity of the SWCNT. The effect of aliphatic, aromatic and steric side groups is discussed in detail. The reinforcement (SWCNT) being about the same size of a typical polymer chain, ordering about the nanoparticles can be a significant contributor to the mechanical properties. Heterogeneous nucleation behavior of the SWCNT, as reported in several articles, is studied for polyamide-6/SWCNT system due to the commercial relevance of polyamide-6 polymer. Ordering in the system and remarkable increase in hydrogen bonding is reported using pair distribution functions. These studies capture the molecular detail of the interfacial interactions between polymers and SWCNTs and present evidence for nucleation due to the presence of SWCNT in polymer bulk.

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Poster Number: 7

Maternal Serum Progesterone Concentration and Early Conceptus Development in Bovine Embryos Produced In Vivo or In Vitro

The majority of pregnancy loss in cattle occurs early in development during the first two to three weeks of pregnancy. Progesterone likely plays a vital role in stimulating the production of endometrial secretions crucial for proper embryo development. The objective of this study was to examine the relationship between maternal serum progesterone levels at the time of embryo transfer on early conceptus development from in vivo or in vitro produced embryos. Embryos were produced in vivo by superovulation of Holstein cows (IVO) or in vitro with serum-containing (IVPS) or serum-restricted media (IVPSR). Single Grade 1 blastocysts from each embryo production system were transferred into heifers at Day 7 and conceptuses were recovered at Day 17 of gestation. Maternal serum progesterone concentrations were determined by radioimmunoassay and compared to conceptus development outcomes. Sex of conceptus was determined by PCR using a Y-chromosome specific probe. Data were analyzed for effect of treatment using Fisher's Exact Test, ANOVA and Duncan's Multiple Range Test. There was no effect of treatment for recipient progesterone concentrations within male and female conceptuses. Compared to in vivo controls, in vitro produced embryos had more ($P=0.055$) degenerated conceptuses (IVO, 0%; IVPS, 18.5%; IVPSR, 20.6%). Interestingly, in vitro treatment groups had lower ($P<0.01$) progesterone concentrations when no conceptus was recovered (Least-squares mean±SEM; IVPS, 2.12±0.42 ng/mL; IVPSR, 2.71±0.35 ng/mL) compared to in vivo controls (4.51±0.57 ng/mL). There was no difference in progesterone concentration between treatment groups for shorter conceptuses (≤194 mm). However, heifers with in vitro produced embryos had lower ($P<0.05$) progesterone levels than in vivo controls for longer (>194 mm) conceptuses (IVPS, 2.21±0.63 ng/mL; IVPSR, 2.32±0.54 ng/mL; IVO, 3.93±0.63 ng/mL). In conclusion, serum progesterone concentrations in recipients at the time of transfer of in vivo or in vitro produced embryos were associated with conceptus development at Day 17 of gestation.

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Advisor: Matthew Breen
Poster Number: 32

Exploration of wild canid genomes using chromosome-specific probes show they share evolutionary breakpoints

Evolutionary breakpoints (EBPs) may reflect naturally occurring fragile regions that have been reused as part of evolutionary related translocation events. In human cancers, common translocations often span EBPs and it has been theorized that the chromosomal reorganization events leading to speciation may also be associated with cancers. In this context, we study genome organization in the Canidae, a group with chromosome numbers ranging from 2n=34+Bs in the Red Fox *Vulpes vulpes* (VVU) to 2n=78 in the domestic dog (*Canis familiaris*-CFA) and other wolf-like canids. Studies have suggested this karyotypic range developed via breakage-fusion events involving whole-arm segments during speciation and reflects a high rate of karyotypic evolution since their divergence from a common ancestor 10-12 million years ago. We have chosen to explore canine EBPs using multicolor fluorescence *in-situ* hybridization analysis to physically map groups of CFA-derived bacterial artificial chromosome (BAC) clones to the karyotypes of eleven species of wild canid. In this process each BAC has been integrated into the dog genome assembly and the chromosome specific panels comprise clones spaced at 1-10 Megabase (Mb) intervals along the length of each dog chromosome. As the panels were hybridized to test species, the order of hybridization signals revealed the orientation of the CFA-syntenic regions. Shared EBPs were narrowed to 1-2Mb regions and compared across each species. Here we present the EBPs found in CFA13-syntenic regions and the patterns preserved across the Canid genome. Our work has shown that breakpoints between chromosome segments involved in karyotypic reorganization in the canids are shared, and the pattern of karyotype reorganization corresponds to accepted phylogenetic groupings. These EBPs are also shared across non-Canid genomes and may represent naturally occurring fragile regions that are also involved in cancer.

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Poster Number: 38

MRSA Trans Infection Between Companion Animals and Outpatients

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a significant pathogen in both human and veterinary medicine. It can cause a broad range of clinical symptoms including lethal infections. The importance of companion animals as reservoirs of human infections is currently unknown. The objective of this project was to investigate the significance of pets/companion animals as sources of MRSA infection or re-infection for human outpatients.

Forty nine MRSA-positive human patients seen at a large southeastern United States hospital were identified and served as study cases. Cases were defined as human outpatients treated for culture-confirmed MRSA infections who had a companion animal in their residence. Identified and consenting subjects were visited at their homes and nasal and rectal samples were collected from their animal(s) to determine MRSA status. A control population consisted of dogs and cats owned by NCSU students and staff who were visiting a "wellness clinic" to obtain pet vaccinations and routine medications. Occurrences of MRSA-positives were compared for human and animal case and control populations.

Four of 49 MRSA-infected patients (8.2%) had MRSA-positive companion animals. In contrast, no MRSA was found in the control population of 50 humans and 75 animals (45 dogs and 30 cats). Using pulsed field gel electrophoresis, MRSA isolates in patient and animal pairs were found identical in 3 pairs and different in 1 pair.

These results suggest that companion animals of MRSA-infected patients can be culture-positive for MRSA, representing a potential source of infection or re-infection for humans. Further studies with a larger cohort would contribute to an understanding of the epidemiology of MRSA human animal trans-infection.

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Poster Number: 53

The unique contribution of the aquatic shredding insect, *Tipula*, to organic matter in streams

Shredding insects play an important role in the breakdown of leaf litter that falls into streams. They produce a significant portion of fine particulate organic matter (FPOM) and dissolved organic matter (DOM) in rivers by processing the leaf litter through various feeding methods. The products of this process provide important nutrients for other animals downstream. Different detritivores contribute differently to the organic matter particulates. Controlled laboratory studies with three genera of shredding insects (*Pteronarcys*, *Tipula*, *Pycnopsyche*) were conducted to assess differences in particulate and dissolved material production. At four time points over a period of three weeks, water samples were taken from tanks containing the separate genera of insects. These samples were analyzed by three methods. We used flow cytometry to count the number of particles in the sample, absorbance spectroscopy to measure concentration of light-absorbed DOM and determine complexity of these particles, and fluorescence spectroscopy to study chemical composition changes over time. *Tipula* significantly increased FPOM and light-absorbing DOM concentrations over controls. Spectral slopes of the absorbance data showed that *Tipula* create more complex DOM molecules. Gut bacteria may be responsible for this increased particle complexity, likely from microbial attachment. *Tipula* were found to change the DOM chemical composition by increasing protein content over time. *Pycnopsyche* also increased protein content over time, but not as much as *Tipula*. Increased protein content indicates increased bacterial concentration. *Tipula's* contribution to FPOM and DOM exceeded that of the two other insects tested. These animals may provide a more important ecological contribution to the river ecosystem than previously thought. *Tipula's* unique processing of FPOM and DOM likely provides some of the nutrients important for the overall health of other aquatic species in river ecosystems.

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Advisors: Adam Birkenheuer, Michael Levy, and Shila Nordone
Poster Number: 101

Expression and function of triggering receptor expressed on myeloid cells-1 (TREM-1) on canine neutrophils

The triggering receptor expressed on myeloid cells-1 (TREM-1) is a newly discovered cell surface molecule expressed on neutrophils, mature monocytes and macrophages. Activation of TREM-1 synergistically enhances proinflammatory cytokine production induced by toll-like receptor (TLR) stimulation. A soluble form of TREM-1 has shown promise as a sensitive and specific biomarker for sepsis in humans. However, expression and function of TREM-1 in the dog has yet to be characterized.

Here we describe, for the first time, the expression of function of TREM-1 on canine neutrophils. In vitro, expression of TREM-1 on canine neutrophils is significantly up-regulated by stimulation with microbial agonists of TLR2/6 (Pam2CSK4), TLR1/2 (Pam3CSK4), and TLR4/MD2 (ultra pure LPS and wild type LPS). Kinetics of TREM-1 protein up-regulation are rapid, with significant increases observed within 2h of neutrophil activation. In contrast, IV administration of LPS to dogs resulted in a significant decrease in TREM-1 expression on neutrophils from 6h through 12h and a significant increase after 72h post LPS administration. The disparity between in vitro and in vivo effects of LPS suggest other factors, such as systemic and local cytokine production and neutrophil turnover, may influence expression and shedding of TREM-1 on canine neutrophils. Functionally, canine TREM-1 synergistically enhances LPS-induced production of IL-8, TNF-α and a canine homologue of CXCL1. Collectively, these data suggest that TREM-1 expression in dogs, as it is in humans, is an amplifier of pro-inflammatory responses to microbial products. These results have direct application to veterinary diagnostics as well as the potential to enhance the utility of canine disease models in the assessment of potential therapeutics in the treatment of human sepsis.

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Poster Number: 126

Indomethacin induces gastric epithelial barrier dysfunction via a p38 MAPK-dependent mechanism in MKN-28 cells

Tight Junctions (TJ) create a paracellular barrier that is compromised when nonsteriodal anti-inflammatory drugs (NSAIDs) injure the gastric epithelium, leading to increased permeability. However, the mechanism of NSAID-induced gastric injury is unclear. Here, we examined the effect of the NSAID indomethacin on gastric mucosal barrier function and tight junctions in MKN-28 cells. In dose response studies, 500μm indomethacin induced an approximately 50% decrease in transepithelial resistance (TER; 45.7 vs. 24.4 Ω·cm ^{2} for control and indomethacin-treated cells respectively, $p<0.05$), and increased dextran permeability by approximately 90% ($p<0.05$). Both the indomethacin-mediated drop in TER and increase in dextran permeability were completely prevented by the p38 inhibitor (SB-203580) and a selective JNK-II inhibitor (Calbiochem®, Gibbstown NJ), but not the MEK/ERK inhibitor (PD-98059). We found that all MAPKs were phosphorylated following indomethacin-induced injury but there was only a significant increase in phosphorylation of p38 MAPK and JNK as determined by western analysis and densitometry ($p<0.05$). In further western analyses of TJ proteins, expression of occludin was reduced by indomethacin, whereas there was no change in expression of claudin-2, claudin-4 and ZO-1. The loss of occludin expression induced by indomethacin was prevented by inhibition of p38 MAPK but not JNK or ERK. Confocal microscopic immunofluroscence revealed disruption of occludin localization at the site of the tight junction in indomethacin-treated cells, and this was attenuated by p38 MAPK inhibition. Since indomethacin is known to cause gastropathy via apoptosis, we also studied activation of caspases. Indomethacin did indeed induce apoptosis, as determined by evidence of activated caspase-3 immunofluroscence on confocal microscopy. This process was reduced by inhibition of p38 MAPK. Collectively this data suggests that indomethacin induces gastric epithelial barrier dysfunction by changes in occludin expression and induction of apoptosis via a p38 MAPK-dependent mechanism. In future studies we intend to elucidate the mechanistic role of p38 MAPK in indomethacin-induced epithelial barrier dysfunction in gastric epithelial MKN-28 cells.

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Poster Number: 156

Development of an Ex-Vivo System to Analyze the Safety and Efficacy of Genetically Modified Lactobacilli as Vaccine Vectors

Companion animals are routinely vaccinated by systemic injection against infectious agents that target mucosal tissue, including the respiratory, intestinal, and reproductive tracts. However, orally delivered vaccines are an attractive alternative, as they directly target the mucosal immune response and avoid injection-site reactions. There are several challenges in creating an orally delivered vaccine, including development of an antigen delivery system and assessment of the mucosal immune response.

Lactobacilli are commensal bacteria that are regarded as safe for use in animals and are relatively easy to modify genetically, making them appealing candidates for a vaccine platform. Careful studies of bacteria/host interactions and immunologically strategic modifications of lactobacilli are required to rationally develop these bacteria as immunogenic vaccine vectors. We hypothesize that *Lactobacillus*-based vaccine candidates can be evaluated by ex vivo techniques that will minimize or eliminate the use of a live animal model.

The Ussing chamber is an apparatus used to determine the effect of stimuli on intact tissues ex vivo, allowing the use of samples from animals that are humanely euthanized for unrelated reasons. With this approach we tested the safety of genetically modified lactobacilli. We compared wild-type *L. acidophilu*s with *L. acidophilus* expressing FliC, a flagellar protein known to stimulate the immune system. Treating intestinal tissue with lactobacilli expressing FliC did not result in a significant increase in the flux of FITC-labeled dextran across the epithelium, suggesting that tight junctions remained largely intact. Co-cultures of the intestinal epithelium with bacterial treatments indicated that addition of flagellin to *L. acidophilus* causes a significant increase in

TNF-alpha production by the feline intestine as compared to *L. acidophilus* alone. Our results revealed that genetic modification of *L. acidophilus* can significantly alter downstream immune responses without negatively affecting epithelial integrity, justifying further development of these bacteria as vaccine platforms with FliC as an adjuvant.

INDEX