7TH ANNUAL

NC STATE UNIVERSITY

GRADUATE STUDENT RESEARCH

SYMPOSIUM

ABSTRACTS

March 20, 2012 ▪ 1:00 - 5:30 pm ▪ McKimmon Center

Seventh 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 (2011-2012)

Adeline Brym, Marine, Earth and Atmospheric Sciences (Chair)
Stacie Flood, Plant Biology
Jennifer Gamble, Electrical Engineering
Erin Glant, History
Veronica Mbaneme, Biological and Agricultural Engineering
Chelli Plummer, Sociology and Anthropology

AGENDA

12:00 pm - 1:00 pm	Poster Set Up	Area 1
1:15 pm - 1:30 pm	Welcoming Remarks and Symposium Overview Bryan Hoynacke, University Graduate Student Association President Dr. Duane K. Larick, Senior Vice Provost for Strategic Initiatives and Dean of the Graduate School Dr. David Shafer, Assistant Dean of the Graduate School	Room 6
1:30 pm - 4:00 pm	Poster Session and Competition	Area 1
4:15 pm - 5:30 pm	Announcements of Awards and Reception	Rooms 2A & 2B

TABLE OF CONTENTS

College of Education

College of Engineering

College of Humanities and Social Sciences

College of Management

College of Natural Resources

ABSTRACTS

Brittany Alston
Graduate Program: Biological and Agricultural Engineering
Advisor: Michael D. Boyette
Poster Number: 2

The Rapid Production of Biochar

Charcoal produced from biomass, otherwise known as biochar, has many applications, including use as a high energy cooking fuel in developing countries, a soil amendment to improve soil characteristics, filtration and pollution abatement. In addition, the environmental implication of using biochar for carbon sequestration is an area of particular interest in the field of global climate change. The current methods for the production of charcoal are very inefficient, polluting and uncontrolled. In this study, a top-lit, updraft (TLUD) gasifier is being developed to produce biochar by pyrolysis. Most of the charcoal produced today is from forestry products, resulting in deforestation, erosion and other environmental problems associated with deforestation. In an effort to reduce the demand for forestry resources, annual agricultural waste is the biomass of interest in this study. The methods for producing biochar from crop waste biomass are a relatively new area of investigation and information about operating parameters is scarce. Crop wastes such as peanut hulls, rice hulls and corn stover as well as wood chips have been tested in the TLUD gasifier. These materials have different moisture contents, particle sizes and bulk densities and therefore, systematically varied operation parameters have been applied to these materials. Preliminary guidelines for the operation parameters with different biomasses and the production of biochar in similar systems have been established from the collected data and will be presented.

Jennifer M. Archambault[1], W. Gregory Cope[2], and Thomas J. Kwak[1]
Graduate Programs: Zoology, North Carolina Cooperative Fish and Wildlife Research Unit[1]; Environmental and Molecular Toxicology[2]
Advisors: W. Gregory Cope and Thomas J. Kwak
Poster Number: 4

Ecological Relevance in Freshwater Mussel Thermal Tolerance Tests: Implications for Climate Change

Because the global climate is warming, and available lethal temperature (LT) data on early life stages of freshwater mussels suggest they may already be living near their upper thermal tolerances in some systems, we expanded mussel LT research to include ecological factors that affect mussels in natural systems, such as sediment and flow regimes. We developed a method for assessing the thermal sensitivity of juvenile freshwater mussels in sediment, thus incorporating their benthic ecology into the tests. Using these sediment testing protocols, we evaluated the relative sensitivity of juveniles of four species of mussels to a range of common and extreme temperatures during summer in streams with low flow and dewatered (e.g., drought) conditions in the southeastern and central United States, using two temperature exposure regimes. We also conducted water-only LT tests with glochidia and juveniles of four previously untested mussel species and tested adult *Lampsilis fasciola* to determine thresholds of sublethal effects with biomarkers of thermal stress and tissue damage. The median lethal temperatures (LT_{50}s) for all tests ranged from 33.3 to 37.2°C, indicating a narrow range of upper thermal sensitivity, regardless of life stage, test type, species, or conservation status. Preliminary analysis of biomarker data indicates that mussels may become stressed at temperatures as low as 31°C, well below the lethal temperature. Future tests will incorporate a vertical temperature gradient into sediment testing protocols, providing additional realism and relevance to the benthic ecology of freshwater mussels. Finally, our data will be incorporated into regional mussel occupancy models to predict the response of imperiled mussels to changes in water temperature, as related to flow and climate change scenarios.

Mary H. Archer
Graduate Program: Horticultural Science
Advisor: Anne Spafford
Poster Number: 5

Rooftop Urban Agriculture: Design Considerations and Potential for Development in Raleigh, North Carolina

Undeveloped rooftops are unused, sterile spaces that contribute to problematic urban issues including high levels of stormwater runoff and the urban heat island effect. Green roofs and rooftop gardens mitigate these effects, bringing about numerous environmental and economic benefits including stormwater management resulting in the reduction of total outfall volume and peak discharge flows as well as a prolonged roof life. The past few years have seen a rise in the popularity of urban agriculture and this has brought about the construction of innovative green roofs and rooftop gardens that produce food. These green roofs take the benefits a step further, providing a source of locally grown fresh produce in urban areas that often lack food production. They also provide sites for community programing and urban agriculture education in addition to the

common environmental and economic benefits. Case studies were performed on recent green roof and rooftop garden projects that incorporate food production, and focused on design considerations including layout, media type, production style, access, programming, and staff support as well as project goals and response to design challenges. The evaluation of these design considerations revealed that similar projects could be supported Raleigh. Comparisons of the different projects led to the development of standard considerations to be applied for a potential design on a productive rooftop in downtown Raleigh.

John Beck[1], Michelle Schroeder Moreno[1], Gina Fernandez[2], Julie Grossman[3], and Nancy Creamer[2]
Graduate Programs: Crop Science[1]; Horticulture[2]; Soil Science[3]
Advisor: Michelle Schroeder-Moreno
Poster Number: 8

Enhancing soil quality and nutrient availability for strawberry production in the Southeastern United States through summer cover crops, beneficial mycorrhizal fungi, and vermicompost

Cultural practices – such as cover crop rotations, addition of compost, and inoculation with beneficial soil inoculants – are often underutilized in strawberry production systems. With the impending removal of methyl bromide fumigation as the primary pest management tool, strawberry growers need integrated pest management practices that serve as sustainable alternatives to chemical inputs. The objective of this study was to examine the integrated effects of compost and cover crops with beneficial soil inoculants on organic strawberry plant growth, yield, weed pressure, and soil nitrogen levels. Compost and cover crop treatments consisted of 1) pearl millet, 2) soybean, 3) cowpea, 4) pearl millet/soybean, 5) pearl millet/cowpea, and 6) a no cover crop control treatment without compost. Beneficial inoculant treatments consisted of the background native arbuscular mycorrhizal fungi (AMF) species present in the field and AMF with added vermicompost. Organic fertilizers were applied to meet the recommended rates for strawberry production in the Southeastern US. Compost/cover crop and inoculant treatments were assessed for their impact on plant growth and yield, weed abundance, AMF colonization and inorganic NO_3^- and NH_4^+ levels. While cover crop treatments did not increase strawberry yields, they were similar to the control treatment both years. The integrated use of AMF and vermicompost improved strawberry biomass and yield, and soil N content, but not AMF colonization both years. Weed suppression by cover crops in the summer did not carry over into the strawberry season, where weed abundance was lowest in control plots. The amount of total N supplied through compost and cover crops in subsequent strawberry seasons appear to equalize the effect of adding supplemental fertilizers in organic production systems. Results from our research suggest that recommended fertilizer application rates for the Southeast might exceed the N requirements for strawberries when using cover crops and organic amendments.

Amanda Boury
Graduate Program: Zoology
Advisor: Craig V. Sullivan
Poster Number: 11

Reproduction of striped bass, *Morone saxatilis*: Discovery of differentially expressed ovarian genes during early stages of oocyte growth

Due to the lack of data on physiological mechanisms involved in reproduction in the genus Morone, I used a non-traditional model species, striped bass, to identify ovarian genes and proteins that are differentially expressed during the primary, early secondary and vitellogenic stages of oocyte growth. With limited genomic information available, this species is a good candidate from which to elucidate ovarian factors that regulate oogenesis in teleosts. Changes in the ovarian transcriptome between the three main stages of oocyte growth were assessed using differential display PCR (Seegene GeneFishing® method) to compare relative expression of mRNAs across oocyte stages using random PCR primers to amplify cDNAs from differentially expressed transcripts. Real time quantitative (rtq)RT-PCR, was employed to verify changes in the expression of a subset of genes, many of known reproductive function. Housekeeping gene selection was performed and two chosen to use for rtqRT-PCR data normalization. Differential display showed representatives of several functional gene families present including large lipid transfer proteins (apolipoprotein D), ribosomal proteins, zona pellucida proteins, signal transduction proteins, and transporter proteins. Ribosomal proteins and zona pellucida transcripts showed higher expression during primary growth, while genes responsible for yolk and lipid incorporation, like apolipoprotein D and fatty acid binding protein showed higher expression during later stages (vitellogenic). The results of this project should open avenues of future research in reproductive physiology of fishes by characterizing the cascades of gene induction during the major phases of oocyte growth.

Sarah Cash[1], Marcé Lorenzen[2], and Fred Gould[2]
Graduate Programs: Genetics[1]; Entomology[2]
Advisor: Fred Gould
Poster Number: 21

***Medea*: a mechanism for suppression of arthropod-vectored diseases**

Arthropod-vectored diseases have a devastating impact not just on human health, but on plants and animals as well. By coupling anti-pathogen constructs with a gene-drive mechanism, we could push anti-pathogen genes into arthropod populations, suppressing transmission of disease. The drive mechanism of *Medea*, a selfish genetic element found in the red flour beetle, seems ideal for this task. While models make promising predictions about the element's spread, the dynamics of *Medea* within actual populations have yet not been thoroughly investigated. By surveying the geographic distribution and frequencies of the two naturally-occurring *Medea* elements that are present in some United States populations of flour beetles, and by tracking the element's spread in laboratory and wild-derived populations, we can better understand the factors which influence the spread of *Medea*. The results will not only offer insight into the interesting biology of selfish elements, but also have practical applications, as empirical data will be useful for assessing *Medea's* potential for use in genetic pest management.

Sushila Chaudhari, Katie Jennings, and David Monks
Graduate Program: Horticultural Science
Advisors: Katie Jennings and David Monks
Poster Number: 24

Herbicide Tolerance of Grafted Tomatoes

Due to the phase out of methyl bromide, growers have to rely on other methods of control for weeds, diseases, and insects. Tomato grafting has emerged as an alternative to control many soilborne pests and diseases by using a tolerant variety as the rootstock. Most of the research conducted has been on developing rootstocks that are tolerant to diseases. However, a high level of herbicide tolerance in grafted tomatoes would be desirable, but there is a lack of information in this area. A greenhouse study was conducted to determine the effect of four herbicides on grafted tomatoes. Grafting treatments included non-grafted Amelia (a commercially used tomato hybrid in NC), Amelia grafted on Maxifort or DP-106 rootstocks. Herbicide treatments included metribuzin preemergence or postemergence at 0.13, 0.25, 0.5 and 1.0 kg ai/ha, *S*-metolachlor preemergence or postemergence at 0.52, 1.07, 2.2 and 3.2 kg ai/ha, halosulfuron postemergence at 0.014, 0.027, 0.054 and 0.108 kg ai/ha, and fomesafen preemergence at 0.105, 0.21, 0.42, and 0.84 kg ai/ha. A nontreated check was included for comparison. Preemergence treatments were applied prior to transplanting and postemergence treatments were applied three days after transplanting. Data collection included crop injury and tomato height measurements at 10 and 20 days after treatment (DAT). Tomato injury included chlorosis, necrosis and deformation of leaves. Above ground plant fresh weight was measured at 40 DAT. At 10 DAT, tomato injury increased as herbicide rate increased with the exception of halosulfuron. Within rates of fomesafen, tomato injury was greater in non-grafted tomato than grafted tomato. No differences were observed between grafted and non-grafted tomato with *S*-metolachlor and metribuzin. However, injury was generally greater from the postemergence applications than the preemergence applications. At 20 DAT, a similar trend was observed with crop injury however, injury was less. Tomato fresh weight and tomato height were not affected by grafting and herbicides except with halosulfuron. Among halosulfuron treatments, plant fresh weight and height decreased as rate increased in grafted and non-grafted tomato. Generally, there were no differences between grafted and non-grafted tomato with the exception of fomesafen where grafted plants exhibited less injury.

Brigitte D. Crawford and John M. Dole
Graduate Program: Horticultural Science
Advisor: John M. Dole
Poster Number: 31

Propagation success of unrooted cuttings as influenced by stock plant age and crop season

The production of healthy rooted cuttings is affected by numerous factors, one of which may be the age of the stock plant from which the cutting is taken. The objectives of this study were to quantify the effect of stock plant age and production environment on coleus, New Guinea impatiens (NGI), and geranium cuttings' quality and propagation success, and to determine the interaction of stock plant age, production environment, and rooting hormone on propagation success. For coleus and one of two cultivars of NGI cuttings, shoot and root fresh and dry weights increased from first harvest to last harvest (34 weeks for coleus and 14 weeks for NGI). Rooting hormone increased root fresh weight of one of two NGI cultivars ($p=0.0159$), but not of coleus cuttings. For geraniums, shoot and root fresh and dry weights initially increased then decreased from first harvest to last harvest (28 weeks), and use of rooting hormone increased root fresh and dry weights ($p<0.0001$). For coleus and geraniums, cuttings harvested at the same time from stock plants of three distinct ages were not different. Variations in postharvest parameters may be due to environmental parameters such as day length and light intensity. Coleus shoot and root fresh and dry

weights were positively correlated with both day length and light intensity averaged over 28 days prior to cutting harvest date (r^2=0.734 to 0.853, p<0.0001; r^2=0.695 to 0.852, p<0.0001, respectively). Geranium fresh weights were negatively correlated with both day length and light intensity averaged over 28 days prior to cutting harvest date (r^2=-0.483 to -0.259, p<0.0001 to =0.0020; r^2=-0.482 to -0.263; p<0.0001 to =.0017, respectively).

Lauren M. Dembeck[1,2], Michael M. Magwire[1,2], Faye Lawrence[1], Richard F. Lyman[1], and Trudy F.C. Mackay[1,2]
Graduate Programs: Genetics[1]; W.M. Keck Center for Behavioral Biology[2]
Advisor: Trudy F.C. Mackay
Poster Number: 34

Genome-wide association analysis of natural variation in tergite melanization in *Drosophila melanogaster*

Pigmentation varies within and between species and is often an adaptive trait crucial for fitness. *D. melanogaster* females generally have light to medium stripes of melanization on the posterior end of each tergite. We measured natural variation in female abdominal pigmentation in 158 sequenced inbred lines of the *Drosophila* Genetic Reference Panel, derived from the Raleigh, NC population. We visually scored females for the proportion of melanization on tergites 4-6 on a scale from 0 (no melanization) to 5 (total melanization). We found significant genetic variation in melanization for each tergite, with broad sense heritabilities ranging from 0.239 – 0.876. We performed genome-wide association analyses for each tergite using 2.5 million single nucleotide polymorphisms (SNPs). We identified 30 SNPs associated with the proportion of melanization on tergite 6, the most significant of which was in *bric-a-brac 1*, a gene known to affect the proportion of melanization in female *D. melanogaster*. We also identified a SNP in the *cis*-regulatory element of *tan*, which was previously shown to affect interspecific differences in pigmentation. After accounting for linkage disequilibrium and imputing missing genotypes, we conducted a forward regression to estimate the fraction of variance explained. Five SNPs constituting 22 haplotypes account for 52% of the variance among the lines. We are currently conducting studies to further confirm the effects of these SNPs. This study will provide insight into the genetic architecture of melanization and also shed light on the question of whether genes causing variation within a species are the same as those involved in trait divergence between species. [Dembeck is supported by NIH Training Grant #GM045146.]

Tiffany A. Garbutt
Graduate Program: Genetics
Advisor: David Threadgill
Poster Number: 46

Identifying Genes Controlling Epigenetic Stability In Induced Pluripotent Stem Cells (IPSCs)

The retroviral transduction of four embryonic stem cell transcription factors, *Myc*, *Klf4*, *Oct3/4*, and *Sox2*, collectively referred to as MKOS, are capable of reverting mouse fibroblast cells into an embryonic stem cell like fate. MKOS induced stem cells are referred to as *I*nduced *P*luripotent *S*tem *C*ells (IPSCs). However, IPSCs retain an epigenetic memory of their previous cell fate and exhibit incomplete reprogramming of specific methylation sites. I hypothesize that specific polymorphisms control the persistence of epigenetic marks in IPSCs. If this hypothesis is true then the reduced expression of regulatory genes will significantly decrease the presence of epigenetic marks in IPSCs. I am reprogramming fibroblasts from the recombinant inbred mouse strains of the Collaborative Cross by introducing a lentiviral vector containing the MKOS genes. Upon successful reprogramming I will profile the methylation patterns of an established embryonic stem cell line in addition to differentiated fibroblasts and reprogrammed IPSCs from each mouse strain. Methylation profiles will be compared to identify strains with the greatest retained fibroblast marks. These will be used in a genome-wide quantitative trait analysis to identify candidate genes regulating epigenome stability. Candidate genes will be tested using a *ROSA26* targeting vector designed with an entry site that will be used to introduce candidate gene-specific RNAi's. The methylation patterns of IPSCs will be analyzed for changes in expression of epigenetic marks in response to candidate gene expression knockdown. At the end of this research we hope to have a list of identified, tested, and confirmed candidate genes affecting IPSC epigenetics.

Jose G. Garzon and Michael Boyette
Graduate Program: Biological and Agricultural Engineering
Advisor: Michael Boyette
Poster Number: 49

Sweetpotato Long Term Storage

In the last decade the production of sweetpotato in the US has increased in nearly one billion pounds, reaching a total production of two billion pounds with a value of 424 million Dollars (US Sweetpotato Collaborators Newsletter, winter 2010). Advances in sweetpotato long term storage have been a crucial component in making this growth possible. North Carolina is the largest producer of sweetpotatoes in the US with an annual production of nearly 494 million kg. (NCDACS, 2010)

Our goal is to measure the variation in weight and quality of different Sweetpotato varieties under different environmental conditions, develop tools to reduce and predict weight loss during storage periods, and develop a density Index which relates to storage conditions and quality.

Sweetpotatoes are alive and respire during storage, consequently the weight loss, is proportional to the storage temperature. During 2009-2010 and 2010-2011 tests were conducted in two of the Universities' cooler rooms, where five varieties of sweetpotatoes were placed on electronic scales. One room temperature was changed in cycles from 58 to 74°F while relative humidity (RH) remained constant at 88% ±5%, inside a second cooler RH was changed in cycles from 65 to 95%, while temperature was constant at 58°F ±2°F. In both coolers weight was recorded every hour over a period of 300 days, simultaneously electronic scales where placed in commercial facilities where temperature and RH are stable during the same period of the test. Samples were taken in order to measure density and other quality parameters over the storage period. The data shows the daily weight loss under both circumstances, the difference between varieties, and yields some interesting observations about the influence of genotypes and environmental conditions, also the reduction in density as indicator of change in internal composition during long term storage of sweetpotatoes.

E.E. Glista-Baker, B.C. Sayers, A.J. Taylor, and J.C. Bonner
Graduate Program: Environmental and Molecular Toxicology
Advisor: James C. Bonner
Poster Number: 55

Nickel Nanoparticles (NiNP) and Platelet-derived Growth Factor (PDGF) Act Coordinately to Increase Pro- and Anti-Fibrotic Factors in Rat Pleural Mesothelial Cells

Nickel nanoparticles (NiNP) are used as catalysts in the manufacture of multi-walled carbon nanotubes (MWCNT). There is concern that NiNP or MWCNT could cause cancer or fibrosis in humans. We recently reported that inhaled MWCNT migrate to the pleura in mice to cause subpleural fibrogenesis, a disease process that involves angiogenesis. Fibrotic lesions that were caused by MWCNT is accompanied by increased levels of platelet-derived growth factor (PDGF), a mediator of fibrosis. We hypothesized that NiNP, a catalyst used in the manufacture of MWCNT, and PDGF act coordinately to stimulate pleural mesothelial cells to increase pro- and anti-fibrotic factors. In order to test this hypothesis, rat pleural mesothelial cells (NRM-2) were grown to confluence, rendered quiescent in serum-free medium, and then dosed with NiNP (10µg/cm2) in the absence or presence of PDGF-BB (50 ng/ml). RNA was collected for Taqman quantitative real time RT-PCR to measure CXCL10 (an anti-fibrotic chemokine) and CCL2 (a pro-fibrotic growth factor). RT-PCR results showed that NiNP alone caused a several-fold increase in CXCL10 or CCL2 mRNA levels at 24 h, while PDGF alone only marginally increased CXCL10 or CCL2 mRNA levels. However, PDGF synergistically increased NiNP-induced CXCL10 and CCL2 mRNA levels. The synergistic action of PDGF-BB on NiNP-induced CCL2 and CXCL10 was blocked by pretreatment with PD98059, a MAP kinase (ERK-1/2) inhibitor. Western blot analysis showed that PDGF also amplified NiNP-induced increase in the hypoxia-inducible factor -1alpha (HIF-1α), a transcription factor involved in nickel signaling. PD98059 blocked PDGF-induced HIF-1α but not NiNP-induced HIF-1α protein levels. These data suggests that ERK-1/2 is important for PDGFBB amplification of NiNP-induced HIF-1α signaling and CCL2 production that leads to inflammation and fibrosis. However, PDGF also amplifies NiNP-induced CXCL10 that serves to reduce fibrosis and promote wound healing. [Funded by NIEHS RC2-ES018772-01 and NIEHS T32-ES007046.]

Mohamed Goher, J. Hicks, N. Trakooljul, and H.C. Liu
Graduate Program: Animal and Poultry Science
Advisor: Sunny Liu
Poster Number: 56

Characterization of microRNA function in the chicken immune system

MicroRNA (miRNA) is a class of ~22-nucleotide non-coding RNA molecules. They are crucial for the post-transcriptional regulation of gene expression via binding to target messenger RNAs (mRNAs) in most eukaryotes. MiRNAs are particularly important during eukaryotic development. Many miRNAs are expressed in a specific spatio-temporal pattern while others are more ubiquitously expressed. Therefore, in order to fully characterize a particular miRNA's function its expression profile as well as its target genes need to be determined. To establish the involvement of miRNAs during avian development we have recently developed multiple approaches. First, pyrosequencing and miRNA Real-Time PCR (RT-PCR) are utilized to determine expression profiles of avian miRNAs across tissues in both embryonic and post-hatch chicks. In addition, potential miRNA binding sites are predicted using the miRNA target prediction algorithm miRanda (www.microrna.org). A group of potential miRNA target genes is then selected based on gene function and/or miRNA target site conservation in other species. Our work suggests that a wide range of miRNAs are dynamically expressed in developing chicks' immune organs and that avian miRNAs have many diverse functions including the regulation of cell proliferation and differentiation.

Bo-Wen Huang, Kenta Iwasaki, Paul D. Ray, and Yoshiaki Tsuji
Graduate Program: Environmental and Molecular Toxicology
Advisor: Yoshiaki Tsuji
Poster Number: 69

Transcriptional Regulation of Antioxidant Genes by Histone Arginine Methyltransferases

Oxidative stress is implicated in various diseases such as cancer and neurodegeneration; therefore, gaining insight into the molecular mechanism through which antioxidant detoxifying genes are regulated is important to understand the pathogenesis of oxidative stress-related diseases. Antioxidant genes such as ferritin, hemooxygenase-1 (HO-1) and NAD(P)H quinone oxidoreductase 1 (NQO1) are transcriptionally regulated by the transcription factor, nuclear factor-E2-related factor 2 (Nrf2), via an anti-oxidant responsive element (ARE) under oxidative stress. Histone modifications generally play a cooperative but essential role in transcriptional regulation; however, how and what histone modifications regulate antioxidant gene transcription is still unclear. We recently found that an oxidative stressor, the metalloid arsenite, upregulates gene transcription of these antioxidant genes concomitantly with induction of histone H4 Arg-3 (H4R3) and H3 Arg-17 (H3R17) methylation. We hypothesized that methylation of H4R3 and H3R17 is involved in transcriptional regulation of these antioxidant genes. To test this hypothesis, we focused on the roles of two histone arginine methyltransferases, protein arginine methyltransferase 1 (PRMT1) and coactivator-associated arginine methyltransferase 1 (CARM1), which mediate methylation of histone H4R3 and H3R17, respectively. Indeed, we found that nuclear translocation of PRMT1 and CARM1 as well as methylation of histone H4R3 and H3R17 were induced around the AREs of ferritin, NQO1 and HO-1 after arsenite treatment. Furthermore, knockdown of PRMT1 and CARM1 attenuated arsenite-mediated expression of these antioxidant genes. These results suggest that PRMT1- and CARM1-mediated methylation of histone H4R3 and H3R17 regulate the ARE enhancer activity in response to arsenite. To further elucidate the interplay between histone arginine methylation and Nrf2 on the AREs, we are currently investigating whether Nrf2 recruits these histone arginine methyltransferases or methylation of histone H4R3 and H3R17 facilitates Nrf2 binding to the ARE regions of these antioxidant genes.

Jennifer A. Kimball[1], M. Carolina Zuleta[1], Karen R. Harris-Shultz[2], Kevin E. Kenworthy[3], and Susana Milla-Lewis[1]
Graduate Programs: Crop Science, North Carolina State University[1]; Crop Genetics and Breeding, USDA-ARS[2]; Agronomy, University of Florida, Gainesville, FL[3]
Advisor: Susana Milla-Lewis
Poster Number: 78

Evaluating Genetic Diversity in Zoysiagrass using Simple Sequence Repeat (SSR) Markers

Zoysia spp. are warm-season turfgrass species widely used as turf throughout the southern regions of the United States and upwards into the transition zone for their superior heat and drought tolerances as well as their relatively low input requirements. *Zoysia japonica* and *Zoysia matrella* are the two main species of *Zoysia* commonly used in cultivar development and are regularly differentiated by their leaf texture, cold hardiness, and aggressiveness. However, their phenotypic ranges tend to overlap and interspecific hybridization has been reported making the level of speciation and genetic relationships among these species unclear. Understanding the genetic diversity, population structure and gene flow present within U.S. *Zoysia* germplasm collections can assist plant breeders in parent selection for future breeding strategies and enhance their ability to capture and exploit available variation. The objective of this study was to assess the genetic diversity and population structure of *Zoysia* species using simple sequence repeat (SSR) marker and inflorescence trait analyses. Sixty-two *Zoysia* accessions selected as a subset of geno- and phenotypically diverse *Zoysia* genotypes were genotyped with fifty SSR markers. Both UPGMA cluster and PCO analyses revealed a continuous flow of genetic variation present within and among the species. The model-based program, STRUCTURE, revealed evidence of admixture between the species. Six inflorescence phenotypes also revealed a continuous range of phenotypic variation between species. Based on these findings, this study was able to verify the presence of hybrids between *Z. japonica* and *Z. matrella* and further validate the hypothesis that *Zoysia* spp. are actually subpopulations or ecotypes within one species rather than separate species.

Erika Larsen[1], Greg Hoyt[1], Shuijin Hu[2], Deanna Osmond[1], and Julie Grossman[1]
Graduate Programs: Soil Science[1]; Plant Pathology[2]
Advisor: Julie Grossman
Poster Number: 82

Evaluating Soil Biological Properties in Long-Term Organic and Conventional Farming Systems

Organic farming practices are known to build soil organic matter and potentially reduce the risk of sediment and nutrient runoff losses. However, heavy reliance on tillage to control weeds in organic agriculture can promote soil degradation. Project objectives were to 1) determine the impact of long-term management practices on soil biological properties; 2) identify soil properties that correlate with runoff and nutrient losses under conventional and organic management; and 3) determine long-term management impacts on total organic matter lost from runoff. The experiment was carried out on plots in Mills River, NC

under continuous management for over 15 years. Treatments included 1) organic management + no tillage, 2) organic management + conventional tillage 3) conventional management + no tillage 4) conventional management + conventional tillage, and 5) a control, replicated 4 times each. Soil samples from all plots were analyzed for particulate organic matter (POM) using density fractionation, and microbial biomass using chloroform fumigation extraction. Soil bulk density was assessed using an Uhland coring device. A homogenized runoff sample from each rain event was collected and oven dried until water evaporated, and sediment analyzed for total carbon. Results indicate that organic no-till plots had significantly more microbial biomass carbon when compared to a conventional system. In addition, free light fraction POM in the organic no-till plots was significantly higher than all other treatments, however these plots also had the highest total carbon in runoff. Bulk density was highest in the chemical no till plots and lowest in the organic plots, which may be attributed to the high organic matter content in the organic plots. Results provide evidence that long-term organic management increases soil microbial activity and organic matter in agricultural soils, especially where tillage is absent, but that such soils may also lose more of this carbon via surface runoff.

Gina Lee and R.A. McLaughlin
Graduate Program: Soil Science
Advisor: R.A. McLaughlin
Poster Number: 83

Effects of Mulch Type and Polyacrylamide on Runoff and Vegetation Growth on Steep Slopes

Soil erosion and sediment pollution can be big problems in and around construction sites due to land disturbing activities and unprotected soil during active construction. Establishing vegetation to control erosion on these sites can be difficult due to poor soil, steep slopes, and no irrigation. Our study was conducted on two road construction sites to evaluate different erosion control treatments on steep slopes for erosion control and vegetative establishment. First site was located in the Mountain region near West Jefferson, NC. The soil was sandy loam – loamy sand soil on a cut 2:1 slope. Second site was located in the Piedmont region in Garner, NC. The soil was a subsoil material excavated from nearby slopes and used as 2:1 fill for road construction. On both sites the area was divided into 20 plots: 3.05 m wide and 6.1 m long. Four replicates were installed for each treatment. Treatments were: 2268 kg ha^{-1} wheat straw (S); 2268 kg ha^{-1} wheat straw with 22.4 kg ha^{-1} of granular, linear, anionic polyacrylamide (SP); three types of hydromulches: 3900 kg ha^{-1} flexible growth medium (FGM); 3900 kg ha^{-1} bonded fiber (BFM); 3900 kg ha^{-1} stabilized mulch matrix (SMM). Straw mulch was selected as the standard treatment for comparison. The sites were seeded according to North Carolina Department of Transportation (NCDOT) guidelines, and the establishment of vegetation was monitored over the growing season. Runoff volumes, turbidity levels, and eroded sediment data were collected after natural rain events, and grass growth and cover was evaluated once it reached a height of 10-12 cm. On the first site there were no differences among the treatments in runoff water quality or vegetation establishment, possibly due to the relatively light rainfall events that occurred there. On the second site, hydromulch treatments reduced overall runoff volume compared to straw alone, FGM treatment significantly reduced overall turbidity compared to straw alone from 1367 NTU down to 426 NTU, and all treatments reduced TSS compared to straw. However, the straw cover resulted in the best grass growth compared to hydromulch, probably due to better moisture holding between storms.

Ethan M. Lineberger[1], Rebecca B. Neumann[2], A.B.M. Badruzzaman[3], and Matthew L. Polizzotto[1]
Graduate Programs: Soil Science, North Carolina State University[1]; Civil and Environmental Engineering, University of Washington[2]; Civil Engineering, Bangladesh University of Engineering and Technology[3]
Advisor: Matthew Polizzotto
Poster Number: 87

Chemical and physical controls on arsenic removal from flowing irrigation water in Bangladesh

Years of irrigating rice fields with arsenic-contaminated well water in Bangladesh have led to a buildup of arsenic in soils and subsequent translocation of arsenic into rice. Due to the quantities of water involved and the resources required for complex technological treatments, there are currently no widely used practical methods for large scale removal of arsenic from irrigation water. Consequently, while low dose arsenic poisoning from drinking water is known to affect millions of Bangladeshis, but recent studies indicate that contaminated rice may now contribute up to 66% of their daily dietary arsenic intake.

Distribution systems made of native soils can remove arsenic from flowing irrigation water by promoting sorption to soils or co-precipitation of arsenic-bearing solids, as indicated by observed decreases in arsenic concentrations along flow channels and across rice paddies. However, the chemical controls driving these reactions and interplay between chemical and physical parameters has yet to be resolved, limiting our ability to manage irrigation in a way that maximizes arsenic removal prior to field application. We have established an experimental field area in Bangladesh to examine the physicochemical controls on arsenic removal from flowing irrigation water. By varying channel widths and lengths and making measurements over space and time, we have investigated the impacts of soil contact area and residence time on arsenic transport, oxidation, sorption, and precipitation during irrigation flow. Arsenic concentrations are compared with dissolved iron, phosphorus, and silicon, each of which may co-regulate arsenic removal from solution. Preliminary results show a consistent 30% decrease in dissolved arsenic

concentrations with a five-fold increase in channel length and a 10% decrease in arsenic in channels with three-fold width increases as compared to controls. These results will be coupled with future experiments assessing limits on arsenic removal and long-term sustainability of alternate irrigation management strategies.

Jared Locklear
Graduate Program: Plant Biology
Advisor: James Mickle
Poster Number: 89

Fossil *Taxodium* seeds of Pleistocene age from Southeastern North Carolina

A recently discovered locality in an open aggregate mine pit owned by the Martin Marietta Corporation near Wilmington, North Carolina (34° 22.368' N, 77° 50.356' W), has produced abundant macrofossil remains that show a wide range of diversity. The exact environmental setting is uncertain, but appears to be channel-fill or lacustrine deposit, based on the matrix. The material is preserved in loose clay and was recovered from the spoil heap. Palynological analysis and comparisons to other southeastern sites suggests a Pleistocene age and also shows a wide range in diversity. Pollen types found include, but are not limited to, *Pinus, Taxodiaceous* types, *Picea, Alnus, Liqudambar, Betula, Quercus, Ilex,* Monolete Fern types, *Ambrosia spp.,* and other *Compositae*. Fungal, diatom, and protozoan palynomorphs are also present, which presents evidence of a wetland or riverine setting. The locality lacks *Isoetes* spores, considered to be an indicator of an interglacial period. Macrofossil specimens were recovered by maceration and include abundant well preserved seeds, fruit, flowers, conifer and angiosperm wood, cones, and insect fossils. Plant fossils include cf. *Fagus*, *Pinus*, *Quercus*, and *Vitus*. A dominant seed type in the fossil flora is *Taxodium*, based on key characteristics such as overall size, raised marginal features, and lack of wings. Comparisons with other species in the genus and statistical analysis suggest that this may be a new fossil species of *Taxodium*. Little is known of Pleistocene macrofossil floras of the southeastern United States and interglacial palynological assessments are absent for North Carolina. The study of this locality will add to our knowledge of this time period in this region.

William S. Marshall
Graduate Program: Entomology
Advisor: David Orr
Poster Number: 92

Effects of Lawn Plant Diversity on Arthropod Diversity

With increased interest in organically managed landscapes, it is important to determine if this type of management changes insect populations. This includes insects that act as pests, but also those that are beneficial (e.g. pollinators, predators, bird food sources). There are currently very few studies that have determined the impact of lawns on arthropod diversity and abundance. The main focus of this study is to determine whether lawn plant has an impact on arthropod diversity, species richness, species evenness, and overall abundance in urban lawns. This study will be the first to determine how arthropods are being affected by lawn diversity and how that may have cascading effects to other wildlife that depend on arthropods as sources of food.

Lisa A. McPhatter[1], Pierre Sonveaux[2], O. Michael Colvin[3], and David W. Threadgill[1]
Graduate Programs: Physiology, North Carolina State University[1]; Pharmacology, University of Louvain, Belgium[2]; Medicine Oncology, Duke University Medical Center[3]
Advisor: David W. Threadgill
Poster Number: 93

Combination Therapy of Bevacizumab and Rapamycin in antitumor activity

The extension of the tumor vascular network during angiogenesis is essential for tumor growth, with persistent immaturity of the resulting neovessels facilitating metastasis. Because of the importance of the vasculature and because of the unique aspects of the tumor vasculature, disrupting tumor angiogenesis is a promising antitumor strategy.

An efficient approach to block new vascular development is to inhibit the vascular endothelial growth factor pathway (VEGF) with Bevacizumab/avastin, a humanized anti-VEGF monoclonal antibody. However, upon inhibition of VEGF inactivation, the VEGF-activated PI3K/Akt/mTOR promitogenic pathway is frequently compensated for by other oncogenic factors, which could result in resistance to treatment. We therefore reasoned that combining Bevacizumab and Rapamycin, an immunosuppressive drug that inhibits mTOR, would have superior antitumor activity than either agent alone.

We tested our hypothesis in a model of human colon adenocarcinoma (HT29) in nude mice, and analyzed tumor growth and pathway activation by IHC and ELISA.

We observed a more than additive antitumor effect when mice were treated with the combined treatment *versus* Bevacizumab or Rapamycin alone. Importantly, the antitumor effect was associated with changes in the tumor microenvironment.

Keena A.E. Mullen[1], Roberta L. Lyman[2], Steven P. Washburn[1], and Kevin L. Anderson[2]
Graduate Programs: Animal Science[1]; Population Health and Pathobiology[2]
Advisors: Steven P. Washburn and Kevin L. Anderson
Poster Number: 98

Efficacy of Two Herbal Remedies as Alternatives to Antibiotics in Dry Cow Therapy: Preliminary Microbiology Results

Mastitis is a costly disease in the dairy industry and is normally treated using antibiotics either in response to clinical cases of mastitis or for prevention when the cows are not lactating (the "dry period"). The aim of preventive therapy during the dry period is to eliminate existing infections and to prevent new infections from occurring before calving. This study evaluated the effectiveness of two herbal remedies as dry period treatments: Phyto-Mast (Penn Dutch Cow Care, Narvon, PA) and Cinnatube (New AgriTech Enterprises, Locke, NY). If proven effective, those treatments could reduce antibiotic usage on all dairy farms. Data were taken from a research herd over two years. Five intramammary dry treatments were assessed: 1) antibiotic and internal teat sealant (conventional); 2) Phyto-Mast; 3) Cinnatube; 4) Phyto-Mast plus Cinnatube; 5) no treatment. Milk samples were aseptically collected from each functional quarter of each cow (n=121) before treatment and once within 3 to 5 days post-calving. Microbiological content was assessed using methods consistent with those of the National Mastitis Council. The combination of Phyto-Mast and Cinnatube was significantly better than all other treatments at curing existing infections; it cured 15.5 ± 3.9% of previously infected functional udder quarters, compared to 4.1 ± 3.7% (Cinnatube), 4.6 ± 3.6% (conventional), 4.9 ± 3.7% (no treatment), and 7.7 ± 3.7% (Phyto-Mast). Conventional treatment was most successful at preventing new infections post-calving: 11.6 ± 6.0% of cows' udder quarters treated conventionally had new infections post-calving, compared to 22.1 ± 6.2% (Cinnatube), 24.7 ± 6.5% (Phyto-Mast and Cinnatube), 25.3 ± 6.2% (Phyto-Mast), and 33.4 ± 6.2% (no treatment). Based on preliminary microbiology results, Phyto-Mast and Cinnatube used together was the best option for curing existing infections during the dry period whereas conventional treatment was more successful in preventing new infections.

Rodrigo A. Olarte[1], Bruce W. Horn[2], James T. Monacell[3,1], Rakhi Singh[1], Eric A. Stone[4,3], 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: 105

Sexual recombination and heterokaryosis: refining biological control practices

Aspergillus flavus contaminates many important crops worldwide and is the major producer of aflatoxins (AFs), which are cancer-causing secondary metabolites. A unique ability 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 $1.6 billion annually. AF contamination in peanut export worldwide accounts 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 for evidence of genetic exchange and recombination, and to 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 deleterious mutation in the AF cluster and an aflatoxigenic parent can restore AF production in a progeny strain. The recombinant F1 progeny strain regained aflatoxigenicity through a single crossover event within the AF gene cluster; overall, genetic exchange and recombination are associated with significant heritability of AF and CPA in progeny. Finally, we observed non-Mendelian inheritance of extra-genomic AF cluster alleles in crosses with partial AF cluster parents, suggesting a possible role of cryptic heterokaryosis, in addition to sexual recombination, in modulating AF production. Collectively, these processes may contribute to and drive genetic and functional hyperdiversity in *A. flavus*.

Anushadevi Panneerselvam[1], Ratna Sharma-Shivappa[1], Praveen Kolar[1], and Thomas Ranney[2]
Graduate Programs: Biological and Agricultural Engineering[1]; Horticultural Science[2]
Advisor: Ratna Sharma-Shivappa
Poster Number: 108

Sodium hydroxide pretreatment of energy canes for bioethanol production

Pretreatment is an important step in the production of biofuels from lignocellulosic materials. This study focuses on alkaline pretreatment of *Miscanthus* and *Saccharum* varieties to determine their bioethanol production potential. These energy canes are being treated with sodium hydroxide (NaOH) at concentrations ranging from 0.5-2% over treatment times up to 60 min at 121°C. Low temperature treatments will be investigated to reduce process cost while maintaining effectiveness. Extent of delignification and availability of carbohydrates in treated and untreated samples serves to estimate pretreatment efficiency.

Efficiency of the pretreatments will be further evaluated by enzymatic hydrolysis using excess Cellic® Ctec2 at 30 - 40% (w/w) enzyme/biomass loading.

Kristen Parker Gaddis[1], Joe Cassady[1], John Cole[2], and Christian Maltecca[1]
Graduate Programs: Animal Science, North Carolina State University[1]; Animal Improvement Programs Laboratory, Agricultural Research Service, USDA, Beltsville, MD[2]
Advisors: Christian Maltecca and Joe Cassady
Poster Number: 109

Incidence validation and causal relationship analysis of producer-recorded health event data from on-farm computer systems in the U.S.

Great progress has been made improving production traits in dairy cattle. With an emphasis on production along with a negative correlation between production and fitness, there has been a decrease in health and fitness of dairy cattle. These traits are generally difficult and/or expensive to measure, however health event data collected from on-farm computer management systems may provide an effective and low-cost source of health event information. The aims of this study included analyzing the reliability of health event data recorded through on-farm recording systems throughout the United States. In order to validate editing methods, incidence rates of on-farm recorded health event data were compared to incidence rates previously reported in literature. A second aim of this study was to examine putative causal relationships between common health events using on-farm recorded data. Calculated incidence rates ranged from 1.37% for respiratory problems to 7.98% for mastitis. Most health events reported had an incidence rate lower than the average incidence rate found in literature. Logistic regression was used to examine putative causal relationships between health events within a lactation for three timeframes: 0 to 60 days in milk (DIM), 61 to 90 DIM, and 91 to 150 DIM. Herd, season, parity, breed, and year were included in each model as fixed effects. Health events occurring on average before the health event of interest were included in the model as predictors when significant ($P<0.05$). Path diagrams developed using odds ratios calculated from logistic regression models for each of thirteen common health events allowed putative relationships to be examined. The results of this analysis provide evidence for the usefulness of on-farm recorded health information.

Alex Putman, Ignazio Carbone, and Lane Tredway
Graduate Program: Plant Pathology
Advisors: Ignazio Carbone and Lane Tredway
Poster Number: 118

Signatures of Global Migration and Substructure in the Metapopulation Biology of the Plant Pathogenic Fungus *Sclerotinia homoeocarpa*

The filamentous ascomycete *Sclerotinia homoeocarpa* causes dollar spot, the most economically important disease of turfgrass worldwide. A poor understanding of the basic biology of *S. homoeocarpa* has hampered efforts to improve management of dollar spot. To elucidate worldwide metapopulation dynamics of the fungus, we have characterized the genetic basis of sexuality in *S. homoeocarpa* and identified and developed microsatellite markers from the pathogen. In an early draft genome assembly, we found that the mating-type (*MAT*) locus of *S. homoeocarpa* is organized in a heterothallic fashion, indicating that individuals of opposite mating types are required for sexual reproduction. Multiplex PCR protocols were developed to determine the distribution of *MAT* genes among worldwide populations of the pathogen. In a preliminary screen, we found that the ratio of the two mating types was skewed based on geography. Furthermore, both mating types were found at several locations, suggesting that sexual reproduction in nature is possible. Of 822 candidate microsatellites isolated from either a bead capture enrichment protocol or in silico from a draft genome assembly, we identified and characterized 14 polymorphic loci as usable genetic markers. From samples genotyped to date, Bayesian genetic clustering methods have detected population structure that is delimited by geography and host plant and revealed unexpected substructure associated with mating type. In addition, we have identified multiple clones that were isolated from multiple continents, suggesting that certain genotypes may have been recently disseminated over large distances. Taken together, our research may lead to identification of sources of pathogen inoculum and a better understanding of how the *S. homoeocarpa* metapopulation is shaped by evolutionary forces imposed by management practices and the environment.

Elizabeth D. Riley and Helen T. Kraus
Graduate Program: Horticultural Science
Advisor: Helen T. Kraus
Poster Number: 128

N Rate and N:P:K Ratios Affect Growth of Herbaceous Perennials

Kraus et al. found that two herbaceous perennials had nitrogen (N) requirements similar to annual plants with phosphorus (P) and potassium (K) requirements similar to wood perennial species (HortScience 46(5):776-783. 2011). Experiments were conducted over two years (2010 & 2011) to determine the effect of N:P:K ratios (4:1:2, 8:1:2, and 12:1:2) and N rates of 50, 100, and 200 $mg \cdot L^{-1}$ on the growth of 4 additional herbaceous perennials; *Leucanthemum* 'Shasta', *Musa veluntina*, *Lilium formosanum* and *Pennisetum alopecuroides* 'Hamlin' . These species were grown in 3.8-L black plastic containers filled with an 8 aged pine bark: 1 sand (by volume) substrate amended with 1.2 $kg \cdot m^{-3}$ dolomitic limestone. At harvest, plants were separated into shoots (leaves + stems) and roots. Roots were washed to remove substrate. Before drying all shoots were triple rinsed in deionozed water and all plant parts were dried to a constant weight at 62°C then weighed. For both years and all species the interaction between N:P:K ratios and N rates were generally non-significant so the main effects of N rate and N:P:K ratios will be discussed. For both years the N rate tended to be significant while N:P:K ratios were not. In 2010, N rate did not affect the total dry weights for any of the species. In 2010, N rate did not drastically alter carbohydrate partitioning between root and shoot growth for all species. In 2011, total dry weights were least with 50 $mg \cdot L^{-1}$ N for both, *Musa* and *Lilium* while 200 $mg \cdot L^{-1}$ N generally produced the largest total dry weights for all species. In 2011, high N (200 $mg \cdot L^{-1}$ N) increased shoot growth of all species over low N (50 $mg \cdot L^{-1}$ N); however, only root growth of *Musa* was impacted by N rate and was highest with 100 $mg \cdot L^{-1}$ N.

David Rosero[1], Jack Odle[1], Dean Boyd[2], and Eric van Heugten[1]
Graduate Programs: Animal Science, North Carolina State University[1]; Hanor Company[2]
Advisor: Eric van Heugten
Poster Number: 129

Essentiality of fatty acids during lactation for adequate subsequent reproductive performance of sows

The lactating sow requires large amounts of nutrients to support her progeny. Intake of essential nutrients may be limited for sows under heat stress. Reduction of essential fatty acid intake, particularly linoleic (c18:2) and linolenic (c18:3) acid, seems to affect subsequent reproduction. Thus, the objective of the present study was to investigate the impact of essential fatty acid intake during lactation on the subsequent reproductive performance of sows. Data were collected during the summer. In Exp. 1, 387 sows were randomly assigned to a 2 x 3 factorial arrangement and a control diet with no added fat. Factors included: 1) fat sources: animal-vegetable blend (A-V; 26.9% linoleic, and 1.1% linolenic acid) and choice white grease (CWG; 12.6% linoleic, and 0.5% linolenic acid) and 2) fat level (2, 4, and 6%). In Exp. 2, milk samples were collected from 30 sows fed either a control, 6% A-V, or 6% CWG diet. Milk output was greater for sows fed CWG (P<0.01, 646) than sows fed control or A-V diet (569 and 564, respectively). Additionally, milk fat content was greater for sows fed CWG (P=0.04, 7.4%) than control or A-V (6.3 and 6.7%, respectively). Supplementation of A-V (P<0.01, 23.2%) or CWG (18.9) resulted in greater linoleic acid in milk than control diet (17.4). Sows fed no supplemental fat were in a negative linoleic acid balance (-7.1 g/d). Inclusion of fat on lactation diets improved the percentage of pregnant sows (P<0.01; 63, 75, 72 and 75% for 0, 2, 4 and 6% added fat) and percentage of sows that farrowed in the next cycle (P<0.01; 69, 81, 73 and 82%). In conclusion, fat supplementation improved sow reproductive performance, which in turn will increase profitability. Sows that were not fed additional fat had a negative linoleic acid balance, which may be related to poor subsequent reproductive performance.

Farhana Runa[1], Ignazio Carbone[1], Deepak Bhatnager[2], and Gary A. Payne[1]
Graduate Programs: Plant Pathology, North Carolina State University[1]; Southern Regional Research Center, USDA, New Orleans, LA[2]
Advisor: Gary A. Payne
Poster Number: 130

Heterokaryons and diploids in *Aspergillus flavus* derived from protoplast fusion

Conidia of *Aspergillus flavus* are multinucleate but it is unknown whether they are predominantly homo- or heterokaryotic. A heterokaryon could serve as a source of genetic diversity within strains for pathogenicity and aflatoxin production if homokaryotic as well as heterokaryotic nuclei are packaged selectively into conidia during conidiation. To study nuclear condition in *A. flavus* we transformed strain AFC (arg7, pyrG) with either plasmid HH2B-ECFP to create AFC-ECFP (pyr), a strain expressing nuclei with cyan fluoresce, or with plasmid HH2A-EYFP to create AFC-EYFP (arg), a strain expressing yellow fluorescing nuclei. Protoplasts from the two strains were subjected to polyethylene glycol mediated cell fusion. Putative fusants were selected for their ability to grow on minimal medium, which should not allow the growth of neither nutritional mutant AFC-ECFP (pyr) nor AFC-EYFP (arg). The putative fusants produced mycelia with some nuclei expressing ECFP and other nuclei expressing EYFP. We also observed that conidia from these fusants have three types of nuclei: only EYFP expressing, only ECFP expressing, or both EYFP and ECFP expressing. Ploidy analysis by flow cytometry indicated that the putative 11-2 fusant is

heterokaryotic. Moreover, flowcytometry and merged fluorescence microscopy image data showed that the majority of conidia within 11-2 are homokaryotic, expressing either EYFP or ECFP in subsequent generations; however, a very small percentage of conidia maintain nuclei expressing both. Conidia having nuclei with merged fluorescence have been separated and sorted by FACS. We will determine whether the merged fluorescence microscopy images are indicative of nuclei expressing EYFP+ECFP, maintained predominantly as heterokaryons or as diploids. Confocal microscopy will be applied to track the migration of EYFP+ECFP nuclei during germination and conidiation. This work will allow us to understand the mechanism whereby heterokaryons or diploids are maintained in multinucleated conidia of *A. flavus.*

Sarah Smith[1], Julie Grossman[1], and Seb Prohn[2]
Graduate Programs: Soil Science[1]; Psychology[2]
Advisor: Julie Grossman
Poster Number: 138

Preparing Students for a Diverse Future: Designing and Evaluating a Cultural Competency Training Program for Community Engagement in Agriculture

As urban populations continue to grow in cultural, ethnic and economic diversity and size there is need for extension agents and food system leaders trained to work with diverse populations. NC State's Soil Agroecology course has for 3 years partnered with the Inter-Faith Food Shuttle NGO in community garden projects based in low-income Raleigh neighborhoods. Students were initially found to lack skills to effectively engage middle-school aged children, educate them on complex soil science and sustainable agriculture topics, and remain sensitive and aware of the cultural and socioeconomic differences that exist between student-teacher and community member. To better prepare students we developed a cultural competence guide and training focused on teaching diverse audiences. In Fall 2010 and 2011 students in the course underwent training prior to embarking on their service-learning experience. Student pre and post service-learning experience interviews and survey data are being triangulated with observational findings collected during student teaching to evaluate the efficacy of the training and determine areas for improvements. Preliminary results show that soil science students who engaged in a service-learning experience rate themselves as having a greater ability to teach diverse audiences than a control group of soil students who had no such experience. Soil Agroecology students report improved professional cultural competence skills as a result of their experience and credit the training session for preparing them to work with and teach the members of their assigned diverse community.

Eleanor Spicer Rice
Graduate Program: Entomology
Advisor: Jules Silverman
Poster Number: 139

Speak softly and carry a big stick: Submissive behavior contributes to the displacement of a unicolonial global invader

An essential challenge in invasion ecology is discerning the role behavioral adaptations play in competition between species. When evaluating the impacts of invasive species, the mechanisms underlying coexistence between organisms and the displacement of organisms within a community mosaic are often ignored yet are necessary for understanding these impacts. Ants make an excellent model for observing behavioral adaptations and competition because they are a diverse family with a plethora of evolutionary histories and competitive tactics. Here, we examine the behavioral mechanisms underlying the displacement of the established global invader, the Argentine ant (*Linepithema humile* Mayr) by the newly invasive Asian needle ant (*Pachycondyla chinensis* Emery). Using a series of individual and group assays, we show that the numerically, behaviorally dominant Argentine ant is less aggressive towards neighboring Asian needle ants than towards strangers and that the Asian needle ant's submissive behavior through habituation to Argentine ants can contribute to its ecological success across an Argentine ant-invaded landscape. Understanding factors driving Argentine ant and Asian needle ant coexistence may help explain how small populations of a behaviorally submissive species such as the Asian needle ant establish.

Jennifer S. Stanley, Alexander Krings, Jon M. Stucky, and Richard R. Braham
Graduate Program: Plant Biology
Advisor: Alexander Krings
Poster Number: 142

A Guide to the Vascular Flora of Picture Creek Diabase Barrens (Granville County, North Carolina)

Picture Creek Diabase Barrens [PC] is a biologically unique area located in the northeastern Piedmont of North Carolina. Designated a "Nationally Significant" area by the NC Natural Heritage Program [NHP], this 407-acre site lies within the Triassic basin where diabase intrusions have given rise to mafic soils rarely found in the Piedmont. PC is a remnant Piedmont prairie, boasting a high density of rare, threatened and endangered plant species. The NHP lists 48 taxa in Granville Co. as being rare in NC. Of these, 34 are associated with mafic soils. To date, at least 18 of these have been found at PC, of which half are threatened

or endangered in NC. PC also supports the largest known population of the Federally Endangered *Echinacea laevigata* as well as *Marshallia* sp. 1, an as yet undescribed species designated a Federal Species of Concern. To preserve the unique biodiversity of PC, a better understanding its flora must be acquired. To achieve this goal, specimens are being collected weekly for identification and archival in the herbarium. To date nearly 900 specimens have been collected and approximately 500 identified. Of those identified, over 300 different species have been encountered. Once a comprehensive list of species has been assembled, a guide including taxonomic keys and illustrations, will be developed to aid in the identification of plants occurring at PC. The guide will provide land managers with the tools to determine which species are growing on the site and which have been known there historically. This information will help inform precision natural resource management and aid in the effort of monitoring population changes in response to management practices.

Samuel C. Suarez
Graduate Program: Environmental and Molecular Toxicology
Advisor: Scott D. McCulloch
Poster Number: 143

Active Site Mutants of DNA Polymerase Eta Alter Fidelity and Bypass of DNA Damage

DNA polymerase eta (pol eta) is a eukaryotic, Y-family DNA polymerase with a role in bypass of DNA damage generated through multiple routes, including cyclobutane pyrimidine dimers (CPD) and 7,8-dihydro-8-oxo-guanine (8-oxoG). CPDs are generated through exposure to UV radiation while 8-oxoG is created by reactive oxygen species (ROS), either endogenously created or as a result of environmental exposures. Evidence shows trans-lesion synthesis (TLS) can occur at multiple points throughout the cell cycle, and recent reports demonstrate bypass of 8-oxoG can occur independent of S-phase by a Rad18 and MSH2/MSH6 dependent mechanism in human cells. Pol eta is able to bypass CPDs and 8-oxoG with differing, lesion dependent, efficiency and fidelity. To investigate these differences, candidate amino acids and mutations in the active site were selected from previously published mutation screens and crystal structures, as well as single nucleotide polymorphisms (SNPs) selected from the NCBI database. From that set, we created single amino acid substitution mutants in order to determine functional differences in bypass and fidelity while copying undamaged and damaged DNA. Our results indicate that these residue changes can alter polymerization activity of the enzyme, as well as fidelity and bypass past multiple DNA lesions. Some mutants display a decrease in bypass coinciding with a decrease in error rate when copying undamaged and damaged DNA, while others have an opposite effect. These results suggest that the primary amino acid sequence of pol eta has been evolutionarily selected to maintain a balance between ability to bypass lesions and replication fidelity. The maintenance of bypass at the cost of decreased fidelity has implications for an organism at multiple levels. The characterization of these mutants gives us insight to the molecular determinants of pol eta performing its proposed function of bypassing lesions and preventing mutation during lesion bypass.

Lamyaa Taysir Negm
Graduate Program: Biological and Agricultural Engineering
Advisors: Mohamed A. Youssef and R. Wayne Skaggs
Poster Number: 147

Development and Application of the DRAINMOD-DSSAT Model for Simulating Hydrology, Soil Carbon and Nitrogen Dynamics, and Crop Growth for Drained Agricultural Land

Agricultural drainage effluent enriched with nutrients has resulted in severe ground and surface water contamination. Process-based simulation models of agricultural systems have been valuable tools for assessing the long-term impacts of different management practices on land productivity and water quality at both field and watershed scales. Upon entering the 21st century, however, more threats and challenges are confronting food security, land and water resources, in addition to the increasing concerns about climate change and global warming. This emphasizes the critical need for developing whole-system models which can help the design of effective water and nutrient management practices that reduce nitrogen (N) drainage losses and maintain high agricultural productivity under the anticipated scenarios of climate change and water availability. Most of the available models; however, emphasize certain processes in the agronomic ecosystems. The current study focused on the development of a whole-system model (DRAINMOD-DSSAT) for crop production on drained fields by fully integrating deterministic crop growth modules of the DSSAT model (namely CERES-Maize and CROPGRO) with the hydrologic model, DRAINMOD, and the soil carbon and nitrogen model, DRAINMOD-NII. The integration between the three components was setup on a day-by-day basis on the source code level to allow for data transfer and feedback between the physiological crop development and soil and weather conditions. DRAINMOD-DSSAT was tested using a corn-soybean production system on a subsurface drained field in Iowa, with corn receiving different N fertilization rates. The model was calibrated using the data set collected from the high-N treatment, and validated for the other two treatments. This study demonstrated the capability of the DRAINMIOD-DSSAT model to simulate water and nitrogen balances and crop growth in response to nutrient management practices, and can be engaged in finding practical strategies and management regulations to help adapt agro-ecosystems to emerging needs and changing environment.

Robert W. Thornhill[1], Alexander Krings[1], David L. Lindbo[2], and Jon M. Stucky[1]
Graduate Programs: Plant Biology[1]; Soil Science[2]
Advisor: Alexander Krings
Poster Number: 149

The Vascular Flora and Soils of the Wet Pine Savannas of Shaken Creek Preserve (Pender County, North Carolina)

Shaken Creek Preserve is a 6050-acre Nationally Significant Natural Area in Pender County, North Carolina. Best known for its high-quality savanna habitat, the site supports at least 28 state-listed plant species (including three federally-endangered species) and is the only site in the state to contain four distinct Wet Pine Savanna communities, three of which are globally rare (G1). Formerly a private hunting club, the site was virtually unknown to scientists until the 1990s; consequently, few biological inventories of the site have been conducted. In particular, no systematic floristic inventories of the species-rich savannas have been undertaken, despite the fact that floristic data are critical to the effective management of any natural area. The ongoing goals of this study are to 1) document the vascular flora of each of the savanna sites with voucher specimens and tissue samples collected during weekly site visits; 2) compare the vegetation and soils of the four Wet Pine Savanna communities; and 3) create a taxonomic guide (complete with identification keys, synonymy, phenology, notes on abundance, and illustrations) to the savanna flora. To date, 1253 specimens representing 353 taxa have been collected, including 5 state-listed species not previously known from the site. Besides providing the baseline data for site management, the information from this study will facilitate further biological and ecological research on site and will ultimately provide a valuable educational resource for anyone interested in the exceptional flora of these rare savannas.

Priyanka Tyagi[1], Vasu Kuraparthy[1], Michael Gore[2], and Daryl Bowman[1]
Graduate Programs: Crop Science, North Carolina State University[1]; USDA-ARS, Maricopa, AZ[2]
Advisor: Vasu Kuraparthy
Poster Number: 152

Assessing Genetic diversity of U.S. cotton (*Gossypium hirsutum* L.) cultivars using SSR markers

Establishing genetic diversity of cultivars is essential for germplasm enhancement and genomic analysis in crop improvement programs. The objective of this study was to characterize genetic relationships of 384 upland cotton cultivars, representing breeding programs from across the U.S. cotton belt. Genotyping was done with 120 SSR markers using high-resolution capillary-based SSR genotyping. SSR marker sequences were obtained from Cotton Marker Database and a minimum of four markers per chromosome were selected for genotyping. The structure of genetic diversity of upland cultivars in the form of phylogenetic tree and the genetic relationships of the cotton cultivars using marker data will be presented.

Matthew Vann
Graduate Program: Crop Science
Advisor: Loren Fisher
Poster Number: 155

The Effect of Potassium Rate, Application Method and Timing on the Yield and Quality of Flue-cured Tobacco

With rising input costs, growing environmental concerns, and higher yielding cultivars, fertilizer recommendations for flue-cured tobacco production must be accurate. Research was conducted in North Carolina in 2009 and 2010 to evaluate the effect of various potassium rates and application methods on the yield and quality of flue-cured tobacco. The purpose of this research was to evaluate current potassium recommendations and alternative methods of application that could reduce the workload for producers as the season progresses. Treatments included four rates of potassium from potassium magnesium sulfate (0-0-22); 84, 140, 196, 252 kg K_2O/ha, applied at four different timings; all broadcast one month before planting, all broadcast one week before planting, all banded at planting, and a split application with one-half rate at planting and one-half rate at layby (approximately four weeks after transplanting, when plants were roughly 38 cm tall). In addition to yield and quality measurements, tissue samples were collected at three separate intervals: at layby, at topping, and after curing; and were later analyzed for nutrient and chemical content. Data were subjected to an analysis of variance (ANOVA) using the PROC GLM procedure in SAS. Treatment means were separated using Fisher's Protected LSD test at $p \leq 0.05$. Rates above 84 kg K_2O/ha did not significantly improve any measured parameters. In both years, crop yield and quality were unaffected by application rate and application method. Under the environmental conditions observed at the research locations, lower rates of potassium applied earlier in the season was acceptable. It is likely that early broadcast applications of potassium with lower rate recommendations would only be of concern with combinations of conditions that included coarse soil textures, low potassium indices, and/or excessive rainfall.

Steven Vensko, Eric A. Stone, Trudy F. C. Mackay, Michael Magwire, Brittny Calsbeek, and Mary Anna Carbone
Graduate Program: Genetics
Advisor: Eric A. Stone
Poster Number: 156

Detection of sex-variant alternative splicing in an experimental Drosophila population

Sexual dimorphism exists in nature across diverse species as well as within nearly every facet of the genotype-to-phenotype framework. Instances of transcription-level sexually dimorphic activity, such as sex-specific gene expression, can have implications for sexual dimorphism of organismal phenotypes. An example can be found in the *Drosophila melanogaster* sex-determination pathway in which sex-variant alternative splicing (along with other sex-variant events) plays a key role in the development of sex-specific characteristics. Affordable transcriptome-wide RNA sequencing has made studying sex-variant alternative splicing on the transcript isoform level feasible; however, recent studies have utilized fewer genetic backgrounds in exchange for deeper depth RNA sequencing. This deeper depth allows for discovery of novel sex-variant transcripts but is inherently constrained to transcripts within the transcriptome of the sampled genotypes. The Drosophila Genetic Reference Panel (DGRP) provides a platform to investigate sex-variant alternative splicing across 158 unique *D. melanogaster* genetic backgrounds. By harnessing genome-wide transcription abundance estimates across all 158 genetic backgrounds, we expect to detect sex-variant alternative splicing events with high confidence and few false positives. Progress towards discovering novel cases of sex-variant alternative splicing within the DGRP experimental population as well as a comparison between DGRP sex-variant transcripts and other comparable datasets will be presented.

Jason Whitham[1,2], Jesse Daystar[2], Mari S. Chinn[3], Michael C. Flickinger[4], Joel Pawlak[2], and Amy M. Grunden[1]
Graduate Programs: Microbiology[1]; Forest Biomaterials[2]; Biological and Agricultural Engineering[3]; Chemical and Biomolecular Engineering[4]
Advisors: Amy Grunden and Joel Pawlak
Poster Number: 163

Development of an analog simulation of syngas fermentation using nanoporous bioactive coatings

The autotrophic bacterium *Clostridium ljungdahlii* has been demonstrated to convert carbon monoxide, carbon dioxide, and hydrogen from synthesis gas into ethanol. Thermochemical conversion of synthesis gas to ethanol has been modeled by the National Renewable Energy Laboratory (NREL) (2006). In the NREL model, synthesis gas formation resulted from the gasification of hybrid poplar. Here we created a simulation that couples the front end of NREL's process to a nanoporous bioactive coating system to generate ethanol biochemically from synthesis gas. A comparison of ethanol yields was generated from the simulation in response to different feed stocks (corn stover, eucalyptus, natural hardwood, pine, and switchgrass). Though the simulation in its present form does not include all aspects required for an exhaustive model, the purpose of the current version of this simulation is to produce the foundation of a predictive model that could be used to quantify biochemical conversion of synthesis gas to ethanol given different sources of lignocellulosic biomass.

Erin Yost[1], Michael T. Meyer[2], Boknam Lee[3], and Seth W. Kullman[1]
Graduate Programs: Environmental and Molecular Toxicology, North Carolina State University[1]; Organic Geochemistry Research Laboratory, United States Geological Survey, Lawrence, KS[2]; Duke Environment at the Nicholas School, Duke University, Durham, NC[3]
Advisor: Seth W. Kullman
Poster Number: 171

An Integrated Approach to Developing a Total Facility Estrogen Budget at a Swine Farrowing CAFO

Naturally occurring estrogens have been demonstrated to adversely affect the reproductive health of aquatic organisms at concentrations as low as the parts-per-trillion range, making them amongst the most potent known endocrine disrupting compounds. Concentrated animal feeding operations (CAFOs) have been demonstrated to contain abundant levels of natural estrogens in their waste, and thus represent a potential source of these compounds into the aquatic environment. Here, we present our findings on the occurrence and fate of natural estrogens in a North Carolina commercial swine farrowing CAFO, which houses 5,000 pregnant and lactating female swine. Analysis of estrogens was made in relation to: 1) reproductive status and estrogen excretion by individual animals; 2) the stability of estrogens in open pit holding lagoons; and 3) mobility of estrogens following spray field application of swine waste as fertilizer. LC/MS-MS results indicate that raw swine excreta contains appreciable levels of natural estrogens, with estrogen output increasing in relation to the reproductive stage of the animal. During storage in the waste lagoon, the mixture of natural estrogens in the raw swine excreta (e.g. 17β-estradiol, 17α-estradiol, estrone, estriol) appears to undergo a transformation to estrone, which is the potent ketonic form of natural estrogen. As a result of this transformation, estrone is by far the predominant form of estrogen in the lagoon, with concentrations averaging 6.2µg/l in lagoon wastewater liquids and 1.7g/kg (dry weight) in lagoon suspended solids. Following the land application of lagoon waste onto crop fields, estrone was found to persist in the top 6" of soil at parts-per-trillion concentrations for at least 2 months post-application. Estrogen concentrations from these 3 levels of the CAFO (animals,

lagoon, soil) were used for input into Bayesian network models, which can be used to explore and predict the behavior of estrogens within the swine CAFO system.

Jessie Braverman and Shawna Hammon
Graduate Program: Architecture
Advisor: David Hill
Poster Number: 13

A look at prototypical architectural design and its potential uses as shelter

The design of prototypical architecture, and the study of its uses as a shelter, has a long and celebrated history. From Buckminster Fuller's Geodesic Dome to Shigeru Ban's cardboard tube structures, prototype architecture has been used to alleviate a variety of the world's shelter issues. The goal of our research into prototype design was to continue the search for a module that could be used to produce a lightweight, efficient, affordable, and semi-permanent shelter to be used around the world. The module we ultimately developed is the circle with an inscribed triangle. This module was explored using paper as a quick medium to create self-supporting structures. Of these structures, we singled out a potential candidate for material analysis and preliminary construction. Our initial material selection was corrugated plastic because it was inexpensive, lightweight, and flexible. The module was then created in AutoCAD and cut using a CNC Router. We then assembled the modules to create the first structure – the Folding Modular Retreat (FMRp). As we continued to explore different structural possibilities, we constructed a second shelter that was twice as large as the first and tested it in a variety of weather conditions. We are continuing our module research by looking into the properties of other materials, as well as considering joint connections, which would mitigate the water leakage problems the original design displayed. Overall, the prototype performed well in hot and cold weather and was able to support at least seven adults of an average of 150 pounds at one time.

Michael Carbaugh
Graduate Program: Graphic Design
Advisors: Santiago Piedrafita, Martha Scotford, and Scott Townsend
Poster Number: 16

Designing Tools for Citizen Participation for in City Planning

Physical environments of cities continuously change, responding to varying needs of citizens, business, and organizations. These alterations happen for many reasons, ranging from aesthetic improvement to functional infrastructural developments. The development of the Raleigh metropolitan area is particularly interesting because it had the second highest growth rate in the United States between 2000 and 2010. As this area continues to grow at a staggering rate, citizens will be asked to voice their opinions about proposals for change in their everyday environments. Current forms of civic participation in planning often take the form of public workshops, presentations, public hearings, and online commenting forms. I believe design can present new perspectives and provocations at this stage of city planning while respecting existing and anticipated public policies. The objective of this project is to design a digital tool that envisions new ways of citizen participation in city planning processes, as well as a space for citizens to obtain information, discuss issues, and ultimately hold their own opinions. An audit of existing projects and case studies was conducted to acknowledge current efforts with similar goals. Analyzing how planning information is presented to the public was also performed to identify qualities of possible alternate visualizations. Scenarios were developed to anticipate where and why citizens would interact with the tool; these activities brought up core themes including mobility, the public sphere, and cognitive mapping. Designing with location-based mobile technologies provides opportunities to connect physical sites to augmented digital spaces, layering supplemental information and visualizing changes in context. Developing a tool that lives on multiple platforms makes sustained discussion and participation more accessible.

Ya-Lin Chen
Graduate Program: Industrial Design
Advisors: Bong-Il Jin and Haig Khachatoorian
Poster Number: 25

Urban Search and Life Extension Robot

The increasing frequency of natural disasters, especially earthquakes, require the tremendous resources of urban search and rescue (USAR) teams. Recently, most of the nations around the world have invested in people and resources for disaster problems. Disaster rescue has become one of the most serious issues, involving large numbers of human and technical resources. USAR is a life-saving vocation, and the ability to save a life is often dependent on how quickly the victim(s) can be found and accessed. Therefore, we except much more safer and efficient task accomplishments by integrating robotics into the USAR process. The intention of this project is to a) Design a product concept that will provide a future vision for search and rescue work; b) Contribute to the understanding of designing for search and rescue robotics; c) Create a role for the industrial

designer in the domain for research in human-robot integration; and d) Improve on existing solutions. According to Federal Emergency Management Agency (FEMA), the survival rate of victims drops extremely from 80% to less than 10% after the first 3 days. The reasons that influence survival are various; basically they depend on the injures and health of victims, the temperature conditions, location, and if the victim lacks water or oxygen. According to Emergency Response Team (ERT), humans can basically live for 3 days without water, and 3 weeks without food. Based on the research above, we can come up with a conclusion that there is a chance to prolong life after a disaster by providing water, basic nutrition, and sometimes emergency medical aid to trapped victims. Which means, we can expect an increasing rescue rate by designing a robot with victim-locating and life-support capabilities.

Kirby Culbertson
Graduate Program: Design
Advisor: Patrick Fitzgerald
Poster Number: 32

Animator's Toolkit: Applying Traditional and Alternative Techniques to 3-D Character Animation

Computer Animation has evolved to the point that it is now capable of completely copying a live performance. The film Benjamin Button was a huge technical accomplishment, and the animators on that project were very successful in mapping the live performance of Brad Pitt onto the computer animated model on screen. But this doesn't mean that subtle and effective performances in animation can only be realized by completely copying a live actor. Characters in older hand drawn animated films like Jungle Book or Iron Giant connected with audiences and had life of their own because of the techniques developed by masters like Frank Thomas and Ollie Johnson. This research investigates the role of the computer animator as an actor and not a technician. Lessons learned from film, dance, theatre, and traditional animation can provide a framework that will help guide the ideas and decisions the animator makes when creating a character performance. Research into each of these categories will generate a checklist that can be used as a tool by the animator to craft and continually refine the movement and acting of their characters.

William H. Dodge
Graduate Program: Architecture
Advisors: Bryan Laffitte and Marvin Malecha
Poster Number: 36

"Modern" Warfare

I was fortunate enough to be a part of a small but incredible team of designers, professors, and researchers tasked with solving the monumental design challenge of developing a "sustainable", collapsible, bulletproof, fireproof, compact, and expandable rapid deployment base camp system for the US Army. This system must also be able to accommodate nearly all weather environments/topographies, weigh less than 10,000 lbs, and fit in a standard shipping container of 8' x 8' x 20'. Additionally I will be presenting research on the subject of urban warfare defense mechanisms, terrorist extraction units, and disaster relief/emergency response/housing systems as my previous research led me to explore a more wide array of issues than originally anticipated. I am hopeful that when put into practice this research will cut down on resources needed, save time/money, provide greater comfort, and ultimately save lives. [This research was made possible by a grant provided to the North Carolina State University College of Design by the US Army Research Office.]

Sile Gao
Graduate Program: Industrial Design
Advisors: Bong-Il Jin and Haig Khachatoorian
Poster Number: 45

Design for Overcoming Depression

Depression is a common and debilitating mood. It can cause impairment in many areas of functioning – including school, work, family, and social life. It is treatable, but the majority of people with depression do not receive, at the least, minimally adequate treatment. Based on research, there are two main problems of depression. The first one is the cognition of depression; second one is current ineffective treating method. The cognition of depression is deeply impressed by American culture, so that people suffering from depression are more likely to talk about physical symptoms rather than symptoms related to emotions. Current treatment methods including medications, talk therapy or seeing a psychiatrist, doing exercises, and chemical treatments are not appropriate for most of the patients. So that a new method of treating depression mood and reduce potential patients is in need. From psychological viewpoint, compassion has been viewed as central to liberating minds from the power of destructive emotions such as fear, anger, envy and vengeance. And compassion not only is a process that underpins the building of prosocial relationships with others, but also has great potential to heal minds and bodies. Compassion involves being open to

the suffering of self and others, also involves a desire to relieve suffering, cognitions related to understanding the causes of suffering, and behaviours. After analyzing the symptoms and causes of depression, designing a platform that helps people overcome depression is considered. The platform is defined as a personal product that uses the storytelling therapy process to provide pleasure and stimulation, while at the same time helping patients to look outside to others and to improve spiritual health.

Mary Elizabeth Miller
Graduate Program: Industrial Design
Advisor: Haig Khachatoorian
Poster Number: 95

Co-Active Design Project: Crowdsourcing for Human-Centered Design

Recently there has been a major sift in the designer's role from creator to facilitator. There are now approaches to design that are used to encourage user involvement in the design process, such as co-creation and participatory design, as well as user-centered approaches that call for user's participation in design research. These approaches are focused on developing products that better meet their needs and wants, ultimately reducing the risk of product failure. Design research that requires user participation is expensive and time consuming, often not possible within the stakeholder's timeline and budget. My graduate research looks at how social media can be used to conduct design research and encourage the involvement of the users throughout product development. The end result is a reduction of time and cost of design research when developing a human-centered design.

The open source platform provided by social media allows for users to generate content and discuss their personal experiences with products and services. There are many social media sites that crowdsource for the collection of these opinions in order to generate a large database for people to find information; this is called crowdsourcing for distributed knowledge. Companies have had no choice but to respond to these changes and are now crowdsourcing for users to generate, develop, and implement their ideas through open innovation. Designers can also use crowdsourcing in the form of open innovation and distributed knowledge, to collect user-generated information prompted by designers to aid in design research.

Co-Active Design Project (coactivedesignproject.ning.com) is an online social network that I have created in order to evaluate how social networks can be used to crowdsource for user generated research and aid in open innovation. Social networks provide a platform in which users can share their opinions and observation, and to communicate with others to co-actively problem solve and generate design solutions. I believe that the content created by users can be used to define design criteria through user's needs and wants. I will test this theory by collecting the data created on the site and developing a new product based on the information generated on the site.

Cecilia Mouat
Graduate Program: Design
Advisor: Haig Khachatoorian
Poster Number: 97

The Discourse of the City in American and British Films between the 1930s and the 1960s

Audiovisual media are able to reproduce space and time, and may represent more vividly the spatial condition of architecture. This feature allows the increasing use of animated simulations in teaching and professional practice. However, the mere representation of space, although it can be through sophisticated methods similar to real experiences, the focus is both to reproduce physical characteristics of spaces, and to reproduce body perceptions. This dissertation suggests that architecture must be analyzed not only in terms of physical and perceptual characteristics, but also in terms of cultural discourses. This project analyzes films, as cultural texts, to approach architecture. Films strongly influence the construction of meanings about the city space, and their analysis open up new approaches to understand architecture and its symbolic condition for the human being.

The objective of this project is to understand how America and Britain have represented and commented the city space between the 1930s and 1960s. To achieve this goal, the study analyzes 87 films to illuminate: the main urban and architectonic models represented on screen; the discourses associated with these models; the analysis of the relationship between urban discourses and film genres; and the categorization of films according to their urban discourses. The theoretical framework is the discourse analysis proposed by Michel Foucault, the Genre Theory, and the genealogical method.

The findings suggest that American and British films portrayed a clear dichotomy between city and country; whereas the metropolis is seen as a space of vice and risk, the country is idyllically shown as the best choice for living. In the context of modernity, this dichotomy seems to be solved through the promotion of green suburban models. On the other hand, the findings demonstrate that film genres strongly contributed to distribute this discourse, and help to shape taken-for-granted assumptions of the city space.

Adam Osgood
Graduate Program: Art and Design
Advisor: McArthur Freeman
Poster Number: 106

Developing a unique aesthetic approach to animation through a synthesis of Art Deco and Film Noir

This project aims at developing a unique aesthetic approach for the art direction of an animated story about spies set in WWII Europe, called "Mother". The research analyzes and identifies the key elements and motifs from 1920s-1940s design and cinema (specifically Art Deco and Film Noir) and uses those elements as building blocks for a unique aesthetic representation.

Tracing Art Deco design and Film Noir cinema back to their shared roots in the Avant Garde movements of the early 1900s to their respective heydays in the 1920s and 1940s, the research first assembles a list of commonalities and motifs from important artistic works in both areas such as geometric formality, optical simplicity, distortion of reality, and period representation. After identification, these visual motifs are applied to each sequence in "Mother" to create a unique visual aesthetic that is evocative of the period and setting.

Amina Patton
Graduate Program: Graphic Design
Advisor: Santiago Piedrafita
Poster Number: 112

Designing for Health Literacy and Social Support

Health literacy is defined as the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions. Such an expansive concept involves a range of stakeholders and experts, including designers due to the manufacture and distribution of messages and materials in health communication. Much of the current research fails to address the range of literacy skills beyond reading and writing, as well as the social or cultural contexts that affect health literacy. My research aligns a range of health literacy skills with social support to create new possibilities within health communication. Maternal health literacy is of great concern due to the dominant role women play in their children and families' health. By focusing on pregnant teenagers, I am highlighting an often neglected population that struggles with prenatal care and nutrition. After identifying and evaluating existing health communications based on levels of social support, I have selected a recently developed, publicly and privately sponsored, free service to be the center of the research moving forward. The Text4Baby service sends out three SMS messages a week to expecting and new mothers with pertinent tips and health information. I am currently utilizing the service as launching point for future design expansions that facilitate greater user interactivity and social networking. Recent investigations have included usability analysis of the Text4Baby service, and consequently, an editorial evaluation of the SMS messages. Also, the development of expanded affordances of the mobile and web experiences for users as well as members of their social network that are not signed up for the service. The objective is to develop attributes and behaviors that facilitate self management while also fostering a socially supportive environment with family, friends, and peers.

Heather B. Rhymes and Mary H. Archer
Graduate Program: Landscape Architecture
Advisor: Gene Bressler
Poster Number: 126

Retail Renewal: Durham Station Transportation Center

Located on West Pettigrew Street next to the popular American Tobacco Campus, the newly renovated Durham Station Transportation Center was completed in 2009. The station acts as the public transit hub for downtown Durham by including DATA, TTA, Greyhound, and Megabus services, and is a recent addition to revitalization efforts in downtown. The surrounding area receives high visitor volume due to attractions like the Durham Bull's Athletic Park, Durham Performing Arts Center, restaurants, and commercial and residential spaces, creating great user potential for the site. The project focuses on a post-occupancy evaluation requested by the designers Freelon and Hayden-Stanziale. First-hand observation of the site revealed issues including safety, unused spaces, concentrated activity, lack of a destination, a limited demographic of users, and no sense of place. Development of retail spaces are proposed in response to these issues by increasing the volume, demographic, and length of stay of visitors and users. Including retail in the Durham Transit Station will enhance current user experience by creating interest and activity from potential users. To evaluate this hypothesis, on-site interviews with users were conducted to determine their desires and needs. Support from the users, community, and existing sites indicates a preference for food-related retail with the most support for "quick food." In addition to interviews, potential improvements are examined via case studies of existing transit centers that incorporate retail. Analysis is presented to show retail in the area and to evaluate the need and potential for development. The solution presented can be used to help transform the existing station to a more viable, comfortable, user-friendly destination, serving as a precedent for future transit-oriented development.

Zahra Zamani
Graduate Program: Design
Advisor: Robin Moore
Poster Number: 173

The Cognitive Play Behavior Affordance of Natural elements within Outdoor Preschool Settings

Children learn about themselves and the environment through interaction (Moore and Wong, 1997). Urban areas require child-friendly spaces where children can have daily contact with nature while playing freely. However, due to hazardous urbanized conditions, children's contact with nature, and outdoor play opportunity is decreasing (Malone & Tranter, 2003; Moore and Wong). On the other hand, Preschool settings are rare settings which children can interact freely with nature within a safe condition (Moore and Wong, 1997). Nevertheless, research about the type of cognitive play behavior afforded by various elements has not yet been explored empirically. By acknowledging the significance of natural elements in affording cognitive play behavior, guidelines to combine potential and lacking elements in the design process preschool settings can be proposed. Subsequently, the preschool's outdoor setting can support a learning environment that liberates cognitive learning by affording diverse play opportunities for different abilities. Furthermore, these integrated natural elements support children's daily contact with natural elements, endorsing an effective educational experience, biosphere, and environemntal learning (Moore and Wong, 1997). The current research explored the cognitive play behavior affordances of physical environment features of two outdoor daycare centers. The results of 379 behavior mapping data points indicated the significant potentiality of natural loose elements in affording diverse cognitive play behavior opportunities. Additionally, these elements contributed to the complexity of the outdoor environment by enabling children to manipulate them.

Hannah Carson Baggett and Heather Davis
Graduate Program: Curriculum, Instruction, and Counselor Education
Advisor: Heather Davis
Poster Number: 20

The Untapped Potential of Touch: Exploring Practicing Teachers' Perceptions of Touch in Pedagogical and Relational Contexts

Research from health science fields, including nursing, indicates that touch has many relational and developmental benefits. However, in educational contexts, "no-touch" policies often prohibit teachers from even entering into discourse about touch in the classroom. This study explores the relationship between practicing teachers' desired physical and emotional closeness to students and their perceptions of the risk, appropriateness and comfort of classroom touch in both pedagogical and relational contexts. One hundred nine female and 21 male practicing teachers participated in an online questionnaire in which they rated their desired physical and emotional closeness to their students, and then analyzed five vignettes to rate their perceptions of risk, appropriateness and comfort in each vignette. Teachers represented varying level of experience, from novice to 16 or more years in the profession. In this study, we contrast findings regarding two vignettes that describe the use of touch to teach a concept (pedagogical touch) and the use of touch to build relationships (relational touch). Preliminary findings suggest the teachers' desire for physical and emotional closeness to their students had no relationship with their perceptions of risk, appropriateness and comfort for pedagogical touch. Conversely, teachers' desire for closeness significantly predicted their perception of risk, appropriateness and comfort for engaging in relational touch. These findings indicate practicing teachers consider the type of touch and can make sound, rational decisions regarding touch in the classroom. Findings substantiate the need to view teachers as professionals and highlight the potential "untapped" benefit of pedagogical touch. We discuss findings from this project with data collected from pre-service teachers, and discuss implications for constructing a discourse on classroom touch.

Robert Coven
Graduate Program: Curriculum and Instruction
Advisor: Meghan Manfra
Poster Number: 30

Connecting History: Student Engagement Through Inquiry

The literature on Social Studies education supports the use of experiential, or constructivist methods in the pursuit of greater student engagement and conceptual understanding. This research is designed to address whether student engagement in a range of scholarly activities will give them greater understanding of both the nature of history and the analytical skills necessary to make meaning out of historical data. (Lévesque, 2008) My central question asks whether there is evidence that students are more engaged in learning, in general, and in the activities of a historian when they are completing data collection and management/organization--as when working on a database.

Through the Connecting History Database, I hope to provide students the best qualities of digital history. The students take the lead in the collection of the kinds of data necessary to understand history. The underlying categories and structure--developed by the students--will aid them in developing coherent arguments based on appropriate evidence. The construction of the

Connecting History database--like the conceptual work done in modeling (Manfra & Coven, 2011)--creates a framework for the promotion of instruction that prepares students for authentic intellectual work.

Surveys and interviews were conducted to assess student reaction. Responses were collected and analyzed. This pilot research project suggests that methods that engage students--like modeling and the Connecting History database--are much more effective and rewarding than standardized, content-centered, textbook-driven curricula. Better students come of better teaching. So, perhaps better history can provide a better future.

Richelle C.R. Dietz
Graduate Program: Mathematics Education
Advisor: Karen A. Keene
Poster Number: 35

The relationship between classroom episodes and students' understanding of variable: A mixed methods study

Teachers and researchers often wonder what leads students to erroneous understandings of concepts. Numerous factors in a classroom beyond prepared lessons affect student learning and it is difficult to determine what influences students' construction of a concept.

Research shows that misconceptions of variable are prevalent among high school students. These misconceptions inhibit students' ability to create, explore, and interpret mathematical models such as linear programs. Using a mixed methods design, this study examines students' understanding of variable within a particular curriculum. This study answers the following questions: (a) does students' participation in an enacted linear programming curriculum improve their understanding of variable? and (b) how do individual students' understanding of variable link to the curriculum?

Data were collected from students in a fourth-year secondary mathematics class. Research instruments included pre- and post-surveys, video-taping classroom observations, student work, and student interviews. Preliminary results suggest that students harbored various misconceptions of variable. For example, one student had a dual understanding of variables; a variable simultaneously acted as a descriptor and as an argument. With this duality, the student struggled to learn integral parts of the unit, including the role of the variable in a computer spreadsheet. Currently, video recordings of the interviewed students' interactions within the classroom setting are being coded to determine classroom episodes that link to students' conceptualizations of variable. Commonalties in the codes may reveal trends in the links between classroom episodes and students' conceptions.

The results of the research study contribute to the greater research community in several ways. The study applies a research design to a new content area and employs a new framework to research students' engagement in enacted curriculum. In addition, the study addresses some large gaps in literature on student understanding the role of variable in a linear programming context.

Cyndi Edgington
Graduate Program: Mathematics Education
Advisor: Paola Sztajn
Poster Number: 37

Teachers' uses of a learning trajectory to support attention to student thinking in the mathematics classroom

An emerging hypothesis in mathematics education is that the construct of a *learning trajectory* (LT) has the potential to support teachers in making sense of and use student thinking to improve teaching and learning. The authors of the Common Core State Standards (2010) emphasized the use of research-based LTs in the development of the new standards and committed to using research and evidence of student learning to inform future revisions. The purpose of this study is to examine the influence of LTs on teachers' instructional practices. Through an examination of teachers' uses of one particular trajectory, the study is designed to enhance the field's understanding of how LTs can support teachers' attention to student thinking during mathematics instruction. A multiple case study design was employed to analyze a purposefully selected sample of five second grade teachers who participated in a year-long professional development project to engage teachers in learning about the equipartitioning learning trajectory (Confrey et al, 2009). The participants collaboratively planned and individually implemented a set of lessons on equipartitioning over the course of one semester. The research presented here describes one teacher's use of the LT to attend to student thinking through three cycles of planning, instruction, and assessment. Preliminary findings suggest the LT supported the teacher in choosing appropriate learning goals and instructional tasks, anticipating and identifying common misconceptions, and providing her students with opportunities to make connections among mathematical ideas. Moreover, she was able to use evidence of her students' learning along with the structure of the LT to consider follow-up activities to move her students' learning forward.

Krista Holstein
Graduate Program: Mathematics Education
Advisor: Karen A. Keene
Poster Number: 67

A Characterization of Teachers' Implementation of a Mathematical Decision-Making Curriculum

Over the past two decades, several new K-12 mathematics curricula have been developed. The question asked by many researchers and administrators is: "Do these materials work?" This question has led to research on curricular effectiveness and, more specifically, on teachers' implementations of the curricula. Teachers often transform curricula into a form completely different from the authors' original intentions. One possible explanation for this transformation is teachers' conceptions. To address these issues, the purpose of this study is to examine teachers' implementation of a specific mathematics curriculum and how their conceptions influence this implementation. To evaluate the implementation of this curriculum, a mixed methods study was employed. First, observations and lesson logs were used to examine teachers' implementation of the curriculum. Second, interviews and surveys were utilized to study teachers' conceptions related to their implementation. Six teachers participated in the qualitative portion of the study (observations and interviews); approximately 10 teachers participated in the quantitative portion (lesson logs and surveys). Preliminary results suggest that teachers tend to implement the materials very closely to the written text. Furthermore, most teachers employed pedagogical practices that aligned with the expectations of the curriculum authors. Only one teacher regularly brought in outside resources to supplement or replace the curricular materials; another teacher used pedagogical practices considerably different from the intended practices. Teachers' beliefs about teaching and about students were the conceptions that most consistently influenced their implementations of the curriculum. The results of this study reveal that teachers may or may not stray from the authors' intended curriculum, and whether or not they stray often relates to their personal beliefs. This study contributes to previous research on curricular effectiveness by using innovative methodologies and by taking a more in-depth look at teachers' implementation of a specific curriculum and the reasons for their implementation.

Bess Patton
Graduate Program: Adult and Community College Education
Advisors: Duane Akroyd and Sue Bracken
Poster Number: 113

Identifying Academic Factors Affecting African American Retention in the North Carolina Community College System's Associate Degree in Nursing Program

A 2008 study commissioned by the North Carolina Community College System (NCCCS) examined factors leading to retention for students entering the Associate Degree in Nursing (ADN) program of study in 2002. Results from that study identified the number one factor for attrition in the ADN program was race with African American students 20% more likely to drop out of nursing than their white counterparts. Beginning in 2008, all NCCCS ADN programs use merit based admission processes to select program participants, yet the first year rate of attrition remains over 30%. While still in the planning and design stage, this quantitative research study proposes to identify academic factors that affect African-American student retention in the ADN program.

Iris R. Wagstaff
Graduate Program: Leadership, Policy and Adult and Higher Education
Advisor: Tamara V. Young
Poster Number: 158

A *STEM Career Approach* to Attracting and Retaining Underrepresented Groups to the STEM Pipeline: Preliminary Pilot Study Results

It has been widely reported that females and ethnic minorities that include African Americans and Hispanics/Latino(as) are underrepresented in Science, Technology, Engineering and Math (STEM). While many STEM outreach initiatives have been employed to address this disparity over the last two decades, students at the K-12 level still are not choosing to pursue STEM careers in large enough numbers. The purpose of this study was to investigate a *STEM Career Approach* that employs a hands-on, inquiry-based and real-world focused curriculum facilitated by STEM professionals from the community. The literature suggests that engaging with STEM professionals can help students develop a science identity, provide authentic advice and improve confidence in STEM. A pretest/posttest mixed-methods approach (involving surveys, interviews and open-ended questions) was employed. The study sample included high school students in the NCSU Math, Science, Education Network (MSEN) Precollege Saturday Science Academy. Guided by the Social Cognitive Career Theory (Lent, Brown & Hackett, 1994), students' science self-efficacy, STEM career intent, and stereotypes of scientists were explored. More specifically, the research questions were: 1) Does engagement with hands-on activities centered on specific STEM careers improve STEM career intent and science self-efficacy? 2) Does engagement with female and minority scientists improve images of science and scientists? and 3) Do students

improve their understanding of real-world applications of science? While the survey data does not suggest significant change, preliminary results from inductive content analysis show the students had positive impressions of the scientists, were able to relate to the science activities in the intervention, and desired more discussions of STEM careers and real world science applications in school.

Tanya E. Watson
Graduate Program: Curriculum and Instruction
Advisor: Ruie Pritchard
Poster Number: 162

Gaining an Edge: Re-Discovering the Read-Aloud Strategy for Middle School Students

The Commission on Reading recommended that educators read aloud to students "throughout the grades" (Anderson, Hiebert, Scott & Wikinson, 1985), yet Read-Alouds (R-A) historically have been conducted in elementary schools. This study was conducted to examine how the R-A is being delivered at the MS level (Grades 6th-8th). Employed were qualitative methods which yielded three case studies that described how the R-A is delivered, and documented the literacy practices and related strategies that were used. Findings from the qualitative cases indicated that the three MS teachers used unique delivery methods for the R-A (i.e., visualization, engagement, and shaping opinions). Cross-case analysis indicated that the teachers employed five literacy practices (i.e., text connections, reinforcement, individualized instruction, warm up, and text talk) and a variety of strategies to structure the R-A. Findings indicate that the R-A is in transition on the MS level in areas regarding traditional verbal exchanges, whole class instruction, and related practices. Structuring the R-A in certain ways and embedding it with literacy practices before, during, and after its delivery affords the MS reader opportunities to strengthen efferent and aesthetic stances. Future research should focus on establishing studies that support well-designed R-A lessons for MS learners.

Meixun Zheng
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Poster Number: 177

Fifth Graders' Flow Experience in a Game-Based Science Learning Environment

The rising popularity in digital game-based learning has prompted increased attention to student emotion and subjective experience during gameplay. Students' gameplay experience, especially a sense of playfulness, has been claimed to be an important factor that motivates continuous learning engagement. This mixed methods study examined 5th graders' enjoyable experience in the CRYSTAL ISLAND game-based science learning environment through the lens of flow theory (Csíkszentmihályi, 1975). Flow experience is a state of consciousness that is experienced by a person who is completely involved in an enjoyable activity, also referred to as the "optimal experience". The study investigates students' flow experience based on two gameplay approaches (i.e., solo and face-to-face collaborative gameplay), factoring impacting students' game flow experience, and the impact of game flow experience on students' science content learning and attitude towards science learning. Participants were 73 5th graders from a suburban public school in the southeastern US. Quantitative and qualitative data about students' game flow experience was collected using both an adapted game flow scale (Kiili & Lainema, 2008) and focus group interviews. Quantitative data about students' science content learning and attitudes towards science was collected via pre-and post tests/surveys.

The findings showed that students had high flow experience during gameplay, but there were no flow experience differences that were contingent upon gameplay conditions. The results also revealed important factors that impacted students' flow experience, including major game design features, student reading proficiency, and peer interaction during gameplay. Students made significant content learning gains, but their attitude towards science did not change as a result of gameplay. Flow experience was not found to be a predictor of science learning gains. The results contributed to the understanding of the application of flow theory with elementary school students in the game context. It also has important implications for educational game design.

Chad Bieber
Graduate Program: Aerospace Engineering
Advisor: Larry Silverberg
Poster Number: 9

Dynamic Simulation of Real-Time 3-D Localization using Distributed Ultra-Sound Beacons

Indoor localization continues to pose a challenge in autonomous vehicle development. Trilateration using distributed, active, ultrasonic beacons is one method that is cost effective and easy to implement over normal indoor ranges. Active beacons provide privacy and unlimited number of users, but ultrasound's slow update rate does not provide complete data fast enough

for a flight vehicle, and the method shifts computational requirements to the vehicle, increasing the importance of efficient calculations. The goal of this research is to dynamically simulate three different solutions to the underdetermined trilateration problem and determine which solution will be implemented in C++ on the flight vehicle by analyzing performance in accuracy, robustness and computational speed. The basic solution combines an internally calculated position with a single distance measurement; three different variations are tested here: using estimated measurements to fill in an iterative trilateration solution, a truss-based analysis with a matrix solution, and a spring-based technique with a straightforward algebraic solution. Previous testing with a static solution demonstrated 1-D measurement accuracy 1cm, with a more accurate 3-D solution robust against missing data. Using the statistical characteristics of these previously collected measurements, each real-time solution is tested in a full dynamic simulation modeled in MATLAB. This 3-D localization system will enable development of a multi-flight-vehicle platform to test operator interfaces with very large formations.

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Graduate Programs: Electrical Engineering[1]; Material Science Engineering[2]
Advisor: Salah M. Bedair
Poster Number: 12

Strained Layer Superlattices for Use in Multijunction Solar Cells

Multijunction solar cells (MJSC) consisting of InGaP/GaAs/Ge subcells show promise for large scale terrestrial power production. These cells hold conversion efficiency records because of efficient division of the solar spectrum amongst the subcells. The GaAs subcell, however, limits current production of the total structure and thus limits efficiency. MJSC current could be increased by replacing the GaAs subcell with a semiconductor that absorbs longer wavelengths of light than GaAs (>875 nm). An increase of 1 mA/cm^2 in the GaAs subcell will result in an increase in absolute efficiency of the MJSC structure by 2%. Using metal-organic chemical vapor deposition we have grown strained layer superlattices (SLS) lattice matched to GaAs and incorporated them into the intrinsic region of a p-i-n GaAs subcell. The SLS consists of compressively strained InGaAs quantum wells (QWs) balanced by thin, tensilely strained $GaAs_{0.24}P_{0.76}$ barriers. We have shown that InGaAs QWs extend wavelength absorption of GaAs subcells to longer wavelengths (<960 nm) and improves the short circuit current while having minimally impacting open circuit voltage. By utilizing thin, high phosphorus composition barriers, the proportion of absorbing InGaAs wells within the allowable depletion thickness can be maximized. Spectral response (SR) measurements show the GaAs response of the cell is maintained for SLS devices and indicates that internal quantum efficiency for carrier escape from the wells is high and that transport across the entire SLS is above 99.9%. Results show that carrier transport across the SLS structure for both electrons and holes for devices with thin barriers (<30 Å) is dominated by tunneling and that thermally assisted tunneling is significant. Our concept of staggering QW thicknesses alleviates quantum size effects caused by use of layers thin enough for tunneling conduction, allows for larger indium compositions in the wells, and extends wavelengths absorption farther than standard SLS devices.

Sean Carr
Graduate Program: Industrial and Systems Engineering
Advisor: Stephen D. Roberts
Poster Number: 17

A Simulation-based Approach to the Production and Health Economic Analysis of Regenerative Medicine Technologies

Tissue Engineering and Regenerative Medicine is an emerging field in the biological, chemical, and medical sciences that attempts to take advantage of the body's own healing powers. Currently, many treatments have shown promise from a medical perspective. This field shows much promise in advancing medicine, but many remedies fail to make it to full commercialization due to cost-prohibitive manufacturing.

This research uses simulation tools to help conduct a cost-effectiveness analysis for a regenerative medicine therapy that uses an autologous injection of muscle-derived cells to treat stress urinary incontinence. The case study highlights the expansion of muscle-derived stem cells using cell culturing techniques in a cGMP laboratory facility. However, with the prospect of performing large scale clinical trials, the need arises for determining operational characteristics such as production lead time, variability in output, and cost. Only then can methods for improving productivity, yield, and other measures be evaluated.

First, this research uses an objected-oriented, discrete event simulation implemented in SIMIO to perform a cost and capacity analysis of a tissue engineering production system, in order to precisely estimate its cost per treatment taking into account process variability. The simulation uses specialized constructs to model cell growth and resource-intensive setup requirements. With an estimate of the treatment cost, Monte Carlo simulation is performed to evaluate the treatment's cost-effectiveness, based on the Net Health Benefit measure. The analysis acknowledges that limited clinical data is available for experimental treatments, and thus attempts to provide insightful sensitivity analysis.

The resulting information about cost-effectiveness can be beneficial to informing technology assessment as well as guiding future research and capital investment decisions in the private sector. Key results to date show promise for this treatment from a health economic standpoint. However, more cost-efficient production must be planned for larger volume manufacturing.

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Graduate Programs: Materials Science and Engineering[1]; RTI International[2]
Advisor: Carl C. Koch
Poster Number: 23

Improved high efficiency thermoelectric nanocrystalline materials and devices

Thermoelectric devices, which can convert heat directly into electricity, could play an important role in the search of alternative energy sources to reduce the dependence on fossil fuels if the conversion efficiency, which is represented by the dimensionless figure-of-merit (*ZT*), is further enhanced. The objective of this work is to develop high efficiency thermoelectric devices from a modern materials science perspective to design the ideal structure and process to tailor the thermal and electrical transport properties of the fundamental device components: n- and p-type thermoelectric materials.

A competitive thermoelectric device requires high performance from both n- and p-type materials. In contrast to p-type materials, the advance of n-type Bi_2Te_3-based materials has been rather lackluster while most of the researches focus on thin films and nanowires. Here, we report on bulk nano-composite versions of ***both*** n-type BiTe(Se) and p-type Bi(Sb)Te alloy materials with significantly enhanced *ZT* between room temperature and 150°C. Starting with the mechanical alloying followed by the conventional yet optimized high-pressure hot compaction, this route is able to create bulk materials with a high concentration of nanoscale structures. Such bulk-nano structuring observed by transmission electron microscopy leads to a significantly increased Seebeck coefficient and reduced lattice thermal conductivity while maintaining good electrical transport properties. The combination of these effects allows us to break through the $ZT > 2$ barrier in bulk thermoelectric materials, which have $ZT \sim 1$ for the past three decades.

Incorporation of these developments into early heat-to-electric power conversion devices is shown to result in an improvement in efficiency over state-of-the-art thermoelectric devices made from typical non-nano materials. Overall, this work reinforces and confirms the potential of utilizing thermoelectric phenomenon via a cost effective and scalable approach in the "green" energy harvesting and power generation technology.

Emily Curtis
Graduate Program: Chemical and Biomolecular Engineering
Advisor: Carol K. Hall
Poster Number: 33

Multiscale Modeling for Phospholipid Bilayer Simulations

Liposomes have gained much attention recently due to their ability to mediate the intracellular delivery of cancer therapies. Liposomes are artificial vesicles composed of phospholipid bilayer membranes; they can transport both hydrophilic and hydrophobic drugs. Two major goals of liposomal anti-cancer drug delivery are to promote the accumulation and retention of drug-carrying liposomes in tumor cells and to trigger the release of drug molecules inside the cells. To aid in the design and optimization of these drug delivery vehicles, a multiscale modeling approach was used to develop an implicit-solvent intermediate resolution model to simulate the behavior of phospholipids in solution. By reducing the 1,2-dipalmitoyl-*sn*-glycero-3-phosphocholine (DPPC) representation to 14 coarse-grained sites with unique properties, treating solvent implicitly, and employing discontinuous molecular dynamics, a very fast alternative to traditional molecular dynamics, we are able to simulate the spontaneous formation of a bilayer from a random solution of 256 DPPC molecules in less than 4 hours. Simulation results show that the model accurately reproduces structural properties of the DPPC bilayer including the area per lipid, bilayer thickness, bond order and mass density profiles. The model is also applied to aqueous bilayers composed of two types of phospholipids: those containing phosph-L-serine (PS) head groups and those containing phosphatidylcholine (PC) head groups. The Sofou lab found that liposomes composed of these species phase separate into heterogeneous domains (rafts) as the pH is lowered. Current work is focused on simulating the phase separation that occurs as a liposome composed of DPPC and 1,2-distearoyl-*sn*-glycero-3-phospho-L-serine (DSPS) changes from an initially-homogeneous state (at neutral pH) to a phase-separated state at low pH.

Daniel Fregosi
Graduate Program: Electrical Engineering
Advisor: Subhashish Bhattacharya
Poster Number: 41

Selective Power Transfer in Distribution System at Multiple Frequencies for Energy Storage Systems

Energy storage is necessary for the future power grid because it can add reliability to renewable sources which are intermittent and unpredictable. Storage can make up the difference when power demand is not equal to power generated. We propose a method for distributed energy storage devices to transfer energy among each other in order to share their capacity. This can be accomplished by using frequencies other than fundamental to transfer power in a distribution system. The advantage is an added control variable. We demonstrate how droop control can be used at a harmonic frequency to enable selective transfer of power among devices without the use of communication. In this paper, the concept is further explained and simulation results are given to verify our method.

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Advisor: Joseph M. DeSimone
Poster Number: 42

Engineered Particles for Pulmonary Drug Delivery

The importance of aerosol behavior in achieving a desired therapeutic response in a patient is well established in respiratory drug delivery, yet the ability to control these behaviors in pharmaceutical formulations is limited. Using Particle Replication In Non-wetting Templates (PRINT®), a soft lithography micro-molding technique, we were able to fabricate particles with an unprecedented independent control over particle geometry and composition in a size range capable of pulmonary deposition. Novel shaped PRINT particles were fabricated of small molecule drugs and biological therapeutics, which were successfully aerosolized from dry powder formulations. We then investigated aerosol behavior and the impact of particle shape through *in vitro* sizing with an aerodynamic particle sizer (APS) and Andersen cascade impactor (ACI). Results from these studies indicate that the PRINT fabrication method results in highly dispersible and narrowly distributed aerosols. Aerosols produced from these particles show attractive properties for efficient lung delivery and are expected to show differential respiratory deposition characteristics, based on particle geometry. We are continuing to explore the many ways tuning particle shape affects aerodynamic properties, fluidization and entrainment, deposition, mucociliary clearance and macrophage uptake, in order to establish particle characteristics which are optimized for pulmonary drug delivery.

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Advisor: Jan Genzer
Poster Number: 44

Instability of Surface-bound Polyelectrolyte Brushes in Aqueous Environments

Technologies ranging from solar panels to biological implants to non-fouling ship hulls require careful control of interfacial properties. Macromolecule chains bound to a solid surface via a covalent bond (often called polymer brushes) offer a versatile approach to tuning surface properties using post-polymerization modification reactions. By covalently bonding the chain to the surface, the system should remain stable in a variety of environments over relatively long timescales. Recently, the stability of these polymer brushes has been called into question. We investigated the dependence of the pH and ionic strength of aqueous solutions on the stability of surface-bound polyelectrolyte chains. Our findings show that the chains grown from the most common form of surface polymerization initiator (BMPUS) will degraft over a broad pH range, leading to approximately 20% material loss for weak polyelectrolyte brushes in five days at pH 4 and pH 7.4 at room temperature. We synthesized two alternative initiators, one replacing the ester group in BMPUS with an amide group and the other consisting of only aliphatic carbons. These molecules show improved stability over the original initiator, indicating the ester group in BMPUS as the point of degrafting. Our results suggest the mechanism of degrafting depends on both hydroxide concentration and the tension developed along the chain backbone due to electrostatic repulsion of charged pendant groups. We use this knowledge to suggest ways to improve stability and to take advantage of controlled degrafting of the polymer chains.

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Poster Number: 57

First Principles Studies of Oxygen Transfer at Buried Metal/Metal Oxide Interfaces: Implications for the Performance of Energetic Nanolaminates

Heterogeneous material interfaces between metals and metal-oxides provide a unique opportunity to create active functional materials. In certain applications, it is important to limit the intermixing across the interface and maintain stability of the as-deposited configuration over the lifetime of the device. In contrast, the functionality of other heterostructures is built on enabling this transition. For example, there has been recent research on how to use thin film metal/metal-oxide super-structures to control the power output generated by the exothermic exchange of oxygen across the as-deposited interface. In all of the above systems, it becomes imperative to fundamentally understand the mechanisms that facilitate this transformation, as the dynamics are not currently well understood. In this work, chemically accurate Density Functional Theory calculations have been used to predictively determine likely reaction pathways for oxygen transport in energetic nanocomposite materials and to characterize the stability of novel heterogeneous material interfaces. The ultimate goal is to to tune power output through an understanding of the mechanisms of oxygen transport across heterogeneous interfaces and within the super-structure. Several systems have been investigated, including more traditional thermite materials such as Al and Ti paired with Cu_2O. In these systems, the energy release is large, but there is also a high degree of strain when ideal systems are modeled. Other systems were chosen on a theoretical basis that included structural similarity, minimal lattice mismatch, and the degree of exothermicity associated with oxygen transfer, such as Ca with BaO. Preliminary calculations simulate systems at various early stages to isolate factors that could influence the reaction, such as strain or initial barrier height. The results presented here show qualitative agreement between calculations and experimental observations. [This project has been supported by the Army Research Office through grant # W911NF-10-1-0069.]

Siyao Huang and Hsiao-Ying Shadow Huang
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Advisor: Hsiao-Ying Shadow Huang
Poster Number: 70

Biomimetic Heart Valve Tissue Virtual Experiments

Heart valve tissues constantly experience different stress states during cardiac cycles. However, how tissue-level mechanical forces can translate into altered cellular stress states is unknown. In the current study, we provide an automated finite element analysis to visualize the overall stress distributions in heart valve tissues. Nonlinear and anisotropic material properties of heart valve tissues are adapted. Histological photomicrographs capturing collagen fibers microstructure and cell morphology are incorporated into the finite element analyses. The study shows that heterogeneously distributed collagen fibers are responsible for transmitting forces into cells. Cells adjacent to the collagen fibers experience lower stress states than those are not directly connecting to the collagen fibers, suggesting that cells under higher stress stimuli tend to synthesize new collagen fibers. The finite element simulation result provides a mechanistic understanding of the experimental observations on cells secreting collagen fibers to provide strength and maintain tissue structure integrity. The current study provides new models for better understanding tissue-cell interactions in heart valves.

Reza Jafari
Graduate Program: Civil, Construction, and Environmental Engineering
Advisor: Joseph Hummer
Poster Number: 72

Safety Effects of the Access Points near Signalized Intersections

In the US in 2009, 5.5 million collisions occurred in which over 2.2 million people were injured and over 33,000 people died due to highway collisions. Over half of these total crashes were intersection and access point – related. Most collision reporting systems do not provide the necessary level of information to identify access – related collisions but collision data, where available, indicate a high incidence of access – related collisions.

The objectives of this research were to develop a valid statistical model to estimate the number of access point – related collisions occurring at access points near signalized intersections and providing checklist for site planners and decision-makers to distinguish higher collision sites from lower collision sites and avoid constructing higher collision sites.

Geometric, traffic, and access – related collision data over 5 years, from January 2005 to December 2009 were collected for 108 sites. Out of the 15 independent variables tested, only AADT, driveway width, and Synchro through movement 95% queue at the intersection near the access point were statistically significant in developing the collision prediction statistical model. This model

could be used by state DOTs and municipal traffic engineers to address access management requirements and to predict problems likely to result from site traffic impacts.

To provide checklist for site planners to distinguish the higher collision sites from lower collision sites, the data that were previously collected and some new information such as demographic and socio economic data were used. The higher collision sites were investigated one by one. Quantitative, binary, and categorical variables, and demographic and socio economic information, were analyzed and compared between the higher and lower collision sites. Statistical tests were used to find the contributing factors and provide checklist to certify no access points will be constructed before the safety issues are considered. The proposed policy checklist stated that an access point most likely would be a higher collision site if it was operating full movement, had a driveway peak hour volume of over 120 vehicles per hour, had an intersection peak hour through movement Synchro 95% queue of over 230 feet, and had a driveway left turn over 20% of the AADT.

Vilas V. Jangale and Alexei Saveliev
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Advisor: Alexei Saveliev
Poster Number: 73

Monitoring the physical properties of opportunity fuel blends by multivariate regression modeling and infrared spectroscopy

New and retrofitted power generation technologies are increasingly utilizing "opportunity fuels" owing to reduce the risk of dependency on single conventional fuel (natural gas). The conventional and non-conventional fuels have wide variability in their composition and hence physical and chemical properties due to numerous sources feeding into the nation's pipeline. The gas turbine/engine operating parameters should be varied in order to accommodate transient changes in the fuel properties. Also, to increase combustion efficiency and lower emissions, such adaptive control of combustion process becomes necessary. Conventional method (gas chromatography) used for measuring the fuel composition, is expensive and does not provide real-time information. The other gas measurement methods, such as, infrared, semiconductor, electrochemical, catalytic, etc. are cross-sensitive to multiple gases. In the current work, a real-time method for measuring the physical properties of opportunity fuels and their blends with conventional fuel has been proposed. In this method, optical and non-optical measurements are performed on fuel mixtures to detect all the desired components. These measurements are then mathematically correlated to the fuel composition and energy content using multivariate regression models. The cross-sensitivity of these measurements is accounted for in the regression model. The method measures all major gas components simultaneously, including, but not limited to, methane, ethane, propane, butane, hydrogen, carbon monoxide and carbon dioxide. The method gives better than 1% accuracy in a wide pressure and temperature range and its response time is less than a second.

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Graduate Program: Chemical and Biomolecular Engineering
Advisors: Michael C. Flickinger and Orlin D. Velev
Poster Number: 74

A new optical monitoring technique for investigating continuous convective biocoating assembly as components of photobiological fuel cells

We have developed and characterized a new method for convective colloid suspension (particles and reactive cells) assembly into thin films that continuously supplies and monitors the delivery of coating suspension to the meniscus. The constant renewal of the meniscus in Continuous Convective Assembly (CCA) distinguishes the method from batch deposition, where the total surface area of the colloidal crystal array (coating) is restricted by the continuously depleted meniscus. We examine two CCA configurations: 1) topside CCA, in which colloid suspension flows from a fluid reservoir to the meniscus front along the coating knife's topside, and 2) underside CCA, in which suspension flows from a fluid reservoir to the meniscus back along the knife's underside. We use an optical probe technique to monitor meniscus volume and analyze its effect on coating microstructure. CCA is a rapid, reproducible method for fabricating thin biocomposite coatings containing hydrogen-producing or oxygen-evolving cells – critical components of photoreactive fuel cells. Thin coatings preserve and concentrate cell reactivity, reduce diffusion resistance, cell self-shading, and protect the coated cells from mechanical degradation and deactivation. We have demonstrated that biocomposite latex coatings can be fabricated on flexible polymer sheets. We also describe how known regulators of convective-based particle assembly, namely suspension deposition speed, net particle charge, ambient relative humidity, and previously undefined parameters, such as particle concentration, fluid flow-path sonication, and density, influence coating microstructure during continuous meniscus renewal. Preliminary results show stable photohydrogen production from dissolved acetate by immobilized *Rsp. palustris* CGA009 and adhesive latex followed by drying, rehydration, and incubation under anoxygenic conditions (argon atmosphere).

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Advisor: John Muth
Poster Number: 91

Amorphous IGZO Based Transparent Logic Gates

Room temperature deposited indium gallium zinc oxide amorphous transistors have electron mobilities that are 1 to 2 orders of magnitude larger than organic or other amorphous semiconductors. This results in high potential circuits or electronic systems for room temperature deposited on glass or plastics. Optically transparent inverters, NAND, and NOR logic gates were fabricated and characterized for frequencies up to 5 kHz, using transistors deposited at room temperature with 5, 10 and 20 μm gate lengths and beta ratios between 2.5 and 40. The individual transistors were measured to have saturation mobilities of 14 $cm^2/V{\cdot}s$, sub-threshold swing of 190 mV/decade, and current on/off ratios in excess of 10^8. Logic operations were satisfactorily demonstrated for bias voltage between 1 and 20 V. These results indicate viable digital logic can be applied particularly where optical transparency, or the use of novel flexible substrates is more important than the operating speeds.

Neil Mehta
Graduate Program: Electrical Engineering
Advisor: Alexandra Duel-Hallen
Poster Number: 94

A Physical Channel Model for Vehicular Adhoc Networks (VANETS)

Vehicular ad hoc networks (VANETS) are considered to be an important aspect of highway safety systems in the future as well for data communication between vehicles and access-points on highways. To test these systems, it is essential to choose the correct channel propagation model for simulations to accurately test the performance of upper layer protocols, especially if they are related to safety applications. Several vehicle-to-vehicle (V2V) channel models have been proposed in the literature. These models are broadly divided into two categories, statistical and ray-tracing models. Statistical models easily generate random instances of the propagation channel whose statistical properties are in agreement with the field measurements. However, in many scenarios there is a severe deviation of the simulated channel from realistic behavior. On the other hand, ray-tracing based models accurately calculate the received signal power by taking into account the effect of all the obstacles in the simulation map. However, due to the intense computations involved, these models only consider the path-loss and/or shadowing and do not consider the fast-fading in the simulated channel which is essential while testing the performance of network protocols. We have proposed a physics-based channel propagation model that accurately models diffraction and reflection propagation mechanisms as well as in the transition regions (e.g. when the receiver is moving from diffraction or reflection dominated scenario to LOS). Our model is based is based on a Fresnel diffraction augmentation of the method of images and provides an accurate description of the variations of strength and shape of the received pulse with position in given local environment. As it is not computationally intensive, it is especially suitable for simulations with high mobility. This is of particular importance while testing network protocols which involve decision-making based on the received CSI from multiple nodes in the network.

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Graduate Programs: Operations Research[1]; Industrial and Systems Engineering[2]
Advisor: Reha Uzsoy
Poster Number: 101

Modeling the Evolution of Demand Forecasts with Application to Production Planning

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. We model the evolution of the dependency between demand forecasts by modeling the conditional covariance among them. We show that the progressive realization of the uncertain demands through successive forecast updates results in the evolution of the conditional demand-covariance, in addition to the conditional demand-mean. A multi-period production planning model with conditional chance constraints is used to illustrate the advantages of our approach in a rolling horizon production planning environment. 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.

Thomas Nudell
Graduate Program: Electrical Engineering
Advisor: Aranya Chakrabortty
Poster Number: 103

Distances in Node- and Edge- Weighted Networked Dynamic Systems via the Asymmetric Graph Laplacian

The topology of a network dynamic system (NDS) is characterized by its graph Laplacian matrix. While concepts of distance, including geodesic distance and resistance distance, in edge-weighted graphs are well understood, extending these concepts to node- and edge-weighted graphs is less well defined. We define generalized distance metrics for node- and edge-weighted NDS via an asymmetric graph Laplacian representation. Using a power system archetype, we derive the input/output transfer function and show how residues (the influence of the input on a given state) are parameterized by distance from the input node. We derive the analytic expression for a NDS defined over a tree-graph, and illustrate our results with simulations. This understanding of distance in NDS has many applications including estimating the distance between disturbances in a power system to the measurement points.

Rakhee Pani
Graduate Program: Materials Science and Engineering
Advisor: Yaroslava G. Yingling
Poster Number: 107

The Effect of Solvent Interactions on Reinforcement of Functionalized Gold Nanoparticles and Polymers

Polymer-nanoparticle composite materials already won their place in various industrial applications. With reinforcement of polymer matrix through incorporation of the monolayer protected inorganic clusters can introduce novel properties into the composites. Previous studies indicate how the size, shape, surface modification and surface area of fillers can control their dispersion in the polymer matrix. However, the interfacial properties between polymers and nanoparticles and nanoparticle spatial arrangements affect nanocomposite performance. In this study, we investigate the interfacial properties of polymers (polystyrene (PS), poly-(methyl methacrylate) (PMMA)) and diblock copolymers PS-PMMA and gold nanoparticle functionalized with alkanethiol ligands (AuNP) in polar and non-polar solvent using atomistic MD simulations. We observed that the presence of AuNP changes polymers flexibility and interactions. We found that PMMA will wrap around AuNP more efficiently in a non-polar solvent and interact with AuNP stronger that PS. Whereas, PS tend to fold onto itself through formation of pi-pi interactions and is much less affected by the presence of AuNP. Apart from conformational change the polarity of the solvent significantly influence the flexibility of the polymer and interfacial binding free energy of polymers and AuNPs. Interestingly, in the case of diblock PS-PMMA, the PMMA block coats the AuNP while leaving the PS block on the surface. The results of this study will provide better insight into structural ordering of nanoparticles in these composites.

Babak Parkhideh and Nima Yousefpoor
Graduate Program: Electrical Engineering
Advisor: Subhashish Bhattacharya
Poster Number: 110

Design Considerations in Development of Active Mobile Substations

This paper proposes *transmission*-level active mobile substations that provide back-up in case of power transformer failure or forced reduced operation scenarios in addition to power flow control for seasonal renewable energy transmission. These functions altogether have been aggregated not only because of the technical merits but also to address the economic concerns regarding the cost of the power electronics for transmission applications. The proposed technology is called Convertible Static Transmission Controller (CSTC) which is transportable and connected across the substation power transformer and can be reconfigured to the required modes of operation. The power electronic building block for CSTC is the standard three phase 10-20 MVA drive converter which its high availability and reliability can reduce the overall cost of the power electronics for utility applications. In order to obtain high efficiency and low generated harmonic distortions, a group of converters are operated with line frequency (60Hz) and staggered with medium voltage Harmonic Neutralizing (HN) circuits through the proposed advanced angle control structure vs. PWM methods. From the supervisory control point of view, while the CSTC can operate similarly to BTB HVDC or UPFC applications, it can also operate as the substation voltage/phase angle regulator. The latter enables the CSTC to operate locally without changing the substation power flow and consequently the meshed power system. This mode of operation can be deployed to extend the life time of the existing power transformers without complicating the power system operation and be used as an asset management tool for utilities and system operators.

Jason Patskoski
Graduate Program: Civil Engineering
Advisor: Sankarasubramanian Arumugam
Poster Number: 114

Low-dimensional Models of Annual Streamflow using Tree ring data and Nino3.4 Forecasts

Long time series of streamflow are required for the planning and management of water resources. However, observed streamflow records within the continental United State typically start from 1930. Thus, to compare the observed hydroclimatic extremes with past unobserved events, tree rings are typically used to reconstruct annual streamflow values. The most common approach to reconstruct annual streamflow is to develop a statistical relationship between the principal components of the tree rings and the observed annual flow values and then extend the relationship to reconstruct annual streamflow values for the period for which tree ring data is available. However, this approach has limited skill in reconstructing high flow values since tree ring growth reaches its potential limit during wet years. We propose an alternate approach to overcome this limitation by combining information from Sea Surface Temperature (SST) and from tree ring chronologies. Given the role of El Nino Southern Oscillation (ENSO) in influencing hydroclimatology over the Southeastern US, we predict the periodic component of streamflow using Nino 3.4 – an index representing ENSO – and the non-periodic component of streamflow using the non-periodic variability in tree rings. Given its ability to extract low-dimensional components, we also employ Multi-Channel Singular Spectrum Analysis (MSSA) on tree rings for streamflow reconstruction. These two methods are tested with the traditional approach based on Leave-Five-Percent-Out-Cross-Validation. Results from the study show that MSSA improves the skill of reconstructed streamflows and the hybrid approach (SSTs and tree rings) perform better especially during high flow years.

Barry Peddycord III
Graduate Program: Computer Science
Advisor: Peng Ning
Poster Number: 115

Identification of Network Service Relationships in Distributed Systems: Improvements and Additions to NSDMiner

"A distributed system is one in which the failure of a computer you didn't even know existed can render your own computer unusable." (Leslie Lamport)

As computers are added, removed, and reconfigured within a networked system, maintaining a clear understanding of the relationships between machines can be a daunting task. Subtle dependencies can go unnoticed until a system failure causes internal and user-visible services to go down until the problem can be discovered and repaired. Several tools, such as Sherlock (Bahl, et al., 2007), Orion (Chen, et al., 2008), and NSDMiner (Natarajan, et al., 2011), have been proposed to provide proactive discovery of these dependencies to avoid situations where the relationships are not known until after a failure occurs.

In this work, we introduce further improvements to the tool NSDMiner, an automated method designed for analyzing the dependencies between machines using offline processing of network flow data. In addition to improving the accuracy of discovering dependencies, our contributions introduce new capabilities that make it possible to discover the dependencies of machines with little traffic data available, as well as to group machines that are parts of backup or load-balancing clusters together. We demonstrate and analyze the performance of these approaches on 45 days of live traffic data obtained from the NCSU Computer Science Department's network, a production installation that can be used as a model for an enterprise network.

Nilesh Rajule and Jay Tu
Graduate Program: Mechanical Engineering
Advisor: Jay Tu
Poster Number: 121

Laser Synthesis of Copper-Single Walled Carbon Nanotubes Nano-Composite for Plastic Injection Molding

Copper molds, owing to their high thermal conductivity, offer substantially shorter cycle time and improved product precision in plastic injection molding. However, copper has relatively low fatigue strength, hardness and erosion resistance which lead to drastically lowered mold life. We discovered that adding single walled carbon nanotubes (SWNTs) inside the copper (Cu) matrix can create a new nano-composite with hardness over 39 times that of pure copper. This research, therefore, focuses on synthesizing Cu-SWNT nano-composite using a novel Laser Surface Implanting (LSI). In LSI process, a single mode Nd:YVO4 laser beam is used to generate micro holes on copper substrate. These micro-holes are then filled with SWNTs suspended in water-based gel. Finally, same laser beam is controlled to generate micro well of molten copper to mix with the pre-deposited SWNTs. SWNTs are trapped inside copper matrix due to rapid and non-equilibrium solidification of the molten copper to form Cu-SWNT nano-composite. Dispersion of SWNTs is achieved without thermal damage since they are stable beyond melting temperature of copper. Transmission electron microscopy and spectroscopic analysis of the nano-composite confirmed the presence of SWNTs in copper matrix. Sputtering tests conducted by focused ion beam verified drastic increase in erosion resistance. Cu-SWNT nano-

composites are highly valuable for thermal management applications including dies and molds in plastic manufacturing, electronic packaging, hydrogen storage and catalysis.

Kiran Ramesh
Graduate Program: Aerospace Engineering
Advisor: Ashok Gopalarathnam
Poster Number: 122

Aerodynamic Modeling of Flapping Flight

The first attempts at flight attempted to use flapping wings. However, it has become clear that fixed-wing aircrafts which use separate lift and thrust generation mechanisms are more successful for human-carrying flight. In recent times, there has been a revived interest in studying flapping flight, for the purpose of understanding the remarkable flying prowess of insects in nature and to design bio-inspired Micro Air Vehicles (MAVs). The unsteady aerodynamics involved in such flight fall well outside the realm of existing knowledge. While advances in computational and experimental methods have enabled study of the phenomena involved in flapping flight, a theoretical method for prediction and design is still forthcoming. In this research, such a theoretical model is in development. Building on the Thin Airfoil Theory used in the study and design of fixed-wing airfoils, a Large Angle Unsteady Thin Airfoil Theory has been developed. This theory predicts the flowfield and the forces generated for an airfoil undergoing any arbitrary motion. The large angle of attacks, non-planar wakes and apparent mass forces, all of which are absent in steady aerodynamics are accounted for in this method. Another important feature in unsteady aerodynamics is the presence of Leading-Edge Vortices (LEVs) which have been shown to play a critical role by generating high-lift. In this research, a Leading Edge Suction Parameter (LESP) has been developed, the critical value of which effectively predicts the formation of LEVs. Using this criterion, the model successfully calculates the build-up and shedding of LEVs, and their effects on the flowfield and force histories. The theory will be used to study interesting flight phenomena such as perching and hovering. It is also proposed to extend the theory to a 6DOF model of a flapping vehicle which can be used for real-time simulation and design.

Benjamin Riggan
Graduate Program: Electrical Engineering
Advisor: Wesley Snyder
Poster Number: 127

Microcalcification Detection using Morphological Filters and Support Vector Machines

X-ray mammography is the most widely used screening process to find early indications of breast cancer. Radiologists have a systematic method using low dose x-rays to analyze the breast densities. Although this manual method of screening is very effective, radiologists have been known to make mistakes: either by misdiagnosing breast cancer or by missing early indications of it. In either case, especially the latter, the results can be very detrimental to patients. The main objective of our research is to autonomously detect microcalcifications (one major indicator of breast cancer if located in clusters), so that mammograms can more efficiently be analyzed by radiologists.

In many applications, filters are used to enhance the properties of microcalcifications in mammograms, and most methods use classifiers, such as artificial neural networks or support vector machines, to learn the characteristics of microcalcifications. However, these methods typically use unnecessarily large feature vectors to model microcalcifications, such as a 9x9 region of pixels corresponding to an 81 element feature vector.

Our detection method uses a morphological filter that finds regional maxima, since microcalcifications correspond to locally bright regions in mammograms, and we use a support vector machine to classify regions as microcalcifications. However, a smaller feature vector, composed of intentionally chosen measures, is used to represent microcalcifications. Here we study and analyze the many factors that affect the performance of our detection method including: filter performance, features, training methods, and classifier performance.

Safoura Seifikar[1], Frank Hunte[1], Thomas Rawdanowicz[1], Weston Straka[1], Ali Tabei[2], Nazanin Bassiri-Gharb[2], and Justin Schwartz[1]
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Advisor: Justin Schwartz
Poster Number: 133

Structural properties of $NiFe_2O_4$/$Pb(Zr_{0.52}Ti_{0.48})O_3$ thin film multilayer composites derived via sol-gel processing on silicon substrates (100)

Sol-gel derived $NiFe_2O_4$ (NFO) thin films and NFO/$Pb(Zr_{0.52}Ti_{0.48})O_3$ (NFO/PZT) thin film multilayer composites, with and without an intermediate layer of platinum, are grown on silicon substrates and characterized. X-ray diffraction and scanning

electron microscopy show phase-pure spinel cubic NFO and tetragonal perovskite PZT in the single component films and the multilayered structures. Transmission electron microscopy (TEM) reveals a sharp interface between the NFO and PZT layers in the Si/NFO/PZT multilayers. Using an intermediate Pt layer between the NFO and PZT reduces Pb diffusion through NFO grain boundaries and ultimately into the silicon substrate, as evidenced by TEM and secondary ion mass spectroscopy. The saturation magnetization of Si/NFO/PZT multilayers with and without the intermediate Pt layer increase by 20% and 25%, respectively, relative to Si/NFO films. Use of an intermediate Pt layer (Si/NFO/Pt/PZT) reduces the leakage current with respect to the Si/NFO/PZT configuration. A maximum remnant polarization of 22 μC/cm2 at 100 Hz is measured for Si/NFO(310nm)/Pt(100nm)/PZT(475nm) composites.

Rachita Sharma[1], Rebecca Klimek[1], Suk Tai Chang[2], Sejong Kim[3], and Orlin D. Velev[1]
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Advisor: Orlin D. Velev
Poster Number: 134

Self-propelling particles based on microdevices, gels, and live cells

Self-propelling particles convert energy from the environment into mechanical energy for propulsion. Potential applications of such particles are in lab-on-a-chip devices (as pumps, mixers, cargo carriers, etc.), as sensors for toxicity detection or medical diagnostics, as drug delivery vehicles, in MEMs and micro-robotics, as models to mimic and study the behavior of microorganisms and evolving ensembles of interacting objects. We will present three new classes of self-propelling particles based on hydrogels, live cells, and microdevices. The gel-based particles are composed of an ethanol-infused hydrogel, and exhibit a remarkable pulsating motion in water over long duration. The release of ethanol from the hydrogel generates a cycle of surface tension gradient driven flows (Marangoni effect), and results in periodic propulsion of the particle. A limitation in the design of these gel-boats is that their motion lasts only as long as ethanol is present in the hydrogel. The biocatalytic particles, comprised of yeast immobilized in hydrogel or polyelectrolyte matrix, propel in hydrogen peroxide solution by catalytically decomposing hydrogen peroxide. These yeast-boats keep propelling as long as hydrogen peroxide is available in their environment. The third category of self-propelling particles is based on millimeter-sized semiconductor diodes floating in water. We have previously demonstrated that miniature diodes can be powered by external uniform alternating electric fields. The diodes rectify the voltage induced between their electrodes, and are propelled by the resulting particle-localized electroosmotic flux. We will present a novel technique that allows simple and effective on-demand steering of these diodes. We remotely control the direction of diode motion by modifying the duty cycle of the applied AC field. The diodes rotate and change their direction of motion when a DC component is introduced into the AC signal. This new principle of steering of self-propelling diodes can find applications in MEMs and micro-robotics.

Daniel J. Underwood[1], Jingyu Zhang[2], Brian T. Denton[1], Nilay D. Shah[3], and Brant A. Inman[4]
Graduate Programs: Industrial and Systems Engineering, North Carolina State University[1]; Philips Research North America[2]; Division of Health Care Policy and Research, Mayo Clinic[3]; Division of Urology, Duke University Medical Center[4]
Advisor: Brian T. Denton
Poster Number: 153

Simulation Optimization of PSA-Threshold Based Prostate Cancer Screening Policies

Prostate cancer is one of the most common cancers affecting American men. Statistics show for males in the U.S. during 2009 that prostate cancer represented 25% of new cancers and caused 9% of deaths from cancer (excluding skin cancers). The evidence for prostate cancer screening is unclear, and the issue of whether and how to screen is heavily debated among healthcare professionals and policymakers. Early detection and treatment of prostate cancer can add decades to a patient's life. However, because of the high risk of false positives and the slow-growing nature of prostate cancer, physicians may be hesitant to recommend prostate biopsy for fear of overdiagnosis and overtreatment. The major questions in the PSA-screening debate include how often to screen an individual, when to discontinue screening, and at what PSA threshold is prostate biopsy necessary. We describe a simulation optimization method to design PSA screening policies based on expected quality adjusted life years (QALYs). Our method integrates a simulation model in a genetic algorithm which uses a probabilistic method for selection of the best policy. The best policy generated by our algorithm is compared to previously recommended screening policies. Using the policies determined by our model, we present evidence that patients should be screened more aggressively but for a shorter length of time than previously published guidelines recommend.

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Advisor: Reha Uzsoy
Poster Number: 157

A New Genetic Algorithm for Multicriteria Project Selection and Scheduling

The Project Selection and Scheduling problem requires the decision maker to allocate limited resources to competing projects over time in order to maximize (or minimize) a certain criterion. However, in real applications, more than one criterion needs to be accounted for, leading to a Multicriteria Project Selection and Scheduling problem. A new Genetic Algorithm for Project Selection and Scheduling problem is proposed (PS-NSGA II). This Algorithm uses Random Keys and a Greedy Algorithm to decode these keys into the known NSGA II procedure. The performance of this new algorithm is evaluated with computational experiments comparing the approximations of the Pareto-optimal frontier obtained by NSGA II and PS-NSGA II. PS-NSGA II outperforms NSGA II in terms of quality of solutions and computational time.

Hui Wang[1] and George N. Rouskas[2]
Graduate Programs: Operations Research[1]; Computer Science[2]
Advisor: George N. Rouskas
Poster Number: 159

Partial Linear Program Relaxation Methods for Traffic Grooming Problems in Optical Networks

As proven to be NP-hard, the ILP formulation of traffic grooming problems can be very time-consuming to solve, especially when the network size grows. In this paper, we provide several heuristic algorithms based on partial LP relaxation to address the issue of extremely long solving time of traffic grooming problems in optical networks. Experiments on ring and mesh networks with various sizes are run to compare our heuristic algorithms with the original ILP formulation. By using the partial LP relaxation approach, we are able to find a close-to-optimality solution with much shorter run time.

Stephen Ware
Graduate Program: Computer Science
Advisor: R. Michael Young
Poster Number: 161

Crossed Swords and Broken Hearts: A Computational Model of Narrative Conflict

Conflict is an essential component of interesting stories. It provides structure and keeps the audience engaged. Narrative-oriented virtual environments—like role playing video games, tutoring systems, and interactive training simulations—need to adapt their stories based on the actions of their users. Pre-authored stories are expensive to produce and too rigid to provide the desirable level of user freedom, so we seek to design algorithms for intelligent narrative generation and adaptation. This work is founded on Artificial Intelligence planning algorithms. Planners were originally designed for efficiency in tasks like robot movement, but the most efficient story is rarely the most interesting or the most intuitive to a human audience. By augmenting planning algorithms with models from psychology and narratology research, we describe the CPOCL planner, which writes stories that leverage the structural and aesthetic properties provided by conflict. In addition to a formal model, we have developed seven dimensions of conflict: *participants*, *subject*, *duration*, *balance*, *directness*, *intensity*, and *resolution*. These important aspects are used as heuristics during plan search to select conflicts based on the author's purpose. Our model and dimensions have been validated by two empirical human user studies. Future work will put the CPOCL model to use in an interactive narrative-oriented virtual environment with little or no pre-scripted story.

Mengbai Wu
Graduate Program: Mechanical Engineering
Advisors: Andrey V. Kuznetsov and Warren J. Jasper
Poster Number: 168

Submicron particle filtration in monolith filters – A modeling and experimental study

With over a million micron-sized channels per square centimeter arranged in a regular pattern on a thin film, monolith filters have significant potential for submicron aerosol particle filtration, even though the filtration process with this class of filters has not been well studied. In order to better understand the capture mechanisms and the main factors that affect the capture efficiency, so as to build predictive numerical models and to improve the design of monolith filters, the filtration process in monolith filters was investigated both experimentally and numerically. Using an electrostatic particle classifier (EPC) and a

condensation particle counter (CPC), the experimental platform measured the capture efficiency of salt particles with diameters ranging from 50 to 300 nm on two monolith filter samples. Based on the filtration process and the repeating geometric structure, a single unit model was proposed. The drag force, electrostatic force, and Brownian motion are considered as the major forces affecting particle motion. The single unit model of a monolith filter was then validated and improved by comparing with experimental results. Published theories underestimate the capture efficiency due to Brownian diffusion for small particles and Van der Waals forces for larger particles, which are modified in our current model to gain better agreement with experiment. It is established that submicron particles ranging from 50 to 300 nm in diameter are captured by a monolith filter mainly due to Brownian motion and interception. And the single unit model was also utilized to investigate the main factors that affect the filtration efficiency of monolith filter.

Erik Zdanowicz
Graduate Program: Mechanical Engineering
Advisor: Thomas A. Dow
Poster Number: 174

Nanocoining Optical Features for Anti-Reflective Surface Generation

Anti-reflective (AR) coatings are used in many optical systems such as eyeglass, telescope and camera lenses as well as on covers of photovoltaic cells. Full spectrum light is composed of many different wavelengths and thin film AR coatings (most widely used) are only effective over single wavelengths and near normal viewing angles. Moth eye structures are an alternative type of AR coating which work over full spectrum light and wide viewing angles. Moth eye structures are typically 250 nm tall with 250 nm spacing. Nanocoining is a method of producing AR coatings where a diamond indenter with a nanostructured area (20 x 20 μm) is pressed into a work-piece surface to plastically yield and transfer the nanofeatures. This process is repeated until the desired area has been covered. The focus of this research has been on developing the nanocoining process. Material and contact models were used to mimic experimental results and thus predict indentation behavior. Various indentation experiments have been performed using a four-axis diamond turning machine with indentation rates ranging from 0.1 Hz to 1000 Hz. Low frequency experiments were used to provide information on indenter alignment (many degrees of freedom) and the force/depth requirements. High frequency experiments were performed with a piezoelectric actuator that moved in an elliptical path at frequencies up to 4 KHz. The elliptical path is needed to match the die speed with the drum speed and therefore prevent smearing of the indented image. However the shape of the ellipse (vertical or horizontal) and the frequency dictate velocity of the indenter so relations were developed to ensure work-piece and indenter were at the same speed during indentation. The modeling, experimentation and results analysis have led to a procedure capable of producing areas of indents with precise alignment and well-formed nanofeatures.

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Advisor: Brian T. Denton
Poster Number: 175

Optimization of Treatment Decisions for Blood Glucose Control for Patients with Type 2 Diabetes

Approximately 25.8 million people in the U.S. have diabetes. Glycemic control is an important part of the treatment plan for patients with diabetes because it can reduce the risk of both micro- and macro-vascular complications such as kidney disease, blindness, amputation, heart attack and stroke. However, uncertainty in the progression of the patient's glycated hemoglobin (HbA1c), dangers of overtreatment, and variation in short and long term effects of medication make treatment decisions challenging. We present optimal model-based guidelines for the sequence and initiation time of medications for treating hyperglycemia.

We present a Markov decision process (MDP) model to determine the optimal sequence and start times for the most common hyperglycemia lowering medications (metformin, sulfonylurea and insulin) over the course of a patient's lifetime. The objective of the model is to maximize expected quality adjusted life years (QALYs) prior to the first event (defined as micro- and macro-vascular events and severe hypoglycemia) that the patient's HbA1c is within the treatment goal.

We present results for the optimal treatment plan for a typical patient where the treatment goal is set to be a standard goal of HbA1c<7%. We also present one-way sensitivity analysis on the treatment goal and the risk of hypoglycemia. We conclude that metformin should be the first-line medication for both male and female patients. We find that intensive glycemic control targets may reduce QALYs and that the optimal start time for insulin is significantly affected by the risk of hypoglycemia.

Caitlin Baker[1] and Molly Hartzog Storment[2]
Graduate Programs: Communication[1]; English[2]
Advisor: William Kinsella
Poster Number: 6

Passive Activism in Timothy Treadwell's Legacy

Timothy Treadwell was a grizzly bear enthusiast and an environmental activist who lived in the Alaskan wilderness for thirteen consecutive summers where he filmed his interactions with the grizzlies. His motive was to protect the bears from poachers, research the bears in their natural habitat, and to garner a following for his movement to protect the grizzlies. In 2003, his remains, along with those of girlfriend Amy Huguenard, were found after they had been eaten by a grizzly bear. His extraordinary relationship with the bears and his ironic death have garnered much media attention and incited controversy and curiosity in the general public. Grizzly People, a non-profit organization co-founded by Treadwell, continues their work in the spirit of Treadwell and his legacy. In 2008, Animal Planet released a television series titled *The Grizzly Man Diaries* featuring Treadwell's own footage from his experiences in Alaska. In this project, we rhetorically analyze the websites of both Grizzly People and Animal Planet's supplementary website to *The Grizzly Man Diaries*, along with all eight episodes of the television series in order to compare the motivation of a non-profit organization to a for-profit entertainment company who supposedly share the same story. We have found that each of these organizations encourage a passive form of activism that situates Treadwell himself as the "object of curiosity" and the center of the movement, marginalizing the grizzlies to Treadwell's story. The goal of each organization, therefore, is not to arouse wildlife activism, but to memorialize Treadwell and his extraordinary human-nature relationship where he attempted to fully integrate himself into the bears' social hierarchy. However, by encouraging this passive activism that situates Treadwell as the center of the movement and the television series, each organization aims to re-establish him as the superior species in the human-nature binary.

Emily Breeding
Graduate Program: Anthropology
Advisor: Tim Wallace
Poster Number: 14

Crafting Resistance: The Handmade Revolution and Conscientious Consumption in North Carolina

The spirit of do-it-yourself is not a new phenomenon in American culture. Historic narratives of fortitude, ingenuity, and entrepreneurship place self-reliance and creativity deep in the socio-historic landscape of American consciousness. However, the current environment of neo-liberalism and a globalized, service-based economy privileges consumption over creation. Running counter to this paradigm and drawing upon ingenuity and self-reliance, a social movement has grown in the last decade in the United States that seeks to privilege the handmade over the mass-produced: the maker movement. Also called the "handmade revolution," the maker movement challenges and offers alternatives to rapid consumption. This research investigates the social drivers of the maker movement, and it locates handmaking within anthropological literature on consumption, identity construction, and social movements. Ethnographic data was collected with makers in the Triangle Area of North Carolina from April 2011 – December 2011. Informants were sampled from one type of handmaking, "indie craft," characterized by original design and utilization of recycled materials. The researcher conducted participant observation at handmade markets, crafting circles, and the Maker Fair: NC. A social network map was created to connect makers and nodes of activity. Twenty crafters were interviewed, and five provided self-documentation journals. Through conversations, interviews, and journals, makers shared their methods and the personal and social significance of their crafts. The primary social drivers identified in this research are: sustainability, consumer choice, and a sense of camaraderie with the local crafting community and the larger maker movement. These drivers overlap with the environmental and social justice concerns of conscientious consumption. One key informant stated, "The maker movement is a huge rebellion" against corporate globalism. It is also characterized by innovative design, environmentally sustainable practices, the joy of making, and personal and community empowerment.

Candice Chambers and D. Troy Case
Graduate Program: Anthropology
Advisor: D. Troy Case
Poster Number: 22

Working our fingers to the bone: osteoarthritis in the hands of a historic population

This study examines osteoarthritis (OA) progression in the hands of an urban working class population born during the 19th century. The lives of these individuals were marked by the changing atmosphere propagated by the Industrial Revolution. The present study offers a rare glimpse into the lives of these individuals through osteological and archival analysis.

A total of 816 hands representing 412 individuals from the Hamann-Todd anatomical collection were macroscopically examined for evidence of OA. Using a nonrandom multi-stage sampling strategy, approximately equal numbers of specimens were

selected from each demographic subgroup: 101 African-American males, 102 African-American females, 104 European-American males, and 105 European-American females.

Individuals were grouped into cohorts by age, birth year, sex and ethnicity; frequency differences were assessed using multivariate logistic regression, Kruskal Wallis H, Fisher's exact, and Chi Square tests. OA was discovered in 43% of the sample with European-Americans (104/206) having significantly higher rates ($p = 0.0052$) than African-Americans (74/202). Multivariate logistic regression results reveal that the odds of a female developing OA during this time period were nearly 4.0 times that of males. Also, at any given age, the odds of a female having OA are estimated as 1.9 times greater than for a male at the same age.

Archival research utilizing the Minnesota Population Center's Integrated Public Use Microdata Series (IPUMS) was used to help contextualize these results with regard to occupational stress from the antebellum period to the second industrial revolution in Cleveland, Ohio. As these results demonstrate, industrialism took its toll on the American work force as they toiled in factories and mills in an ever advancing industrial age.

Joy Coker and Tia Sanders
Graduate Program: Social Work
Advisor: Willa J. Casstevens
Poster Number: 28

Exploring Voices in a Mentored Self-Help Approach to Voice-Hearing

Voice-hearing has been considered a first rank symptom of schizophrenia in biological psychiatry, though research has shown that voice-hearing experiences are found in the general population. Anti-psychotic medication, the primary somatic treatment for schizophrenia, aims to reduce psychotic symptoms, including hallucinations that often manifest as voices. This exploratory research examines voice-hearing experiences that were reported in the context of a mentored self-help approach to coping, using the workbook *Working with Voices* (Coleman & Smith, 1997) with the support of a trusted mentor. The workbook was used in conjunction with anti-psychotic medication with participants who were still experiencing psychotic symptoms, despite prescribed medication. This earlier study reported that the Brief Psychiatric Rating Scale factor, Anxious Depression, improved significantly post-workbook completion relative to a comparison group, although BPRS global psychopathology scores did not change significantly ($n = 27$). Further exploration of available voice-hearing data was indicated, and the present study examined Topography of Voices Rating Scale (TVRS) scores and participant-reported stressors. The TVRS was completed by intervention-group participants ($n = 16$) without oversight each time they met with their mentor, and nine participants provided consistently completed TVRS forms that could be scored and graphed. Coker scored the TVRS instruments, and graphed the TVRS total scores for each participant using Microsoft Excel. Sanders reviewed the mentor notes and recorded the presence/absence of documented stressors; the presence/absence of stressors was also graphed for each of the nine participants. Key findings were: (1) no observed connection between TVRS scores and the presence or absence of reported stressors, and (2) no evidence of symptom exacerbation during the workbook intervention. These findings indicate that, for these study participants, the mentored self-help approach using the workbook reduced anxiety and depression without exacerbating voice-hearing.

Rosa Fattahi
Graduate Program: English
Advisor: John Morillo
Poster Number: 39

Rainbows (in Parentheses): Romanticism's Evolving Afterlife in the Postmodern Music of Radiohead

The connection between postmodern literary theory and the works of British rock band Radiohead has been affirmed by numerous scholars and critics alike. However, what has been merely alluded to but not firmly established is the clear evidence of eighteenth- and nineteenth-century Romanticism in Radiohead's music. While 1997's *OK Computer* can be seen to display primarily postmodern ideals in lyrics and form, an examination of 2007's *In Rainbows* exhibits Radiohead's firmly postmodern ideological centre paired with aesthetic sensibilities and thematic content that can be seen as reflections of the ideas of the Romantic period—evidence of what scholar James Chandler terms a "Romantic afterlife"— in the music of Radiohead, as specifically demonstrated in their use of art as a medium for negotiating social and cultural traumas; their move towards pairing the markedly sublime with progressively more beautiful aesthetics in their music's language and sound; their thematic concern with the physical body and its relationship to mind, reason, and subjectivity; and the increasing presence of Romantic allusions in their lyrics. Building on the discourse of scholars who note the Postmodernism in Radiohead's works, I will also highlight in Radiohead's music the incidence of forms, concepts, and themes associated with Romanticism, thereby demonstrating the way that their work can be seen as a fusion of postmodern sentiments and Romantic concerns. Furthermore, by applying literary theory and academic research to the music of a band like Radiohead, my research will illuminate the changing boundaries of what is currently considered a scholarly literary "text," while at the same time exemplifying the persistent relevance and importance of Romantic studies today, as a tool for better understanding the works of our prominent, "other" modern day authors— popular songwriters and musicians.

Leah Gardner
Graduate Program: International Studies
Advisor: Lada V. Kochtcheeva
Poster Number: 47

Explaining Civilian Risk Perception of Nuclear Disasters

While nuclear disasters are low-probability events, they affect large geographical areas and populations and therefore weigh heavily on the public psyche. As nuclear energy is a widespread energy resource, nuclear disasters involving power plants have effects on public opinion. The objective of this paper is to explore the factors that influence civilian risk perception of nuclear disasters. This paper builds a framework of analysis for civilian risk perception of nuclear disasters, which can be extrapolated to other cases. It argues that the history of nuclear energy and disasters, perceived safety, the quality of governance, and the quality of information are key influential factors. The paper also finds that demographics, the availability and feasibility of other energy resources, and the strength of anti-nuclear and other environmental movements have a degree of influence in shaping civilian risk perception of nuclear disasters. Hence, it finds that the government and civilian populations play critical roles in establishing a more thorough approach to disaster risk analysis.

Amy L. Garrett
Graduate Program: Anthropology
Advisor: Ann Ross
Poster Number: 48

Osteological Analysis of a Late Woodland North Carolina Ossuary

This study represents a comprehensive osteological analysis of the Piggot ossuary site (31CR14) from coastal North Carolina. Calibrated radiocarbon dating indicates an age of AD 1420-1640, situating the site within the Late Woodland/Protohistoric period. The skeletal remains were not processed or catalogued prior to this investigation. The primary goal of this study is to determine the demographic profile of the site—including age and sex distributions and most likely number of individuals (MLNI)—as part of the inventorying process. This investigation additionally documents all evident pathologies in order to interpret overall levels of health and nutrition. Biological sex is assessed for adults through pelvic and cranial morphology. Adult ages are determined by cranial, dental, and pelvic degeneration, as well as Lamendin et al's (1992) aging technique based on dental transparency. For subadults, age is estimated through dental eruption and calcification, maximum lengths of long bones, and epiphyseal union. Results indicate the Piggot ossuary originally comprised 121 individuals, containing an incomplete, non-representative population with a significantly higher-than-expected percentage of subadults (74%). Prominent pathologies include osteoarthritis, otitis media, periostitis, osteomyelitis, and probable scurvy. Results also indicate the presence of congenital syphilis. However, due to the protohistoric nature of this sample, results of this investigation cannot contribute to the debate concerning the origins of venereal syphilis in the New World. The pathological evidence along with an over numeration of subadults suggests the sample could represent a Native American population experiencing the first wave of disease resulting from European contact.

Rebecca Gorham
Graduate Program: Foreign Languages and Literatures
Advisor: Jim Michnowicz
Poster Number: 58

Pronouns of Address in Costa Rica

The Spanish in Costa Rica incorporates three different pronouns of address: the *ustedeo*, *voseo* and *tuteo.* The use of the *voseo* is one of the most distinguishing features of many dialects of Latin American Spanish and is often called a symbol of linguistic identity for this area (Cisneros E. 1998: 90). At the same time, Lipski (1994: 224) notes that Costan Rican Spanish employs the *voseo and* the *ustedeo* among close friends or family members in contrast to most other Central American dialects. In a study conducted by Thomas (2008: 194), it was found that the *ustedeo* dominates all communicative situations and that the use of the *tuteo* is rapidly growing in Costa Rica.

The data consists of 150 surveys distributed to native Costa Ricans between the ages of 18 and 40. The surveys questioned participants' demographic information, their choice of verb conjugation (*ustedeo*, *voseo* and *tuteo*) according to hypothetical questions to different interlocutors (*amigo, abuela, niño etc*), and their personal opinion of when and why to use each pronoun. The 30 questions consisted of an even distribution of conjugations of common verbs and uncommon verbs. Preliminary results suggest that *usted* is the most common form, followed by *vos*, and then by *tú.* The use of the *voseo, ustedeo* and *tuteo* are evenly distributed among common and uncommon verbs. The *voseo* is mostly used with the interlocutors *amigo, niño and novio/esposo*. *Tuteo* is mostly used with *novio/esposo* and *niño*. *Ustedeo* is mostly used with *profesor* and *jefe* and males' and females' use of all three pronouns is evenly distributed. Non-students use the *voseo* slightly more than students and participants

who live and were born in San Jose, Costa Rica mostly use the *ustedeo* and *voseo.* Upper class participants use *voseo* more and the lower class participants use more *tuteo* and *ustedeo.*

Kristen Gossett
Graduate Program: Communication
Advisor: Joann Keyton
Poster Number: 59

Making sense of leader-member exchange theory and relationships: Understanding the dyad from an individual perspective

Leader-member exchange (LMX) relationships have been consistently studied within the organizational communication realm. However, research on these relationships has neglected how a person involved in the dyad cognitively creates, influences, or shapes the environment within which a LMX relationship is created, the relationship itself, and its quality. This paper positions sensemaking as a means by which we can better understand how members and leaders create and sustain their relationships with one another.

Amanda Hale
Graduate Program: Anthropology
Advisor: Ann H. Ross
Poster Number: 62

Linear Enamel Hypoplasias as stress indicators to interpret the effects of urbanization in the Iberian Peninsula

Linear enamel hypoplasias (LEH) have frequently been used to infer general health conditions. This study documents LEH presence to infer and compare the quality of life between temporally similar rural and urban populations from late 19^{th} – early 20^{th} century Portuguese. Due to the effects of urbanization an increase in LEH is expected in the urban sample. Data was collected from the Coimbra identified collection and the new Lisbon collection. This data is compared to the Oloriz collection in Spain. Measurements of hypoplasias were taken to calculate percentage of enamel affected. Craniometric data from each population was also utilized to calculate *Fst* values to establish genetic affiliation. *Fst* values suggest a close relationship with the expected variation between the Lisbon and Coimbra collections (*Fst*=0.038). However, the Lisbon and Oloriz collection exhibited the closest relationship (*Fst*=0.009) of all three samples. Paired t-tests were performed to compare the LEH frequencies and the percentage of enamel affected. The frequency comparison for central incisors (*p-value* = 0.001) suggests there is a significant difference between the groups. The sample comparison using percentage of enamel affected (*p-value* = <0.000) also indicates there is a significant difference between the two populations. These results suggest that using overall percentage enamel affected may not be a more sensitive parameter than frequency alone. The methods employed in this study as well as the use of identified collections can illustrate the need to detect more sensitive parameters used in future LEH studies. Also, it can contribute to our understanding of European dynamics during this time period.

Kenda K. Honeycutt, Ann H. Ross, and D. Wes Watson
Graduate Program: Anthropology
Advisor: Ann H. Ross
Poster Number: 68

Distinguishing Perimortem and Postmortem Fracture Patterns in a Mass Grave Scenario

Forensic anthropologists are often asked to assist in the investigation of international human rights violations. The purpose of this study is to perform experimental research to simulate a mass grave with the intention of identifying the effects of taphonomy on fracture characteristics with relation to time-since-death.

To replicate the conditions of a mass grave, a sample of ten intact pig carcasses were used. The sample of ten were euthanized by captive bolt pistol and transported to the NCSU field facility to observe taphonomic processes and the effect they have on fracture patterns. In addition to the original injury from the captive bolt pistol, each of the ten pigs received both blunt force and sharp force trauma. All ten pigs were then haphazardly interred together in an open grave to allow for observation and to accelerate decomposition.

Documentation of trauma was conducted through gross morphological assessment, photography, diagrams, and charts. The macroscopic features observed include: fracture outline, fracture edge, fracture angle, surface weathering and color of the fracture surface—fractures will be determined as perimortem or postmortem based on these indicators. Observations were also made regarding stage of decomposition, insect activity, scavenging, and daily temperatures/precipitation.

The null hypothesis tested is that taphonomic processes do not affect the appearance of peri- and postmortem fractures. It is expected that, due to moisture retention from bodily fluids, pigs on the periphery of the grave will skeletonize more quickly and the bone damage (fractures) will appear to be more characteristically perimortem than the pigs located in the center and

bottom of the grave. Thus, this research should display how the conditions of a mass grave will simulate bone damage that will appear perimortem for an extended period of time and help establish guidelines for forensic scientists working globally in post armed conflict arenas.

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

Media use, body (dis)satisfaction, and behavioral intentions: Toward a model of media effects and health during pregnancy

Pregnancy is a time of change for women, wherein their appearance, lifestyle, and health decisions come under great scrutiny and may be altered radically. A significant amount of research explores the links between body satisfaction, media use and behaviors in young adults. However, the links during pregnancy are still unclear. It is important to understand the various contributors to health decisions and risks, as these can affect the woman during pregnancy, as well as post-partum behaviors and the health of the baby. This study begins filling this research gap by exploring the relationships between media use, body (dis)satisfaction and health behaviors during pregnancy. It is hypothesized that pre-pregnancy body satisfaction, sociocultural attitudes towards attractiveness, and high media consumption and media literacy will predict pregnancy body satisfaction. An online survey method was employed to explore these hypotheses and research questions. Questionnaires were sent to pregnant women (N = 218). Participants provided basic information and then responded to several scales and questions. Scales included a general media literacy scale (Cronbach's α = .78), sociocultural attitudes towards attractiveness (Cronbach's α = .91), pre-pregnancy body satisfaction (Cronbach's α = .94), pregnancy body satisfaction (Cronbach's α = .57) and feelings of fatness during pregnancy (Cronbach's α = .70). Participants were also asked about the types of media they use and how often they utilize media and, finally, health behaviors. Preliminary testing revealed that pre-pregnancy body satisfaction (M = 3.03, SD = .5), sociocultural attitudes towards attractiveness (M = 2.96, SD = .80), and general media literacy (M = 5.31, SD = .65) are significant predictors of feelings of fatness during pregnancy (M = 2.99, SD = .38). The study continues to explore these relationships, as well as the media use variables to gain a clearer understanding of how these variables relate in effecting health during pregnancy.

Ashley R. Kelly and Meagan Kittle Autry
Graduate Program: Communication, Rhetoric, and Digital Media
Advisor: Carolyn R. Miller
Poster Number: 77

Temporal Trends in Digitally-Mediated Environmental Debate: An Analysis across Media to Assess Social Media Use in Local Environmental Debate

Purportedly acting as a catalyst for revolutions around the world, Twitter.com and similar social media sites have gained considerable and contested attention from communication scholars. The exact role of such sites in inciting or organizing protest, for example, remains unclear. In light of these "Twitter revolutions" or involvement with revolutions, we ask how the social media site Twitter is used to report and respond to the merging of two large utilities companies in the United States. When Duke Energy Carolinas (DUK) and Progress Energy (PNG) announced their intention to merge in early 2011, the companies were met with immediate public backlash. Building on a pilot study of the proposed merger (Kittle Autry & Kelly, forthcoming), this research expands the speculations of our pilot study to examine how discussion of environmental and economic issues unfolded online. To contextualize our Twitter data within a larger media ecology, we also looked to local newspapers' online articles as a point of reference and comparison. We explore how online newspaper articles work to construct and contain discourses surrounding the merger and how these discursive constructions are perpetuated or subverted by publics using Twitter. After collecting data from the period surrounding the merger announcement in January 2011 and from September 2011, when the processes to approve the merger began, we coded and analyzed our data looking for trends across time. Our data suggests that Twitter is representing discourses framed by the popular press and that these discourses have a distinctly economic focus. Implications for this work concern communication of environmental concerns related to energy generation, including nuclear energy.

Charles King
Graduate Program: English
Advisor: Carmine A. Prioli
Poster Number: 79

Rhetoric as a Form of Cross Cultural Intelligence

This research responds to an effort to maximize cross cultural understanding and awareness, which has gained fresh imperative this past decade by a wide range of actors, significant among them the U.S. military. Specifically, this research will investigate the utility of employing techniques of contrastive rhetorical analysis within the domain of conflict resolution, particularly with respect to the challenge of counterinsurgency. Professionals within this domain seek the twin transformational goals of security and development. While they are enabled by the growth of World English and consequent falling language barriers, cultural barriers remain high. Critical for them is the need to engage in "sense making" across these barriers, often under extreme stress, and seldom with the aid of extensive preparation. Thus the need to rapidly engage across a spectrum of cultures, at significant depth and nuance, and without a great deal of preparation is at a premium. While a great deal of work has been done in this past decade in the field of cross cultural communication, one resource set which has seldom been systematically mined is that of the literature, symbols, and rhetoric of a second culture. I will seek to demonstrate that certain principles, assumptions, and research techniques developed under the rubric of contrastive rhetoric are available today with which to approach a second society's rhetoric in order to better understand and evaluate that society, permit more successful sense-making of complex cross-cultural situations, and improve the navigation by an outsider in search of decisions and action. The research is qualitative, based on case studies and focused interviews, utilizing examples of military decision making across cultures. The results should provide international actors with an example of a neglected tool in cross cultural competency, and provide them with a new perspective of the different cultures within which they work.

Tingting Liu[1], Sarah London[1], and Valeska Redmond[2]
Graduate Programs: Communication Studies[1]; Communication, Rhetoric, and Digital Media[2]
Advisor: Joann Keyton
Poster Number: 88

Investigating Verbal Workplace Communication Behaviors

This two-part study with working adults examines which communication behaviors occur at work and how these communication behaviors are evaluated. Through an analysis of organizational communication publications (articles, organizational case studies, textbooks), authors identified 343 communication behaviors; sorting analysis reduced this list to 163 verbal communication behaviors used in the workplace. In an online survey, 126 working adults identified which of these communication behaviors had been heard or observed the previous day in the workplace. 44 communication behaviors were identified by 50% or more of the participants, indicating their frequent use in the workplace. In Study 2, 331 working adults evaluated their effectiveness on the 44 verbal communication behaviors. Factor analysis reduced that list to 36 verbal workplace communication behaviors comprised of four factors: information sharing, relational maintenance, expressing negative emotion, and organizing communication behaviors. The Workplace Communication Behavior Inventory is presented.

Paul Love
Graduate Program: International Studies
Advisor: Michael J. Struett
Poster Number: 90

Slow to Reform: Accountability and the Dual Nature of the International Monetary Fund

The International Monetary Fund (IMF), as a Bretton Woods post-WWII institution, has changed it role and the scope of its activities drastically since the end of the gold standard. Leaving behind its old role in the maintenance of the gold standard, the IMF has moved to emphasize structural adjustment loans to member states. These structural adjustment loans have ushered in an era of greater conditionality. Conditions on loans have extended into many facets of domestic policymaking including rule of law reform. Given this greater role of the IMF in debtor states' policymaking, there is a corresponding concern about the accountability of the institution towards the people it directly affects and the member state governments. This concern for accountability has lead to considerable amount of research devoted to the criticisms and reform proposals concerning accountability for the IMF. Efforts on the part of the IMF to establish mechanisms and engage in certain exercises that enhance accountability have been somewhat limited and have lagged other Bretton Woods institutions such as the World Bank. Reforms have been largely focused on representation of member states and less on direct accountability mechanisms that could handle outside complaints by individuals affected by IMF policies. The hypothesis of this project is that lag of reforms and nature of reforms concentrated on state participation is a function of improperly conceptualizing the IMF. A synthesis of constructivist understandings of the IMF as autonomous institution and realist concepts of institutions as instrument of state power will provide for a better basis from which to develop and study accountability reform.

Alexandra K. Mullins and Ruchi K. Patel
Graduate Program: Psychology
Advisor: Bart Craig
Poster Number: 99

Leadership Ratings: Does Gender Matter?

Prior literature suggests that gender stereotypes present in the workplace can affect which job positions are perceived to be more suitable for each gender. Previous research suggests male leaders are evaluated more positively than female leaders, despite lack of evidence for actual behavioral differences. The current study examined whether leader gender influenced evaluators' rating patterns of leaders as over-doing or under-doing various leadership behaviors. This study also expanded on previous literature and investigated the interaction between organizational level and leader gender, as well as the interaction between rater gender and leader gender. This investigation's purpose was to identify whether there are gender differences between leaders in rated patterns of over-doing or under-doing particular leadership behaviors, and if these differences are related to rater gender, rater source (i.e. subordinate, superior, peer), and a leader's organizational level. The Leadership Versatility Index was used to examine leadership behaviors on four dimensions: forceful, enabling, strategic, and operational leadership. Then, leaders were analyzed on each of the twelve sub-dimensions for forceful, enabling, strategic, and operational leadership. A set of multilevel models were used to analyze how leader ratings were affected by rater effects and leader effects. Results suggested that there were no gender differences between leaders and their ratings for any of the LVI dimensions or sub-dimensions. These results indicate that, despite many preconceived notions and theories about men and women in leadership, raters are not discriminating against leaders by gender. This may mean that men and women do, in fact, behave similarly on leadership dimensions or that raters do not rate one gender more favorably than the other.

Katherine M. Ngaruiya and Anne-Lise Knox Velez
Graduate Program: Public Administration
Advisors: Richard M. Clerkin and Jami Taylor
Poster Number: 80

Public Service Motivation and the Military: Dimensions for Attraction, Selection, and Retention

Determining the underlying motivations of those that choose to join the ROTC may have important implications for military recruitment and retention. This research uses the Kim et al. (2011) public service motivation (PSM) instrument and questions from literature on military enlistment (Moskos 1986) to survey both ROTC cadets and non-ROTC affiliated undergrads at two large state universities. The aim of this research is 1) to determine whether PSM levels differ between ROTC cadets and non-ROTC undergraduates and 2) whether institutional motivators for enlistment, which have been shown to make military enlistment more likely, are correlated positively with the normative dimension of PSM for ROTC cadets. Confirmatory factor analysis of the PSM model on samples of undergraduate students from a large Southeastern and a small Midwestern open admissions university as well as a sample of ROTC students from the Midwestern university will be used to determine whether certain dimensions of PSM are higher for ROTC. We will also examine the correlation between institutional motivators and the normative dimension of PSM. The results of this research have the potential to influence how ROTC cadets are recruited and motivated to remain in the military.

Emily Nwakpuda
Graduate Program: Public Administration
Advisor: Rajade Berry-James
Poster Number: 104

The Business Case for Diversity: Culturally Competent Nonprofit Organizations

According to the National Center for Charitable Statistics (2010), there are more than 42,000 nonprofit organizations in the State of North Carolina. Like many private businesses, nonprofit organizations must routinely invest in the training and development of their human resources. This ensures that the knowledge, skills and abilities of a nonprofit's employees are relevant to the communities the nonprofit serves. The adoption of culturally competent practices into the professional ethos of nonprofits, seeks to further this goal. Empowering nonprofits with the skills to address the widening "cultural divide" will undoubtedly have some profound effect on disparities in areas concerning education, employment, housing, justice, physical health, emotional health, citizen engagement, and overall quality of life for North Carolina residents.

A community-based needs assessment for training and development in the North Carolina nonprofit sector was developed to gather information about the current needs and problems preventing nonprofits from being culturally competent in their communities. This information was then transformed into an online survey and disseminated to a randomly selected group of nonprofits. The analysis of the survey results were then used as a market-justification to create a graduate certificate in cultural competence at North Carolina State University. Offering a graduate certificate in cultural competence would significantly contribute to the academic mission of the university, as well as offer a cross disciplinary tool for students in all departments.

Kristen Rectenwald
Graduate Program: Anthropology
Advisor: D. Troy Case
Poster Number: 124

Relative Long Bone Proportions and Developmental Stress in a Modern Thai Population

Research concerning relative, or scale-free, limb proportions has revealed interesting patterns of variability with regards to environment. However, there have been no direct attempts to correlate variability in limb proportion with unrelated stress indicators. In response, this study examined the relationship between long bone length ratios and linear enamel hypoplasia (LEH) frequency in a modern Thai population.

Proximal/distal limb bone length ratios were calculated for 259 adults (105 female/154 male) and compared against LEH frequency. Analysis using Pearson's product-moment correlation coefficients indicated significantly shorter relative distal limb lengths in the lower limbs of individuals with high LEH frequencies. This pattern was strongest in females, with statistically significant correlations in the tibia/femur ($p=0.019$) and the fibula/femur ratios ($p=0.007$) when compared with LEH frequencies, especially on the right side. LEH frequencies were also highly correlated with stature among females. In males, only the fibula/femur ratio demonstrated a significant relationship with LEH frequencies ($p=0.008$), and only on the left side of the body. No correlation between stature and LEH frequency was found in males, or between LEH frequency and long bone length proportions in the upper limbs of either sex.

These findings support the claim that distal limb growth is more strongly affected by developmental stress than proximal growth. In this study, the upper and lower limbs demonstrate different responses to environmental stress. This disparity, in addition to the strong association of limb bone length ratios and LEH frequency in females, may have significant implications for our understanding of human limb development and catch-up growth.

Valeska Redmond
Graduate Program: Communication, Rhetoric, and Digital Media
Advisor: Jessica Jameson
Poster Number: 125

The Influence of Power in Upward Employee Dissent

Power affects the way employees engage in discourse with one another and the type of tactics they use to dissent. While there has been a lot of work on power in organizations and much research on organizational conflict, there is a notable absence of communication research that specifically examines the intersection between organizational members' perceptions of power and whether and how they choose to dissent. This essay fills that gap by bridging the research on power, employee dissent, and organizational conflict in order to present a model of the strategies that employees use to express dissent. Using research conducted by communication scholar Jeffrey Kassing as the framework for this examination, the essay investigates how power moderates the type of dissent tactics employees select in order to be heard at the workplace. It primarily reviews upward dissent strategies in relation to concepts of facework, superior-subordinate relationship quality, and freedom of speech. The introduction of a Power-Dissent Impact Model illustrates the power distribution based on these concepts and helps predict the types of formal or informal upward dissent strategies employees may use to address a conflict. The Power-Dissent Impact Model suggests that the stronger the superior-subordinate relationship is, the more informal dissent strategies are selected marked by upward dissent tactics of reasoning. Further, employees who perceive their organizations as having low levels of freedom of expression are more likely to engage in formal upward dissent strategies or dissent outside their workplace. Thus, employees have a very clear idea of how to voice their opinion given the power structures and (im)balances at work.

William Sink
Graduate Program: Communication
Advisor: Melissa Johnson
Poster Number: 137

Women's Liberation and #Occupy: Defining a Genre of Emancipation Rhetoric

The purpose of this essay is similar to Karlyn Kohrs Campbell's (1973) landmark essay The Rhetoric of Women's Liberation: An oxymoron. Campbell argues that women's liberation discourse is its own genre of rhetoric and thus deserving unique treatment. Similar to Campbell, I begin with the hypothesis that the rhetoric of Occupy Wall Street (#Occupy) does not fit into classical rhetorical theory and merits special consideration. #Occupy is analogous to women's liberation for several reasons; fundamentally the politics of #Occupy are as profound and upsetting to the status quo as that of women's liberation. #Occupy, like the women's liberation movement "attack the entire psychosocial reality, the most fundamental values, of the cultural context in which it occurs" (Karlyn Kohrs Campbell, 1973, p. 75). #Occupy shares many characteristics of women's liberation; previous scholarship on that subject has provided several useful tools for analysis. While similar, #Occupy is different and

presents new challenges to the practice of rhetorical criticism. The very nature of #Occupy, its recent genesis, and its rapidly evolving manifestations, make it particularly difficult to critique. A goal of this essay is to identify and address those challenges, creating new "tools" for the rhetorical toolbox. This essay traces the pedigree of #Occupy through the Arab Spring back to the social movements of the 1960's and 70's. It examines the roles new media and communication technology are playing in #Occupy and its future implications for the movement. An analysis of rhetorical artifacts that adequately represent the discourse of #Occupy support the claim that a new manifestation of emancipation rhetoric is being articulated, forcing us to expand the genre of women's liberation rhetoric outlined by Karlyn Campbell to include the rhetoric of new liberation movements.

Catherine Sprankle
Graduate Program: Technical Communication
Advisors: Stan Dicks and Carolyn Miller
Poster Number: 140

Influencing the Future of Toxicology: Analysis of Discussions of "Toxicity Testing in the 21st Century"

Testing chemicals to evaluate their safety or toxicity is important for protection of human health and the environment. However, it has been widely acknowledged for many years that the traditional approach to toxicity testing using laboratory animals is unsatisfactory. In addition to ethical and species extrapolation issues that arise when testing chemicals in animals for potential human health effects, the ability of traditional animal-based methods to provide hazard information on all the chemicals of human health interest is rapidly being outstripped by the demand for such information. To address these concerns, the U.S. National Research Council (NRC) published a long-range vision and strategy for toxicity testing in a 2007 report. The NRC proposal is controversial among toxicologists and toxicology community stakeholders, and the discussion surrounding the proposal put forth by the NRC report is serving to coordinate the social action necessary to move the science of chemical safety testing forward. This project analyzed discussions of the NRC proposal both among scientists and in the wider stakeholder community to understand the rhetorical strategies being used to coordinate that social action.

The analysis revealed that authors and speakers promoting an aggressive approach to implementing the proposal put forth arguments using the *topoi* of modernity and new technology and *pathos* appeals to enthusiasm and betterment of the human condition. On the other hand, those promoting a more conservative approach to implementing the proposal focus their arguments on the *topoi* of caution and realism, and use *logos* appeals to highlight the potential shortcomings of the proposal. There is also a struggle between the two groups surrounding stasis, with rhetors favoring an aggressive approach focusing on questions of policy ("*How do* we implement this strategy?") and rhetors favoring a more conservative approach focusing on questions of value ("*Should* we implement this strategy?").

Daniel S. Stanhope
Graduate Program: Psychology
Advisor: Samuel B. Pond III
Poster Number: 141

Development and Validation of the School Technology Initiative Leadership Evaluation Scale (STILES)

Analyzing qualitative data collected from a representative sample of North Carolina schools, and drawing from past research and best practices, the author first set out to develop a theoretically sound framework for understanding effective leadership during school technology initiatives. Informed by this leadership framework, the author then engaged in a psychometric scale development process to create and validate a School Technology Initiative Leadership Evaluation Scale (STILES). The STILES was developed to evaluate school leadership on each dimension of the leadership framework and, ultimately, to assist schools and districts with identifying and assessing the quality of school-based leadership during school technology initiatives. After conducting analyses on quantitative data from a representative set of North Carolina schools (different sample from aforementioned qualitative data), the author reports the results of a series of studies targeted at developing and validating—using methods that included factor analysis, correlational analysis, regression analysis, multilevel modeling, and structural equation modeling—the leadership framework and the accompanying leadership evaluation scale. This research established supportive reliability and validity evidence, including internal consistency reliability, content validity, structural validity, and criterion-related validity. Results support the use of the STILES as a valid and reliable measure that should prove useful in identifying and assessing the quality of school-based leadership in a time when school technology initiatives are becoming increasingly more pervasive.

Jeff Swift
Graduate Program: Communication, Rhetoric, and Digital Media
Advisor: Carolyn R. Miller
Poster Number: 146

Digital Demagoguery and the Virtue of Bias

The rhetorical concept of demagoguery has, since the days of Plato, been focused on individuals using rhetoric in ways deemed unethical in one way or another. This ethical component has prompted scholars to be wary of the term because it is often used to silence those in disagreement or exclude those who don't play by the right set of rules.

In this project I use Brian Garsten's definition of demagoguery as *pandering* and *manipulation* to argue that demagoguery can be best understood in relation to claims of objectivity--individuals and institutions engage in demagogic rhetoric when they pretend to be "unbiased" while actually stifling dissent.

I use two websites as case studies for this kind of digital demagoguery: RealClearPolitics.com (a political news and opinion aggregation site run by an institution), and the politics page of Reddit.com (a community-driven link sharing forum). I examine the top stories on each website over the course of one week, examining whether either site displays diversity of opinion or allows dissenting links. I find that each engages in what I will call digital demagoguery—each manipulates its respective audience through claims to openness and diversity in opinion, while actually severely limiting the realm of arguments presented.

These findings suggest interesting problems for the study of demagoguery: I am not suggesting that every website, blog, advocacy page, or movement must present "both sides" of every issue. This project argues that this new iteration of demagoguery, *digital demagoguery*, is ironically rooted in the very premise (and facade) that is the opposite of demagoguery: objectivity. One might expect political opinion aggregators with institutional or community-based norms of openness and inclusion to be sites most open to dissenting opinions, but the very sites that claim to avoid demagoguery actually depend on it.

Krissen Womack
Graduate Program: International Studies
Advisor: Michael Struett
Poster Number: 166

Effectiveness of US engagement in International Organizations

In October 2011, Palestine became a member of UNESCO, a technical agency in the United Nations System, forcing the US to withhold funding from the organization due to existing US law prohibiting funding to any organization that allows the Palestinian Liberation Organization the same standing as member states. As much of the legitimacy in international organizations comes from one's financial contribution, Palestinian participation in international organizations could harm US efforts in multilateral diplomacy. Because of the very possible scenario of the US withholding funding and losing its legitimacy, this paper examines how US exclusion will impact the effectiveness of US engagement in international organizations. This paper looks at a number of cases in which US involvement has produced a desired result, for instance, US engagement in the Human Rights Council, which the US joined in 2009 after being absent for many years, and US involvement in a leadership change in the International Atomic Energy Agency while an ongoing battle over nuclear weapons was taking place. Overall, evidence will show that US engagement is effective and if forced to withhold funding, the US may lose its legitimacy and its voice in a number of important venues in which US involvement has been proven to make a difference.

Luyuan Niu and Michael Wohlgenant
Graduate Program: Agricultural and Resource Economics
Advisor: Michael Wohlgenant
Poster Number: 100

Is There a Discrepancy in Consumption Patterns of Fruits and Vegetables Between Low-income Households and High-income Households? A Censored Demand System Analysis Using Micro Data

"Increase intake of fruits and vegetables" comes first in the key recommendations of the 2010 USDA *Dietary Guidelines for Americans*. Americans are encouraged to eat more fruits and vegetables since fruits and vegetables are important components in a healthy diet. Many food policies and food assistance programs are targeted at low-income households. For policies and programs like these, quantitative information on demand for fruits and vegetables at the household level and for different segments of the population is required to inform public policy. This study examines households' demand for fruits and vegetables segmented by income levels, determining whether a discrepancy exists in the consumption patterns between high-income households and low-income households and comparing the differences across three categories of fruits and vegetables: fresh fruits, fresh vegetables and processed fruits and vegetables. This study uses a micro-level dataset from the 2002-2006 Diary Survey of Consumer Expenditure Survey. A censored demand system and a correlated random effect specification are applied and the model is estimated by quasi-Maximum Likelihood Estimation (QMLE). Results show that statistically significant

differences are found between the high-income households and low-income households. Seasonal effects and demographic variables, such as region, race, and household composition, play an important role in the fruit and vegetable consumption for both income groups. Education does not have a statistically significant impact on consumption of fruits and vegetables for low-income households. Conditional price elasticities indicate that the three categories are gross complements and net substitutes. Moreover, compared to the high-income households, the low-income households are more responsive to own price changes when consuming all the three categories of fruits and vegetables; these households are also more responsive to income changes when consuming fresh fruits and processed fruits and vegetables.

Jieyuan Zhao
Graduate Program: Economics
Advisor: Barry K. Goodwin
Poster Number: 176

Volatility Spillovers in Agricultural Commodity Markets: An Application Involving Implied Volatilities from Options Markets

This study provides a new approach to analyze the issue of volatility spillovers. In particular, we investigate relationships and transmissions between implied volatilities in corn and soybean markets – two of the most important agricultural commodity markets in the United States. Using weekly average data from 2001 to 2010, we estimate a VAR model with Fourier seasonal components as exogenous variables. Results from this model indicate that volatility spillovers exist from the corn market to the soybean market, but there is no volatility spillover from the soybean market to the corn market. Impulse response functions from this model show that a standard positive shock in the implied volatility of corn has a positive impact on responses of the implied volatility of soybeans. However, responses of the implied volatility of corn to a shock in the soybean market are not significant. To examine the time invariance property of this model, we conduct three bootstrap versions of Chow tests (sample-split, break-point, and Chow forecast). All of these tests suggest significant structural break points in several time periods. To improve the accuracy of our model, we develop a threshold VAR model with four regimes that depend on previous levels of volatilities. Results from the threshold VAR model indicate that when both volatilities are relatively low, volatility spills over from the corn market to the soybean market, but when the implied volatility of soybeans is relatively high, volatility spillover effects reveal an opposite direction. Finally, using futures prices, we estimate a BEKK-GARCH model, which is commonly used to investigate volatility spillover effects. Results from the BEKK model show that volatility spillovers exist between the two markets, which is different from what we have found using implied volatilities.

John Carr and Heather M. Cheshire
Graduate Program: Forestry and Environmental Resources
Advisor: Heather M. Cheshire
Poster Number: 18

Assessing Embedded Geospatial Learning Outcomes

Geospatial tools and technologies have become core competencies for natural resource professionals. To equip undergraduates with the needed background, geospatial instructional activities have been integrated across curricula and courses in the Department of Forestry and Environmental Resources at North Carolina State University.

The effectiveness of the integration and how well students are meeting geospatial outcomes are unknown. We developed a flexible outcomes-based framework to assess student learning and to determine if students were successfully exposed to the technologies. Assessment instrumentation included tracking questions, rubrics, pre- and post-assignment questionnaires, and incoming and outgoing knowledge surveys.

Analysis of students' coursework shows forestry seniors met skills-based, information literacy, and conceptual knowledge outcomes. Natural resources seniors demonstrate adoption and internalization, desired affective outcomes, in their coursework. Analysis of pre- and post-assignment questionnaires show increased student learning after course-embedded activities; however, many improvements are not statistically significant or fail to meet the intended performance standard. Analysis of longitudinal knowledge surveys shows that students' awareness of and confidence in their ability to use the tools increased significantly but fell short of the performance target.

Data indicate students had more success with frequently repeated material, and success increased with higher levels of integration. This suggests that additional instructional opportunities and better integration within students' ongoing coursework are avenues for improving learning. The assessments helped us identify instances where there were instructional missteps and unforeseen issues with assessment methods. The assessments have produced baseline student learning information we can use to objectively evaluate student performance and our own performance as educators.

Carlos A. Carrillo[1], Orlando J. Rojas[1,2], Lucian A. Lucia[1], Daniel Saloni[1], and Martin A. Hubbe[1]
Graduate Programs: Forest Biomaterials, North Carolina State University[1]; Department of Forest Products Technology, Aalto University, Finland[2]
Advisor: Orlando Rojas
Poster Number: 19

High water content microemulsions in a novel method for wood pretreatment and extraction

Wood pretreatment is a critical process in wood preservation, wood chemical and pulp production as well as in biorefineries. In addition to the involved energy intensity (pressure and temperature) wood pretreatment and impregnation usually involves high capital and operation costs. We propose a new approach based on microemulsions with high water content (>85 wt-%) for the rapid and effective impregnation or pretreatment of wood at atmospheric pressure and temperature. The microemulsions are formulated by mixing water, oil and a surfactant in exact compositions to obtain one-phase systems with special properties. Wood wicking and sorption isotherms followed different kinetic regimes and demonstrated improved impregnation performance relative to that of the base fluids. The key properties of the microemulsions to effectively penetrate the complex capillary structure of wood are discussed; microemulsion formulation and resultant viscosity are found to have a determining effect in the extent of fluid uptake. Considerable solubilization of cell wall components is observed. The relationship between phase behavior and formulation is discussed in light of the new method proposed for effective wood pretreatment.

Judith Gisip, Richard L. Lemaster, and Herman van Dyk
Graduate Program: Forest Biomaterials
Advisor: Richard L. Lemaster
Poster Number: 53

Optimization of Wood-Based Machining Operations on CNC Router through Extending Tool Life

Optimization of machining processes provides economic benefits through increased productivity and product quality. The goal of this research was to optimize a wood-based machining operation on a computer numerical control (CNC) router through extending tool life. Two methods of extending tool life are being considered, i.e. feedback control, and tool cooling. The objective was to establish a relationship of the effect of tool grade and spindle speed on tool wear, the degree of chipping of melamine-coated particleboard, and spindle vibration. The relationship provides crucial information for the feedback control technique. Particleboard samples were machined on a CNC router with three grades of tungsten carbide tool inserts with different degrees of hardness (soft, medium, and hard). Another experiment was conducted using three spindle speeds (12000, 15000, and 18000 RPM). Tool wear as a measure of tool life was measured on the tool cutting edge with an optical microscope. The degree of chipping of the particleboard was measured to determine the quality of cut. Three frequency bands were selected to identify the frequency of the spindle vibration that changes the most as a tool becomes worn. A frequency band that shows significant changes as tool wear increases could be used to monitor the cutting tool condition for optimizing machining operation on a CNC router. LabVIEW™ software was used to acquire machine vibration signals through an accelerometer that was attached to the CNC router tool spindle. Results showed that the highest amount of tool wear, and chipping occurred when cutting with the softest carbide grade. The mid- and upper- frequency bands showed patterns as tool wear and chipping increased. The highest spindle speed reduced chipping; however, it accelerates the wear on the cutting tool. Thus, a control system that can regulate the spindle speed is needed to optimize tool life and product quality.

Viola Glenn, Oluyede Ajayi[2], and Fred Cubbage[1]
Graduate Programs: Forestry and Environmental Resources[1]; World Agroforestry Centre (ICRAF), Nairobi, Kenya[2]
Advisor: Fred Cubbage
Poster Number: 54

An Econometric Assessment of Faidherbia ablida yield impacts in Malawi

Land scarcity and pressing nutritional needs no longer allow smallholder farmers in Malawi to use traditional fallowing methods to maintain soil fertility. Consequently, staple food crop yields have considerably diminished in recent decades. Researchers at the World Agroforestry Centre (ICRAF) posit that an indigenous tree species, Faidherbia albida, may be a critical tool in treating fertility issues. This nitrogen-fixing species extracts nitrogen from the air and transfers it to the soil through root systems and leaf and pod litter. Additionally, the trees exhibit the unique quality of reverse leaf phenology—where leaves drop at the beginning of the rainy season, just before the planting of maize crops, but remain dormant throughout the crop growing season—minimizing competition for resources.

Experimental results indicate interplanting Faidherbia albida with maize crops increases maize yields by 280% in some areas, but no formal analysis has been conducted on its effectiveness in non-experimental settings. This study collected data in 2011 using a semi-formal household survey of 391 farms in Malawi under the advisement of ICRAF, and in conjunction with the US Agency for International Development (USAID) and Malawi's Department of Forestry (DOF). The vast majority, 93%, of farmers who have themselves planted Faidherbia albida report noticeable increases in yield.

Econometric models are estimated to precisely assess the impact of the presence of trees in maize fields. Three ordinary least squares (OLS) models are used to estimate the relationship between maize yield and a suite of key predictors including: tree (count, diameter), soil (type, fertility level) and household characteristics (income, gender, education, experience), regional environmental fixed effects, and other farming practices (chemical fertilizer, other agroforestry species). Regardless of how the trees are described in the models, each produces a statistically significant result (1%), indicating a yield increase of 10% to 14% per acre depending on the metric used to measure presence of trees.

Brett M. Hartis
Graduate Program: Fisheries, Wildlife, and Conservation Biology
Advisor: Stacy A.C. Nelson
Poster Number: 64

Satellite Remote Sensing of Submerged Aquatic Vegetation Distribution and Status in Currituck Sound, NC

In coastal regions with extensive, non-linear water bodies, large scale submerged aquatic vegetation (SAV) surveys are rarely done due to logistical difficulties and high costs. Our study examines whether remote sensing can be used for regional monitoring of SAV in the Currituck Sound of North Carolina. Currituck Sound supported a diverse assemblage of SAV which provided food and habitat for wintering waterfowl. In the past 30 years, SAV has rapidly decreased. Our study attempts to determine if levels of SAV cover, species or growth forms could be detected using high-resolution satellite sensors, and to determine if predictions of SAV abundance and distribution can be improved by including sediment type or measures of water clarity. The Currituck Sound was sampled during peak plant biomass (June–September 2010). Four Quickbird images were acquired between June and September, 2010 to coincide with *in-situ* sampled data. The littoral zone of the Sound was mapped using a geographic information system (GIS) and overlain with points which represented survey points. Plant cover was assessed at each point for an area of 10m x 10m. A variety of variables were measured at each point (depth, salinity, sediment type, secchi depth) and plant composition was assessed by recording plant presence and plant cover. Plant cover was split into four levels 0 (0–20% plant cover), 1 (21–40% plant cover), 2 (41–80% plant cover), and 3 (81–100% plant cover). Binomial and multinomial logistic regression models were developed to examine relationships between SAV measures and spectral values. Initial results suggest that depth and sediment type play a significant role in growth of SAV within the Sound. Models have demonstrated significant correlation with Band 4 (near- IR) spectral values. Difficulty in determination of relationships has occurred due to overwhelming amounts of sun glint and cloud cover in images.

Camilla Hodge[1], Ramon Zabriskie[2], Gilbert W. Fellingham[3], Sarah Coyne[4], Neil Lundberg[2], Laura Padilla-Walker[4], and Randal Day[4]
Graduate Programs: Parks, Recreation, and Tourism Management, North Carolina State University[1]; Department of Recreation Management and Youth Leadership, Brigham Young University[2]; Department of Statistics, Brigham Young University[3]; School of Family Life, Brigham Young University[4]
Advisors: Ramon Zabriskie and Michael Kanters
Poster Number: 66

The Relationship between Media in the Home and Family Functioning in Context of Leisure

Research has established a positive relationship between family leisure, family health and well-being, family functioning, and family life satisfaction. Family leisure is increasingly media-based; in fact, scholars estimate about half of people's free time is spent in media consumption. Research examining the relationship between media-based family leisure and family functioning, however, is limited. Because research has demonstrated family leisure is related to family functioning, and media is one of the most common leisure activities, further studies are needed to understand the relationship between family leisure media use and family functioning. Furthermore, because much of family leisure research has been limited to individual-level analyses, there is a need to use statistical methods that appropriately account for family as well as individual variability. Therefore, the purpose of the study was to examine the relationship between media-based family leisure and family functioning with at least one adolescent child. Specifically, this study examined the relationship between family functioning and media use, media connection, and parental media monitoring over time. Furthermore, because the data were nested in families, this study used a mixed model statistical approach to account for both family-level and individual-level variance. Because the sample (n = 500) included responses from parents and children (ages 11 to 16) from each family, mixed models were used to account for family-level and individual-level variance. Findings indicated a negative relationship between media use and family functioning; media connection and parental media monitoring were positively related to family functioning. This was stable over time even when accounting for variance explained by depression, anxiety, conflict, and other demographic variables. The mixed linear model analysis and use of longitudinal data add to existing research. Current findings suggest parental involvement in adolescent media use is the most important factor in explaining variance in family functioning in context of family leisure.

Jacob B. Hughes
Graduate Program: Fisheries, Wildlife, and Conservation Biology
Advisor: Joseph E. Hightower
Poster Number: 71

Combining Sonar Technologies to Assess Spawning Runs of Anadromous Fishes

Hydroacoustics, the study of sound under water, is an established yet evolving method for assessing fish populations. Advantages of using sonar to count fish include its effectiveness in deep or swift waters or sites with underwater obstructions where traditional netting would be infeasible. I used a combination of side-looking split-beam and side- and down-looking DIDSON sonars to assess spawning run size of striped bass *Morone saxatilis*, American shad *Alosa sapidissima*, hickory shad *A. mediocris*, alewife *A. pseudoharengus*, blueback herring *A. aestivalis*, and semi-anadromous white perch *M. americana*, in the Roanoke River, NC during 2010 and 2011. A 430 kHz split-beam transducer was deployed at a fixed location, aimed cross-channel, perpendicular to flow, to gather count data on upstream moving fishes in the mid-channel and near-bottom zones of the river. Long range capabilities of split-beam sonar make it a valuable technique for assessing counts and cross-channel distributions of fish migrating up river. However, unevenness in river bottom profile caused 'blind-spots' in beam coverage, leading to fish moving past the sonar site undetected. Narrow beam width close to shore, where migration rates are highest, also led to concerns of underestimation. I used a boat-mounted down-looking DIDSON deployment at multiple locations across the river channel to address blind-spots in split-beam coverage and monitor cross-channel and vertical distributions. I also used a fixed-location side-looking DIDSON deployment which was more effective than the split-beam system in covering the first 10 m near shore. DIDSON deployments also provided size and shape information that is useful in partitioning run size estimates by species. This combination of techniques and gears and our focus on areas with highest concentrations of upstream migrants resulted in improved accuracy and precision of our estimates. I recommend this as a replicable and reliable protocol for sampling southeastern US rivers.

Katharine Kelley, Michelle Gacio Harrolle, and Jonathan Casper
Graduate Program: Parks, Recreation, and Tourism Management
Advisor: Jonathan Casper
Poster Number: 76

How Can Professional Teams Make More Money? An Investigation of a National Hockey League Team

Sport spectators are responsible for roughly $28 billion, of the sport industry's consumption through ticket, merchandise, and food and beverage purchases (Plunkett, 2008). Game day consumer spending is critical for sport organizations' sustainability and profitability, especially in the National Hockey League (NHL) as nearly half the NHL franchises generate more than two-thirds of their annual income from ticket sales (Masteralexis, Barr, & Hums, 2008). Sport consumers' intentions and motivations to purchase have been linked to satisfaction and self-esteem theories (e.g., Cialdini et al., 1976; Oliver, 1997; Van Leeuween, Quick, & Daniel, 2002). This study applied these theoretical frameworks to game day spending. The purpose of our study was to analyze financial data to understand the influence of game day variables, including game outcome, month in season, opponent, day of week, game time, and special promotion, on ticket sales, merchandise per cap sales, and food and beverage per cap sales for a NHL team. Game day variable data and consumer spending financial data were collected from the NHL team's website and official game day event revenue summaries for 123 regular season home games. A t-test revealed that game outcome did not have a significant influence on merchandise ($p = .24$) or food and beverage ($p = .42$) per cap sales. However, regression results indicated that non-performance game day variables (i.e., month in season, day of week, game time, and special promotions) had a statistically significant influence ($p < .001$) on game day spending. The variables tested explained 43.4 % of the variance in ticket sales, 40.5% of the variance in merchandise per cap sales, and 34% of the variance in food and beverage per cap sales. Findings provide practical implications for teams who hope to maximize game day revenue by predicting and reacting to expected attendance.

Grace D. Lee Jenni[1], M. Nils Peterson[2], Fred W. Cubbage[1], and Jessica Katz Jameson[3]
Graduate Programs: Forestry and Environmental Resources[1]; Fisheries, Wildlife and Conservation Biology[2]; Communications[3]
Advisor: M. Nils Peterson
Poster Number: 84

Military perspectives on public participation in environmental management

Environmental management decisions on military lands are becoming increasingly important as militaries attempt to balance operations with environmental sustainability. Successfully managing the juxtaposing goals of military training with conservation has major implications for the environment given the US military alone manages over 12 million ha of land hosting a variety of wildlife species, rare ecosystems, water resources, and historical and anthropological sites. In this paper we used a grounded theory approach to explore military perceptions of public participation in environmental decision-making. We found that although the Department of Defense was actively engaged in public participation, participation was associated with one-way

public relations. Informants believed the primary purpose of public participation was to improve and manage relationships with surrounding communities. We found barriers to more meaningful forms of public participation included: a perceived lack of public interest, turn around in military and civilian leadership and operational security concerns. Our informants considered these barriers unique to military contexts. We conclude by describing how dialogue, trust building exercises, and identifying and sharing low risk information can be used to improve military conservation efforts and relationships between installations and the communities they interact with.

Anna Miller, Philippe Lenfant, and Reda Neveu
Graduate Program: Parks, Recreation, and Tourism Management
Advisor: Yu-Fai Leung
Poster Number: 96

Artificial Reef Impact Assessment: Artisanal Fisheries in Languedoc-Roussillon, France

Global fish stocks have been in decline since the late 1980s. Overfishing contributes to global decline, reduces biodiversity, modifies ecosystem function and is a leading environmental and socioeconomic problem in the marine environment. Fisheries managers developed artificial reefs in an effort to rebuild fish stocks diminished by overfishing and other pressures. Overfishing is one factor in the decline of fish populations in the Gulf of Lyon, France. This region exhibits high species diversity for the Mediterranean Sea as well as economic dependence on the fishing industry. Artificial reefs have been deployed in the Gulf of Lyon since 1985, however studies to quantify their impacts are scarce. This study assessed the impacts of artificial reefs installed along the coast of Languedoc-Roussillon, France (a region of the Gulf of Lyon) in 2004-2005 through analysis of catch data from artisanal fisheries in this area over a four-year period (2007-2010). Using spatial and statistical analyses of the two main gear types, the study found that mean individual weight in red mullet (*Mullus sp.*) gillnets increased over the four-year period while catch per unit effort (CPUE) increased in sole (*Solea sp.*) trammel nets. This information in combination with the knowledge that fishermen can earn larger profits per pound from larger fish led to the following conclusions: (1) impacts on mean individual weight and CPUE vary by species group and (2) artificial reefs may economically benefit local fishermen.

Carlos L. Salas, Mariko Ago, Lucian Lucia, and Orlando J. Rojas
Graduate Program: Forest Biomaterials
Advisors: Orlando Rojas and Lucian Lucia
Poster Number: 132

Soy protein as surface modifier: adsorption and nanofiber systems

The large amount of proteins available in soybeans (>50%) make them attractive as key biopolymer in plastics, adhesives and composites. Development of such bio-based materials requires a thorough understanding of surface and intermolecular interactions. This work summarizes the results of our investigations on the interactions of soybean proteins with lignin and the development of nanofibers. The adsorption from aqueous solution of soy glycinin and beta conglycinin, the two main storage proteins in soybeans, was studied by quartz crystal microgravimetry and surface plasmon resonance under different physical-chemical environments. The native as well as the denatured (2-mercaptoethanol and urea) proteins were used. Compared to cellulosic substrates, higher protein adsorption was measured on lignin, which was explained by favorable hydrophobic interactions. The water contact angle (WCA) reveals an increased hydrophilicity of the surface upon protein adsorption, with typical reductions in WCA of ≈ 35°. This observation further highlights the role of hydrophobic interactions as driving mechanism for adsorption. Complementary studies involved the production of nanofibers from soy proteins and lignin (70:30 weight ratios) by using electrospinning. Scanning electron microscope (SEM) imaging revealed that defect-free fibers (171±16 nm) were produced after addition of polyethylene oxide as coadjutant. Thermal treatment of the fiber mats at 80° C increased the water contact angle from 55 to 70°. These results together with other analyses (FTIR, XPS, etc.) suggest the good compatibility between soy proteins and lignin. Overall, these two polymers are proposed as platforms for development of new materials taking advantage of the fact that they are readily available, abundant and interact effectively in multicomponent systems.

Marta Simon Pongor
Graduate Program: Forest Biomaterials
Advisors: Ilona Peszlen, Perry Peralta, and Jean-Christophe Domec
Poster Number: 135

Free air carbon dioxide enrichment effect on the wood quality of loblolly pine (*Pinus taeda* L.)

Rising atmospheric carbon dioxide (CO_2) concentration is considered a contributing factor to global climate change. However, CO_2 is not only a greenhouse gas but also a vital plant-nutrient which enhances photosynthesis, growth, and yield in plants including trees. Starting in 1996, loblolly pine (*Pinus taeda* L.) trees have been exposed to ambient and elevated (ambient + 200μL L^{-1}) CO_2 treatment in a Free-Air Carbon Dioxide Enrichment (FACE) facility at the Duke Forest. Starting with the 2005

growing season, each treatment plot was split into two halves with one-half of each plot fertilized at a rate of 11.2 g N m^{-2} y^{-1}. Eight plots of 26-year-old loblolly pine trees with four treatment groups such as ambient (A), elevated (E), ambient fertilized (AF), and elevated fertilized (EF) were harvested in Spring 2011. Disks above breast height were cut from 32 sample trees. Growth ring width and wood density were measured using a Quintek QTRS-01X x-ray densitometer and statistical analyses were performed. This presentation discusses the variation in growth ring width and wood density as affected by elevated CO_2 and fertilization treatments.

Nitin K. Singh
Graduate Program: Forestry and Environmental Resources
Advisor: Ryan E. Emanuel
Poster Number: 136

Catchment Isotope Ecohydrology: The Influence of Vegetation and Topography on Runoff Generation in Forested Headwater Catchments

The combined influence of topography and vegetation on runoff generation and streamflow in headwater catchments remains unclear. Natural stable isotopes such as of hydrogen (^2H) and oxygen (^{18}O) can be used to investigate the combined influence of topography and vegetation on runoff generation. We investigated two pairs of small (< 15 ha) forested catchments at the Coweeta Hydrologic Laboratory (CHL) in the southern Appalachian Mountains. Each catchment pair consists of one broadleaf deciduous watershed and one evergreen coniferous watershed. Beginning in June 2011, we collected monthly water samples at 25 m intervals along each stream, from shallow full screened wells, and rain gauges within each catchment. We analyzed these samples for δ^2H and $\delta^{18}O$ using cavity ring-down laser spectroscopy. The results suggested high spatial and temporal variability in δ^2H and $\delta^{18}O$ among stream and well waters. We attributed some of the temporal variability in isotope concentrations to seasonal and storm-scale variation in precipitation isotopes, and we linked additional temporal variability to mixing of water sources and isotopic fractionation within the watersheds. Within catchments we observed spatial variability that included enrichment of δ^2H and $\delta^{18}O$ in stream water from the channel head to the outlet. Among catchments, we also observed that streamflow was lighter and more variable in δ^2H and $\delta^{18}O$ in evergreen-dominated watersheds than in deciduous-dominated watersheds. Among all catchments, streamflow at the bases of hillslopes was isotopically similar to nearby hillslope groundwater, suggesting distinct contributions of hillslopes to runoff. High resolution terrain and vegetation analysis will be conducted on LIDAR data to understand the variability and organization of isotopic signatures in each catchment. Understanding the role of landscape heterogeneity in the generation of runoff will help scientists and environmental managers to assess the impacts of vegetation activity and disturbance on water quality and quantity downstream of forested headwater catchments.

Shuangyu Xu, Samantha Rozier Rich, Michelle Gacio Harrolle, and Katharine Kelley
Graduate Program: Parks, Recreation, and Tourism Management
Advisors: Samantha Rozier Rich and Michelle Gacio Harrolle
Poster Number: 169

Impact of Summer Residential Camps on the Tourism System

Summer camps can have positive impacts on surrounding communities due to the influx of camp families traveling to the area (Gunderson, 1989; Lewis & Deller, 1993). Within these economic times, many camp directors feel the need to justify their value to local policy makers. However, little research has been conducted looking at the impact of summer camps on the travel and tourism industry. Hence, the purpose of this study is to better understand the contributions of organized camps to the tourism system and local economy.

This study was conducted using a group of summer residential camps in Western North Carolina, specifically within four counties (Buncombe, Henderson, Jackson, and Transylvania) during the summer of 2010. Data were collected using an online survey instrument. Altogether, 40 surveys from camp/camp directors, 540 from camp staff, and 4,600 from camp families were valid for analysis. IMPLAN software was used to estimate the economic impact of these summer camps. In addition to demographic data, camp staff and camp families were asked to indicate their activities during their travel, the influence of camp on visits/travels around NC, sources of information used for trip planning, and the days and money spent in WNC before/after camp.

Results show in addition to the generation of considerable economic impact ($365 million), summer camps also draw the majority of camp families and staff to travel great distances to the local area (average 500 miles), spend large amounts of money in the area (families spent average of $2,096), and actively participate in tourist opportunities (top 3 activities = shopping, visiting scenic areas, hiking). Further, majority would not have visited NC if it were not for the camps. Results also suggest a need to develop partnerships between camps and local tourist attractions and related businesses to further increase the positive impacts of camps.

Zhiying Yu, Hasan Jameel, Hou-min Chang, and Sunkyu Park
Graduate Program: Forest Biomaterials
Advisor: Hasan Jameel
Poster Number: 172

Fundamental insights into lignin inhibition on enzymatic hydrolysis of woody biomass

Bioconversion of softwood, a dominant lignocellulose in North America, provides a great opportunity for a sustainable biorefinery from forest resources into transportation fuels. However, softwood is highly recalcitrant to enzymatic hydrolysis as compared to hardwood. It has been speculated that this difference is due to lignin content, structure, and distribution between softwood and hardwood, which consequently influence lignin-enzyme interactions such as non-specific adsorption of enzyme onto lignin, physical blockage of enzyme penetration into biomass structure, and chemical blockage of binding sites through lignin-carbohydrate linkages. In this research, biomass structure was mimicked to investigate these inhibitory effects of lignin on enzymatic hydrolysis. Different types of lignin were isolated from softwood (loblolly pine) and hardwoods with different S/G (syringyl and guaiacyl) ratio (eucalyptus and maple) via ball milling and dioxane extraction, and then reconstructed biomass was prepared by acid re-precipitation of isolated lignin onto bleached pulps. It was found that softwood lignin by itself adsorbed more cellulase than hardwood lignin. The enzymatic hydrolysis of bleached hardwood and softwood alone had no differences. When 20% lignin was physically mixed and reconstructed with bleached hardwood and softwood pulps respectively, it showed that the physically mixed lignin and bleached pulps did not have a significant impact on enzymatic hydrolysis. However, when reconstructed hardwood and softwood were tested, the 96 h carbohydrate conversion of reconstructed eucalyptus, maple and pine was dropped by 7.2%, 11.6% and 17.6%, respectively, compared with the untreated bleached hardwood and softwood pulps. These results indicated a significant impact of physical blockage of lignin on substrate digestibility. With the decreasing of S/G ratio, the recalcitrance of lignin increased and thereby resulted in a greater inhibition on enzymatic hydrolysis. This phenomenon is probably due to the more branched structure of Guaiacyl lignin units which cover a wider surface area of the bleached pulps.

Tim Antonelli[1], Michael Robert[1], Fred Gould[2], and Alun Lloyd[1]
Graduate Programs: Mathematics and Biomathematics[1]; Entomology[2]
Advisors: Alun Lloyd and Fred Gould
Poster Number: 3

Investigating the role of density dependence in the spread of *Wolbachia*

Wolbachia is a maternally inherited bacterium that occurs in a broad range of insects, including mosquitoes. It has been shown to interfere with dengue virus replication in the mosquito *Aedes aegypti*, the primary vector of dengue. Release of *Wolbachia*-infected mosquitoes has been proposed as an alternative to traditional dengue control methods. *Wolbachia* is expected to become fixed in subsequent generations, provided release ratios surpass some threshold. We used a deterministic reaction-diffusion model to predict the spread of *Wolbachia* through a population of *Ae. aegypti*, in order to determine what release conditions are necessary for *Wolbachia* to become established in a given region. We found that the ability of *Wolbachia* to spread in time and space depended largely on the amount of adult dispersal, the fitness cost of *Wolbachia*, and the degree of density-dependent mortality. In general, density dependence decreases *Wolbachia*'s ability to spread; however, for high per-capita birth rates of mosquitoes, density-dependent mortality can actually facilitate spread. This result highlights the importance of density dependence in determining whether a particular release strategy will result in spread of *Wolbachia* throughout a population of *Ae. aegypti* in a given region.

Sayantan Banerjee
Graduate Program: Statistics
Advisor: Subhashis Ghoshal
Poster Number: 7

Bayesian analysis of preterm births in North Carolina

The causal factors relating to preterm birth, that is, birth of a child before the gestation period of 37 weeks, are not explicitly known, which make the control of preterm births difficult. Preterm births have adverse consequences of ill-health conditions in such children and also contribute substantially to neonatal mortality. WHO statistics show preterm birth rate of 12.2 percent in the United States in 2009, which is much short of the federal government's 'Healthy People 2020' target of 11.4 percent.

The aim of this study is to determine the contribution of the suspected risk factors relating to preterm births. We conduct a Bayesian analysis of a randomly selected subset of births recorded in North Carolina in 2010 to determine county-wide variation in preterm birth rates along with identifying variations in the rates according to several other factors like race and gender, using a generalized linear mixed model framework. We also apply the Stochastic Search variable selection method for identifying the factors which are most important relating to the overall preterm birth rates in the state. Results show that drinking and smoking habits of mother significantly affect the preterm births, and also the rates vary among the counties by race, with higher preterm birth rates for non-white parents.

Laura Boehm[1], Brian Reich[1], Montserrat Fuentes[1], and Francesca Dominici[2]
Graduate Programs: Statistics, North Carolina State University[1]; Biostatistics, Harvard School of Public Health[2]
Advisor: Brian Reich
Poster Number: 10

Spatial Variable Selection Methods for Health Effects of Speciated PM

Previous research has suggested a connection between ambient particulate matter (PM) exposure and acute health effects, but the effect size varies across the United States. Variability in the effect may partially be due to differing community level exposure and health characteristics, but also due to the chemical composition of PM which is known to vary greatly by location and over time. The scientific goal is to identify particularly toxic chemical components of this chemical mixture. Because of the large number of potentially highly correlated components, we must incorporate some regularization into a statistical model. We assume that at each location, regression coefficients come from a mixture model, with the flavor of stochastic search variable selection, but utilize a copula to share information about variable inclusion and effect magnitude across locations. The model will differ from current spatial variable selection techniques by simultaneously describing local and global variable selection. The model will be applied to fine PM (PM < 2.5 μm), measured at 119 counties nationally, and cardiovascular emergency room admissions among Medicare patients, over the period 2000-2008.

Edwin Cadena
Graduate Program: Marine, Earth, and Atmospheric Sciences
Advisors: Mary Schweitzer and Daniel Ksepka
Poster Number: 15

New discoveries of fossil turtles; evolutionary, paleobiogeographical, and molecular paleontology implications

Here I present a summary of my research as a PhD student at the NC State University, Marine Earth and Atmospheric Sciences department; on new fossil turtles discoveries and their evolutionary, paleobiogeographical, and molecular paleontology implications. The first of these discoveries corresponds to the early Cretaceous (~140 million years old) side-necked turtles from Zapatoca, Colombia, constituting key fossils to understand the dispersion of tropical turtles after the splitting event between Africa and South America. A second locality is the middle-late Paleocene (~60 million years ago) fossil turtles from the Guajira Peninsula, Colombia, South America, which represent the closer relatives to the most abundant extant side-necked turtles in the Neotropics, and the first giant freshwater turtle after the extinction of non-avian dinosaurs. The third locality is at the Panama Canal Basin, Panama, where Eocene-Early Miocene (~20 million years ago) turtles show a very early interaction between North-Central American and South American faunas, much earlier to the emergence of the isthmus of Panama. Campanian (~80 million years old) fossil turtles from the Gobi desert, Mongolia, show the best preservation of bone cells (osteocytes) in any late Cretaceous vertebrate reported until today and offers a perfect candidate for molecular paleontology studies, particularly for the potential preservation of proteins, as for example collagen and osteocalcin.

Timothy Cleland
Graduate Program: Marine, Earth, and Atmospheric Sciences
Advisor: Mary H. Schweitzer
Poster Number: 27

Preservation of blood vessels in a new specimen of *Brachylophosaurus canadensis*

The nascent field of molecular paleontology has led to the detection of ancient proteins from various fossil and subfossil bone. Recently, soft tissue structures resembling blood vessels have been detected from bone of *Tyrannosaurus rex* (MOR 1125) and *Brachylophosaurus canadensis* (MOR 2598). These soft tissue structures were re-interpreted by other investigators to be biofilms and because of this interpretation; a new specimen of *B. canadensis* (MOR 2967-B2-1) was collected from channel sandstone from the Judith River Formation, Montana. We used aseptic techniques and, contrary to standard field practices, collected this bone without preservatives specifically to analyze the blood vessel-like structures for molecular preservation. Structures morphologically similar to blood vessels were collected from demineralized cortical bone, and multiple analyses, including immunological and high-resolution, bottom up (i.e., digestion with trypsin) proteomic techniques, were employed to test the hypotheses that the blood vessel-like structures collected from the bone are endogenous and that they retain original biomolecules. Polyclonal antibodies directed against multiple proteins associated with blood vessels showed positive reactivity with these fossil-derived structures, including localized antibody-antigen complexes through in situ assays. These same antibodies did not react with the microbial biofilm, supporting the endogeneity of the blood vessels over a biofilm source. Collagen I peptides were also detected from vessel extractions. The combination of mass spectrometry and antibody evidence supports that these structures are endogenous to the bone and are not biofilm.

Adrian Coles and Arnab Maity
Graduate Program: Statistics
Advisor: Arnab Maity
Poster Number: 29

A Non-parametric Approach for Testing for the Effect of a Functional Covariate in Functional Regression Models

In recent years, functional data analysis (FDA) has emerged as a viable analytical tool in many fields of applied sciences such as biomedical studies, chemometrics, and economics. In this work, we consider functional regression models where the response variable is scalar but the covariates are of functional nature. Our primary goal is to develop a testing procedure to test for the effect of the functional covariate on the scalar response. Classical tests for the effect of these covariates are often parametric in nature and assume a particular functional form for the covariate effect. The goal of our research is to develop a flexible non-parametric test for the effect of the functional covariates that does not assume any particular functional form. We present a non-parametric approach based on the Kernel Machine Regression framework and develop a Score like test statistic, and investigate its theoretical properties. We offer simulation results to investigate the performance of our proposed method in a variety of settings. We find that our proposed test maintains nominal Type I error but shows similar or better power compared to the naive method which ignores the functional structure of the data. We also demonstrate our method using a real data example.

Christina Erbacher
Graduate Program: Mathematics
Advisor: Kailash Misra
Poster Number: 38

Root Multiplicities of the Indefinite Kac-Moody Algebra HD_4^{(3)}

Lie algebras and Lie groups are closely related to the study of symmetries in nature and are naturally related with numerous physical phenomena. A Lie algebra is a vector space equipped with a product called the "bracket" satisfying some simple relations. The finite dimensional simple Lie algebras were completely classified by 1894 by Cartan. In 1968 Victor Kac and Robert Moody defined the infinite dimensional analog of finite dimensional semisimple Lie algebras, now known as Kac-Moody Lie algebras. An important class of infinite dimensional Kac-Moody Lie algebras is the affine Lie algebras, which are known to physicists as current algebras. Kac-Moody Lie algebras contain a maximal abelian Lie algebra called the Cartan subalgebra, which acts on the Lie algebra via what is called the "adjoint" action. The eigenvalues under this action are called "roots" and the corresponding eigenspaces are called "root spaces". The dimension of a root space is called the root multiplicity of the corresponding root. Determining root multiplicities for Kac-Moody Lie algebras of indefinite type is still an important open problem. I will present my results on some root multiplicities of an indefinite type Kac-Moody Lie algebra denoted by HD_4^{(3)}. A key approach to my study is to view the roots for this algebra as weights for a suitable representation of the affine Lie algebra D_4^{(3)}, and then use the crystal base theory that was introduced by Kashiwara and Lusztig (independently) in 1991. The crystal base for an integrable representation of the affine Lie algebra D_4^{(3)} has a nice combinatorial structure which is encoded in a directed graph called a crystal graph. In this process, determining the root multiplicities reduces to counting the vectors of certain weight on the crystal graph. I use the combinatorics of path crystals to derive my results.

Anthony Franklin
Graduate Program: Statistics
Advisors: Howard Bondell and Lexin Li
Poster Number: 40

Penalization Techniques for Latent Class Regression

When data is believed to have hidden clusters, it is common practice to identify the clusters then conduct analysis in each cluster separately. Methods have been proposed to perform the cluster and regression analysis simultaneously for a pre-specified number of clusters. This process has been referred to in literature as latent variable regression analysis. This research investigates imposing penalization techniques to identify and collapse regression parameters that may be "shared" or redundant across clusters for a given model.

Sean F. Gallen
Graduate Program: Marine, Earth, and Atmospheric Sciences
Advisor: Karl W. Wegmann
Poster Number: 43

Assessing fault activity using Quaternary marine terraces: Testing models for earthquake hazards and topographic development above the Hellenic subduction zone Crete, Greece

Two competing models have been put forward to explain how deformation is accommodated in the overriding plate of the Hellenic subduction zone, the largest, fastest, and most seismically active subduction zone in the Mediterranean. One hypothesis posits that faults within the overriding plate are compressional and thus capable of producing earthquakes $\geq 8 M_w$; the other model suggests that these same faults are extensional-to-transtensional structures and can therefore produce earthquakes with a maximum magnitude of $7.5 M_w$. Testing these different hypotheses is important because it will both improve estimates of seismic hazards throughout the Eastern Mediterranean and will provide insight into the construction and architecture of offshore basins that may maintain economically recoverable hydrocarbon resources.

We have designed an experiment to test competing models for the kinematics of one of the faults in question that lies offshore in the Ptolemy basin. A 55 km long segmented extensional fault is located along the south-central coastline of Crete 10 km north of the Ptolemy basin, termed the South-Central Crete fault. We use well-established fault scaling relationships to show that activity along this onshore fault and a hypothesized compressional fault coincident with the Ptolemy trough are mutually exclusive. Resolving the movement history of the South-Central Crete fault will, therefore, determine the likelihood of offshore compressional faulting in this location. We use Quaternary marine terraces along the coastline of Crete to document the rates and patterns of uplift and identify fault activity. We mapped, surveyed, sampled, and used radiocarbon geochronology to date marine terraces across the South-Central Crete fault. Our results show this fault has accumulated ~60 meters of vertical displacement over ~125,000 yrs and is indeed active; thus, the structure that formed the Ptolemy basin is not compressional and earthquake hazards are not as high as some pose for the Eastern Mediterranean.

Yuan Geng, Wenbin Lu, and Hao (Helen) Zhang
Graduate Program: Statistics
Advisors: Wenbin Lu and Hao (Helen) Zhang
Poster Number: 50

Model-Free Prediction of Survival Probability for High-Dimensional Covariates

Great promise has been shown to use gene expression data as predictors to estimate survival in cancer study. The traditional semiparametric methods like the proportional hazard model and the proportional odds model have difficulty in high dimensional gene data. They also suffer the systematic bias in case of model misspecification. We propose a nonparametric weighted support vector machine (SVM) method using the inverse censoring probability weight (ICPW), which is robust of model specification and performs well for the high dimensional data. Furthermore, the proposed method is also reliable when the censor rate is high.

Ziyue Li
Graduate Program: Physics
Advisor: Chueng-Ryong Ji
Poster Number: 85

Improvement on Meson Spectrum Calculation in Light Front Quark Model

The fundamental building blocks of the universe, as far as we know today, are quarks and leptons. The study of mesons, which are one big family of hadrons made out of one quark and one antiquark, give information about how things are structured and how they interact at the smallest scale that we can probe. Although Quantum Chromodynamics has been a very successful theory, the commonly used perturbative calculation becomes very complicated and difficult to carry out in relatively low energy regime. So finding a good non-perturbative method to not only simplify the computation, but also to provide a physical picture to help our understanding of these hadrons' inner working becomes of paramount of importance. Our work is to improve these phenomenological models to further this endeavor. We present here a calculation of meson mass spectrum using Light Front Quark Model constrained by variational principle for the QCD-motivated Effective Hamiltonian. This Light Front framework has the advantage of being Lorentz invariant, thus simplifies form factor calculation for our future work. Previous calculations usually treated the hyperfine interaction between quarks as a perturbation to avoid the negative infinity one encounters when using variational principle for Pseudoscalar mesons. We improved the calculation by smearing out the 3 dimensional delta function to avoid the singularity and included this hyperfine interaction in our parameterization process. An analytical formula for the masses of ground state mesons is obtained. And compared to previous calculations handling the hyperfine interaction as perturbation, our new approach appears to generate mass values that are closer to the experimental data. As the hyperfine

splitting is large, this treatment seems to provide more accurate predictions. The parameter fixed model can then be used to calculate decay constant and other meson related observables. An extension to baryons is also underway.

Jacob Norton
Graduate Program: Biomathematics
Advisors: Kevin Gross and Alun Lloyd
Poster Number: 102

Exploring the Variance of Doubly Infected Hosts in a Two-strain Pathogen Contact Process Model

Cereal and barley yellow dwarf viruses (C/BYDV) are an economically important group of viruses that slow leaf and root development, can prevent seed production, and can kill their host (oats, wheat, and barley among others). Two critical characteristics of C/BYDV are that there are multiple strains of the C/BYDV group that can infect a host and each strain can infect multiple hosts. As a result, along with C/BYDV's aphid vectors and plant hosts this community is an ideal system for studying the community ecology of infectious disease in general, and coinfection in particular. Coinfection, when two or more pathogen species infect an individual host or vector simultaneously, can have severe negative or positive impacts on both host and pathogen populations. However, little is known about coinfection when its dynamics are complicated by multiple hosts, and less is known about whether spatial aggregation affects vector-transmitted pathogens in multi-host systems. We created a stochastic model of the C/BYDV system to investigate the dynamics of multiple strains of the pathogen in a single host species population. We created two continuous time, discrete state Markov processes on a ring lattice with varying transmission parameters in order to explore how space affects the variance of the number of doubly-infected hosts. The long-run behavior of the model was determined through numerical simulation. We found that the variance of the number of doubly infected hosts is greater for small neighborhoods of infection (local transmission) than for large neighborhoods of infection (non-spatial global infection).

Robert W. Pattie Jr.
Graduate Program: Physics
Advisor: Albert R. Young
Poster Number: 111

UCNA : A high-precision measurement of the beta-asymmetry, A, using ultra-cold neutrons

Measurements of neutron decay provide fundamental information on the parameters characterizing the weak interaction of the nucleon. Results from such measurements can be used to extract a value for the CKM quark-mixing matrix element V_{ud}, and impact predictions for the solar neutrino flux, big bang nucleosynthesis, the spin content of the nucleon, and tests of the Goldberger-Trieman relation. High-precision results also place constraints on various extensions to the standard model such as super-symmetry, exotic couplings, and left-right symmetries. Angular correlations measurements in neutron beta-decay have been performed with thermal or cold neutron beams, including all previously reported measurements of the beta-asymmetry. The use of ultra-cold neutrons (UCN) for these measurements provides a different and powerful approach to controlling some key sources of systematic errors in measurements of polarized neutron decay: the preparation of highly polarized neutrons and the backgrounds intrinsic to the neutron decay sample. The UCNA experiment uses 800 MeV protons from the linear accelerator at the Los Alamos Neutron Science Center to create UCN in densities that rival the best sources in the world, > 60 UCN / cc. Since 2007 an experimental regiment has been carried out to characterize all relevant systematics, Monte Carlo corrections, and achieve the eventual goal of a precision of < 0.5% measurement of the neutron beta-asymmetry.

Ashley Penrod, Kai Wang, and Yang Zhang
Graduate Program: Marine, Earth, and Atmospheric Sciences
Advisor: Yang Zhang
Poster Number: 116

Future Air Quality: Degradation or Improvement due to Climate and Emissions?

Major air pollutants including ozone (O_3) and fine particulate matter ($PM_{2.5}$) have many adverse health, societal, and climate effects, making air quality (AQ) degradation a major environmental concern on urban, regional, and global scales. As we enter a time of rapid climate and emission changes, the drivers of the state of AQ need to be better understood, from an emission policy-making and societal impact standpoint. However, due to the complex relationships among AQ, emissions, and climate change, predicting how AQ will change in the future is complicated. The purposes of this study are to understand the individual and the combined impacts of future climate and emissions on AQ, and to provide policy makers scientific information to make informed decisions regarding future emission controls and climate mitigation strategies. To achieve these goals, simulations are conducted for 5 current (2001-2005) and 5 future years (2026-2030) using the Weather Research and Forecast (WRF) model version 3.2 and the Community Multiscale Air Quality (CMAQ) model version 5.0 over the contiguous United States. A

performance evaluation of WRF and CMAQ is also conducted to assess their ability in reproducing observations. The preliminary results indicate a decrease by up to 10 ppb (up to 22%) in the maximum 8-hr average concentrations of O_3 and a decrease by up to 10 $\mu g\ m^{-3}$ (up to 81%) in $PM_{2.5}$ concentrations over most of the U.S. in the summer of 2030. This appears to be driven by the reductions in emissions of nitrogen oxides, sulfur dioxide, and primary $PM_{2.5}$ by 28.1%, 74.8%, and 9.4 to 34.7%, respectively, although many changes in future climate (e.g., increases in temperature and decreases in planetary boundary layer height) tend to increase pollutant concentrations. These results indicate that future emissions and climate will have a considerable impact on AQ.

Ruoyi Qiu
Graduate Program: Physics
Advisor: Keith Weninger
Poster Number: 119

Conformational Changes in MutS during Mismatch Repair Signaling Determined with Single Molecule FRET

DNA mismatch repair (MMR) is required for high replication fidelity in organisms ranging from bacteria to humans. MutS protein initiates MMR by recognizing base-base mismatches and insertion-deletion mismatches in double stranded DNA. MutL protein then interacts with MutS in the presence of ATP. The mechanism of how the mismatch communicates with a distal strand discrimination signal is unknown. We used single molecule fluorescence resonance energy transfer (smFRET) to characterize conformational changes in Thermus aquaticus (Taq) MutS as it scans homoduplex DNA, recognizes mismatches, activates to a sliding clamp, and interacts with MutL. We found that MutS alone undergoes large conformational changes as it is converted to sliding clamp in a two step process. Interestingly, MutL interacts with MutS before it slides off the mismatch and the SxL complex likely contains multiple proteins. This information provides constraints for modeling the downstream MMR pathways.

Eric Raymer and John Blondin
Graduate Program: Physics
Advisor: John Blondin
Poster Number: 123

Hydrodynamic Simulations of Algol Systems with Tilted Accretion Disks

Recent observations have shown that the Algol-type binary systems U CrB and RS Vul possesses gas located outside of the orbital plane, including a tilted accretion annulus in U CrB. Observations of circumstellar gas surrounding the mass donor in RS Vul show out-of-plane velocities at L1 that are similar to those near magnetically active regions on the donor. This suggests magnetic effects could be responsible for deflecting the accretion stream out of the orbital plane. A deflected stream would introduce angular momentum with a non-z component into the system and potentially cause a tilted annulus to form. To determine whether a tilted annulus is possible due to a deflected stream at L1, we use three-dimensional hydrodynamic simulations of the mass transfer process in RS Vul. By deflecting the stream 45 degrees out of the orbital plane and boosting the magnitude of the stream's velocity to Mach 3, we mimic the effects of magnetic activity near L1. We find that for both undeflected and deflected streams, the structure of the annulus remains essentially the same. Deflecting the stream produces a slightly larger annular radius and some warping along the outer radii due to the stream-disk interaction. We measure a net tilt of ~0.5 degrees, with no more than 3 degrees of tilt at any point within the disk. The evolution of the disk is relatively independent of the orientation and speed of the stream at L1, from which we conclude that deflection at L1 is insufficient to transport a significant portion of gas from the orbital plane unless the stream is boosted to hypersonic velocities.

Katherine Ryker and David McConnell
Graduate Program: Marine, Earth, and Atmospheric Sciences
Advisor: David McConnell
Poster Number: 131

Reforming Introductory Geoscience Labs

Undergraduate students are typically required to take at least one introductory level science lab as part of their curriculum, but retention rates remain low. Research has shown significantly higher learning gains and more interest generated in reformed, active learning science classrooms. However, even when re-designed, there is little guarantee that the labs are taught in a consistently reformed manner. Graduate Teaching Assistants (GTAs) are expected to teach these labs at NC State and in universities across the country, often with little to no formal teaching training. Given their role in teaching content and the potential impact on recruitment, it is important that we understand what is happening in the labs and how to encourage best teaching practices. It is also important to understand the skills we can expect the GTAs to "naturally" bring to the table.

Of NC State's introductory geoscience labs, the geology labs are the only ones to have been redesigned around the principles of reformed, active learning. This provided a unique opportunity to understand the difference the reformed redesign can make.

Measurements and field notes were collected on 54 introductory labs using the Reformed Teaching Observation Protocol, or RTOP. Using these, I have been able to quantify the degree to which the GTAs teach in a reformed manner naturally (i.e. their first semester) versus with experience or training. In addition to observational data, interviews based on the Teacher Belief Inventory, or TBI, were conducted with seven of the geology GTAs to gain an understanding of their beliefs regarding the teaching and learning process.

Our findings suggest that we can create effective GTAs with more student-centered beliefs with simple changes to lab design and minimal pedagogical training. With this information, I have developed easy guidelines that the GTAs can implement to increase their teaching power in the classroom.

Amanda Traud
Graduate Program: Biomathematics
Advisors: Alun Lloyd and Robert Dunn
Poster Number: 151

Are ant communications dictated by movement?: Using Movement Models to Approximate Interaction Networks

Some conversations take place between two people who just happen to occupy the same space. We hypothesize ants interact in this way: their movement dictates their interactions. To test this hypothesis, we create four ant movement models that treat each ant as an individual: a random walk model, two different correlated random walk models, and a gas kinetics model. We use the simulated trajectory of each ant to estimate the interactions of each ant. We compare the interaction patterns resulting from each model to data gathered from a small population of Formica subsericea ants.

Jeff Willison
Graduate Program: Marine, Earth, and Atmospheric Sciences
Advisor: Walter A. Robinson
Poster Number: 164

The Importance of Accurately Representing Frontal Precipitation when Simulating Cyclones

Extratropical cyclone activity dominates mid-latitude climate, and is concentrated in regions called "stormtracks." Previous research has shown that latent heat release associated with frontal precipitation can strengthen cyclones through a variety of complex mechanisms. Climate models, however, are currently run at resolutions that do not accurately represent mesoscale frontal structures and subsequent latent heat release. This work considers the consequences of under-resolving these moist processes when simulating cyclones. Our objective is to demonstrate the sensitivity to horizontal resolution for individual storms, and extend this analysis to multiple seasons in order to quantify a systematic influence on stormtrack behavior. The Weather Research and Forecast (WRF) model is used to simulate cyclones at relatively coarse (120 km) and fine (20 km) horizontal grid spacings. We then use dynamical analysis to isolate and quantify the effects of latent heat release on cyclone structure and development at both resolutions. Our findings indicate that simulated cyclone development is highly resolution dependent as a result of moist processes, and that systematically underestimating mesoscale precipitation results in a less active stormtrack. This study has implications for projections of stormtrack behavior and climate outside of the mid-latitudes, as extratropical cyclones are a crucial component of the global energy cycle.

Sarah Giovannini
Graduate Program: Textile and Apparel, Technology and Management
Advisor: Yingjiao Xu
Poster Number: 52

The Impact of Brand Consciousness and Brand-Self Congruency on Young Consumers' Behavior for Luxury Fashion Products

The $180 billion United States' luxury market has seen an increase in consumption from young consumers. With the increasing purchase power and growing size of the young consumers in the US market, it is of strategic importance for the luxury industry to understand the consumption behaviors of this group. This research investigated the influence of personality traits (pubic self-consciousness and self-esteem) on consumer behavior for luxury fashion products through their influence on brand consciousness and consumption motivations. The consumption behaviors brand loyalty and purchase intention for luxury fashion products were examined. Motivations behind these consumption behaviors, including both social-(conspicuous consumption) and self-(brand-self congruency) motivations, were explored. Also, considering the prevalent role that brand consciousness plays on the consumption behaviors of these consumers, this study explored the influence of young consumers' brand consciousness on their luxury consumption. This study also investigated the relationship between personality traits and consumers' brand consciousness. Data were collected through an online survey from United States' consumers between the ages of 25 - 40 and who had an annual household income of greater than $75,000. The results were analyzed using a Structural Equation Modeling (SEM) analysis to test the relationship among personality traits, brand consciousness, consumption

motivations, and consumer behavior for luxury fashion products. Results showed that both self-esteem and public self-consciousness of consumers had a strong positive influence on their brand consciousness. Both brand-self congruency and conspicuous consumption motivation behaviors of luxury fashion consumers had a significant positive impact on both their brand loyalty and intention to purchase these products. The findings of this study will help luxury retailers understand the consumption behaviors of their targeted consumers.

Rashi Grewal
Graduate Program: Fiber and Polymer Science
Advisor: Julie Willoughby
Poster Number: 60

Transport of Small Molecules through Fibrous Media

The purpose of this study is to gain a fundamental understanding of the governing factors that drive moisture vapor transport (MVTR) and in turn moisture vapor permeability (MVP) in barrier films. This understanding will provide the foundation for work on creating tunable moisture vapor barriers that can respond to their environments. Further emphasis will be on creating barriers from renewable materials that currently are poor moisture barriers. Our objective is to systematically control and tune the molecular transport of small molecules for films, nonwovens and their composites. In efforts to improve the inherently poor MVP properties of polymers derived from renewable resources (or biopolymers), many researchers are focusing on creating more hydrophobic surfaces. Our aim is to correlate super-hydrophobicity to moisture vapor permeability (MVP) for a model material (polydimethylsiloxane). Using the technique of creating mechanically assembled monolayers (MAMs), we hope to demonstrate the relationship between hydrophobicity, packing density, and MVTR. This work will determine the modification threshold for biopolymers as it pertains to MVP. Our end goal is to design tunable moisture vapor barrier with environmental responsiveness for nonwovens and fibers.

Alper Gurarslan
Graduate Program: Fiber and Polymer Science
Advisors: Alan Tonelli and Melissa Pasquinelli
Poster Number: 61

Competitive Threading of Guest Polymers by Host Cyclodextrins: Modeling and Experimental Observations

Self-assembly of polymers into the channels of cyclodextrin (CDs) yield inclusion complexes (ICs). Despite their abundant usage, there are still unresolved uspects of IC formation. For instance, how host CDs choose their guests when two polymer chains favorable for making an IC are both present? Tonelli *et al.* discovered that even if the PLLA chains are inside the CD channels initially, PCL chains replace them by pushing out the primary host PLLA chains. This study investigates competitive IC formation between N-6 and N-11 both experimentally and with computer simulations. The MD simulations reveal that neither PCL nor N-11 have significantly different interaction energies than PLLA or N-6, respectively, when they are inside the α-CD channel. Thus the principal reason for competitive IC formation has yet to be revealed, but further MD simulations should assist in achieving this goal.

Brian Hamilton
Graduate Program: Textile Technology Management
Advisors: William Oxenham and Kristin Thoney
Poster Number: 63

High Cotton Prices: Causes, Impacts

The 2010-2011 cotton season saw a substantial elevation in global cotton prices. The international price of cotton eclipsed $2 per pound in the Spring of 2011 after being less than $1 per pound for decades. This research identified the specific causes for this price elevation and the implications for the global textile supply chain. Background and historical information from the literature was reviewed, as well as current periodicals and anecdotes from members of the global textile supply chain. A variety of strategies and reactions was revealed. Additionally, the advent of high cotton prices revealed an unexpected consequence for the competitiveness of US yarn manufacturing, as total manufacturing costs became cheaper than for equivalent yarn produced in other countries, including China.

Ying Li
Graduate Program: Fiber and Polymer Science
Advisor: Xiangwu Zhang
Poster Number: 86

Improve the cyclic stability of Si/C nanofiber composite anodes for next-generation rechargeable lithium-ion batteries

Since the first commercialization by Sony in 1991, 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. Commercial lithium-ion batteries are using graphite which has a theoretical capacity of 372 mAh/g as the anode material. To develop rechargeable lithium-ion batteries with high energy density, Si has been studied extensively 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 enormous 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 allows them to withstand large volume changes during cycling.

In this presentation, we discuss the effect of different surfactants and binders on the electrochemical performance of Si/C nanofiber composite anodes made from electrospun 15 wt % Si/polyacrylonitrile (PAN) precursors. Sodium dodecanoate (SD) and hexadecyltrimethylammonium bromide (CTAB) were first used in 15 wt % Si/PAN precursor to modify the surface of Si nanoparticles and improve the dispersion of Si in the resultant nanofibers. Poly(binylidene fluoride) (PVdF) and Polyamide imide (PAI) were introduced into Si/C nanofiber composite anodes. Various states of charge and depths of discharge were investigated as well and the results indicate that the PAI binder is quite effective on restraining the volume expansion of Si/C nanofiber composite anodes.

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

Xiaohang Sun
Graduate Program: Fiber and Polymer Science
Advisor: Hoon Joo Lee
Poster Number: 144

Modeling of metastable wetting behavior in terms of Gibbs free energy

The current work based on surface Gibbs free energy system could approximately predict the wetting behavior of a droplet on a rough surface, while the prediction is only valid when the droplet is sufficiently large compared with the typical scale of roughness. In some cases, for example monofilament, modeling is a key to study the wetting behavior. Our research utilizes the modeling of metastable wetting behavior as a guidance to produce superoleophobic surface. By improving our modeling, our goal is not only to obtain a result that is reasonable and matches the experimental data but also find out the structure that is significantly suitable for repelling liquids.

Metastable droplet on a rough surface can lead to higher apparent contact angle. However is it until recently that metastable state attracts scientists' attention. Thus understanding the metastable wetting behavior on a rough surface is essential for designing and controlling the properties of designed rough surface. To model a superoleophobic surface wetting behavior, both the surface structure and the chemical composition must be taken into consideration. A droplet on a rough surface is thermodynamically at equilibrium, which is energy dependent. Thus, the problem of studying the equilibrium state of a droplet on a designed surface can be converted to a problem of studying the Gibbs free energy of the system. In other words, by studying the Gibbs free energy changes with droplet wetting conditions, it is possible to macroscopically predict wetting behavior of the surface. In addition to the aspects that are studied before, our modeling will take droplet volume and shape in three dimensions into consideration. The method also aimed at applying the prediction to those the droplet is not large enough compared with the typical scale of roughness.

Nagarajan Thoppey[1], Jason R. Bochinski[2], Laura I. Clarke[2], and Russell E. Gorga[1]
Graduate Programs: Fiber and Polymer Science[1]; Physics[2]
Advisors: Russell E. Gorga and Laura I. Clarke
Poster Number: 148

Edge Electrospinning for High Throughput Production of Quality Nanofibers

We present a stationary, unconfined, edge-cylinder geometry for high throughput electrospinning that utilizes a reservoir filled with polymer solution and a concentric cylindrical collector. In this "bowl" electrospinning configuration, under high voltage initiation, multiple jets spontaneously form on the fluid surface, rearrange until they are approximately equidistant along the reservoir-edge and spin towards the collector, producing high quality fibers after the voltage is reduced to a working value. The

technique produced poly(ethylene oxide) nanofibers with average diameter of 225 nm and a demonstrated throughput approximately 40 times higher than traditional single-needle electrospinning. The electric field patterns generated by traditional, bowl, and our previously reported edge-plate geometries show the significance of field magnitude and gradient at spinning site on jet initiation and fiber quality. We discuss how the interaction between fluid properties and the applied electric field determines the effective flow rate, jet stability versus time, throughput, and fiber quality.

Yongxin Wang[1], Stephen Michielsen[2], Hoon Joo Lee[3]
Graduate Programs: Fiber and Polymer Science[1]; Textile Engineering Chemistry and Science[2]; Textile and Apparel, Technology and Management[3]
Advisors: Stephen Michielsen and Hoon Joo Lee
Poster Number: 160

Removal of Oil from Super-Oleophobic Surfaces via Capillary Bridges

To protect the super-oleophobicity of super-oleophobic (SO) fabrics, removal of the oil from SO surfaces is desirable. The fundamental method for removing oil contamination is to transfer the liquid oil from the contaminated SO surface to an oleophilic surface. A capillary bridge will be formed between the two surfaces. The study of the capillary bridges can help to increase the transferred volume of oil to the oleophilic surface.

The Laplace pressure and Young's contact angle (CA) equation are introduced to solve the capillary force of the oil capillary bridge, which can be expressed as forces due to surface tension and Laplace pressure, respectively. The capillary force is characterized from formation to rupture of the capillary bridge. Also, the robust pressure can be measured for SO surfaces. The robust pressure refers to the minimum pressure required to squeeze the liquid drop into the SO surfaces. Most importantly, oil contamination can be removed effectively and potential threats would be reduced through application of capillary force analysis. Therefore, the capillary force of the oil capillary bridge was analyzed and excellent agreement was found between the experimental results and theoretical predictions.

The study of capillary bridge will contribute to obtaining a better understanding of the behavior and characteristics of oil liquids on SO surfaces. Also, it could be used to evaluate the re-entrance capability of SO fabrics, the penetration properties of oil liquid through SO fabrics, and the robustness of SO fabrics against the interactions with oil liquids under certain pressures.

Dorothy Wu
Graduate Program: Textile and Apparel, Technology and Management
Advisors: Marguerite Moore, Kate Carroll, Jane Boyd Thomas, and Lori Rothenberg
Poster Number: 167

Trimming Down on Consumption: Voluntary Simplicity among The Great American Apparel Diet (GAAD) Participants

The purpose of this inductive research was to examine consumers' motivations to participate in voluntary simplicity in the current market environment. Voluntary simplicity is a lifestyle choice with the "defining characteristic" of "reduced material consumption and the removal of clutter from one's life" (Ballantine & Creery, 2010, p.45). This research is unique because it explored personal information shared in the blog entries of participants in The Great American Apparel Diet (GAAD). The GAAD began on September 1, 2009 as a small project led by Sally Bjornsen of Seattle, Washington, quickly growing into a movement of more than 300 members. Participants in the GAAD chose to abstain from purchasing new apparel for a period of one year. This provided a means for participants to achieve the lifestyle of voluntary simplicity and share their struggles with one another through the online blogging community. Using established qualitative research methods, 834 individual autobiographies and blog entries from the GAAD were examined and coded into categories. The following seven general categories of internal and external motivations to engage in voluntary simplicity were identified: Personal, Lifestyle, Social, Economic, Financial, Environmental, and Miscellaneous. Findings expand fashion marketers' understanding of voluntary simplicity and the role of virtual communities inspiring behavior in the contemporary marketplace.

Rui Yang
Graduate Program: Textile and Apparel, Technology and Management
Advisor: Yingjiao Xu
Poster Number: 170

Influence of Public Self-Consciousness on Chinese Consumer Behavior for Luxury Fashion Products: a Cultural Perspective

With the growing rise of the economic and purchasing power, China has become the world's second largest luxury market in 2009 and China's market keeps growing rapidly. Culture has played a significant role in shaping the personality and behavior of a person. This research is designed to study the influence of culture on Chinese consumer behavior for luxury fashion products through shaping consumers' public self-consciousness. Specifically, the following three dimensions of culture from Hofstede's

framework were investigated: individualism, uncertainty avoidance and power distance. Chinese consumer behavior for luxury fashion products was studied in terms of: luxury consumption motivations (social identification, social salience, and self-oriented motivation) and purchase intentions (buying genuine luxury fashion products and buying both genuine and counterfeits luxury products). A survey was administered through street intercept interviews in Shanghai in May, 2011. Data from the surveys were entered into SPSS. By using SPSS and AMOS, descriptive analyses, Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) Analysis were conducted. The SEM results indicated a significant influence of culture on Chinese consumers' public self-consciousness, which, in turn, had a significant influence on consumers' social consumption motivations, including social identification and social salience. Significant relationships were also found between consumers' social consumption motivations and their intention to purchase genuine and counterfeit luxury fashion products. Consumers who had a motivation of using luxury products as a social identification tool to gain social respect would more likely to be loyal to luxury products, and less likely to purchase counterfeits. However, on the contrary, consumers who believed luxury products are symbols of success and wealth had opposite intentions in terms of purchase genuine vs. counterfeit luxury products. Consumers' loyalty to luxury fashion products was also positively determined by their motivations to satisfy self-oriented needs, instead of social needs.

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Dengue Virus Non-Structural Protein 1 Inhibits Pattern Recognition Receptor (PRR) Signaling

Dengue Virus (DenV) and West Nile Virus (WNV) are RNA viruses belonging to the Flaviviridae family. Their ssRNA genome encodes 3 structural and 7 non-structural proteins. Both viruses are transmitted to humans by mosquito vectors and typically cause self-limiting disease. However, in some cases WNV infection can lead to fatal encephalitis and Dengue fever can result in Dengue Hemorrhagic Fever or Dengue Shock Syndrome, both life-threatening conditions. The innate immune system pattern recognition receptors (PRR) such as Toll-like receptors and RNA-Helicases (RIG-I) play an important role in recognizing viral pathogens and trigger a cascade of pro-inflammatory cytokines to limit virus spread. However, many viruses including DenV and WNV have evolved mechanisms to evade innate immunity leading to enhanced virus replication and high viremia, hence more severe disease. Non-structural protein1 (NS1) in both viruses is a secreted protein that is necessary for virus replication and has been shown to have immunomodulatory function.

Our lab has shown that both secreted and intracellularly expressed WNV NS1 inhibits TLR3 signal transduction and TLR3 mediated induction of an antiviral state. Our objective here was to compare the immunomodulatory role of intracellularly expressed and secreted DenV NS1 to our findings with WNV NS1 in an effort to better understand the virus-host interaction during dengue infection. We used epithelial cells and macrophages, stimulated them with various TLR ligands in the presence of DenV NS1, and measured pro-inflammatory cytokine production by ELISA. The preliminary data obtained from this study suggest that intracellular and secreted DenV NS1 also inhibits TLR signaling similar to WNV NS1, and suggest that RIG-I signaling, a major inducer of IFN production is also inhibited.

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Mast Cell Corticotropin-Releasing Factor Receptors Play Opposing Roles in Mediating Stress-Induced Barrier Dysfunction

The link between life stress and the onset of gastrointestinal disease is well known; however, the precise signaling pathways are poorly understood. Previous research has shown that stress triggers intestinal barrier dysfunction that is mediated by corticotropin releasing factor (CRF) and activation of intestinal mast cells (MCs). The pathway of MC activation by CRF in the stress response remains unclear. Here we investigate the role of MC CRF receptors 1 and 2 (CRF_1 and CRF_2) in stress-induced intestinal barrier dysfunction. MC-deficient mice (*W-sh/ W-sh*) were repleted with bone marrow-derived mast cells (BMMCs) from wild type (WT), CRF_1 KO, or CRF_2 KO mice. Following the successful repletion of BMMCs, mice were subjected to 3 hours of restraint stress (RS). Transepithelial electrical resistance (TER) and paracellular flux of FITC-dextran (FD4) were measured in Ussing Chambers as indices of barrier function. There was a significant increase ($p=0.003$) in the rate of FD flux in WT mice subjected to RS but not in *W-sh/ W-sh* mice. Repletion of *W-sh/ W-sh* mice with WT BMMCs restored stress-induced barrier dysfunction ($p=0.01$). Repletion of *W-sh/ W-sh* mice with CRF_1 KO BMMCs ameliorated stress-induced increases in FD4 flux. In contrast, repletion of *W-sh/ W-sh* mice with CRF_2 KO BMMCS exacerbated stress-induced barrier dysfunction compared with WT BMMC controls ($p<0.05$). These data definitively show that MC CRF_1 mediates stress-induced intestinal barrier dysfunction while CRF_2 plays a critical protective role. These opposing roles of CRF receptors may help in identifying novel preventative and therapeutic targets to mitigate stress-related GI disorders.

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Indomethacin Decreases Recovery of Gastric Barrier Function after Acid Injury in a Novel *Ex Vivo* Canine Model

Non-steroidal anti-inflammatory drugs are a common cause of gastric ulcer injury, although the mechanisms of NSAID prevention of repair of pre-existing mucosal injury have yet to be completely characterized. The dog serves as a useful model for gastric injury in people due to distinct similarities in gastric physiology. We developed an *ex vivo* model of acid injury (pH 1.2) in canine gastric mucosa and subsequently examined the effect of indomethacin on recovery from acid injury. Our previous work has shown that a slightly higher pH (pH 1.3 and above) does not decrease transepithelial electrical resistance (TER). Gastric tissue was collected from 10 random unadoptable dogs from a local animal control facility and maintained in Ussing chambers. TER of control tissues maintained in neutral Ringer's solution did not change significantly over a 210-minute treatment period (time 0: 129.7±4.5Ω.cm ^{2}, time 210: 148.0±7.3). Application of acid Ringer's solution to the mucosa at time 30 for 45-minutes significantly decreased TER (50.7±6.44Ω.cm ^{2}, $p<0.001$). After washout of acid Ringer's solution and replacement with neutral Ringer's, gastric tissue progressively recovered over the subsequent 105-minutes to a level that was not significantly different than control. Indomethacin, applied immediately after acid injury, inhibited recovery of TER versus both acid-injured and control tissue ($p=0.034$). Acid injury induced an increase in prostaglandin E_2 (PGE_2) and thromboxane B_2 (TXB_2) (change in prostanoid from baseline, PGE_2: control 78.7±35.7pg/ml, acid 466.4±188.8pg/ml; TXB_2: control 15.1±8.3pg/ml, acid 121.4±34.8pg/ml). Indomethacin blocked the increase in PGE_2 (82.4±27.2pg/ml, $p=0.014$) and TXB_2 (38.9±9.2pg/ml, $p=0.017$). There was marked variability in COX-1 and COX-2 expression among the dogs although both isoforms were detected in select animals. However, there was no significant effect of treatment on COX-1 or -2 expression. This model of injury provides a novel model of peptic ulcer disease that can be studied *ex vivo* and is likely of translational importance to people. Overall, the current data indicates that indomethacin reduces recovery after acid injury at least in part by inhibiting gastroprotective prostanoids.

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Multilocus Sequence Typing and Phylogenetic Analysis of *Campylobacter* Isolated from Conventional and Antimicrobial-Free (ABF) Swine and their Environment

Campylobacter is one of the leading pathogens causing foodborne illnesses in the US. Epidemiological evidence has indicated that food animals, including pigs, act as reservoirs of *Campylobacter* strains that can infect humans. The purpose of this study is to determine the clonality or diversity of *Campylobacter coli* isolated from the conventional and ABF production systems at farm, slaughter and environment using multilocus sequence typing (MLST). A total of 129 *C. coli* isolates were selected from fecal, environmental and carcass samples of ABF (N = 71) and conventional (N = 58) production systems. Seven housekeeping genes (*asp, gln, glt, gly, pgm, tkt, unc*) were amplified using PCR and the amplified product was sequenced. Sequence data was analyzed for the determination of allelic profiles and identification of sequence types (STs). Dendrograms and minimum spanning trees were generated to establish the relationships between the genotyped isolates. Isolates with similar sequence types were found between the pigs and their environment at farm and slaughter (ABF: 13, I_A = 0.1308; Conventional: 20, I_A = 0.1357). Higher genotypic diversity was observed among isolates from the conventional swine production systems (ABF: 0.3455 +/- 0.0901; Conventional: 0.3929 +/- 0.0805). Phylogenetic analysis revealed a genotypically diverse *C. coli* population with the presence of *C. coli* isolates sharing a common ancestry in both production systems. Overall, MLST of *C. coli* isolates from two distinct production systems unveil a weak clonal population and diverse genetic makeup of this species.

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MARCKS phosphorylation relies on PKC isoform delta (δ) in human neutrophils

MARCKS (Myristoylated alanine-rich C kinase substrate) is a PKC (Protein Kinase C) substrate that is involved in mucin and neurosecretion, postnatal survival and regulation of cell morphology and migration. In most cell types, MARCKS is associated with the cell membrane in the resting state and is translocated into the cytosol when it is phosphorylated by PKC. We previously determined that MARCKS plays an important role in neutrophil migration and adhesion using a cell permeant peptide (MANS) derived from the MARCKS myristoylated aminoterminus. To unravel how MARCKS phosphorylation affects neutrophil migration and adhesion, we identified the PKC isoforms involved in MARCKS phosphorylation. We tested PKC isotypes alpha (α), beta (β),

delta (δ), and zeta (ζ), known to be present in human neutrophils, using specific PKC isotype inhibitor Go6976, CG53353, rottlerin and ζ pseudosubstrate, respectively. Human neutrophils were pretreated with inhibitors and MARCKS phosphorylation was measured after stimulation of cells with fMLF. Pretreatment of neutrophils with the pan-PKC inhibitor staurosporin blocked fMLF induced MARCKS phosphorylation in a dose dependent manner, as did specific inhibition of PKC delta; but other PKC isoforms including alpha, beta and zeta did not affect MARCKS phosphorylation. The IC50 of staurosporin and rottlerin were 1.43 μM and 8.14 μM respectively for the fMLF induced MARCKS phosphorylation. Subcellular fractionation assay showed that the PKC isotype delta, but not others, translocated from cytosol to membrane in response to fMLF and PMA stimulation. These results suggest that PKC delta plays a crucial role in fMLF induced MARCKS phosphorylation in human neutrophils.

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Poster Number: 154

Activation of the TGF-β pathway in a dimethylnitrosamine-induced fish model of hepatic fibrosis

Chronic liver injury results in hepatic cirrhosis that causes long lasting functional impairment and increases the risk of liver cancer and death worldwide. Our laboratory has developed a toxicant induced small fish model of hepatic fibrosis progressing to neoplasia. To be effective, an animal model must parallel the human disease, both at the molecular and morphological level. In mammals, hepatic stellate cell (HSC) transdifferentiation into a fibrogenic myofibroblast-like phenotype is a key event and the transforming growth factor beta (TGF- β) pathway is a critical mediator of this process. In this study, we examined the changes in the mRNA expression of tgfb1, tgfb receptor I (tgfbr1) and II (tgfbr2), and smad3 during development of hepatic fibrosis in a Japanese medaka fish model of hepatic injury. Immunohistochemistry was used to localize the cells producing Tgfb1. We also assessed hepatic stellate cell activation using muscle specific actin immunohistochemistry and collagen content using Masson's trichrome-stained liver sections. Three-month-old medaka were exposed to dimethylnitrosamine (DMN) in the ambient water for two weeks and euthanized 2, 4, 6, or 10 weeks after exposure. Gene expression was determined using quantitative RT-PCR and correlated with histology. Levels of tgfb1, tgfbr2 and smad3 mRNA were significantly upregulated during development of fibrosis. Expression level of tgfbr1 remained unchanged. Tgfb1 was mainly expressed in bile preductular epithelial cells. Increase in tgfb1, tgfbr2 and smad3 mRNA expression coincided with activation of HSC and deposition of extracellular matrix. Collectively, these data support a role for the TGF- β pathway in mediating the development of fibrosis during chronic liver injury in the medaka fish model.

INDEX