NC STATE UNIVERSITY

12th Annual
Graduate Student Research Symposium

ABSTRACTS

Wednesday
March 22, 2017
1:00 to 5:30 pm
McKimmon Center

Twelfth Annual
Graduate Student Research Symposium
North Carolina State University

SYMPOSIUM ORGANIZERS

Graduate School

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

Graduate Student Association (2016-2017)

Jessica Nash, Materials Science and Engineering (Co-Chair)
Desiree Unselt, Genetics (Co-Chair)
Danielle Lawson, Parks, Recreation, & Tourism Management
Erin O'Brien, Psychology
Chris Pap, Chemistry
Lauren Pellegrino, Adult Education, Training & Development
Casey Reagan, Crop and Soil Science
Amin Salehi, Physics
Kathryn Schinabeck History
Sugandha Singh, Civil, Construction & Environmental Engineering
Matt Zimmer, Nuclear Engineering

AGENDA

12:00 pm - 1:00 pm	Poster Set Up	Area 1
1:15 pm - 1:30 pm	Welcoming Remarks and Symposium Overview	Room 6
	Mr. Tyler Allen, GSA President	
	Dr. Maureen Grasso, Dean of the Graduate School	
	Dr. David Shafer, Assistant Dean of the Graduate School	
1:30 pm - 4:00 pm	Poster Session and Competition.....	Area 1
4:15 pm - 5:30 pm	Announcements of Awards and Reception	Room 2
	Dr. Peter Harries, Senior Associate Dean of the Graduate School	
	Dr. David Shafer, Assistant Dean of the Graduate School	

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ABSTRACTS

College of Agriculture and Life Sciences

Pragya Adhikari[1], Dilip R. Panthee[1], Inga Meadows[2], Tika Adhikari[2] and Frank J. Louws[2]
Graduate Programs: Horticulture Science[1], Plant Pathology[2]
Advisors: Dilip R. Panthee and Frank J. Louws
Poster Number: 1

Characterizing Pathogen Phenotypes and Diversity to Inform Optimum Management Decisions to Control a Bacterial Disease of Tomato in North Carolina

Bacterial spot is one of the most important diseases of tomato in North Carolina and many other states, caused by multiple bacterial species and physiological races within the genus Xanthomonas. The control of this disease is based on integrating multiple tactics including the use of cultural practices and chemicals such as copper, antibiotics (streptomycin) and plant activators. However, the failure of these chemicals and antibiotics to control bacterial spot of tomato has been reported from different parts in North Carolina. Therefore, we designed a systematic sampling protocol and assessed 183 Xanthomonas strains in 2015 and 124 Xanthomonas strains in 2016, isolated from different cultivars, fields and counties of Western NC, for copper and streptomycin sensitivity. Strains able to grow on a specialized bacterial (SPA) media containing 200 ppm of CuSO4 or 100 ppm of streptomycin were considered as copper and streptomycin resistant, respectively. We discovered 94.0% and 96.0% of the Xanthomonas strains were resistant to copper and 44.8% and 24.8% of the strains were resistant to streptomycin in 2015 and 2016 respectively. The high incidence of copper resistance is presumably associated with frequent copper use in fields. The variation observed in the levels of streptomycin resistance between years might be due to different management practices as well as seed and transplant sources that place differential selection pressure or introduce diverse bacterial populations. All fields sampled harbored bacteria that were copper or streptomycin resistant, which is consistent with growers' report of control failure. These data indicated widespread existence of copper resistance and a modest level of streptomycin resistance, enabling the translative outcome to recommend the use of streptomycin in the transplant production phase and discontinue use of copper. These data also document the need to develop more sustainable and alternative strategies to manage the disease.

Babanifemi Adio
Graduate Program: Agricultural and Extension Education
Advisor: Travis Park
Poster Number: 2

Impact of Indigenous and Background Agricultural Knowledge on College Students

Agriculture is a very important part of our everyday life: from the clothes we wear, food we eat, to the job opportunities available. As we are constantly surrounded with agriculture around us, children and teens of today have a myopic understanding of what it entails. There is a disconnection between the agricultural field and the children of this generation. The idea of a farmer is the stereotypical old man with a farm, having a cow and a tractor. Agricultural knowledge is important to have, especially at a young age in order to be well educated about where and how our food arrives at the table, the best practices to employ for a more sustainable environment and the diversity of opportunities within the discipline. The objective of this research is to find out if college students can attribute and connect their indigenous or inherent knowledge of agriculture while growing up to their current knowledge of agriculture or if it was something they only learned in school. A survey including 25 items was administered to participants. These questions included basic questions about agriculture and they were scored after completion. The remaining 4 questions were demographic questions to determine the participants' background: rural/urban/sub-urban, farm/non-farm, domestic/international student and major in school. The last question asked for suggestions on what they think could be done to increase their knowledge of agriculture. From the findings, academic majors and nationality indicate differences in the basic knowledge of agriculture. The conclusion is there might be a difference in the way agriculture is being taught in other countries. Also, Students from the arts and social sciences are less equipped with agricultural knowledge compared to the science and agriculture counterparts.

Najwa AInsour*[1], Wayne Robarge1, and John Walker[2]
Graduate Programs: Soil Science, North Carolina State University[1], Office of Research and Development, National Risk Management Research Laboratory, U.S. Environmental Protection Agency, RTP, NC[2]
Advisor: Wayne Robarge
Poster Number: 6

Ammonia Exchange from Soils-Laboratory Study

The exchange of ammonia between terrestrial ecosystems (soil, litter, plant surfaces, and through plant stomata) and the atmosphere is bidirectional. Quantifying ammonia exchange over agricultural ecosystems is necessary to improve our understanding of the fate and transport of ammonia in the environment. The bidirectional exchange of ammonia with environmental surfaces is controlled by the compensation point. This is especially true for bi-directional ammonia exchange over crops following N fertilizer application. This work focuses on the exchange of ammonia with soil surfaces. In particular, one objective is to assess/develop a soil extraction procedure that will better predict whether a soil will absorb or emit ammonia from the atmosphere. Past experience using traditional extraction protocols (e.g. 2M KCl) suggests that the amount of extractable ammonium removed from soils overestimates the fraction of soil ammonium that is available for soil-atmosphere exchange of ammonia. It has been proposed that part of the reason for this apparent over-estimate might be liberation of ammonium from microbial cells that are destroyed during the concentrated salt extraction, and/or displacement of ammonium from the soil complex that would kinetically not be involved with the ammonia equilibrium. Critical soil parameters that need to be considered include soil pH, soil texture, cation exchange capacity, soil moisture, and soil organic matter content. Time integrated measurements of ammonia emissions from treated soils are made under controlled conditions using annular denuder technology. “Success” is defined as being able to characterize the air/soil interface sufficiently well in order to accurately predict the soil ammonia compensation point and better model emissions or deposition of ammonia from soils.

Roel Becerra
Graduate Program: Animal Science
Advisor: Eric van Heugten
Poster Number: 17

Improving Sow Productivity and Nursery Pig Performance by Injecting Sows with d-α-tocopherol, Retinyl Palmitate, and Cholecalciferol

Vitamins A, D, and E play important roles in preventing cell damage, enhancing immune function, and improving fertility. We hypothesized that highly productive sows need additional supplementation of fat-soluble vitamins to maximize reproductive performance and improve performance of their offspring. Fifty-four sows were allotted by parity to 3 treatments: 1) control (C; a single, 5 mL i.m. injection of saline at d 107 of gestation; 2) 2 injections (V2) of 5 mL i.m. of a multi-vitamin product containing 3 fat-soluble vitamins (300 I.U vitamin E, 200,000 I.U of vitamin A, and 100,000 I.U of vitamin D at d 107 of gestation and on d 4 of lactation; and 3) same as V2 plus a 5 mL i.m. injection of vitamins on d 14 of lactation (V3). Serum samples from piglets were collected on d 3, 7, 17, and 25 (4 d post-weaning). Serum retinol concentrations in piglets increased over time ($P<0.001$), but were not impacted by injection. Piglet serum α-tocopherol decreased ($P<0.001$) from d 3 to 25 but was not affected by treatment. In piglets, serum 25(OH)D3 increased ($P<0.05$) on d 7 and 17 with V2 compared to control. Pigs from V3 sows had greater ($P<0.05$) serum 25(OH)D3 on d 7, 17, and 25 compared to control and had greater ($P<0.05$) serum 25(OH)D3 on d 17 compared to piglets from V2 sows. Piglet BW at birth and weaning was greater ($P<0.05$) with 3 injections compared to 2 injections, whereas BW after 14 d ($P=0.06$; 8.76, 8.83, and 9.33 kg for control, V2, and V3, respectively) and 35 d BW in the nursery was improved with 3 injections compared to 2 injections and control ($P=0.005$; 18.03, 18.31, and 19.73 kg for control, V2, and V3, respectively). Data indicate that fat-soluble vitamins in sows improved piglet performance through the nursery phase.

Perejitei E. Bekewe and Miguel S. Castillo
Graduate Programs: Crop and Soil Sciences
Advisor: Miguel S. Castillo
Poster Number: 18

Defoliation Management Effects on Production and Persistence of 'Performer' Switchgrass

Switchgrass (Panicum virgatum L.) is a warm-season perennial grass with dual-potential as a bioenergy crop and forage to feed livestock. 'Performer' switchgrass was released in 2006 by the USDA-NCSU forage program because of its greater digestibility and potential to positively impact animal responses compared to standard cultivars grown in the region. Nevertheless, there is limited information on defoliation management. Productivity and persistence information is critical to develop recommendations that ultimately will provide management recommendation for grazing systems. The objectives of this study were to determine the effect of the factorial combination (4 x 4) of defoliation intensity (clipped to 10, 20, 30, and 40-cm stubble heights; SH) and defoliation frequency (clipped every 3, 6, 9, and 12-wk) on total herbage harvested, canopy characteristics, and weed infestation. The experiment was conducted at the Central Crops Research Station using a mature stand (>8 yr) of 'Performer' switchgrass. Treatments were allocated in a complete randomized block design replicated four times. Total herbage production ranged from 3.77 to 12.08 Mg ha-1. Lower SH (e.i. 10 and 20-cm) resulted in greater herbage production (~11 Mg ha-1) for 9 and 12-wk defoliation frequencies; nevertheless, there was no effect when defoliated every 3 and 6-wk (~5.5 Mg ha-1). Leaf to stem ratio decreased from ~2.5 for both 30 and 40-cm SH clipped every 3-wk to ~0.7 for 12-wk. Weed infestation was mainly due to crabgrass (Digitaria spp.) and was greater (~70% infestation) when defoliation occurred every 3-wk at 10-cm SH and remained below 15% for all other treatments. Higher leaf to stem ratios occurred for lower total herbage production. 'Performer' switchgrass is productive forage and defoliation frequencies every 6-wk to 10-cm or every 3-wk to 20-cm SH or greater ensure stand persistence and prevent weed infestation.

Amanda Bostian
Graduate Program: Animal Science
Advisor: Daniel Poole
Poster Number: 30

Chronic Exposure to Ergot Alkaloids Suppresses Growth Hormone in Beef Steers

Tall fescue [Lolium arundinaceum (Schreb.) Darbysh] is commonly associated with the fungus Epichloë coenophiala and is the predominant grass that cattle graze throughout the southeastern United States. Infected tall fescue produces ergot alkaloids and grazing it leads to fescue toxicosis in cattle. In this study, crossbred Angus steers (n=8) were placed in Calan gates and randomly assigned to receive either endophyte-infected (EI) or non-infected fescue seed (EF; control) for 63d. Weekly measurements and blood samples were taken to monitor physiological responses. Data were analyzed using repeated measures in the MIXED procedure of SAS. Upon completion of the feeding period, animals were euthanized and tissue harvested. Body weight and average daily gain (BW 425.8 vs 409.5 kg; ADG 0.99 vs 1.14 kg/d) tended to increase in the EF group compared to EI (P=0.09). Body condition score tended to be greater in the EF group compared to EI (5.46 vs. 5.39; P=0.07). Heart, liver, spleen, kidney and pancreas weights did not differ between treatment groups (P>0.05). Circulating luteinizing hormone (LH) concentrations were no different between treatment groups during chronic exposure to ergot alkaloids, whereas, circulating growth hormone (GH) concentrations were reduced in the EI (1.3 ng/ml) group when compared to the EF controls (7.2 ng/ml; P<0.05). These findings indicate that GH could play an important role in the reduced weight gain that is seen in animals that are chronically exposed to ergot alkaloids. Determining exactly how ergot alkaloids are functioning along the hypothalamic-pituitary axis to alter GH production could help to further elucidate the mechanisms that leads to losses associated with fescue toxicosis.

Alexandra E. Briner[1,2], Emily D Henriksen[2], Emily Stout[2], Katelyn Brandt[1,2], Rodolphe Barrangou[1,2]
Graduate Programs: Genomic Sciences[1], Food, Bioprocessing, and Nutrition Sciences[2]
Advisor: Rodolphe Barrangou
Poster Number: 34

Defining activity of endogenous CRISPR-Cas systems to develop novel Cas9-based genome editing tools

CRISPR-Cas immune systems defend against invasive mobile genetic elements in bacteria and archaea. Native Type II systems protect a bacterium using the Cas9 signature nuclease guided by the trans-activating CRISPR RNA (tracrRNA):CRISPR RNA (crRNA) duplex to identify target sequences flanked by a protospacer-adjacent motif (PAM) to bind, cleave and destroy the foreign DNA target. Type II CRISPR-Cas are rare in nature, but occur preferentially in lactic acid bacteria (LAB). Here, we explore the natural diversity of Type II systems by comparing the occurrence, diversity, and composition of previously uncharacterized clades of CRISPR-Cas systems found in 113 lactobacilli and closely related LAB. We fully characterize CRISPR-Cas systems in five organisms: Lactobacillus rhamnosus, Lactobacillus gasseri, Lactobacillus casei, Lactobacillus pentosus, and Lactobacillus jensenii. The first stage of CRISPR immunity, acquisition, was characterized by prediction of active CRISPR loci containing all necessary cas genes and CRISPR repeat-spacer arrays that likely provide immunity against foreign genetic elements, such as phages and plasmids. To characterize the second stage of interference, expression, we characterized the expression profiles of the tracrRNAs and crRNAs responsible for guiding Cas9. Finally, to characterize the interference stage of CRISPR immunity, we predicted and validated the PAM recognition sequence that is unique to each Cas9 and confirmed targeting through plasmid interference assays in the native host. For one organism, L. gasseri, we took the additional step to exploit the CRISPR-Cas9 system as a genome editing tool by creating synthetic guide RNAs that mimic the native tracrRNA:crRNA duplex to perform a self-targeting assay. By understanding of all stages of native CRISPR immunity in several unique Type II systems, we can develop novel Cas9-based genome editing tools that expand the current available technologies in the CRISPR toolbox.

Stephanie Buhler and Craig A. Layman
Graduate Program: Applied Ecology
Advisor: Craig A. Layman
Poster Number: 35

Multiple anthropogenic stressors can disrupt a positive feedback loop in coral reef

Coral reefs are highly productive ecosystems despite often being located in nutrient poor waters. With little external nutrients available, their productivity is likely due to mechanisms that aid in tight nutrient cycling. Recent evidence suggests that fish, historically the largest consumers and forms of biomass on reefs, may provide an ideal ratio of nitrogen (N) to phosphorous (P) for coral fitness (~20:1) through their excretion of assimilated nutrients. However, multiple anthropogenic stressors, e.g., habitat degradation and overfishing, may alter the ratio and amount of nutrients available, potentially decreasing coral growth. Here, in two experiments, we test: (1) how the loss of both habitat structure complexity and a large-bodied piscivore affect a coral fish community and (2) how changes in the fish community may disrupt a positive feedback mechanism between reef fish aggregations and coral growth. In a factorial experiment using artificial reefs, we manipulated reef complexity (high and low) and the presence of a large-bodied predator, Nassau grouper. After three months, high structural complexity and predator presence had an additive effect on fish biomass, increasing average total fish biomass by 200% compared to low structure complexity with no predator presence. Our second experiment examined how changes in fish biomass, mediated through manipulating habitat structural complexity, affects the growth of an endangered coral species. After one year, coral growth was highest in our high structural complexity treatments, suggesting the presence of structure complexity may initiate a feedback mechanism. Specifically, coral-structural complexity attracts dense fish aggregations, which increases fish-mediated nutrient availability for coral growth, ultimately feeding back to further increase reef complexity. Our findings suggest that coral reef restoration should utilize this positive feedback loop by reintroducing live coral fragments in a way that maximizes their structural complexity to increase initial coral growth and survival in natural habitats.

Jessica Cain
Graduate Program: Soil Science
Advisor: Matt Polizzotto
Poster Number: 36

Water Quality and Stratification in Jordan Lake; Assessment of Spatial, Temporal, and Inter-Annual Variability

B. Everett Jordan Lake supplies the drinking water for approximately 300,000 residents in the Towns of Cary, Apex, and Morrisville. The lake was added to the North Carolina impaired waters list in 2002 due to over-enrichment of nutrients and algal blooms. During summer stratification, low dissolved oxygen and high concentrations of dissolved iron, manganese, and nutrients occur near the bottom. Additionally, phytoplankton, including species that produce geosmin and 2-methyl-isoborneol, grow abundantly near the surface. Water quality concerns and taste and odor issues, along with the increased costs associated with water treatment needs, provide motivation for evaluating water quality and stratification patterns. Accordingly, the towns asked the USGS to determine spatial and temporal variability in lake water quality parameters in the vicinity of their water-supply intake. Biweekly samples were collected from April through October during 2012 and 2013 at four locations in the New Hope arm of Jordan Lake. Constituents for data collection included: secchi depth, the depth to one percent incident light, turbidity, iron, manganese, chlorophyll a, geosmin, 2-methylisoborneol, and nutrient fractions [NH3, TON (TKN-NH3), TN (TKN+NOx), TP, PO4, NO3+NO2]. Also, vertical profiles of pH, specific conductance, dissolved oxygen, and water temperature were measured. Preliminary results suggest that differences exist between study sites and indicate the importance of sampling multiple years to account for natural water quality variability to support decision making. Future work will include detailed statistical analyses for interpreting the drivers and significance of observed water quality trends. Overall, the benefit of the project will be a more in-depth understanding of water quality and stratification in an area of the lake where the Town of Cary plans to install a large water-column destratification system. Documenting pre-installation conditions will facilitate future evaluations of the effects of the mixing system on water quality in this high-profile reservoir.

Bin Cheng
Graduate Program: Biological and Agricultural Engineering
Advisor: Lingjuan Wang-Li
Poster Number: 42

Responses of secondary inorganic PM2.5 to the changes of precursor gases in the southeastern U.S.

Animal feeding operations (AFOs) have been the largest ammonia emission source in United States. However, the impact of ammonia emissions from animal feeding operations (AFOs) on the formation of secondary inorganic PM2.5 (iPM2.5) has not been systematically assessed. Under the SEARCH program, the concentrations of iPM2.5 chemical compositions and its precursor gases were measured at four paired urban/nonurban sites in the southeastern U.S. during 1998–2015. Using the SEARCH data, this research aims at corroborating the contribution of AFOs NH3 emissions to the formation of secondary iPM2.5 and determining the spatial heterogeneity of secondary iPM2.5 under urban and rural conditions. This paper will report analysis results of the SEARCH data from the YRK and JST (rural vs. urban) sites. The onsite measurements provided processed 1–hr average concentrations of precursor gases, iPM2.5 chemical compositions, and meteorological condition measurements. The concentrations of gas and particle–phase pollutants and meteorological conditions at the urban and rural sites will be analyzed and compared using statistical means. The pollutant concentrations as a function of wind direction will indicate the contributions of potential emission sources to the differences of iPM2.5 chemical compositions under the urban and rural conditions. Time series analysis of the precursor gases and iPM2.5 chemical compositions from 1998 to 2015 at YRK and JST sites will reveal the responses of secondary iPM2.5 to the changes of precursor gases and other atmospheric conditions. In addition to the time series analysis, the sensitivity test employing ISORROPIA II will be performed to test the responses of secondary iPM2.5 to the changes of precursor gases under ambient conditions. The applicability of ISORROPIA II under different conditions will be better understood. Results of this research may also improve our understanding of which precursor is more effective to reduce the concentrations of secondary iPM2.5 in the Southeastern U.S.

Angel Cruz
Graduate Program: Crop Science
Advisor: Michelle Schroeder-Moreno
Poster Number: 48

Examining the Relationship Between Soil Health and Food Security in El Salvador

One of the most important functions of soil is food production and it is becoming widely accepted that healthy soils are the basis for food security. Despite the obvious connections between soils and food security, there have been no empirical studies quantifying this relationship. The objective of this study was to determine if farms with increased soil health have improved household food security and livelihoods in rural El Salvador. A stratified simple random sampling method was utilized where three distinct household strata are identified based on level of food insecurity (low, middle, and high food insecurity). The goal was to have at least 6 farm households from each stratum, with a total of 18 farms. The total sample size was based on the total number of members in the cooperative. Soil samples were randomly taken at 3 fields within each farm composed of 10 composite soil cores per sampling point at each farm. Parameters for soil health were chosen based on the Cornell Comprehensive Soil Health Analysis, the NRCS Soil Quality Kit and the CATIE Agroecological Soil Test Manual. Spearman correlations (for non-parametric data) and chi squared were used to determine the relationship between overall soil health and food security, as well as other livelihood indicators. Analysis of variance (ANOVA) were utilized to compare means between different soil indicators and food security. The Cornell Soil Health Analysis Scores were significantly correlated with food security for the farming households. Micronutrients and CEC appeared to be the indicators most impacting food security. However, food security was also impacted by other factors, such as land area planted and total yield. The results demonstrate the complexity of the causes of food insecurity indicating that not one variable will solve the problem, but improving soil health could be part of the solution.

Kevin Curry Jr., Wendy Warner, Travis Park and Gary Moore
Graduate Program: Agricultural and Human Sciences
Advisor: Travis Park
Poster Number: 49

How Motivation Influences Competitor Performance in FFA Career Development Events

Career Development Event (CDE) participation can provide FFA members with valuable life skills such as goal setting, dedication to the completion of tasks, and a desire for excellence. With the potential impact for competitors and the large numbers of participants nationwide, it seems logical FFA members are highly motivated to compete; but how so? Further, what impact does the level of motivation have on competitor performance? The purpose of this study was to examine the relationship between motivation and performance in FFA CDE competition. More specifically, the research sought to determine the relationship between an individual's grit, interest, and self-efficacy and their performance in the event. Cluster sampling was used to draw a representative sample of the 24 Career Development Events offered at the 2016 National FFA Convention. A census of all competitors (N = 1306) in nine events representing team-based content, team-based leadership, and individual leadership events was conducted. Competitors were surveyed on the motivational constructs of grit, interest, and self-efficacy, and survey data were connected to individual performance in the event (gold/silver/bronze emblem). GPA and all motivation measures surveyed had small positive correlations with individual performance. Further analysis displayed differences between the different genres of competition. Competitors in individual leadership events were grittier than students from all other genres of competitions and displayed higher values of self-efficacy even though there was no difference in GPA between the groups. Coaches should explore ways to build the self-efficacy of their students and future research needs to investigate the underpinnings of why students in individual FFA leadership events are more motivated to compete than their team-based counterparts.

Catherine D. Doyle[1], Leandro De León[2], Mary M. Dallas[1]. Jose Ascencio-Ibáñez[2] and Linda Hanley-Bowdoin[1]
Graduate Programs: Plant and Microbial Biology[1], Molecular and Structural Biochemistry[2]
Advisor: Linda Hanley-Bowdoin
Poster Number: 50

Functional Characterization of a New Type of Satellite associated with Cassava Mosaic Begomoviruses

Cassava is the largest crop produced in Sub-Saharan Africa, where 57% of the global total is produced. Cassava is grown by smallholder farmers and plays an important role in food security across the African continent. With increased demand for biofuel and industrial starch, cassava is also rising in global importance and trade. Cassava mosaic disease (CMD) caused by cassava begomoviruses (CMBs) severely limits cassava production, and can reduce yields by up to 95% in Africa. CMBs have circular, single-stranded DNA genomes that replicate through double-stranded DNA intermediates. A novel DNA sequence, SEGS-2 (sequences enhancing geminivirus symptoms), enhances CMD symptoms. It is thought that the SEGS-2 episome originally came from the cassava genome and acquired the ability to be encapsidated into virions and transmitted by whiteflies through a recombination event with an alphasatellite. We report that SEGS-2 enhances CMD symptoms in wild-type and SEGS-2 transgenic Arabidopsis thaliana when co-inoculated with African cassava mosaic virus (ACMV). SEGS-2 also breaks resistance to geminivirus infection by an immune Arabidopsis accession. Using rolling circle amplification, an episomal form of SEGS-2 was found in Arabidopsis and detected in virions from CMB-infected plants. SEGS-2 replicated in the presence of the ACMV in cultured tobacco cells. An 825-bp region is transcribed from the SEGS-2 epsiosme, which contains an internal promoter. Together these results suggest that SEGS-2 represents a new class of geminivirus associated satellites.

Jennifer Fideler[1,2], Måns Ekelöf[3], David C. Muddiman[3] and Suzanne D. Johanningsmeier[2,1]
Affiliations: Department of Food, Bioprocessing and Nutrition Sciences, North Carolina State University, Raleigh, NC[1]; Food Science Research Unit, USDA Agricultural Research Service, Raleigh, NC[2]; Department of Chemistry, North Carolina State University, Raleigh, NC[3]
Advisor: Suzanne D. Johanningsmeier
Poster Number: 61

Discovery of bioactive peptides in high salt acidified and fermented cucumbers by direct analysis IR-MALDESI mass spectrometry

Bioactive peptides possessing therapeutic properties are well documented in lactic acid bacteria fermented foods including milk, sourdough, and cured meats as well as in raw vegetables and grains such as garlic, broccoli, and rice. However, bioactive peptides have not been investigated in fermented vegetables. Cucumber pickles, the most commonly consumed fermented vegetable in the United States, are not amenable to typical peptidomic workflows without extensive sample preparation due to their high salt content. Here, direct analysis infrared matrix-assisted laser desorption electrospray ionization (IR-MALDESI) mass spectrometry (MS) was employed to explore the hypothesis that bioactive peptides are produced during cucumber fermentation. Natural fermentations were conducted in triplicate by brining cucumbers in sodium chloride solutions (648 mM NaCl, equilibrated) and incubating at 28°C for 6 weeks. Acidified cucumber treatments were prepared similarly with the addition of 8mM sodium benzoate to prevent fermentation and 110 mM lactic acid to mimic fermented cucumber acid content. Direct MS analysis was performed on 100µm thick cucumber slices using IR-MALDESI coupled to an orbitrap mass analyzer run in positive ion mode with 140,000 nominal resolving power. Putative matches of known food-derived bioactive peptides were identified using MSiReader imaging and confirmed by targeted MS/MS with 1 m/z isolation windows. Five antihypertensive, angiotensin converting enzyme (ACE) inhibitory peptides were identified in both acidified and fermented cucumbers: lysine-proline, isoleucine/leucine-proline-proline, valine-proline-proline, and arginine-tyrosine. Quantification using labelled standards will provide information regarding their formation or degradation during fermentation. Bioactive peptides, although often present at low concentrations compared to other food constituents, are valuable functional food components due to their high potency. To date, no bioactive peptides have been identified in raw or fermented cucumbers, nor has the potent and most prevalently studied ACE-inhibitory peptide, isoleucine-proline-proline, been previously documented in a vegetable source.

Jonathan J. Giacomini[1], Lynn S. Adler[2], Scott McArt[3], David R. Tarpy[4], Evan C. Palmer-Young[2] and Rebecca E. Irwin[1]
Graduate Programs: North Carolina State University, Dept. of Applied Ecology[1], University of Massachusetts Amherst, Dept. of Biology[2], Cornell University, Dept. of Entomology[3], North Carolina State University, Department of Entomology[4]
Advisor: Rebecca E. Irwin
Poster Number: 68

Sunflower Pollen Defends Bees Against Parasites

Plants may play critical but largely unrecognized roles mediating bee-pathogen dynamics. Growing evidence suggests that pollen has an important role in reducing disease transmission and infection intensities. Pollen is the sole source of lipids and protein for bees and varies wildly in nutritional content, morphology, and secondary chemistry. Pollen affects the expression of host immunity genes and upregulation of detoxification. We conducted a series of laboratory experiments and a large-scale field survey to investigate the effect of pollen diet on bee disease. We first tested the potential for different pollen diets to reduce Crithidia bombi parasitism, a trypanosome gut-parasite of bumble bees, in the Common Eastern Bumble Bee (Bombus impatiens). Sunflower (Helianthus annuus) pollen dramatically reduced infection levels by >80%. This effect was robust across a series of experiments comparing variation in parasite strain and sunflower cultivars. We then explored the generality of our findings in a honey bee-pathogen system. We experimentally infected honey bees (Apis mellifera) with Nosema, a pathogenic fungus, and found that sunflower pollen reduced Nosema infection in honey bees by 20% relative to control (buckwheat) pollen. Lastly, we tested the hypothesis that increasing sunflower acreage at farms reduces Crithidia infection in free-flying bumble bees. We sampled B. impatiens workers from 22 farms in Massachusetts, USA, with varying acreage of sunflowers and quantified Crithidia infection. We found a significant, negative relationship between the area of sunflower planted on each farm and disease intensity. Here we document that a single flowering species can play a pivotal role in reducing disease in managed and wild pollinators. As domesticated crop and native wild species, sunflower could be easily included in agroecosystems and native habitat. For food security and biodiversity conservation, there is a critical need to move beyond documenting pollinator declines and identifying simple solutions to reduce bee disease.

Simon Gregg and Dr. William Hunt, III
Graduate Program: Biological and Agricultural Engineering
Advisor: William Hunt, III, PhD, PE, DWRE
Poster Number: 69

Urban Stormwater Mitigation with Suspended Pavement Systems

Land use changes and urbanization negatively impact aquatic environments. Urbanized watersheds produce downstream flooding, while exporting pollutants, including sediment, oils and grease, heavy metals, nutrients, and pathogens. Stormwater Control Measures (SCM) mitigate the hydrologic and water quality impacts of increased imperviousness; however, in highly urbanized areas available surface area and high land cost inhibit the installation of many SCM types. The urban forest and canopy cover mitigates some of the impact of urbanization by increasing initial abstraction and storage within the canopy. Similarly, urban trees are able to capture atmospheric pollutants on leaves and stems eventually storing them via stem flow in soil at their roots. Urban trees, however, struggle to grow, access water, and thrive due to compacted urban soils beneath pavements and sidewalks, often leading to premature death. Suspended Pavement Systems (SPSs) incorporate a structural component to distribute the load of pavement to the underlying soil layer leaving an uncompacted soil volume beneath parking lots, sidewalks, and roads. In SPSs stormwater is routed through this soil volume via horizontal distribution pipes and underdrains. SPSs have concomitant benefits of (1) improved rooting environment for urban trees and (2) pollution mitigation via vertical filtration, sorptive processes, infiltration, and denitrification. SPSs can be a tool to meet urban forestry and stormwater management goals in municipally-owned right-of-ways. Four SPSs with varying loading ratios and underlying soil conditions are being tested in Durham and Fayetteville, North Carolina, to determine system performance characteristics, identify key design elements, and develop regulator guidance.

Yu-Hung Hung, Changqing Zhang and Tzung-Fu Hsieh
Graduate Program: Plant Biology
Advisor: Tzung-Fu Hsieh
Poster Number: 83

Functional Analysis of the Conserved Domains of DEMETER Demethylase

DNA methylation plays critical roles in maintaining genome stability, genomic imprinting, transposon silencing, and development. DNA methylation pattern is maintained by DNA methylation and demethylation processes. Genomic imprinting is established in the central cell by DEMETER (DME) mediated active DNA demethylation before fertilization, and is required for seed viability in Arabidopsis. DEMETER is a glycosylase that works via base excision repair pathway to recognize and replace 5-methylcytosines with unmethylated cytosines. DME encodes a large protein with multiple conserved domains. However, except for the well-characterized glycosylase domain, the functions of these domains have not been elucidated. By studying the function of these conserved domains, we can shed some light on the targeting mechanism of DME. This study will extend our knowledge and possibly enable epigenetic manipulation in the future. Using genetic engineering, we investigated the in vivo function of the different isoforms and truncated versions of DME by complementation assay. In addition, generation of whole genome DNA methylation profile allows us to examine the DME target sites on a single nucleotide base resolution. Here, we show the three conserved domains (termed AGB, for the A, Glycosylase, and B domains) in the C-terminal half of DME are sufficient for DME in planta activity. We found that DME AGB is more efficient in complementing dme-2 seed abortion phenotype than the full length DME. In addition, when CG differentially methylated regions (DMRs) between wild type DME and AGB were compared, the AGB has wider targets and causes deeper demethylation, suggesting a regulatory role of the NTD on DME activity in vivo. Bioinformatics analysis of DME-like proteins uncovered a permutated CXXC motif and a RRM motif, both implicated in epigenetic targeting, within the domain B. Our result suggests that DME AGB contains sufficient information for targeting whereas NTD regulates and fine-tunes its enzymatic activity.

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Graduate Program: Microbiology
Advisor: Sophia Kathariou
Poster Number: 90

Assessment of Survival and Virulence of Salmonella in low moisture foods

Low moisture foods (LMF) have been implicated in multiple outbreaks of salmonellosis. However, mechanisms mediating survival and virulence of Salmonella in such foods remain poorly understood. The objective of this study was to assess the survival and virulence of Salmonella in LMF. A two-strain mixture of Salmonella enterica serotypes Typhimurium and Enteritidis was used to inoculate two model LMF, chocolate and in-shell pistachios. Products (100g) were inoculated with 4ml of the Salmonella cell suspension, dried for 1-3h until Aw approximated that of the uninoculated product, aliquoted into 15-ml centrifuge tubes and stored in the dark at 22oC. Salmonella populations immediately after inoculation, after drying and at 1, 4, 6, 10, 15 and 21d were determined in triplicate on non-selective (TSA-YE) and selective (XLD) media. Virulence was tested in the insect Galleria mellonella model by injecting 10 µl of rinsate from products at 1d into the last left proleg of 10 larvae. Rinsate from uninoculated products were also injected as controls. The larvae were incubated at 37oC and larval mortality was daily monitored. The population of Salmonella in the inoculated products was 8 and 9 logCFU/g immediately after inoculation and 7.3 and 8 logCFU/g after drying for chocolate and pistachios, respectively. Populations decreased to 4.5 and 7.5 logCFU/g by 21d in chocolate and pistachios, respectively. Recovery of Salmonella from either product on TSAYE and XLD was similar. Larvae inoculated with 3.4 logCFU/ml of the cocktail had a mortality of 100% after 24h compared to 80% of larvae inoculated with 3.9 logCFU/ml cells from chocolate and 30% for larvae inoculated with 3.7 logCFU/ml cells from pistachios. The mortality of controls was 0 and 10% for uninoculated pistachios and chocolate, respectively. Findings show that Salmonella can survive in chocolate liquor and pistachios and that cells adapted to the LMF environment retained virulence.

Lisa K. Johnson[1], Chris C. Gunter[1], Mike D. Boyette[2], J. Dara Bloom[3], Rebecca D. Dunning[1] and Nancy G. Creamer[1]
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Advisor: Nancy G. Creamer
Poster Number: 93

Lost in the field: understanding edible but unharvested vegetable crops

In the US, 40% of food that is produced never reaches the consumer. However, a significant portion is overlooked in research and reporting, making that a low estimate. In fruit and vegetable production, edible crops of high quality may be left unharvested because of a variety of market factors. Vegetable growers that supply the wholesale market are working within specifications for quality provided by their buyers. Reducing these losses could have a triple bottom line impact. The aim of this project is to understand why edible vegetables are left unharvested, what volume is available for recovery, and pilot a potential solution. An interdisciplinary approach is allowing for quantitative and qualitative studies to come together to feed a solution.

Grower interviews and surveys designed to uncover decision making and identify barriers to utilization of the entire crop are key to meeting this objective. A simple protocol for field measurement has been developed to determine the volume of produce left in the field for a variety of crops. A major barrier to utilization has been identified as the harvest costs, therefore the solution in pursuit is a low-tech mechanized harvest-aid that makes a last-over harvest more efficient, and may make it more profitable.

In 2016, an average of five cucumber fields revealed 12,846 pounds were edible but unharvested per acre. With 5,300 acres in North Carolina in cucumber production, the available amount for recovery could be over 68 million pounds. An average of three fields showed that 4,081 pounds of edible sweetpotato was left unharvested per acre. This is NC's largest crop with 64,000 acres, meaning over 261 million pounds could be available. Recovering these crops could benefit growers' profits, make food available for consumers, and make more efficient use of resources such as land, water, and chemical inputs.

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Advisor: James B. Holland
Poster Number: 116

Genomewide recurrent selection for Fusarium ear rot and fumonisin resistance in maize

Fusarium ear rot (FER) of maize is caused by Fusarium verticillioides, which produces fumonisin (FUM), a mycotoxin linked to human and animal health risks. Sources of resistance to FER have been identified, but the resistance is polygenic and difficult to incorporate into elite hybrids. Extensive field trials, laborious inoculation, and expensive antibody assays are required to reliably assess resistances to FER and FUM contamination in breeding populations. Genomic selection (GS) could improve the efficiency of breeding for these complex disease resistance traits by training selection models on a subset of a breeding population and applying them to a larger sample of genotyped but untested lines from the population. This can increase the number of lines screened beyond the limits of field screening capacity, effectively increasing selection intensity. To evaluate the potential utility of GS in an ongoing maize breeding program, we called 6131 SNPs on 508 S0:1 families from an advanced generation of a recurrent selection program using low coverage sequence. A training set of 263 S0:1 lines was evaluated for FER and FUM at three locations during two years. The remaining 245 S0:1 lines were evaluated as an independent validation set in a subsequent year. Preliminary results indicate high accuracy between predicted and true genetic values for FER (0.59) and FUM (0.65) for an independent set of lines tested in the same year as the training set. The 20 most resistant lines predicted on the training set were less affected by Fusarium verticillioides compared to the population mean and the mean of the most susceptible lines. These results provide evidence that GS is a very promising breeding strategy for Fusarium resistance. We are developing strategies to implement GS for additional generations of selection before retraining the model.

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Advisor: Jonathan R. Schultheis[1]
Poster Number: 126

Preharvest and postharvest effects on incidence and severity of internal necrosis in "Covington"

Internal Necrosis is characterized by necrotic areas in the sweetpotato flesh appearing at the proximal end of the root. Severity can go from 1 (No IN) to 5 (Unmarketable), even when severity is the highest, IN will disappear about 1/3 to 1/2 of the length of the root. Regrettably IN cannot be identified unless the root is cut making this problem even harder to be investigated.

The appearance of IN in sweetpotatoes might be related to a stress respond of a gene. This stress could be caused by preharvest and postharvest treatments. To determine if there is a preharvest effect, two different fertilizers were used, one with high chlorine and one with low chlorine. The second preharvest treatment tested was mowing vs not mowing the vines previous harvest. To determine if postharvest temperatures influence on incidence and severity of Internal Necrosis, three different temperature treatments (78ºF, 85ºF & 59ºF) with five different curing duration (1/2, 1, 2, 3 & 5 weeks) were tested.

A total of 4 treatments x 4 replications per treatment resulting 16 plots per farm with a total of three farms participating in the test. The fertilizers were applied up front and up front + layby. High Chlorine Fertilizer: Muriate Potash (0-0-60) Vs No Chlorine: Potassium Sulfate (0-0-50) and mowing (10-14 days before harvest) Vs not mowing with a mower.

The roots will be harvested and placed in onion bags with at least 30 roots, then in lugs. Five curing durations will be tested (1/2, 1, 2, 3 and 5 weeks) at two different temperatures (75ºF and 85º F).

Previous research has been conducted over the past eight years, identifying some things that might induce the occurrence of IN such as clone bounded to cultivars "Covington" and "Hatteras", Ethephon have increased significantly the incidence and some other things that do not cause IN like disease nor a virus, herbicides and insecticides, application of Ethylene when curing.

DurreShahwar Muhammad, Rosangela Sozzani and Terri A. Long
Graduate Program: Plant and Microbial Biology
Advisor: Terri A. Long
Poster Number: 127

Elucidating the Molecular Mechanism of POPEYE Movement Involved in Iron Homeostasos, in Arabidopsis Thaliana

Iron (Fe) is an essential plant micronutrient required for proper growth and development. However one-third of the Earth's soil is calcareous, having a pH higher than 7, which prevents Fe(III) from reducing into usable Fe(II). As such, plants must tightly regulate iron sensing, acquisition, transport, and storage to ensure sufficient iron for growth. Transcription factors (TFs) regulate genes involved in responding to these processes. Characterizing and understanding the dynamics of POPEYE, an iron responsive TF that directly and indirectly negatively regulates iron homeostasis genes, will allow us to elucidate the mechanism by which it functions in iron homeostasis. This knowledge has the potential to be used for downstream applications, such as engineering agricultural crops, ornamental plants, and trees that are able to thrive in iron stressed environments. POPEYE mRNA and protein accumulate under iron deficient conditions. However, mRNA expression is localized to the root pericycle, while protein expression is localized to the nucleus in all root cell types. Little is known about the discrepancy between POPEYE mRNA and protein expression patterns in specific root cells. We used two approaches to address this concern; (1) scanning fluorescence correlation spectroscopy microscopy with a transgenic line expressing GFP-POPEYE to examine inter-cellular protein movement in response to iron deprivation, and (2) created and analyzed GFP-POPEYE-pye lines driven by cell specific promoters to mis-express POPEYE protein. Using these approaches we have shown that POPEYE transcript is induced in the pericycle under iron deficiency and its protein moves symplastically to outer root cell types. These new discoveries explain why we see differences between mRNA and protein expression. Additionally, performing iron specific assays on POPEYE mis-expressed transgenic lines suggests that this iron deficiency induced movement is critical for POPEYE function.

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Advisor: Alan Franzluebbers
Poster Number: 143

Fall stockpiled tall fescue yield response to nitrogen fertilizer depends on soil biological activity

Nitrogen (N) fertilizer application to tall fescue during late summer is common to promote herbage accumulation prior to winter grazing. However, little is known of the N supplying capacity of soil under tall fescue pastures. We hypothesized that pastures with low reservoir of biologically active soil N would respond significantly to late summer N fertilizer application and pastures with high reservoir would not respond as much. Twenty pastures with diversity in management were selected across North Carolina and Virginia. Each field had four treatments (0, 45, 90, and 135 kg N/ha as urea, applied in early September 2015) replicated four times in a randomized complete block design. Dry matter accumulation was determined in mid-January 2016. Soil was sampled at 0-4" depth in August 2015 from each of the four replicate blocks of each field. Soil N supplying capacity (i.e. N mineralization) was assessed with inorganic N accumulation during aerobic incubation at 25°C for 24 days, as well as from the flush of CO2 during 3 days. The flush of CO2 was highly related to net N mineralization (R2 = 0.77). Those sites with greatest yield response to N fertilizer had lowest net N mineralization and flush of CO2. Our hypothesis was accepted – fall-stockpiled yield response to N fertilizer declined with increasingly greater biologically active soil N. Adjusting fertilizer recommendations for fall-stockpiled tall fescue based on biologically active soil N appears appropriate, but we are repeating the study with additional sites.

Rebecca K. Poole, Thomas L. Devine, Joseph C. Mackey, Matthew H. Poore and Daniel H. Poole
Graduate Program: Animal Science
Advisor: Daniel H. Poole
Poster Number: 146

Ergot Alkaloids from Endophyte-Infected Tall Fescue Alters Ovarian Follicle Growth and Development in Beef Heifers

Fescue toxicosis is a disease common in cattle grazing tall fescue [Lolium arundinaceum (Schreb.) Darbysh] containing an endophytic fungus (Epichloë coenophiala) that produces ergot alkaloids. Previous research from our lab demonstrated that chronic exposure of ergot alkaloids reduced ovarian blood flow, potentially altering ovarian function. Therefore, the objective of this study was to determine if ergot alkaloids from endophyte-infected tall fescue suppresses follicular development. Angus X Senepol heifers (n = 30) were blocked by weight and genotype [Slick (S) or Normal (N)] placed in Calan gates then randomly assigned to receive either endophyte-infected fescue seed (EI) or noninfected fescue seed (EF; control) for 63d. During exposure, weekly measurements were collected to monitor physiological responses. Following 30d of exposure, heifers were synchronized and inseminated to examine daily follicle mapping and AI pregnancy rates. Data were analyzed using repeated measures in the PROC MIXED of SAS. The number of recruited (2-4mm) follicles was significantly greater in EI-N heifers (13.7) and significantly lower in EF-N heifers (10.6) compared to other heifer groups ($P < 0.05$; 11.1, 12.2 follicles for EI-S, and EF-S, respectively). No differences were observed ($P > 0.05$) in the number of selected (5 to 8mm) follicles. Whereas, the number of dominant (> 9mm) follicles was reduced in EI-N heifers (0.52) compared to other heifer groups ($P < 0.05$; 0.85, 0.87, 0.93 follicles for EI-S, EF-N, and EF-S, respectively). AI pregnancy rates were decreased in EI-N heifers (0%) compared to other heifer groups ($P < 0.05$; 86, 50, 43% for EI-S, EF-N, and EF-S, respectively). Based on these data, ergot alkaloids from endophyte-infected tall fescue alter ovarian follicular development, potentially contributing to the poor reproductive performance in infected cattle. However, the slick hair genotype appears to aid in offsetting the physiological symptoms associated with fescue toxicosis, resulting in improved pregnancy rates.

Raul Rivera, Miguel Castillo and Travis Gannon
Graduate Program: Crop and Soil Sciences
Advisor: Miguel Castillo
Poster Number: 154

Harvest management to extend the supply of feedstock and forage from two NCSU's switchgrass (Panicum virgatum L.) cultivars

The search of alternative energy sources different than fossil fuels has turned attention to switchgrass as a potential renewable lignocellulosic feedstock for production of bioenergy. Switchgrass is a high-yielding, C4, perennial warm-season grass well-adapted to North Carolina, and the transition region in USA, with dual-potential as a bioenergy feedstock and forage for livestock. This study focuses on evaluating the effects of harvest frequency (one, 1x; or two, 2x, clippings per year) and time of harvest (before frost, BF; after frost, AF, and late-winter, LW) on productivity (dry matter yield; DMY), canopy characteristics (leaf to stem ratio), and lodging ranking of two switchgrass cultivars. Cultivars 'Performer' and 'BoMaster' were released by the USDA-NCSU forage program because of their potential as a forage and feedstock, respectively. The research was conducted at the Central Crops Research Station in Clayton, NC. The experimental design was a split-plot design with main-plots arranged in a randomized complete block design replicated three times. Main-plot factor was harvest frequency and sub-plot factor was time of defoliation. Experimental unit area was 25 m2. For BF harvest, dry matter yields were similar between 1x and 2x harvest frequencies for both cultivars and were 9 Mg ha-1 for 'Perfomer' and 10 Mg ha-1 for 'BoMaster'. Dry matter yield was 34% lower when harvest timing was delayed from BF to AF for both cultivars. Leaf to stem ratio for both cultivars were greater for 2x clippings vs. 1x and were reduced from BF to AF. The lodging ranking indicated higher standing canopies for 'Performer' compared to 'BoMaster'.

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Graduate Programs: Crop and Soil Sciences
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Poster Number: 156

Soil Health Assessments Do Not Differentiate Management of North Carolina Soils

Soil productivity varies across regions, climates, and soil types. Recently developed soil health assessments evaluate 'soil health' on a universal scale, but have not been evaluated in regionally-unique soil conditions. The objective of this work was to evaluate three soil tests in North Carolina. We used long-term trials with different agronomic management in three regions: mountain (20 yr), piedmont (30 yr) and coastal plain (16 yr). Mountain and coastal plain experiments included combinations of organic or conventional production with or without tillage, whereas the piedmont experiment included nine tillage treatments using moldboard, chisel, disk, subsoiling, or no-till equipment. Soil samples were collected and submitted for analysis as recommended by the North Carolina Department of Agriculture and Consumer Services (NCDA&CS), Haney Soil Health Test (HSHT), and Cornell comprehensive assessment of soil health (CASH) labs. Plant nutrients were variable and not statistically different across treatments, though still sufficient for crops. The HSHT generally recommended more phosphorus than NCDA&CS, but nitrogen and potassium recommendations were the same. Physical soil indicator results of the CASH were not different regardless of tillage intensity at the locations. Differences in biological soil indicators varied depending on location and soil test, and were not consistent between treatments. Overall CASH soil health scores were low to very low for all but one treatment. Haney soil health scores were all in good range except moldboard tillage. Despite inconsistent management differentiation by soil health testing, conventionally managed no-till treatments generally had the greatest long-term yields.

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Advisor: Craig A. Layman
Poster Number: 157

Multiple Stressors in a Caribbean Dwarf Mangrove Ecosystem

Mangroves are foundation species in coastal ecosystems providing an estimated US $1.6 billion in ecosystem services worldwide. These services range from providing essential nursey habitat for marine organisms to land accretion and carbon sequestration. Unfortunately, mangrove forests are declining as a result of myriad factors, many related to human activity. Although human activities are the driving cause of mangrove loss globally, natural factors result in mangrove loss. Here, we present a case study from Abaco, The Bahamas in which dwarf Red Mangroves (Rhizophora mangle) are dying on a large scale. Initial data suggest that prior to death these dwarf R.mangle are stressed by multiple factors, including a fungal plant pathogen, herbivory, and altered abiotic conditions (e.g., hyper-salinity). In order to determine how each of these factors contribute to the die-off we are using a series of empirical experiments. Herbivore exclusion cages were placed on live dwarf mangroves to examine effects of herbivory on mangrove health in the die-off region. Next, disease incidence surveys were completed in the die-off area and infected leaf samples were collected and sequenced for fungal DNA. A simulated grazing experiment was conducted in dwarf mangroves to determine if there is an interaction between herbivory and pathogen. Our results show that herbivory facilitates disease infection on mangrove leaves. In both the herbivore exclusion experiment and simulated grazing experiment we found that grazed leaves were positively correlated with disease incidence. We have identified a potential fungal pathogen, a Pestalotiopsis species, on infected mangrove leaves from DNA sequencing. Though, Koch's postulate experiments are ongoing to confirm pathogen identity and virulence. Future work will incorporate how hyper-saline conditions in the presence and absence of both the plant pathogen and herbivore contribute to mangrove health.

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Poster Number: 160

Resident Macrophages Are Regulated by TAK1

Resident macrophages are critical for tissue homeostasis through the removal of dead cells and invading pathogens. However, the mechanism by which resident macrophages are maintained within tissues is still largely unknown. Here we report that a protein kinase, TAK1, is selectively required for resident macrophage survival during embryogenesis. Hematopoietic lineage-specific deletion of Tak1 gene (Tak1HKO) caused accumulation of cellular debris in the thymus and caused abnormal lung development in perinatal mice. While no abnormalities in other hematopoietic cells, including T cells and neutrophils, were observed in Tak1HKO mice, we found that resident macrophages were selectively diminished. This suggests that TAK1 is required for resident macrophage development and/or maintenance. In the in vitro setting, we found that macrophages were killed by Tak1 deficiency without any exogenous stressors. We identified that tumor necrosis factor (TNF) signaling elicits lysosomal dysfunction, leading to cell death in Tak1-deficient macrophages. These results demonstrate that TAK1 is required for macrophage maintenance by preventing TNF-induced lysosomal rupture. Finally, we show that Tnfr1 deletion restored thymic and lung macrophages in Tak1-deficient mice in vivo. These results suggest that autocrine and potentially paracrine TNF kills Tak1-deficient macrophages. Many tissues constantly express TNF in response to tissue injury and pathogenic invasions but TNF can also induce cell death if it is not properly regulated. Our results revealed, for the first time, that TAK1 is the safety breaker to limit TNF signaling in resident macrophages.

Mackenah Simmons
Graduate Program: Agriculture and Human Sciences, Agriculture and Extension Education
Advisor: Travis D. Park
Poster Number: 173

North Carolina Teacher Perceptions of Global Agriculture Instruction

Few can deny that we will live in a global society, especially with increases in technology, communication, and information. Preparing students to understand and work in such a society requires that educators work to teach subjects globally and help provide students with a global perspective. This is especially true for students in agriculture, since agriculture is a world market with large amounts of international trade and cooperation, and the international aspect of agriculture will continue to be important as we come to face the challenge of feeding a growing population. North Carolina curriculum requires students to learn about global agriculture however, little research has been conducted to determine the perceptions of teachers toward current global agriculture education, its importance, nor the resources and preparation to teach such topics. This research investigates these perceptions through descriptive survey of current teachers in NC. The survey focused on four areas which were; perceptions of current global agriculture objectives, perceived importance of global agriculture instruction, preferred methods of instruction and analysis of current resources. Demographic information on the respondents was also recorded. Teacher responses indicated that global agriculture instruction is perceived as being important, however, responses related to current implementations revealed that global agriculture objectives are not being emphasized as much as desired. The survey also uncovered a need for more resources related to global agriculture instruction. Results yielded non-consensus of how global agriculture should be directed in schools between focused curriculum or infusion of global agriculture perspectives into all agriculture curriculum topics. Much research is still needed to evaluate global agriculture instruction initiatives and to understand how global agriculture instruction is aiding students in becoming global citizens.

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Poster Number: 176

Ammonia Elicits a Different Myogenic Response in Avian and Murine Myotubes

Increased myostatin expression, resulting in muscle loss, has been associated with hyperammonemia in mammalian models of cirrhosis. However, there is evidence that hyperammonemia in avian embryos results in a reduction of myostatin expression, suggesting a proliferative myogenic environment. The present in vitro study examines species differences in myotube and liver cell response to ammonia using avian and murine derived cells. Primary myoblasts and liver cells were isolated from embryonic day 15 and 17 chick embryos, to be compared with mouse myoblasts (C2C12) and liver (AML12) cells. Cells were exposed to varying concentrations of ammonium acetate (AA; 2.5mM, 5mM, or 10mM) to determine the effects of ammonia on the cells. Relative expression of myostatin mRNA, determined by quantitative real-time PCR, was significantly increased in AA (10mM) treated C2C12 myotubes compared to both ages of chick embryonic myotube cultures after 48 hours ($P < 0.02$). Western blot analysis of myostatin protein confirmed an increase in myostatin expression in AA-treated C2C12 myotubes, compared to the sodium acetate (SA) controls, while myostatin expression was decreased in the chick embryonic myotube cultures when treated with AA. Myotube diameter was significantly decreased in AA-treated C2C12 myotubes compared to controls, while avian myotube diameter increased with AA treatment ($P < 0.001$). There were no significant differences between avian and murine liver cell viability, assessed using 2', 7'- bis-(2-carboxyethyl)-5-(and-6-)-carboxyfluorescein, acetoxymethyl ester, when treated with AA. However, after 24 hours, AA treated avian myotubes showed a significant increase in cell viability compared to the C2C12 myotubes ($P < 0.05$). Overall, it appears that there is a positive myogenic response to hyperammonemia in avian myoblasts, compared to rodent myoblasts, which supports a proliferative myogenic environment. This material has been published in In Vitro Cellular and Developmental Biology-Animal, <DOI:10.1007/s11626-016-0088-z>, the only accredited archive of the content that has been certified and accepted after peer review. Copyright and all rights therein are retained by Society for In Vitro Biology.

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Graduate Program: Plant and Microbial Biology
Advisors: Alexander Krings and William Hoffmann
Poster Number: 178

Classification of the Piedmont "prairie" community complex

The concept of the Piedmont "prairie" encompasses a complex of heterogeneous communities generally characterized by a semi-open canopy with a prairie-affinity forb and graminoid understory. Many rare species of state and federal concern are associated with Piedmont prairies, such as Echinacea laevigata, Helianthus schweinitzii, and Symphyotrichum georgianum. Piedmont prairies require periodic disturbance and quickly degrade when historical disturbance patterns are disrupted, as under fire suppression. The classification of these communities is challenging because few high-quality examples remain and many sites have degraded beyond recognition, resulting in a loss of the diverse herbaceous understory following the development of a closed canopy. Using a dataset of over 2000 Piedmont plot records extracted from the Carolina Vegetation Survey database, we seek to explore the Piedmont prairie concept in the context of the current landscape and to circumscribe these communities to better fit within the US National Vegetation Classification (USNVC) framework. We used hierarchical cluster analysis and fuzzy clustering to quantitatively identify subsets of these plots that best fit within the USNVC hierarchy. Non metric multidimensional scaling was used to ordinate the plots and explore compositional trends across the Piedmont landscape. Ongoing analyses include determination of diagnostic species and exploration of environmental factors influencing the occurrence and persistence of Piedmont prairie communities. We are also interested in identifying signals for distinguishing potentially degraded Piedmont prairie communities from other Piedmont forest communities.

Hande Z. Ulus
Graduate Program: Nutrition
Advisor: Jonathan C. Allen
Poster Number: 189

Processing Human Milk to Increase Nutrient Density for Preterm Infants

Preterm birth can cause problems with initiation of lactation. In this situation direct intragastric feeding can use donor breast milk from a milk bank, infant formula, or a combination. Concerns regarding the choice of feed are catchup growth and health effects. Formula might cause NEC and negative long term health effects but has faster catchup growth. Preterm infants have better tolerance for human milk, but lower caloric density of term mothers' milk or donor milk might not meet preterm infant's increased growth needs.

Aims of this study were to concentrate donor breast milk to have a higher caloric density and protein, but at the same time avoiding side effects of higher lactose concentration and hyperosmolarity by precipitating lactose at low temperature.

Donor breast milk was obtained from WakeMed Mothers' Milk Bank. For preliminary results 10 human milk samples of 50 mL were concentrated by evaporation to different concentration levels at 35oC, followed by refrigerated centrifugation for lactose removal. Measurement of lactose was performed with enzymatic analysis on supernate vs control.

Preliminary data found that low temperature removal of lactose from unprocessed human milk was minimal. Therefore milk was concentrated to varying volume reductions. Macronutrients were concentrated in the milks during the evaporation procedure in proportion to the amount of water removed, so caloric density was higher. Volume reduction (%) vs. Lactose concentration (g/L) yielded a linear relationship. Lactose was not consistently precipitated at the lower levels of volume reduction. Regression analysis found that every percent of concentration increased 1.2 g/L of lactose in milk, but the effectiveness of low temperature lactose precipitation was not statistically significant. Similar concentration should be true for protein and other bioactive factors.

Jordan Wood[1], Elizabeth Koutsos[2], Corinne J. Kendall[3], Jb Minter[3], Alejandra McComb[4] and Kimberly Ange-van Heugten[1]
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Advisor: Kimberly Ange-van Heugten
Poster Number: 203

Preliminary Analysis of the New NC Zoo African Elephant (Loxodonta Africana) Diet and Circulating Nutritional Concentrations

Managed elephants are often over-conditioned and consequently many zoos aim for reduced caloric intake and increased activity levels. In addition, diets containing higher dietary browse and forage percentages with lower inclusion of pelleted components may stimulate increased foraging behavior. The North Carolina Zoo is feeding a low-inclusion, grain-free supplement (Hay EnhancerTM, Mazuri®) while increasing the daily browse offerings. Two goals of current research are: 1) Determine percentage and complete nutrient profile of all browse species consumed by the six NC Zoo African elephants (Loxodonta Africana) from February 2016 to April 2017; 2) By assessing both diet and circulating blood nutrient concentrations, determine if pelleted diet meets estimated elephant nutrient requirements. Elephant weights, blood and fecal samples are collected monthly. Blood is analyzed for glucose, insulin, protein, vitamins, minerals, and fatty acids. Every six weeks, a four-day diet item weigh-in and -out is completed (all offered browse species, pasture, and hay; each analyzed for nutrients). Estimated daily food intakes ranged from 61-72 kg, similar to wild consumption data. Current results show 39 browse species fed between February 2016 and January 2017 and browse consumption ranging from 5-20 kg. per elephant, representing an increase in the percentage of dietary browse, though still a small part of the overall diet. Browse species varied in nutrient content due to season and species. When complete diets were analyzed for each elephant, intake of some nutrients appeared to be of marginal concern (e.g., sodium). This research is active and ongoing with preliminary data now available. The data thus far generated will enable the NC Zoo and other zoos within the region to better incorporate browse into animal diets, and ensure nutrient intakes are appropriate based on current knowledge.

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Poster Number: 205

Using RNA-Seq to Identify Candidate Genes for Resistance to Mummy Berry Disease in Blueberry

Blueberries (Vaccinium corymbosum and V. virgatum) are an increasingly important commodity, with a projected 25% increase in production over the next 4 years. Similar to other crop plants, blueberries are not immune from biotic and abiotic stresses. One of the most damaging and widespread diseases that affects blueberries is mummy berry disease. The causal agent of the disease is the Monilinia vaccinii-corymbosi fungus. In 2002, in no-spray rabbiteye blueberry fields in North Carolina, 70-80% of crop loss was reported. Current methods for controlling the disease include cultural practices and heavy fungicide use. Developing resistant cultivars is a more efficient method of disease control. Resistant cultivars can save growers thousands of dollars each year, keep costs down for consumers, and reduce the environmental impact of farming. To identify genes that are differentially expressed in response to the disease, we performed a gene expression analysis comparing infected and an uninfected tissues of a susceptible blueberry cultivar, 'Arlen'. A total of 24 RNA-Seq libraries of various tissues were constructed and run on the Illumina MiSeq and HiSeq4000 platforms. The sequencing data, aka reads, were used to create a reference transcriptome sequence assembly for blueberry. Reads were mapped back to the transcriptome assembly in order to identify differentially expressed genes with the edgeR test. Transcripts that met the cutoff criteria for differential expression were selected for functional annotation and KEGG pathway mapping. These annotated transcripts were filtered based on key words in their corresponding BLAST hits and gene ontology (GO) terms in order to narrow down the results to those only related to disease. Bioinformatically identified gene sequences will be used to develop quantitative PCR (qPCR) assays to validate their abundance in treated and untreated samples. The validated genes will be used as candidate genes for further genetic mapping studies.

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Poster Number: 210

Improved Ammonia Emission Inventory for Animal Feeding Operations in NC

Ammonia (NH3) is one of the precursor gases for the formation of secondary inorganic PM2.5. Although livestock and poultry production has long been identified to be the largest source of NH3 emission, it still exists a huge research gap in establishing a solid NH3 emission inventory for animal feeding operations (AFOs), which serves as the fundamental knowledge for forming local or regional impact assessment, effective mitigation strategies, and regulatory tools. Due to limited access to individual farm formation and shortage of NH3 monitoring studies, it is very challenging to quantify NH3 emission on the farm level and on daily basis. The purpose of this study is to establish an improved NH3 emission inventory with temporal resolution for AFOs in NC. The improvements include updated animal activity data and emission factors (EFs) with high spatial and temporal resolutions. In this work, a geospatial database for AFOs in NC will be established and validated using public resources. GIS techniques will be applied to investigate the spatial distribution of AFOs. Farm-level NH3 emission will be determined through applying temporally-resolved EFs and activity data for animal housing, manure storage, and land application. It has been found that EFs are very effective in reflecting animal type and age, litter/manure condition, animal management practices, and other impact factors of NH3 emission. The resulted NH3 emission distribution in the state will be utilized to determine hotspots of NH3 emission in NC, and also, it will provide fundamental basis for input parameter of atmospheric modeling and prediction on secondary inorganic PM2.5.

College of Design

Ezgi Balkanay
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Poster Number: 15

“Performative Urbanism” in Informal Economy: Learning from Gecekondu, Favela, Slum and Ghetto…

Urban mobilization indicating an ongoing social crisis, beyond mere economic catastrophe, necessitates re-considering the boundaries of the terms, for different scales. Violence that can penetrate everyday life breaks the borders between unpredictable, abnormal and ordinary one. Permeability between rural and urban dissolves the accepted boundaries of the cities. Similarly, massive human flux between different geographies, such as 2.5 million Syrian refugees that fled to Turkey, millions of others waiting at the borders of European countries, or ongoing re-definitions and actions for “immigrants” in USA require urgent measures within the framework of urban development of related parties. These inevitable impacts of social crisis that create a flux of urbanization in between different scales are delimiting the urban itself. Thus, another urbanism is questioned, and another design methodology for the urban is generated – “Performative Urbanism”.

Within this main theoretical framework and philosophical standpoint, the current focus on the research is a critical archeology/ mapping for “Informal Urbanism” with historical references in a transnational position. The study renders both the subject-matter, “ghetto” as a dynamic landscape in “informal urbanism” and the process, “ghetto-ization” in “formal urbanism”. This process has non-linear, diachronic interpretations using historical-theoretical methodology –archival research. Although some catastrophes could have negative impacts on society, such as fear, violence or mourning, each crisis has its own genuine, intrinsic quality and spatial meaning. Therefore, this study provides a critical inquiry to history and social/spatial transformations of ghettos.

The outcome of this effort will provide a theoretical framework for an alternative design methodology, “Performative Urbanism” as a new approach.

John Clark Cochran
Graduate Program: Industrial Design
Advisors: Bryan Laffitte, Helen Armstrong and Doug Gillan
Poster Number: 46

Slow Design, Smartphones, and Sleep: A Product Intervention to Reduce Screen-Time Before Bedtime

The purpose of this study is to address sleep deprivation among young adults caused by smartphone use. A 2011 poll conducted by The National Sleep Foundation found that 63% of Americans’ sleep needs were not being met during the week [1]. Moreover, young people were found to be most affected by a lack of sleep due to smartphones. In the same study, more than half of generation Z’ers and almost half of generation Y’ers said that they send, read, or receive text messages every night or almost every night in the hour before bed. The blue light emitted from smartphones has been shown to suppress melatonin, a natural chemical found in the human body that promotes sleep.

This research project investigates the activities, behaviors, and attitudes college-age individuals have toward smartphone use before going to sleep. In addition, this study draws upon insights from Slow Design, a growing sub-field of Human-Computer Interaction. Slow Design is a design approach aimed at creating devices that encourage reflection and thoughtful interaction rather than productivity and efficiency. Research methods include focus groups and interviews with college-age individuals. Prototypes will be created and evaluated to aid in the development of a physical product used to help limit screen-time before bedtime.

[1] Czeisler, C. A. “Annual sleep in American poll exploring connections with communications technology use and sleep.” (2011).

Mark Evans
Graduate Program: Design
Advisors: Cecilia Mouat and Marc Russo
Poster Number: 56

Sound of September

September 11, 2001 extracts an almost instant temporal and visual recollection of a tragedy stitched quickly and permanently into the fabric of our history. Through socio-cultural knowledge and media exposure, most people can easily bring to their minds images of the attack and construct a visual narrative; nevertheless, the sound of September 11 has not been vividly reproduced and does not form part of the collective memory.

Sound of September is an immersive sound installation shaped by my personal story as a survivor of the September 11 attack in New York. The project aims to communicate a completely new experience of the event. Through the use of auditory media as a modality to convey semiotics in sound, this installation delivers an emotionally evocative and engaging aural experience through pairing ones existing mental imagery with my autobiographical soundscape account from that day in order to activate episodic memory in all who have experienced the attacks mediated by their exposure to mainstream media.

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Advisor: Prof. Robin Moore
Poster Number: 67

Does Street Quality Affect Transit Users Route Choice?

As a contribution to counteract the reduction of adult physical activity in recent decades, the investigation examined the attributes of routes that may attract a commuting pedestrian to choose one route over another. The route choice is a novel methodology that reduces the self-selection bias and also provides variations in settings. Until now, some studies suggest that walkers consider the shortest path to minimize distance or walking time. Other studies found route quality also to be a predictor of route choice. The focus of this study is on micro-level street segments attributes to examine whether urban design qualities of streets are associated with pedestrians' preferences and their choice of routes to four light rail stations in Charlotte, NC. Objective data about the environment was gathered by using the PEDS inventory tool, while the number of pedestrians along a route was estimated using Urban Network Analysis. Subjective preference data was gathered using an online survey questionnaire.

Within light rail stations, 51 transit users were recruited by distributing notice forms in the selected stations and were asked to identify actual walking routes. To generate route alternatives not picked, the -shortest path algorithm produced 112 alternative routes. Conditional logistic regression was used to analyze the data. Results confirm that distance is a dominant attribute of routes. However, sloping terrain negatively associated and crossing aids (traffic control devices and pedestrian facilities to cross streets) were positively related to route choice. Similarly, number of trees and sidewalk width were positively associated with route choice. Results suggest that, pedestrians in the sample area willing to walk 562.7 feet (171.5 meters or about 3 minutes in walking time) longer if the sidewalk has more trees and shade. Furthermore, the coefficient of slope indicates that the odds of not being selected for a slight and steep routes is 6-time higher than the flat routes and pedestrians are willing to walk 302.8 feet (92.3 meters or 1.5 minutes) more if the route is flat.

Alexandra Grossi
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Advisor: Helen Armstrong
Poster Number: 72

Hearing Your User: Designing a User Interface for Cochlear Implant Recipients using User-Sensitive Inclusive Design

Assistive Technology is a relatively new focus in design practice that has been slow to adopt the highly regarded methods of Human-Centered Design (HCD), Participatory Design, and Design Empathy. In this niche market, design decisions are not fueled by the need to attract and retain users. The Cochlear Implant (CI) is a biotechnological feat that provides deaf and hard-of-hearing recipients digital hearing. CIs act as the user's connection to the hearing world making the CI user a deeply invested stakeholder. Unlike mainstream devices such as laptops that provide consumers with a wide array of product choices, CI recipients are locked-in users to one company's devices for life.

User-Sensitive Inclusive Design is a research method devised by HCD researcher Alan Newell. It combines traditional design methods to foster a rich understanding of the users, their experiences and emotions, resulting in design that is responsive to users' distinct needs. Using this as a framework for the design of a more user-centered CI Interface, this investigation utilizes contextual inquiries and interviews to create personas and corresponding user journey maps.

Interviews with CI users revealed that its interface demonstrates the poor user experience that can result from designers disregarding specific needs of users with a disability. Research gathered from literature confirmed that aspects of the current user interface do not adhere to HCD principles. Larger questions to be addressed in this investigation include, "How can designers grant assistive device users a stronger role in the design process?" and "How can networked assistive technology foster communication between users and designers?" While these investigations center on the design of a CI Interface, the results of this research will benefit all designers who are creating for any user with specific needs.

Karen G. Jones
Graduate Program: Art + Design, Animation/Interactive Media
Advisor: Cecilia Mouat
Poster Number: 96

Sign Me A Story: Shared Reading in American Sign Language with Interactive Animated Narration

The development of language and the cognitive abilities necessary to achieve eventual success in literacy are formed during the earliest years of a child's life. While most language acquisition happens naturally in the environment the child is exposed to, those that are born deaf do not have access to the phonological code. Chief among the many factors that contribute to a deaf child's eventual success in literacy are early intervention, parental involvement, and exposure to literacy, including visual language. Early acquisition of a first language is critical, regardless of language choice or mode. Not all families of deaf children choose to use the accepted native language of the Deaf, American Sign Language (ASL), but among those that do, most have no previous knowledge of ASL. Shared reading experiences between a parent and young child have been widely shown to have a positive impact on language and literacy development but deaf children may not have access to that benefit. Sign language is a visual language, but more importantly it is a language in motion. Traditional print picturebooks for ASL users are usually English text with static illustrations of "signs", and many presuppose English literacy. Building on my experience as an author, illustrator and animator I am creating Emerge Story Lab, an e-picturebook for tablet that provides an opportunity to share reading in ASL. An embedded animated character narrates the story in ASL while English text and effective illustration serve to support rather than dominate the discourse. Additional interactivity provides greater exploration in building word recognition and print awareness. Emerge Story Lab offers an inclusive means of storytelling for those that wish to share reading activities in ASL, as well as support for non-native ASL users.

Margo Rae Jordan
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Poster Number: 97

Green Honey: A Healing Journey Through Games

While games typically provide a source of entertainment, they can also be used for therapeutic purposes. Whether we realize it or not, by playing a game, we are allowing a vulnerable side of ourselves into this virtual reality. The experiences we take away from games can be very profound on our lives, and my research expands upon how those impressions can be applied in a game setting. Green Honey explores emotional healing through gameplay by the use of story and interactions with characters. Thus, my research aids as a type of catharsis. For those who have dealt with a difficult family relationship, a game with similar underlying tones can help relieve that grief. The cathartic release becomes an enlightening experience that helps one in understanding relationships with others as well as self awareness.

Additionally, games are experimental environments by nature due to the possibility of both success and failure as outcomes from playing. The paradox of failure explains that it is both safe and painful to “fail” in a game. So the question arises, why would we seek out something if there is that risk of failure? Green Honey is a short demo of a game that would expand upon what that means and how the answer can be applied to storytelling in a stylized environment.

Natalia Lopes
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Poster Number: 111

Object ZerO: The Power of Science Fiction Storytelling in New Media Comics

Object ZerO is an ongoing digital comic that explores the power of science fiction storytelling in the contemporary age through the use of experimental digital publishing formats. By analyzing the strengths the visual languages offer in their respective media, this digital comic draws upon them to employ effectual storytelling choices that deliberately serve the narrative. In this way the digital comic app interweaves form with content and allows for a deeper level of engagement with the story through its interactive mechanic, making its medium and message one and the same. The plot and setting of Object ZerO follows in the tradition of its literary and visual predecessors of the science fiction genre to comment on our relationship with technology, society and the environment. Additionally, the social utility of the genre is used as a means to generate empathy in the audience toward the story’s nonhuman protagonists, using interdisciplinary research that explores the many ways society has sought to silence its marginalized voices. Through combining research with making, it is the goal of Object ZerO to engage audiences as well as encourage storytellers to create powerful and relevant science fiction stories that continue to address society’s needs.

April Maclaga
Graduate Program: Graphic Design
Advisor: Denise Gonzales Crisp
Poster Number: 115

Interaction Design in a Networked Environment: Prompting In-Person Conversation Toward Empathy

While connected technologies bring together communities on a global scale, a growing concern is that constant connection negatively impacts our interpersonal relationships. Connected devices often interrupt and distract users from others in physical proximity, inhibiting in-person conversation. Sociologists and psychologists assert that in-person conversations uniquely lead to opportunities for self-reflection, understanding, and empathy. This study focuses on encouraging interactions that facilitate conversations and the potential for empathy. Empathy, the ability to identify with the feelings, intentions, and goals of others, importantly helps individuals establish and maintain personal relationships. Although some researchers have found that the presence of technology can reduce the potential for empathy during conversation, this study explores ways of using technology that might encourage and increase empathy between people working toward similar goals.The hypothesis proposes that technological interactions in a physical space can be designed to support in-person conversation and connection that offers opportunity for building empathy.

This research examines designed intervention precedents intended to support different degrees of conversation using responsive environments, smart devices, and mobile or wearable technology during routine activities, and evaluates their potential to promote face-to-face conversations. David Rose’s Balance Table, for instance, uses slow feedback mechanisms to guide turn-taking in collaborative settings. Snapchat favors an ephemeral conversation style that creates a digital atmosphere of intimacy and trust. To explore the research hypothesis, the investigation scenario focuses on older adults who are situated in a wellness setting and who may not be inclined to talk with one another. Methods including observation and interviews influence personas and user journeys that, in turn, inform the resultant visual studies and exploratory prototypes.

Preston Moeller
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Poster Number: 125

The Autonomous RV: Using the requirements of future products to inspire new techniques of concept simulation

Designing an autonomous recreational vehicle provides potential for new users to experience a unique form of mobile living. It also has unique requirements that will need to be considered and tested. To achieve this with the limited time and resources given may inspire new techniques of simulation. The potential of these techniques will lie in there opportunity with testing other concepts of any level from present to future. Problem Statement: Testing concepts for future products can be expensive and timely. As future concepts become harder to test within current limitations, making a well informed decision is important. So how do you become informed about a concept that hasn't been experienced? Research Question: Will constrained idea development provide new forms of problem solving.

Sara Noorani and Foad Faizi
Graduate Program: Architecture
Advisor: David Hill
Poster Number: 59

Carbolight, Exploring the properties of carbon fiber to design a light fixture

The aim of this research is to understand the properties of carbon fiber as a specific material, and use parametric and NURBS based software to propose new material applications, and design a light fixture based on the material characteristics. This research attempts to bridge the digital/material divide, and it employs digital design processes that are predicated on an understanding of specific material capabilities. The material drives the software exploration, and in return, the software provides the means to explore material manipulation and component assembly. This project combines material research with advanced digital design software in order to fabricate light fixtures that explore potential properties and formal outcomes of carbon fiber.

The project has been built with carbon fiber filament pre-impregnated with epoxy resin to stay malleable and sticky until baked. However, it must be wrapped around a mold or jig to give it form prior to baking. In this case, cardboard was used as the mold because removing it from the object is easy by cutting it or dissolving in water. A computer script translated an octagon into eight units with 80 notches around their edges, which were cut and assembled out of cardboard to make jigs. The carbon fiber was wrapped around these edges in a predefined pattern to create a fluid shape with straight lines. After the filament wrapping process, the object is placed in to oven in 260F until it cured for four hours, and then the hardened carbon fiber pieces are soaked in water to remove the cardboard jigs. This process would be very quickly especially by using robot for wrapping, and because it is a parametric shape having been created in Grasshopper, simple jig shape changes create a different array of fixture forms with having control over density and dimensions.

Jinoh Park
Graduate Programs: Design
Advisor: Traci Rose Rider
Poster Number: 140

Economic Value and Occupant Satisfaction: The Case for Multiple LEED Certification for Student Union buildings

The newly constructed student union at North Carolina State University is attempting to obtain LEED O+M Certification (Leadership in Energy & Environmental Design for Building Operations and Maintenance), with the primary goal of cost reduction in the building's operations and maintenance fees. With part of a student's tuition being applied toward approximately 70% of the union's management cost, cost reduction in operation and maintenance activities thereby reduces the level of reliance of the union on student fees. Literature on energy and commissioning suggest that developing an energy efficient green building is more beneficial for reducing cost (Kats, G, 2003). Also, O+M certification may provide students better conditions for socialization in the building, as LEED O+M certification encourages optimal levels of criteria addressing indoor environmental quality such as Indoor Air Quality, Thermal Comfort, Lighting, and Occupant Comfort. During the process of obtaining certification, its cost-effectiveness will be evaluated with the total amounts of expense and income according to the payback period and asset value depression by US code 168. Also, by using post-occupancy methodology, occupant satisfaction will be surveyed from sorted user types of the Talley Student Union building. Furthermore, after the actual benefit of the process has been evaluated, a proposal will be suggested based on reviewing contemporary trends in student union building design and management for student achievement at NCSU. Based on the expected findings above, managers of buildings having a single LEED certification would be able to build a better plan enhancing each value of their buildings strategically with understanding the benefit of a building rather than pursuing multiple LEED certifications. This exploration benefits NCSU and traditional higher education institutes that target enhanced value in student achievement.

Nancy Rekhelman
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Advisors: Carolina Gill and Sharon Joines
Poster Number: 152

Designing The Animal Shelter Experience

According to the American Society for the Prevention of Cruelty to Animals (ASPCA), ~3.9 million dogs enter animal shelters in the US each year; ~1.2 million are euthanized. About half of these dogs enter shelters through owner surrender. The primary reason for surrender is due to behavioral issues experienced with the dog. Studies have shown that when owners cite behavioral issues as a reason for surrendering a dog, often the dog did not have an abnormal behavioral issue, but rather the dog was simply a bad match for the owner's lifestyle. The purpose of this study is to uncover the factors that lead to poor adoption matches. A human-centered, ethnographic approach was used to study the shelter experience. In-depth interviews with shelter staff and volunteers were conducted at two animal shelters (a municipal shelter funded by the county and a private shelter funded from private donations). The shelters had vastly different operational systems and staffing resources. Any behavioral data that staff were able to log, was not being passed along to adopters. Through a collaborative mapping exercise of the shelter experience with shelter staff, gaps in the communication system were uncovered. Filling these gaps would allow adopters to access more accurate information about the dogs. In the second part of the study, surveys were distributed to people visiting the shelters to uncover how adopters perceive the shelter experience and what motivates or concerns them about the adoption process. Results from the study indicate the need for a solution designed to systematically log behavior and convey this knowledge to adopters so that they make informed adoption choices.

Maria Catalina Salamanca
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Poster Number: 162

Design and Innovation for Pediatric Orthopaedics: A study on orthotic devices used during treatment for developmental dysplasia of the hip (DDH)

This study aims to inform the design and development process of a new orthotic device that improves the experience for caregiver/infant dyads during treatment for Developmental dysplasia of the hip (DDH). DDH refers to abnormalities in the immature hip joint that can happen before, during or after birth. Each year, one percent of all newborns are diagnosed with DDH (> 1M infants worldwide). Treatment involves the 'reduction of the hip' (putting it back into the socket and holding it in place as the infant grows) and can be achieved by using orthotic devices. These splints and harnesses were invented by orthopaedic surgeons in the 1950's and have had little innovation in the past sixty years.

This project is an ethnographic study that investigates how the use of current orthotic devices affect mother/infant dyads during DDH treatment. The purpose is to understand the challenges encountered while using the orthotic devices, how life is affected including their daily activities, and the impact on their interaction with people and their environment. Participants involved in the study are medical practitioners (pediatric orthopaedics in the US and Colombia) and mother/infant dyads currently going through treatment for DDH living in the US, Colombia and Australia. The difference in incidence of DDH diagnosis and care between US and Colombian medical practices are explored. Data is collected using semi-structured interviews and observation sessions of mother/infant dyads during six daily activities (sleeping, diaper changing, breastfeeding, playing, eating and dyad interactions). A content analysis of the findings will translate into insights, opportunities, and finally into the design criteria for the new orthotic device. Physical prototypes will be developed and demonstrated using a simulated infant (doll). The mothers, medical practitioners, and caregivers will provide feedback on prototypes during in person interviews or online assessments which will inform the final design.

Ehsan Sheikholharam
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Poster Number: 169

Streets of Resistance, Homes of Desire
Compulsory Hijab and Architecture of Repression in Contemporary Iran

Subjugation of women within religious ideologies is neither new nor exclusive to Iran. Yet, the recent measures (April 2016) are unprecedented. Only in Tehran, 7,000 undercover morality agents have been deployed to "peacefully" crackdown any form of transgression to the compulsory Hijab. Beyond its overwhelming scale and intensity, what distinguishes this phenomenon from its seemingly similar precedents pertain to its ideological formulation. An appropriation of the Foucauldian Panopticon—as anyone can be an undercovered morality police—the paranoiac machinery of oppression aims at producing docile subjects. Out of the antagonistic encounters with the state's ideological and repressive apparatuses, new subjectivities and thereupon new forms of cultural representation are emerging. Although the booming real estate market of Tehran and its alignment with liberal global capitalism appear as an emblem of prosperity and a facet of modernity, the story of Iran's architecture is a poignant drama. The utter discordance between woman's appearance (fully covered and cocooned in scarf) and her inner fantasies (social freedom and equality) is deeply problematic. Not only bodies but also the entire public sphere have turned into a site of resistance where ironically but sadly "lipsticks are weapons." Nonetheless, when the oppressive forces exceed the tolerable limits, the external suppressions turn inward. If symptom could be defined as an expression of disavowed desires into a different medium, as Fredric Jameson argues and Slavoj Zizek endorses, architecture is the medium par excellence. The master signifier of Iran's domestic architecture, the brick screens attached on the façade, stands as the "returned of the repressed." The radical incommensurability between the inside and outside—a pro-Western interior with open-kitchens and satellite TVs to receive CNN, against an exterior which provides explicit references to historical motifs—should not be dismissed as a stylistic discrepancy. This paper is concerned with the function of such symptoms (modes and relations of production), than with their iconographical analysis.

Anantaya Wonaphotimuke
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Advisor: Deborah Littlejohn
Poster Number: 202

Learning to Make: Lowering Barriers to Entry for Novices and Supporting Community Engagement through Contextual User Interface

Theories of learning describe the importance of working in a social context to acquire resources from peers. For online creative communities—where 'making' is the shared interest—members participate and engage in the production of physical and digital artifacts, develop their creative skills, share their process, and seek inspiration and advice from others. Most online platforms designate a specific section(s) for a generic novice member type—the 'newbie.' Novices, however, come from different places in their learning goals and hold different levels of knowledge and experience. Nevertheless, they are lumped into the same 'beginner' category—by other community members as much as through the design of a 'one size fits all' user interface. Although considered beginners, novices learn at different rates and have different engagement strategies and help-seeking needs. Thus, it is important to acknowledge these differences through a more user-centric, contextually responsive design. While HCI designers have developed recommender systems to help enculturate newbies to the community, beginners often fail to participate for various reasons: some social or psychological; some technological.

My research identifies a gradient (i.e., framework) of 'novices' to inform the design of a contextual user interface and information architecture. The goal is to lower novices' barriers to participation and present information in a way that supports online community engagement. Contextual interfaces can help ease novices into their domain by facilitating learning and tailoring information necessary to engage with other members; they can facilitate the novice's learning goals while simultaneously supporting help-seeking and their ability to reach out. Contextual interfaces can take into account the nuance of being a 'novice,' thereby supporting the newbie in becoming a fully-participating member of the community. My research methods are developing and exploring different scenarios and personas, based on information gathered from interviews and observations of live maker events. The three visual studies organized around the contextual interface design, community, and strategies for facilitating learning to make. They address a contextual interface that identifies and scaffolds the level of participation, incorporates tools for different types of novices, and encourages participation and knowledge sharing.

Luis Zapata
Graduate Program: Graphic Design
Advisor: Helen Armstrong
Poster Number: 209

Perceptions in Virtual Reality: A look at how people interact in VR

Virtual Reality (VR) took a giant leap forward in 2014 when Oculus released their affordable consumer-centric VR system. Before that, researchers used cumbersome head-mounted displays (HMD) to explore the VR space. That same year, the Google Cardboard made VR HMDs even more affordable and accessible by opening the market to a variety of phones. Current research builds upon these platforms to consider how players feel present in VR. These researchers use humanoid avatars to test players' abilities to identify with their virtual selves. The research compares user behaviors of the virtual self as a reflection to previously tested psychological concepts, like the Proteus effect. My investigation looks at how different user inputs like gaze and sound can give multiple users a sense of presence and empower them to feel co-present and interact socially within VR.

This sense of presence and corresponding social behavior is key for effective student interaction in educational settings. Studies show that high social presence increases knowledge retention within an online-based learning platform. In a study of group communication, computer-mediated discussions resulted in a more equalized discussion and less individual-driven behavior. I frame my investigation with key elements of social presence: involvement, immediacy and intimacy. I employ user inputs to consider not only user representation in a VR environment, but also how a user communicates an idea. I test how the design of a VR environment, interface, and character determines social cues and affects group dynamics. Early findings suggest that audio has a key role in allowing people to feel another's presence, even when they are not located co-spatially. Ultimately these findings suggest that as schools become more technologically empowered, the students will be able to reach out beyond the walls of a classroom to learn and foster relationships with others that are not located co-spatially.

College of Education

Kathleen Epperson
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Advisor: Allison McCulloch
Poster Number: 55

Preservice Elementary Teachers' Solution Strategies and Justifications When Generating Rules for Figural Growing Patterns

Current research in the mathematics education field reveals that students today require a vastly different approach to learning mathematics than they have in the past. This includes an increasing emphasis on fostering algebraic ideas in elementary students in order to better prepare them for formal algebra. One way to do this is through the constructive use of figural growing patterns. While there is a growing body of research on effective ways to implement these patterns in the classroom with elementary students, there is less information on what knowledge teachers, particularly preservice, possess in regards to solving them. This research attempts to help fill the gap on how preservice elementary teachers solve and justify figural growing patterns. The participants represent a voluntary sample of preservice elementary teachers from a southeastern university in the United States. They had just finished their coursework and were preparing to enter the classroom as student teachers. The data used in this study consisted of task based interviews in which the participants solved figural growing patterns. The analysis of the data revealed that when solving, overall the preservice teachers relied on a mixture of strategies (recursive and explicit) and pattern aspects (numerical and figural). All were successful at finding additional instances of the patterns and most were successful at creating general rules. However, those that struggled relied more heavily on recursive strategies and numerical aspects. When asked to justify why each rule would always work, only a few of the explanations given were deductive. The justifications were overwhelmingly either inductive or lacked any attempt to form a convincing argument. Additionally, the interviews revealed that almost all participants reasoned deductively at some point when solving, but did not necessarily see this as an important part of their justification.

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Advisors: Carl Young[1] and Meghan Manfra[2]
Poster Number: 62

English Teachers' Epistemic Beliefs and their Impact on the Use and Valuing of Constructivist Common Core State Standards

Epistemological beliefs encompass beliefs about the nature of knowledge and learning. The epistemological beliefs that teachers hold can impact their instructional practices (Cheng et al., 2009; Jordan & Stanovich, 2003) and instructional practices utilizing a constructivist learning approach have been proven to positively impact students' academic achievement over traditional methods (Ayaz & Sekerchi, 2015; Villanueva, 2016). Without an understanding of how or if these epistemic beliefs differ by content area and how they may be related to the implementation of effective teaching practices, it is impossible to fully conceptualize the factors that affect teachers' worldviews, their instructional practices, and, potentially, their students' academic achievement. Therefore, this study investigated whether and how English/Language Arts (ELA) teachers' epistemic beliefs differed from those of other content areas, which constructivist ELA Common Core State Standards (CCSS) teachers used most frequently and found most important, and whether ELA teachers' epistemic beliefs could predict their reported use and valuing of those standards. 358 in-service high school teachers, including 92 ELA teachers, from four core content areas completed the Epistemic Beliefs Inventory (EBI) (Schraw, Bendixen, & Dunkle, 2002) to assess their epistemic beliefs. Participants also how frequently they used and how important they found constructivist ELA CCSS in the context of their classrooms. For Omniscient Authority, ELA teachers' epistemic beliefs were significantly more sophisticated than science, mathematics, and social studies teachers' beliefs. For Simple Knowledge, ELA teachers' epistemic beliefs were significantly more naïve than science teachers' beliefs. ELA teachers reported using and valuing ELA CCSS involving collaborative discussions more than any others; the standard involving writing narratives was the least used and valued. Finally, ELA teachers' epistemic beliefs about Quick Learning predicted their reported use and valuing of constructivist ELA CCSS. Study implications are discussed regarding future research and improving teacher education and professional development.

Daniel P. Kelly
Graduate Program: Technology Education
Advisor: Aaron C. Clark
Poster Number: 104

Measurements of Self-Efficacy in Engineering Graphics Students: An Examination of Factors Impacting Student Outcomes in an Introductory Engineering Graphics Course

The United States continues to demand greater numbers of trained STEM professionals with no indication of those trend lines reaching apogee in the near future. To remain globally competitive in STEM areas, the United States will need to produce one million new STEM professionals over the next decade. To meet this demand, it will be necessary to prepare and train 100,000 STEM educators by 2020 and increase STEM participation by women and ethnic minorities who continue to be significantly underrepresented in these critical fields. Only 35% of engineering and 14% of science graduates actually enter the workforce. To meet the demands, science and engineering education must increase enrollment. As enrollment increases and more diversity initiatives are developed and implemented, there will be a demographic shift in the students enrolled in STEM education at all levels. Current pedagogical practices and research based on populations historically present in engineering courses. These potential demographic changes necessitate an examination of how STEM courses are taught and whether the needs and demands of the shifting student demographics are being met. An understanding of the educational needs and dynamics of these groups are essential if efforts to recruit retain members of this group are successful in educational and industrial settings. To that end, this research focuses on self-efficacy measurements in introductory engineering graphics courses. Self-efficacy was selected due to its strong predictive validity with student achievement outcomes and persistence. Although self-efficacy research in is well-established education, self-efficacy research within engineering graphics education is sparse in the extant literature making this a timely study. With nearly 1,000 students involved in the study, self-efficacy scores will be compared to student demographics, course, exam, and project grades to identify salient patterns that can be used to inform future instructional design and objectives for the shifting demographics in STEM courses.

Nancy Smith
Graduate Program: Curriculum and Instruction
Advisor: Kevin Oliver
Poster Number: 174

Development of a Scaffolded Mobile Application to Facilitate Physical Therapist Student Clinical Reasoning

Within the field of education and medical education, research has demonstrated that computer-based instructional scaffolding is capable of assisting learners in developing the practices of scientific clinical reasoning and ill-defined problem solving. However, there is a paucity of research in the field of physical therapist (PT) education on using computer-based instructional scaffolding principles to facilitate scientific clinical reasoning or ill-defined problem solving. Further, no studies exist on the use of instructional scaffolding employing mobile technology to facilitate the process of ill-defined problem solving or scientific clinical reasoning within the fields of education or PT education. Therefore, this project utilized the ADDIE instructional design model to design and create a mobile application to facilitate physical therapist students' learning the sequence and strategies of scientific clinical reasoning, incorporating principles of the scientific reasoning framework scaffolding model. Analysis was conducted using both research on clinical reasoning in physical therapy and the researcher's experiential knowledge in order to identify the problems that PT students commonly have when engaging in clinical reasoning and ill-defined problem solving. A further problem identified during analysis related to the lack of access to just in time knowledge support in the classroom or clinic. Therefore, considering the capabilities of mobile devices and computer-based algorithms, a solution involving the use of a mobile application was designed and developed by defining the major goal of the mobile application: to provide a cross-platform mobile solution that employed scaffolding to assist PT students in structuring the decisional processes that occur while clinically reasoning with an actual patient or practice case. It is hypothesized that further testing of the mobile application will result in an understanding of the applications' ability to structure physical therapist students' sequence and strategies of clinical reasoning and provide suggestions for improvements to the mobile application.

Kevin Sutton
Graduate Program: Technology Education
Advisor: Aaron C. Clark
Poster Number: 177

Investigating Performance Assessment Trends of Post-Secondary Introduction Engineering Design Graphics Courses and Reliability of Current Practice

Performance assessment is a common method of determining proficiency and what students can do with knowledge. Students in engineering design graphics courses performance tasks such as creating technical sketches or solid computer models of parts and instructors must determine how well students can execute tasks aligning with course objectives. The extant literature contains documented changes in the objectives taught in the classes, skills required for industry, and methods of assessing student proficiency in the desired skills. Documented approaches to assessing student performance in engineering design graphics courses are presented and used for further investigation. This study examines the current performance assessment practices utilized in post-secondary introduction to engineering design graphics (EDG) courses.

A survey was developed, distributed, and employed to investigate course performance objectives, the importance of performance assessment, type of work assessed, and performance practices in introductory EDG courses. Responses from current introductory EDG instructors provide insight into current practices and guide a follow-up study that investigates the reliability of current performance assessment methods in introductory EDG courses.

Three example projects of different quality were randomly selected from existing portfolios and stratified by the project grades provided by the original course instructor, were sent to current instructors at other institutions with an existing performance assessment task and assessment instrument. Scores provided by the instructors are analyzed with Kruskal-Wallis and post hoc Dunn's test to determine if there is a difference in the scores given by eight introductory EDG instructors. Inter-rater reliability, project, and type of work are measured to examine the consistency of ratings provided by the participants.

Results of the study are consistent with other investigations of inter-rater reliability for rubrics in engineering design graphics courses and suggest room for improvement in the area of consistency for EDG performance assessments.

Karen Tharrington
Graduate Program: Curriculum and Instruction
Advisor: Kevin Oliver
Poster Number: 182

#Help: The Value of Bringing Pre-Service Teachers into the Fold of Professional Learning Networks with Twitter

With 40% of new teachers leaving within their first five years of teaching (Teague & Swan, 2013), it is essential to provide a level of support necessary for the unique needs of novice teachers, beginning with their pre-service preparation program. Pre-service teachers (PST) need more in-depth experiences to explore the practical side of teaching, yet many World Language teacher education programs have limited opportunities for field experiences. These limitations not only decrease exposure to various pedagogical worldviews, but base the complex theoretical understanding of teaching to one praxis. Twitter has emerged as a platform for virtual Professional Learning Networks for in-service teachers (IST) and studies have shown the positive benefits for Teachers who are members of communities of practice but gaps remain when examining the value these virtual communities have for World Language pre-service teachers. This qualitative case study applies the Value-Creation Framework developed by Wenger, de Laat, and Trayner (2011) to develop a more nuanced understanding of the ways and extent to which a virtual Twitter network provides value for its members through the collection and analysis of personal narratives, value creation stories, and tweet content. The findings from three participants' value creation stories indicate the extent to which value was created across cycles. The overall findings suggest that engaging in a virtual PLN on Twitter, through moderated chats with in-service teachers provides a valuable field experience for World Language pre-service teachers. Results from this study are intended to inform teacher preparation practices of connecting PSTs with ISTs. This research will add to existing literature about PSTs and PLNs, and on using Twitter in higher education; specifically, on connecting World Language PSTs and ISTs to create a more cohesive and relevant experience for World Language pre-service teachers.

Victoria Weber
Graduate Program: Mathematics Education
Advisor: Hollylyne Lee
Poster Number: 193

How Learning Statistical Computing May Impact a Student's Ability to Think and Reason Statistically

How Learning Statistical Computing May Impact a Student's Ability to Think and Reason StatisticallyAs data sets become larger, using the computer to conduct statistical analyses has grown more popular. As such, there is a greater need for students who are studying statistics to learn statistical computing tools. Students are learning how to use the computer to conduct analysis earlier in their statistical careers. As with any technology, this may affect how a student learns the concepts in their field. Through a qualitative study of statistics 2 students with various computing backgrounds, the goal of this research is to determine the affordances and constraints that learning statistical computing has on a student's ability to think and reason statistically. The primary data collection for this project comes from student work while they completed a second course in statistics as well as task-based interviews after completion of the course. Analysis of these data sources is currently being compiled and preliminary results will be presented.

Angela White
Graduate Program: Teacher Education and Learning Sciences, Educational Psychology
Advisor: Jessica DeCuir-Gunby
Poster Number: 194

Understanding the Relationships Between the Racial Identity, Science Identity, and Science Self-efficacy Beliefs of African American Students at HBCUs

For many years now, African American students have underperformed and been underrepresented in science disciplines and fields. Research conducted by the National Science Foundation (NSF) showed that the college graduating class of 2013 consisted of 74.8% White, 8.4% Asian, 7.5% Hispanic, and 7.1% African American (NSF, 2015). The purpose of this study was to investigate various factors that potentially influence the science achievement of African American college students. Additionally, the investigation is situated within the context of historically Black colleges and universities (HBCUs), as they have a disproportionately higher number of African American graduates with science degrees (NSF, 2013; Shorette & Palmer, 2015).

A concurrent nested mixed methods design (QUANT + qual) was utilized to explore the relationships between the racial identity, science identity, and science self-efficacy beliefs of African American college students who attend HBCUs. The study includes biology, chemistry, physics, and pharmaceutical science students (N=400) from five HBCUs located in North Carolina. During the quantitative component, participants responded to questions from three different instruments: Multidimensional Inventory of Black Identity, Science Identity Scale, and a Science Self-Efficacy Scale. Every aspect of this study was viewed through the analytic lens of Critical Race Theory (CRT). Qualitative findings from semi-structured interviews with 15 students enrolled at the various HBCUs have shed light on the perceptions of African American students' lived science experiences at HBCUs, as well as the role of the college context. To this end, Solorzano and Yosso's (2002) approach to composing counter-stories was employed to create counter-stories concerning African American science students at HBCUs. Overall, the elaborated findings from this mixed methods study provide empirical support for recommendations to educators at both HBCUs and predominantly White institutions (PWIs) on how to create environments for African American students that promote the development and interaction of the psychological constructs of interest.

Derek A. Williams
Graduate Program: Mathematics Education
Advisor: Karen Hollebrands
Poster Number: 199

Student Experiences in Community College Precalculus: A Mixed Methods Study of Student Engagement and Understanding

The relationship between student engagement and achievement in mathematics classrooms has been investigated in K-12 settings. Whereby, student engagement has been empirically linked to mathematical growth, academic achievement, and learning. However, the literature lacks studies of student engagement in mathematics classrooms at the undergraduate level, where community college mathematics classrooms are particularly under-represented. Further, calls for research on the effects of teaching on student achievement in undergraduate mathematics are increasingly abundant. This research uses mixed methods and flow theory to describe the nature of student engagement in community college precalculus, characteristics of any relationships between student engagement and understanding of precalculus concepts, and the effects of community college precalculus instructors' teaching approaches on student engagement and the engagement-to-understanding relationship. Fifteen community college instructors and 101 of their students from two community colleges participated in this study during the Fall of 2016. In the beginning of the semester, instructors were interviewed to determine self-reported teaching approach profiles, and students completed an initial demographics survey. Weekly throughout the semester, student participants completed a survey designed to capture indicators (interest, enjoyment, and concentration) and facilitators (e.g., perceptions about their instructor's care for their understanding) of student engagement for each week of the study. In addition to Likert-type items, the weekly survey also prompted students to briefly describe their experiences in precalculus from the previous week as if they were making a social media post. Highly engaged students were observed during three class meetings and participated in two interviews. Preliminary data analysis, quantitative and qualitative, has shown that student engagement varies within- and between-students from week-to-week, and is associated with student perceptions about teaching approaches.

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Graduate Program: Educational Leadership[1], Policy and Human Development[2]
Advisor: Alyssa Rockenbach
Poster Number: 161

Understanding Students' Debt/Loan Experience

This research aims to understand students' decision-making process in taking out federal and/or private loans to finance college. The study conducted interviews with seven graduate and undergraduate students with loans and used phenomenology as the method of inquiry. The analysis is based on the theory of bounded rationality. Findings included the following: a) Students apply to Federal Direct Loans to finance their college program with limited knowledge and resources from institutions, loan servicing contractors and their family. b) Students show minimum concern about payback plans and mainly focus on schools. c) The phenomenon of procrastination and partial naiveté of students is situated in the larger social context whereby student loan servicing contractors are unable to provide standard customer service. d) There is a culture of avoidance in talking about and directly dealing with student loans/debts among students. These findings suggest that higher education institutions should enhance financial education, career counseling and provide intervention to improve the financial literacy of students; student loan servicing companies need enhance their communication with student loan borrowers. Specifically, more consultation for first generation students and students from minority backgrounds can help them better manage their personal finances.

A. S. Alomari, N. Kumar and K.L. Murty
Graduate Program: Department of Nuclear Engineering
Advisor: K.L. Murty
Poster Number: 7

High Temperature Creep Deformation of Alloy 709

To improve efficiency, safety, and reliability of nuclear reactors, Gen-IV reactors are being designed and developed. Sodium Fast Reactor (SFR) is one of the leading Gen-IV reactor concepts that would provide a low-carbon energy option to a diverse U.S. power sources. Nuclear energy releases zero carbon emissions during electricity production, and thus is essential in reducing CO2 emissions from the U.S. power sector. SFR also supports other possible missions, including recycling of used fuel for closing the fuel cycle. Improved structural material performance is one way to improve the economics of SFRs; by increasing thermal efficiency, power output and design lifetimes of the reactor system. Improved performance and reliability of structural materials could also enable greater safety margins and more stable performance over longer times, and reduce down-time of the reactor plant. Hence, there is a need for advanced structural materials with excellent high temperature mechanical properties. Alloy 709 is an austenitic stainless steel with base composition, Fe-20Cr-25Ni. Its high temperature strength, corrosion resistance, thermal stability, sodium compatibility and creep properties relative to Code-approved reference construction materials (304 and 316 stainless steels) make it a preferred candidate material for SFR structural applications. Understanding creep deformation mechanisms of Alloy 709 is essential to link the microstructural evolution with the creep deformation characteristics and to predict its long term creep performance. To that end, uniaxial creep tests of the Alloy 709 are being performed at various temperatures and applied stresses to evaluate the stress exponent and the activation energy, hence, estimate the rate controlling creep mechanisms.

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Youness Alvandi-Tabrizi
Graduate Program: Mechanical Engineering
Advisor: Justin Schwartz
Poster Number: 8

Modeling magnetoelectric coupling in biferroic composite films with patterned interfaces

Magnetoelectric (ME) coupling in biferroic composite films with ferroelectric and ferromagnetic phases enables control of dielectric polarization via magnetic field or switching magnetization via electric field. Of the parameters known to affect the ME coupling is the interfacial connectivity between the constituents. Two common design approaches are based on using vertical interfaces in nano-pillars of one phase embedded in a film matrix of another phase or using horizontal interfaces by depositing alternating layers of each phase. To achieve coupling in the layered structure, the in-plane strain should be utilized which is impacted by clamping imposed by the substrate. The substrate clamping effect hinders the ME coupling in layered structures. By contrast, the coupling in nano-pillar structures uses the out-of-plane strain which is not affected by the substrate clamping. The vertical interfaces in these structures, however, span the entire thickness of the film resulting in current leakage problems. An ideal system thereby would be one containing vertical interfaces that are not continuous in the field direction. A laminated structure with patterned interfaces would serve this purpose. The patterning introduces three-dimensional interfaces, some of which are vertical, consistent with the ideal geometry for ME coupling. The leakage problem is also eliminated because the interfaces are not continuous. The objective of this sturdy is to develop a phase-field model that can be used to analyze the efficacy of such new design in improving the ME coupling. The phase-field model is based on minimizing free energy functional that is obtained from thermodynamic considerations. A multiphysics modeling approach is implemented by coupling micromagnetics, electrostatics, and elastodynamics. The model uses time-dependent Ginzburg-Landau (TDGL) and Landau–Lifshitz–Gilbert (LLG) equations to calculate the temporal and spatial evolution of the dielectric polarization and magnetization, respectively. The role of parameters such as material selection, interfacial patterning, and geometrical configurations is investigated.

Qi An[1], Xiaohu Qian[2], Shu-Cherng Fang[1], Min Huang[2] and Xingwei Wang[2]
Graduate Program: Industrial and Systems Engineering[1], Management, Northeastern University, China[2]
Advisor: Shu-Cherng Fang
Poster Number: 10

Reverse auctions with regret-anticipated bidders

Suppliers may experience emotional/behavioral consequences of anticipated regrets that consist of winner and loser regrets in first- and second-price sealed-bid reverse auctions. Constructing mathematical models that incorporate regret theory to derive closed-form solutions of regret-anticipated suppliers' bid decisions, this paper theoretically examines the effects of anticipated regrets on suppliers' bid prices, buyer's expected procurement cost and auction format decision. Comparing with the no regret scenario, we find that winner regret has adverse effects on the buyer's expected procurement cost in first-price sealed-bid reverse auctions with regret-anticipated suppliers. To mitigate the adverse effects, we propose using the reserve price strategy for the buyer with theoretical analysis and numerical supports. An interesting analysis reveals that as the number of suppliers increases, the optimal reserve price increases or decreases depending on the degree of winner regret is lower or higher than that of loser regret. Also, the classical revenue equivalence theorem no longer holds when the degree of winner regret differs from that of loser regret.

Shireesh Bhat
Graduate Program: Computer Science
Advisors: George N. Rouskas and Rudra Dutta
Poster Number: 24

Bang for the Buck: Choosing the best Network Path(s)

The Internet has made it possible for the world to be connected. The connection is realized by network routers and switches which are responsible for forwarding the packets towards the destination. The Internet is divided into core and edge networks, the core forms the central part of the Internet while the edge comprises the boundary of the Internet. Most of the applications which have made it big sit on the edge of the network but rely on the core networks to be successful. The bulk of the innovation is concentrated on the edge networks, which can be attributed to "Ossification", one of the shortcomings of the Internet architecture which was also recognized by the pioneers who were part of the initial design of the Internet. For innovation in the core of the network two things need to happen. First, it should be possible for the end users to choose the services and the providers anywhere along the Internet. Two, the end users should be free to decide the amount of time they want to use a service while entering into a contract. ChoiceNet was envisioned to solve the time scales for establishing a contract and for the user to be able to choose the Network path. Our research focusses on the later path i.e., choosing among the best Network path(s) based on user preferences. We first model the problem as a graph problem and then employ a suite of shortest path algorithms to come up with these Network path(s). The algorithm comes up with 'K' paths for the user to choose from allowing the user to make the best bang for the buck.

Preston C. Bowes, Jonathon N. Baker, Josh S. Harris and Douglas L. Irving
Graduate Program: Materials Science and Engineering
Advisor: Douglas L. Irving
Poster Number: 31

First-Principles Based Investigation of the Effects of Background Impurities on High Temperature Equilibrium Conductivity in Strontium Titanate

Canonical defect models based on experimentally derived defect reaction parameters have been used extensively to study high temperature equilibrium conductivity (HiTEC) in ceramic SrTiO3 (ST). Due to experimental limitations, such models often attribute the measured behavior to a single dopant despite the presence of several background impurities. In this study, the effects of 8 common background impurities, Si, Fe, Cl, Mg, Ca, Ni, N, and Al, on HiTEC in ST were evaluated. This was accomplished using published carrier mobility data with defect concentrations from a charge balance solver based on the grand canonical ensemble. Defect formation energies for impurity-related point defects were calculated using density functional theory with screened hybrid exchange correlation functionals. These energies were fed into the charge balance solver to calculate defect concentrations as a function of temperature and partial oxygen pressure. The resulting electron, hole, and oxygen vacancy concentrations were used in combination with published mobility data to model conductivity under various conditions. Through explicit simulation of impurity-related defects, the modeled conductivity reflects experimentally observed trends with temperature, doping content, and processing conditions as previously reported for samples with similar impurity content. The results indicate activation energies derived from HiTEC data using the single-dopant assumption may not necessarily correspond to the ionization energy of the assumed isolated defect, and highlight the importance of impurity quantification in studies on the electrical properties of ceramic ST. The authors acknowledge financial support from AFOSR BRI grant FA9550-14-1-0264 and a DoD NDSEG fellowship.

Andrea Brandt, Yue Wen and He (Helen) Huang
Graduate Program: Joint Department of Biomedical Engineering, North Carolina State University and University of North Carolina at Chapel Hill
Advisor: He (Helen) Huang
Poster Number: 33

Quantifying the Functional Use of Robotic Prostheses in People with Transfemoral Amputation

Modern robotic prostheses emulate lower limb muscle function by modulating knee joint stiffness and provide propulsive power to move the amputee user's center of mass forward, enabling transfemoral amputees to ambulate with more natural biomechanics and greater ease. However, the benefits of a robotic knee prosthesis are not only dependent on how the prosthesis is designed and tuned, but also on how much the user trusts and uses the prosthesis. Amputee users must train extensively with the prosthesis to feel comfortable using it during daily activities. Despite similar training protocols across amputee users, we have observed markedly different center-of-mass behavior as people walk with a robotic prosthesis, as well as subjective feedback about the utility of the device. In this study, we aimed to identify the gait strategies and the primary mechanisms that cause these different outcomes with the robotic prosthesis. To that end, we analyzed the ground reaction force characteristics (e.g. impulse) and clinical spatio-temporal gait parameters of 6 transfemoral amputees as they walked with our experimental robotic knee prosthesis. All subjects provided written, informed consent to participate in our IRB-approved study. We have identified 3 distinct gait strategies and ways amputee users have become accustomed to using the robotic knee prosthesis, and step time and phasing between limbs are major contributing factors. Rather than the clinician adjusting settings on a bionic prosthesis and the user adjusting to them, we may be able to also inform the user how to adjust their gait to harness the utility of bionic prostheses with the results from this study.

Gilbert Castillo[1], Jan Genzer[1], Kirill Efimenko[1], Michael Dickey[1] and Christopher Gorman[2]
Graduate Programs: Chemical and Biomedical Engineering[1], Chemistry[2]
Advisors: Jan Genzer and Michael Dickey
Poster Number: 38

Functional Silicate Coatings for Polyesters

The ability to modify the surface of PET in controllable fashion is an important asset to alter surface energy, improve chemical inertness, induce surface cross-linking, increase or decrease surface roughness and hardness, enhance surface lubricity and electrical conductivity, impart functional groups at the surface for specific interactions with other functional groups, and/or provide anti-fouling properties. The addition of reactive functional groups to PET surfaces can serve as a means of generating anchoring points for grafting materials onto the PET surface, which can be utilized to tune its surface characteristics further. Surface modification of PET aims to take advantage of its inherent mechanical and optical properties, and its malleability while retaining its low cost and ease of manufacturing.

We show that PET surfaces react with 3-aminopropyltriethoxysilane in aqueous solutions, and the reaction is much slower in other solvents (alcohols, tetrahydrofuran, and toluene). The procedure described here creates a uniform coverage of hydrolyzed APTES layer on PET surfaces as shown by thickness measurements and ToF-SIMS imaging, which has a lateral resolution of 60 nm. Water is an attractive solvent as it is non-flammable, non-toxic, and inexpensive, and thus makes this process suitable for scale-up. The formation of islands or cross-linked APTES aggregates was not observed either in AFM images or ToF-SIMS images. Furthermore, the described procedure should also apply to polyester fibers.

The activation of PET with APTES followed by silicate films deposition serves as a platform to endow the surface with various functionalities by taking advantage of excess hydroxyl moieties present on the surface. These surface functionalities include (but are not limited to) (1) biocidal, anti-fouling, hydrophilic coatings for biomedical applications; (2) biocidal and anti-fouling finishes for filtering applications; and (3) hydrophobic surfaces for self-cleaning applications.

Chih-Wei Chang
Graduate Program: Nuclear Engineering
Advisor: Nam Dinh
Poster Number: 41

PDE-Constrained Forward Predictions for Two-Phase Flow Simulation Using Deep Learning-Based Closures

The closure model is essential while solving the system-level fluid dynamics problems. Traditionally, the model form of the closure model has to be known, and then we calibrate the model thorough experiment data. This process limits the speed of model development processes while dealing with a newly designed system. Since the model is the data in the compact form, it is possible to discover the pattern through experiment data by the modern machine learning technology. Deep learning (DL) is a relatively new branch of the machine learning family, and a breakthrough has been achieved since Hinton introduces a fast algorithm to efficiently train a feedforward neural network (NN) with multilayer perceptrons. Any NN with more than two layers belongs to DL, and it contains lots of hyperparameters to achieve pattern recognition or regression for complex datasets. Hornik shows that multilayer NN is compatible with universal approximation theorem. There is no constraint for a multilayer NN to achieve capturing the properties of any measurable information. This capability makes DL attractive to develop data-driven modeling for fluid dynamics. The so-called data-driven modeling relaxes the structure of hydraulics system codes to assimilate data instead of limiting to a hardwire-precalibrated correlation. The previous work of fluid dynamics machine learning focuses on statistical learning with basic NN from direct numerical simulations (DNS) dataset. In this work, we demonstrate that a two-phase mixture model with DL-based closure models has adaptive model forms based on observations. This feature potentially improves the uncertainty for new system designs and system conditions. In the meanwhile, we propose the physics-informed deep learning (PIDL) strategy to regularize the DL-based fluid closure by physics to improve its applicability for analyzing nuclear system thermal-hydraulics.

Jonathan Coburn
Graduate Program: Nuclear Engineering
Advisor: Mohamed Bourham
Poster Number: 45

Ablation of Tungsten-Alternative Plasma-Facing Components due to Edge Localized Modes (ELMs) and Disruptions

Plasma-facing components (PFCs) in large fusion reactors like ITER will be subjected to high heat fluxes during ELMs, thermal quench phases and severe hard disruptions. Evaluating the erosive behavior of these PFCs under physical and simulated disruption conditions is important for improving both reactor lifetime and performance. Innovative materials are investigated using a simulated electrothermal (ET) plasma to characterize erosion behavior under ITER-relevant off-normal conditions. The simulations use the ETFLOW ET plasma code developed at NCSU, and the tungsten alternatives evaluated are mono-crystalline silicon carbides and MAX Phase ceramics. Results indicate that erosion properties for SiC and two commercially available MAX Phases, Ti3SiC2 and Ti2AlC, compare well with tungsten and other ITER materials in ablation-dominated erosion regimes. A material-specific ablation constant, measured as total mass removed per incident heat flux per second, relates to a material's sublimation energy and allows for direct comparison of erosion properties. The ablation thickness, calculated from the ablation constant and the specific density of the material, provides a comparison of surface thickness lost during a given off-normal event. Carbon (4.25 cm3/MJ) and tungsten (5.98 cm3/MJ) possess the lowest values. The alternative materials Ti3SiC2 (7.32 cm3/MJ) and α-6H SiC (8.44 cm3/MJ) exhibit the next best values, with Ti2AlC being the least effective (9.35 cm3/MJ). Taking into account vapor shielding effects using both opacity and fractional models, SiC exhibits the best ablation characteristics of the three alternative materials in terms of thickness loss, with Ti3SiC2 giving similar results. Planning is underway for complementary experiments on the DIII-D fusion facility as well as an ET experiment at Oak Ridge National Laboratory, examining erosion rates for W, silicon carbide, and the MAX phases in a sputtering-dominated erosion regime; any preliminary results completed before the symposium will be presented.

Konor Frick
Graduate Program: Nuclear Engineering
Advisors: J. Michael Doster
Poster Number: 64

Coupling and Design of a Thermal Energy Storage System for Small Modular Reactors

The contribution of intermittent (renewable) energy sources such as wind and solar continues to increase as renewables improve in both efficiency and price-point. However, the variability of renewables generates additional challenges for the electric grid in the form of rapidly varying electric loads. Proposed options for accommodating this load in the nuclear industry have included operating nuclear reactors in a load follow mode, or operating the reactor at or near steady state and bypassing steam directly to the condenser. Both of these strategies result in lost energy potential. In addition to lost energy potential, load follow operation can result in increased stress on the fuel and other mechanical components. A more attractive approach is to operate the reactor at or near steady state and bypass excess steam to a thermal energy storage system. The thermal energy can then be recovered, either for electric generation during periods of peak electric demand, or for use in ancillary applications such as desalination and hydrogen production. Sensible Heat Thermal Energy Storage is a mature technology currently used in solar energy systems. This research demonstrates the feasibility of using such a system coupled to Small Modular Reactors to minimize power swings during periods of variable electric load. To study the transient behavior of these systems, high fidelity simulation models have been developed in FORTRAN. The modeling and simulation of an mPower sized reactor coupled to a sensible heat storage system has shown excess thermal energy can be stored during periods of low demand while maintaining reactor power constant. Thus, with the implementation of a TES system, decreases in capacity factor and increased stresses on plant components associated with load follow operation can be minimized, improving economic return over the lifespan of the reactor.

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Advisors: Michael Dickey and Jan Genzer
Poster Number: 80

Curvature of Light Responsive, Shape Memory Polymers for the Production of Biologically-Inspired, Functional Devices

Folding and bending are common phenomena found in nature, prominent in the formation of structures ranging from plants to proteins. By harnessing the potential of man-made materials, self-folding structures have applications in everything from biomedical engineering to transportation methods. This work takes inspiration from nature to design thermoplastic structures that mimic natural systems through the generation and control of self-automated folds and global curvature. By increasing the complexity of possible designs, we can have a greater impact and generate final structures with a wider range of overall applications. We induce self-actuation into our materials by patterning pre-strained polystyrene films with ink from an inkjet printer. The polystyrene sheets are pre-strained to shrink by ~ 55% when heated above their activation temperature (Ta ~ Tg) which is ~ 103°C. By patterning inked regions along the surface of the material localized heating, and therefore shrinkage, is achieved via strain gradients through the thickness of the material. The design of these inked regions (i.e., ink darkness and distribution) determines the direction of folding, onset actuation time, and final structure. These results are compared with finite element modeling as a predictive tool. An indirect and direct mechanism of curvature were identified and systematically studied with our self-actuated polystyrene material. This global curvature is useful for the production of positive and negative Gaussian curvature from planar polymer sheets. The degree of curvature is directly related to the ink distribution and darkness of each sample as well as the aspect ratio and geometry of the starting substrates. Experimental and computational results were quantitatively and qualitatively compared with excellent agreement for the production of biologically-inspired gripping devices with the ability to hold ~ 5,000x their own weight.

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Advisor: Rohan A. Shirwaiker
Poster Number: 82

Effect of 3D-Bioplotted Scaffold Interstrand Spacing on Fiber Alignment and Elastic Modulus of Cell-Secreted Extracellular Matrix In vivo

Musculoskeletal soft tissues such as the knee meniscus and ligaments/tendons typically feature a fibrous extracellular matrix (ECM) composed of highly aligned collagen networks that dictate their structural and mechanical anisotropy. Replicating this native ECM organization is a critical consideration in 3D tissue engineering and regenerative medicine approaches. In this study, we investigated the ability of 3D-Bioplotted polycaprolactone scaffolds with varying interstrand spacing to guide the formation of aligned ECM in vivo. 3D-bioplotted scaffolds (Ø 7.5 x 5 mm) with strand Ø 200 μm and 100 μm or 400 μm interstrand spacing designs (112 ± 24 μm and 408 ± 30 μm, respectively, post-fabrication) were implanted subcutaneously in a rat model for 12 weeks and assessed for induced collagen fiber alignment level and ECM compressive stiffness (n = 3 scaffolds/design). Following harvest, one half of each scaffold was fixed in paraformaldehyde, sectioned, and stained with picrosirius red to analyze the organization of collagen networks, while the other half was used for the biomechanical characterization. Bright field images confirmed complete cellular infiltration and ECM formation in scaffolds of both designs. ImageJ analyses of polarized light images of stained sections indicated the 100 μm design to possess a higher percent pore area featuring aligned collagen fibers (61.8 ± 22.9 %) in comparison to the 400 μm design (46.4 ± 24.6 %). Similarly, compressive moduli determined via atomic force microscopy by fitting a Hertzian model to force vs. indentation curves indicated a significantly higher stiffness in the ECM formed along the 100 μm interstrand channels (8.54 ± 5.24 MPa) when compared to the ECM in the 400 μm channels (2.44 ± 1.46 MPa) ($p < 0.05$). These findings demonstrate the ability of 3D-bioplotted scaffolds with narrower interstrand spacing to guide the formation of aligned and stiffer fibrous engineered tissue.

Sabina Islam
Graduate Program: Department of Chemical and Biomolecular Engineering
Advisor: Orlin D. Velev
Poster Number: 85

Structural Colors: From Butterfly Wings to Polymer Films

Aromatic polyesters are one of the most important classes of polymers in textile and packaging industries due to their superior mechanical, optical, and processing properties. In order to comply with the low-VOC movement, such specialty polyesters were rendered water-dispersible by functionalizing the polymer backbone with ionic monomers. As a result of being partially soluble, these polyesters forms self-assembled nanoscale particles in water without the requirement of any additional stabilizer(s). These extremely small sized (~20 nm) nanoparticles are composed of hundreds of polymer molecules and offer various colloidal and morphological properties that are significantly different from the conventional emulsion polymerized latex particles. For instance, their nanometer dimensions can be very useful for developing nanocoatings with interesting optical properties such as structural colors.

Structural colors of purely physical origin are gaining a lot of interest in industries and academia due to numerous benefits over pigment-based colors, such as more vibrant color formation, resistance to photobleaching, and environment-friendly as no toxic chemical is required. We fabricated nanofilms of brilliant colors using these polymer dispersions via facile convective deposition method. The microscale thickness of these nanofilms was correlated to their macroscale optical properties via the constructive interference theory. Additionally, surface roughness modulation of these nanocoatings allowed us to obtain thin-film interference on both macro- and micro-level. Moreover, we observed coffee-ring effect as the addition of water droplets on such thin-films created multiple colorful ring-patterns where surfactants or electrolytes suppressed this effect. This research is important in understanding the fundamental mechanism of film formation by these polymer nanoparticles. Moreover, the findings of our study open a new possibility and application of such environment-friendly waterborne dispersions in painting, photonic paper, and optical displays.

Md Ashfanoor Kabir
Graduate Program: Electrical Engineering
Advisor: Iqbal Husain
Poster Number: 101

Multilayer AC Winding: Electric Machine Design Approach for Improved Efficiency

Electric motors are the most important type of industrial loads accounting for approximately 70% of industrial electricity. Ensuring significant reductions in global energy consumption and reducing the environmental impact, high efficiency motors are of prime importance for government and industrial sectors. Premium/IE3 efficiency class motors are mandatory in North America since 2011 and Super-premium/IE4 and Ultra-premium/IE5 efficiency classes are also established in the second edition of IEC (International Electrotechnical Committee) 60034-30 standard. This research focuses on high performance alternatives to induction motors (IMs) that dominates the electric motor market (87% market share). IM loss distribution for different power levels reveals its stator conduction losses to be dominant with conventional double layer distributed winding (DLDW) designs with large end-winding lengths. Existing literatures investigated the concentrated wound (CW) alternatives that reduces stator conduction losses but degrades other motor performances (lower power factor, higher induced losses, and higher torque ripple). Alternative multilayer concentrated and fractional pitch windings are presented but these designs suffers from more leakage flux, lower power factor and higher torque ripple. This research presents a new multilayer winding (MLW) concept for AC machines that has shorter end-winding length to reduce stator conduction losses and also provides a high quality rotating MMF with reduced stator MMF harmonics. Performance of the designed winding is evaluated using both finite element analysis (FEA) based simulations and experiments against a commercially available premium/IE3 efficiency class induction machine to show that the designed machine attain higher torque density and efficiency compared its benchmark. This new winding configuration can be a technology trend in gaining efficiency improvement with low cost non-PM designs under the standard frame sizes.

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Advisor: Joseph B. Tracy
Poster Number: 113

Synthesis and Chemical Transformation of Ni Nanoparticles Embedded in Silica

Ni nanoparticles (NPs) are commonly used as catalysts in many different chemical reactions, including dry methane reforming, the oxygen evolution reaction, and the Suzuki coupling reaction. However, in many of these reactions, the Ni catalyst becomes contaminated or decomposes in a short period of time, resulting in high material and labor costs. Therefore, there is a need to develop new Ni NP catalysts with improved durability. Recently, many have investigated the deposition of silica (SiO2) onto inorganic NPs and have found significantly improved chemical, optical, and thermal stability of the composite NPs. Additionally, if a porous SiO2 shell was deposited onto a NP, it provided some protection of the NP cores, while also allowing the reactants to have contact with the NP.

The objectives of this study were to deposit SiO2 overcoatings onto Ni NPs and to analyze chemical and structural transformations of the composite NPs. During the deposition of SiO2 in a reverse microemulsion, 27 nm Ni NPs were etched into many smaller NPs with diameters of ~2 nm and distributed throughout 31 nm porous SiO2 NPs. Etching of the Ni NPs can be attributed to the use of NH4OH as a base catalyst for deposition of SiO2 from tetraethyl orthosilicate (TEOS). The stability of SiO2-Ni NPs was also studied under high temperature oxidizing and reducing environments as applications in catalysis often utilize these high-temperature environments. The structure of the SiO2-Ni NPs remained significantly unchanged after both oxidation and reduction, which suggests structural durability when used for catalysis. The synthetic approach of etching using NH4OH is also potentially applicable to other catalytically active core NP materials.

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Advisors: Alper Bozkurt and Tushar K. Ghosh
Poster Number: 118

Multi-Modal Sensors for Monitoring the Prosthetic Socket Environment

Amputees using socket-based prosthetics may experience discomfort, swelling, and pressure sores due to changes in limb shape over time. High-density sensing across the surface of the prosthetic socket liner could enable better understanding of the physiological effects of normal pressure, shear forces, wetness and temperature on an amputated limb. A major challenge for sensing in the prosthetic socket environment is that sensors must conform to the curved surfaces of the socket liner without adversely affecting comfort and breathability. By combining low-cost textile fabrication strategies in conjunction with polymeric conductive materials, we have produced flexible multi-modal fiber-based sensors that can be conformally integrated with the curved surface of the prosthetic socket liner for long-term monitoring of the socket environment. We have characterized and modeled 3D-printed silicone fibers capable of array-based sensing. These sensors have demonstrated wetness and pressure detection capabilities. We have also produced screen-printable tattoo-based sensors capable of being adhered to the socket liner for sensing normal and shear forces. We are currently characterizing sensing fibers produced using conventional fiber melt extrusion techniques for future integrations of sensors directly into a textile-based socket liner.

Russell Meredith
Graduate Program: Computer Science
Advisor: Douglas Reeves
Poster Number: 121

Increasing Network Resilience: The First Step Towards OSPF Attack Prevention and Recovery

Networked systems are under constant attack and, inevitably, they will be compromised. Therefore planning for recovery is essential. To date, there has been only minimal research on network-related recovery techniques from malicious attack, none of which are solely designed to recover the network and/or its protocols. It is imperative to have a system in place to recover the network from malicious attacks, because the cost, both financial and in terms of data loss of not preparing for recovery; far outweigh any additional costs spent preparing for recovery. We demonstrate that by slightly increasing resilience through the use of available techniques, we are able to add a significant amount of resilience to the network providing more time and opportunities for the inside threat to be recognized while simultaneously freeing up analysts to focus on the attack.

Amit Mishra[1]
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Advisor: Fanxing Li and Erik Santiso
Poster Number: 123

Perovskite Structured Oxygen Carriers for Chemical Looping Combustion and Reforming of Fossil Fuels

Methane is one of the most abundant organic compound on earth. Methane reforming offers versatility to produce value-added fuels/chemicals. Unlike typical methane reforming processes, which suffer from efficiency losses associated with endothermic reforming reactions and/or oxygen/steam generation, the chemical looping reforming (CLR) process utilizes redox properties of a redox catalyst, to partially oxidize methane into syngas with its lattice oxygen. The reduced redox catalyst is subsequently regenerated with air in a separate reactor, providing in-situ air separation. CLR performance process is highly dependent upon the redox catalyst. Perovskites offer many unique properties including high ionic oxygen (O2-) mobility, structural stability, and tunable redox properties. In the current study, CLR performances and underlying mechanisms for perovskite-structured redox catalysts , AMnxB1-xO3 (A = Ca or Ba; B = Fe or Ni), are reported. CaMnO3 and BaMnO3 perovskites are worth investigating due to their desirable redox properties and relatively low cost. BaMnxB1-xO3 (B = Fe or Ni) are shown to be more selective and coke-resistant for methane partial oxidation when compared to CaMnxB1-xO3 (B = Fe or Ni) based redox catalysts. While undoped BaMnO3 also exhibited high selectivity towards syngas, addition of B-site dopants such as Ni or Fe leads to higher oxygen carrying capacity without significantly impacting coke-resistance of the redox catalysts. In contrast, nickel doped CaMnO3 is significantly more prone to coke formation. As a low cost and environmentally benign option, a BaMnxFe1-xO3 based redox catalyst was tested for CLR operations in a fluidized bed reactor. > 95% syngas selectivity was observed with no signs of deactivation over 20 cycles.

James B. Mitchell, William C. Lo and Veronica Augustyn
Graduate Program: Materials Science and Engineering
Advisor: Veronica Augustyn
Poster Number: 124

Hydrated WO^3 for High-Power, High-Energy Density Electrochemical Capacitors

Electrochemical capacitors with high-power, high-energy density storage are essential for power delivery systems utilized in electric vehicles, portable electronics, and power grid storage. This research investigates the role of interlayer structural water in bulk, layered WO3 for high power and high-areal capacitance pseudocapacitive energy storage. Structural water in bulk, hydrated oxides exists as a 2-D, liquid-like layer that could lead to enhanced interfacial charge transfer and solid-state ion transport for high-power applications. The use of bulk hydrated oxides and high mass loadings could result in high areal capacitance, which is an important metric for energy-storage device applications. Hydrated WO3, WO3•2H2O, was synthesized via precipitation of a tungstate salt in acid, and the structural water content was further controlled through thermal dehydration to yield WO3. Morphology and structure of the obtained materials were characterized through electron microscopy, X-ray diffraction, X-ray photoelectron spectroscopy, and Raman spectroscopy. Electrochemical characterization was performed with slurry-cast electrodes and high mass loadings (> 4 mg cm-2) using three-electrode cyclic voltammetry at sweep rates from 1 to 200 mV s-1. These results show that hydrated WO3 exhibits excellent capacity retention, and more importantly, improved energy efficiency at high rates compared to the anhydrous material. The excellent high rate capability of hydrated WO3 is attributed to the presence of interlayer structural water and a semiconductor-to-metal transition upon proton intercalation. Overall, the results present a new design strategy for high-power, high-energy density storage based on bulk hydrated transition metal oxides.

Mostafa Namian
Graduate Program: Civil, Construction, and Environmental Engineering
Advisor: Alex Albert
Poster Number: 132

Key Factors in Improving Hazard-Recognition Performance and Safety Risk Perception Among Construction Workers

Despite efforts to reduce construction injury rates, the industry still suffers from a disproportionate number of fatal and non-fatal injuries. However, past research has shown that most accidents in construction are preventable if effective safety measures are implemented. Among accident causal factors, hazard recognition ability and the safety risk perception of workers have received much recent attention. Recent investigations have found that a significant number of hazards remain unrecognized in dynamic work environments and workers widely underestimated safety risk in their workplaces. Our research effort began with an exploratory phase where the objective was to identify key factors that influence hazard recognition and safety risk perception. In the first phase, we identified 37 factors that were expected to be predictive of hazard recognition and safety risk perception using an extensive literature review and input from expert safety professionals. Our findings suggested that safety training and workplace distractions are particularly influential factors. In the subsequent second phase, we gathered empirical data from 51 active projects across the United States to evaluate the impact of safety training method (i.e. low-engagement and high-engagement) on hazard recognition and safety risk perception. Similarly, to examine the impact of distraction, we conducted experimental studies with 60 construction workers. The results revealed that high-engagement training methods enhance both hazard recognition performance and safety risk perception in practice. Our findings also indicated that the presence of distractions could negatively impact hazard recognition levels, but did not explain the variability in safety risk perception. The results of this research will be useful to safety professionals that seek to improve hazard recognition, safety risk perception, and safety performance in general within construction.

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Advisor: Rohan A. Shirwaiker
Poster Number: 133

3D-Bioprinting of Nanofiber-Alginate-hASCBioink for Fibrous Musculoskeletal Tissue Engineering

Bioinks play a central role in 3D-bioprinting by providing the supporting environment within which encapsulated cells can endure the stresses encountered during the digitally-driven fabrication process, and continue to mature, proliferate, and eventually form extracellular matrix (ECM). In order to be most effective, it is important that bioprinted constructs recapitulate the native tissue milieu as closely as possible. As such, musculoskeletal soft tissue constructs can benefit from bioinks that mimic their nanofibrous matrix constitution, which is also critical to their function. This study focuses on the development and proof-of-concept assessment of a fibrous bioink composed of alginate hydrogel, polylactic acid nanofibers and human adipose-derived stem cells (hASC) for bioprinting such tissue constructs. First, hASC proliferation and viability were assessed in 3D-bioplotted strands over 16 days in vitro. Then, a human medial knee meniscus digitally modelled using magnetic resonance images was bioprinted and evaluated over 8 weeks in vitro. Results show that the nanofiber-reinforced bioink allowed higher levels of cell proliferation within bioprinted strands, with a peak at day 7, while still maintaining a vast majority of viable cells at day 16. The cell metabolic activity on day 7 was 28.5% higher in this bioink compared to the bioink without nanofibers. Histology of the bioprinted meniscus at both 4 and 8 weeks showed 54% and 147% higher cell density, respectively, in external versus internal regions of the construct. Presence of collagen and proteoglycans was also noted in areas surrounding the hASC, indicating ECM secretion and chondrogenic differentiation. We also propose a method of aligning these nanofibers and cells using acoustic energy, to facilitate bioprinting of tissue requiring directional alignment of secreted ECM.

Ellen M. O'Brien[1], J.M. Doster[1], J.W. Engle[2], F.M. Nortier[2], E.R. Olivas[2], J. Peeples[3], M. Stokely[3] and I.A. Bolotnov[1]
Graduate Programs/Institutions: Department of Nuclear Engineering, North Carolina State University[1], Los Alamos National Laboratory[2], BTI Targetry, LLC[3]
Advisor: J.M. Doster
Poster Number: 135

Multi-Physics Coupling to Model a RbCl-RbCl-Ga Target Stack

A computational model has been developed to simulate the performance of the Los Alamos Isotope Production Facility's (IPF) routine production target configuration, which consists of two inconel-encapsulated RbCl salt targets and one niobium-encapsulated gallium target separated by water cooling channels. The methodology involves iteratively coupling particle transport and thermal hydraulic codes to determine the time dependent behavior of the target. Thermal hydraulic modeling, including computational fluid dynamics (CFD) and heat transfer, was performed with ANSYS CFX while particle transport was performed with the Monte Carlo N-Particle code (MCNP). Phase and density changes seen in targets are known to impact beam penetration and distribution. In addition, evidence of energy distributions seen in experimental radionuclide yield measurements at IPF do not match those seen in previous MCNP predictions. Density reduction as a result of heat deposition affects proton energy loss along the particle's track, impacting both radionuclide yields and target design. Accurate modeling of the thermal behavior of these multi-phase targets and the corresponding impact on beam behavior will significantly improve understanding of incident and exit proton energy distributions and resulting radionuclide yields in downstream targets. Computational results thus far have yielded predicted physical and thermal hydraulic behavior in targets and it is hypothesized that these models can be used to predict performance of operating targets in the future.

Ryan O'Mara and Dr. Robert Hayes
Graduate Program: Nuclear Engineering
Advisor: Robert Hayes
Poster Number: 136

Retrospective Radiation Field Energy Determination From Dose Depth Profiles in Bricks

Nuclear safeguards and nonproliferation initiatives are integral to the advancement of peaceful uses of nuclear technology. The tools currently available for safeguarding nuclear technology all require information relating to the nuclear material of interest. However, there are many cases in which this information may be unavailable or continuity of knowledge about the material may have been lost. In many of these cases, the optimal safeguards tool is one that does not require direct access to nuclear material. In this regime, thermally and optically stimulated luminescence offers unparalleled possibilities for retrospective characterization of nuclear material, with no trace of the source material necessary. The present work and results will demonstrate this technique's potential for discriminating the energy of radiations from different sources. By measuring the dose, in bricks, as a function depth into the brick it should be possible to determine the energy of the incident radiation, within some margin of error. Preliminary investigations have shown that it is possible to measure basic energy discrimination from dose depth profiles in brick. These will build upon that foundation by determining the expected energy resolution for such studies. Once the potential resolving power has been defined, it will be possible to determine the applicability of this technique to solving other nuclear security problems. One of the key potential applications could be retrospective isotopic reconstruction of nuclear sources. With further investigation, it may be possible to determine the enrichment of UF6 after the material has left a facility or even the historical burnup and possibly initial enrichment of spent fuel from materials retrieved at a spent fuel cooling pool.

Dishit P. Parekh[1], Collin Ladd[1], Vivek Bharambe[2], Lazar Panich[1], Jeffery Redpath[1], Jacob J. Adams[2] and Michael D. Dickey[1]
Graduate Programs: Chemical and Biomolecular Engineering[1], Electrical and Computer Engineering[2]
Advisor: Professor Michael D. Dickey
Poster Number: 138

3D Printing of Functional Microfluidics & Soft Electronics via Direct-Writing of Liquid Metals

In 2014, TIME Magazine heralded 3D printing as one of the 25 best inventions of all-time signifying that it can lead to a decentralized and highly customizable manufacturing technique in the future. Polymers are the most common materials to be printed today due to the simplicity of extruding them in molten form that quickly cools and hence solidifies. However, there is a great demand for printing conductors to fabricate electronic components such as stretchable antennas and smart sensors conformal to human body for defense communication and biomonitoring applications. Current methods for printing metals are prohibitively expensive and use energy-intensive lasers at high temperatures (> 800°C) – making it incompatible to co-print with polymeric and biological materials. In addition, the techniques need vacuum-like pressures to avoid corrosion, can lead to high porosity and poor electrical conductivity in finished parts, apart from having slow printing speeds. Here, we present a novel yet simple approach that utilizes gallium-based low melting point alloys as complements to existing materials for 3D printing electronics at room temperature. These alloys offer the electrical and thermal benefits of metals like gallium and indium, combined with the ease of printing due to its low viscosity and the presence of a thin (~3 nm) but mechanically stable surface oxide skin. The skin is passivating and forms spontaneously allowing us to direct-write planar and free-standing microstructures down to a resolution of ~10 microns, using a pneumatic dispensing robot at relatively low pressures. Using these printed liquid metals as a sacrificial template, we can pattern 3D multilayered microchannels with vasculature at room-temperature, that can be employed in numerous lab-on-a-chip devices enabling inexpensive fabrication of personalized healthcare sensors. Finally, we have demonstrated the rapid prototyping of soft electronics such as flexible & stretchable antennas and wearable thermoelectric generators for communication and energy-harvesting applications.

Brett Pearce
Graduate Program: Aerospace Engineering
Advisor: Larry Silkenberg
Poster Number: 142

Autonomous Aerobatics: A Linear Algorithm and Implementation for a Slow Roll

Advances in Unmanned Combat Aerial Vehicles (UCAV) have allowed for further use of drones on the battlefield, but to date they have not been implemented in fighters due the complexity of executing the maneuvers required. The typical control approach used in an aviation application breaks down in aerobatic flight due to the nonlinearities in aerodynamics, control response, control inputs required, and the changing aircraft attitudes beyond which a linearized approximation can be applied. The importance of this capability is to form the basis for desired future unmanned fighter aircraft for dogfighting, low level penetration with extreme maneuvering for bombing targets, escape and evasion from missiles, and “jinking” for avoiding ground to air gunfire. This flying is collectively known as Basic Fighter Maneuvers (BFM, the basis of dog fighting and maneuvering). BFM is fundamentally composed of aerobatics, and aerobatics itself is fundamentally composed of a few basic maneuvers. A slow roll is one of three primary fundamental maneuvers, and the objective of this research is to implement an algorithm capable of flying a slow roll. A concurrent objective is to design, fabricate, and test flight a suitable airframe capable of performing in such an extreme envelope, and implementing the necessary routines in an off the shelf autopilot. The algorithm is based upon methods utilized by the author that are taught to flight students as a Certificated Flight Instructor. A robust hyper-maneuverable airframe was constructed as a test vehicle, with the flight controls implemented on an APM Autopilot with a software bridge to MATLAB. The algorithm will be tested by having a fly-off between the airframe and full-sized aerobatic aircraft with pilots, with the maneuvers judged on a standard criteria from the International Aerobatics Club. The scores of the algorithm will be compared against human pilots to give an assessment algorithm quality.

Farhad Yousefi Rad and Michael Elwardany
Graduate Program: Civil Engineering
Advisors: Richard Kim and Cassie Castorena
Poster Number: 54

Accelerated Aging Procedure for Asphalt Concrete Performance Prediction

Aging has long been recognized as a major distress mechanism for asphalt concrete and, by extension, asphalt pavements. Aging causes the material to stiffen and embrittle, which leads to a high potential for cracking. Although a significant amount of effort has been placed on understanding the aging process of asphalt binder, less effort has been put forth to develop laboratory aging procedures for producing aged mixture specimens for performance testing. An optimal laboratory conditioning procedure to simulate long-term aging for performance testing and prediction is required in order to integrate the effects of long-term aging in pavement prediction models and other mechanistic design and analysis methods. In this study, oven-aged asphalt material in the laboratory and material collected from asphalt pavements were evaluated. Effect of oxidative aging on chemistry and rheology of asphalt binder was linked to the mechanical performance of the asphalt concrete. Then, the material characteristics were used as inputs into pavement structural models to simulate traffic and climate. The simulation predicts critical distresses and evaluates life cycle cost analysis of the pavement. In order to validate and calibrate the predictive models, predicted distresses from the simulation were compared against field distress surveys. Data shows that the proposed framework can provide the capability to better predict the long-term performance of pavements which will improve asphalt mixture and pavement structural design procedures to enhance ride quality and save taxpayers' money.

Farhan Rahman
Graduate Program: Civil, Construction and Environmental Engineering
Advisors: Tasnim Hassan and Gracious Ngaile
Poster Number: 149

Development of a novel multiaxial-miniature-testing-system and multi-scale modeling for extrapolation of test data to continuum scale

Cases where material testing of miniature specimen is important can be broadly classified into two categories: one, when a component is of small size itself (e.g., micro-electrical-mechanical-systems), and two, when limited amount of materials are available for testing (e.g., alloy development, life prediction of critical components). In either case, it is important to perform tests under realistic (multiaxial) loading conditions at various temperatures to extract meaningful results. Moreover, to perform in-situ testing within scanning electron or optical microscope (SEM or OM), the test system itself has to be miniature (smaller than 300mmx100mmx50mm). Such a miniature test system is yet to be commercially available and scarce in literature. One of the primary objectives of my PhD dissertation research, sponsored by the National Science Foundation, is to develop a miniature multiaxial testing system (MMTS) with the capabilities of axial, torsional and pressure loading at elevated temperature within a SEM or OM. Due to small sample size, a high temperature, 3D digital image correlation, called VIC-Gauge 3D, will be incorporated for strain measurement. Development of MMTS is especially challenging because all of its components needed to be vacuum compatible for SEM use. The MMTS under development will use tubular specimens with 1 mm outer diameter and a minimum of 0.05 mm (50 μm) wall thickness. Data derived from such miniature specimens, with only two to three grains across the tubular wall, will not provide continuum-scale material properties and fatigue life of macro specimens. Hence, in this research multi-scale material modeling will be implemented to extrapolate miniature specimen material properties to continuum/macro material properties. SEM compatible loading frame with its specialized components: miniature gripper and multiaxial load cell has been designed and fabricated. Initial tensile and high temperature bulging tests indicate successful performance of the different components of MMTS.

Henry Ricca, Dr. Jason Patskoski and Dr. Kumar Mahinthakumar
Graduate Program: Civil and Environmental Engineering
Advisors: Kumar Mahinthakumar and Jason Patskoski
Poster Number: 153

Reducing Error in Water Distribution Network Simulations through Boundary Condition Forcings Using Field Measurements

Reduction of error in water distribution network models leads to simulations that are more representative of actual network conditions and allows for more effective experimentation and realistic system responses. This study attempts to quantify the reduction in model error when considering demand uncertainty by modeling a sub-area of a full water distribution network and enforcing observed head conditions at the boundaries, observed tank elevations, and observed total flow. Forcing the head at the isolated section boundaries with real field measurements reduces the model error due to demand and network input uncertainties outside of the isolated section. Similarly, head boundary conditions can be fixed at all tanks by setting tank levels to the observed levels. Although there is uncertainty in individual demands, demand uncertainty can be reduced by matching the total network flow. The reduction in model error is determined by comparing the modeled pressures obtained by the modeling software EPANET for the full network models and sub-area models to actual network pressures in the section of interest with demand uncertainty. Preliminary results show that at most nodes, pressures simulated by the sub-network model with tank levels, controls, and volume matched to observed values had less error than pressures simulated by the full network model. However, the improvement is reduced in nodes hydraulically distant from the boundary. Results will be analyzed to find further spatial and temporal trends. This illustrates that model error can be reduced by modeling with forced field observed boundary conditions. Models with reduced error can aid water utility managers in decision making related to daily planning and operations, emergency response, energy management, and network repair scheduling, and also improve leak detection and planning for future network expansions and demand increases.

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Advisor: Salah M. Bedair
Poster Number: 164

InGaAsP/InGaP Quantum Well Solar Cells with Improved Sub-bandgap Quantum Efficiency and Optically Enhanced Voltages

Multijunction solar cells are the most efficient photovoltaic technology nowadays with efficiencies approaching 46% using four-junction inverted metamorphic and wafer-bonded structures. In order to achieve efficiencies exceeding 50%, next generation photovoltaic devices will include five and six junction subcells, thus motivating more design flexibility in exploring junctions with optimal bandgaps. InGaAsP/InGaP quantum well (QW) structure is a potential candidate for subcells in next generation multijunction solar cells because of its tunable bandgap and being aluminum-free. Despite this potential, InGaAsP/InGaP quantum wells suffers from poor light absorption in the quantum well region, resulting in sub-bandgap quantum efficiency of less than 30% and poor open circuit voltages.

In this work, we report on the development of enhanced InGaAsP/InGaP superlattice solar cell with improved peak values of external quantum efficiency that are exceeding 75% beyond 680 nm and bandgap-voltage offset of 0.384 V. The improvements are accomplished by: (a) reducing the background doping in the QW region through the use of triethl gallium as a gallium precursors, (b) monitoring the stress evolution during growth using mutlibeam optical sensor to grow 100 QWs, and (c) processing the devices with optical reflector to enhance the absorption in the quantum well region.

Federico Scurti[1], Srivatsan Sathyamurthy[2], Marty Rupich[2] and Justin Schwartz[1]
Graduate Program: Materials Science and Engineering, North Carolina State University[1], American Superconductor Corporation[2]
Advisor: Justin Schwartz
Poster Number: 167

Self-monitoring, "SMART" REBCO coated conductor

High temperature superconducting (HTS) materials have become and enabling technology for applications like accelerator magnets for the next generation of particle colliders as well as compact nuclear fusion reactors. Additionally, numerous applications could benefit from the use of HTS. In fact, HTS technology is currently being studied for fault current limiters, energy storage devices, motors, generators and power transmission cables. All superconducting devices need to be protected from the most severe failure event, referred to as quench, which is an irreversible loss of superconductivity. While the detection of these failure events has been accomplished by voltage monitoring in low temperature superconductors, this becomes ineffective when applied to HTS because of the much slower normal zone propagation. Therefore, any technology based on HTS still suffers from the lack of a fast, effective and reliable quench detection that hinders most applications. A novel way to address the quench detection challenge is developed, based on Rayleigh backscattering interrogated optical fibers (RIOF). RIOF are distributed sensors of temperature and strain that can be interrogated in a real time fashion. After showing the effectiveness of the technology in quench detection by co-winding optical fibers with superconducting wire, a self-monitoring, "SMART" coated conductor has been conceived, developed and manufactured, via integration of optical fibers into the conventional (RE)B2C3O7-x (REBCO) conductor architecture. REBCO is by far the most promising HTS material for applications. Samples of SMART REBCO conductor have been extensively characterized and their quench detection capability demonstrated and compared to that of voltage. In addition to extremely high sensitivity to normal zones and early detection, the SMART REBCO maximizes the winding packing density and it is industry-friendly since it simplifies the magnet winding. The scale up to industrial production of the developed SMART conductor will bring all the aforementioned applications a step closer to fruition.

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Poster Number: 168

Towards designing a high performance geosimulation framework

Simulating geographical changes in nature is a routine task in computational geography. Geosimulations based on computer simulation models capture these spatial and temporal changes and allow researchers to explore the impact of complex geographic events based on alternative future scenarios. However, in practice, these simulations incur high computational and I/O costs particularly when used with high-resolution remote sensing datasets over large geographic regions. The runtime memory overhead, slow execution times, and the inability to alter the underlying simulation model or its inputs at runtime, limit geosimulations for scenario based exploration. We specifically address these issues with geosimulations - speedup performance and lack of user interactivity. To address the issue of speedup performance, we develop a framework to coordinate I/O and computation within a distributed computing environment. We present three general approaches to parallelize geosimulations while preserving spatial relationships with varying degrees of accuracy. We demonstrate speedup using our approaches in our implementation of pFUTURES, an extension of the FUTURES urban growth model. To address the second issue – lack of user-interactivity, we develop a computational steering framework that supports runtime modification of simulation inputs and steering actions to pause, advance or rollback a geosimulation. In our prototype implementation tFUTURES based on the FUTURES urban growth model, we demonstrate the benefits of such user interactivity for improving the quality of simulations and supporting on-the-fly "what if" scenarios. Finally, to further improve speedup performance and interactivity in geosimulations, we propose the use of a mesh refinement scheme with grid overlays to selectively refine the simulation over regions of interest. We hypothesize that by using multi-resolution data based on an on-demand regional refinement criterion, geosimulations can not only capture the spatiotemporal changes at different scales but also be computationally more efficient.

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Poster Number: 103

Comparison of Fuel Economy and Gaseous Emissions of Gas-Direct Injection versus Port-Fuel Injection Light-Duty Vehicles Based on Real-World Measurements

Increasingly stringent U.S. fuel economy (FE) standards have led to the introduction of fuel saving light-duty vehicle technologies, such as gas-direct injection (GDI). GDI is estimated to be 25% more fuel-efficient than conventional port-fuel injection (PFI), and has grown to 45% of the market since it was introduced in 2007. Because of differences in fuel delivery and combustion dynamics, the emission characteristics of GDI engines are expected to be different from PFI engines. GDI engines are known to emit higher rates of ultrafine particles. However, there is comparatively little data regarding differences in real-world gaseous emissions from GDI versus PFI vehicles. The objective of this work is to compare the FE and gaseous emission rates of GDI and PFI vehicles. Comparisons are based on real-world measurements of vehicles using a portable emission measurement system (PEMS), and certification data available from U.S. Environmental Protection Agency (EPA). Field measurements involve measurement of each vehicle over 110 miles of predetermined routes. Comparable GDI and PFI vehicles are selected based on body type, engine displacement, horsepower, curb weight, and engine aspiration. The preliminary PEMS results, which are based on a set of 18 vehicles, indicate that the real-world FE advantage of GDI vehicles may not be as great as originally anticipated and that there is a trade-off with higher NOx emission rates, along with prior findings of higher ultrafine particulate matter emission rates, versus lower CO and HC emission rates. Results from EPA certification data are consistent with results from PEMS data. However, these differences are not statistically significant because of large inter-vehicle variability for both GDI and PFI vehicles. Research is ongoing to increase the vehicle sample size to attain statistically significant results. The fleet turnover to an increasing share of GDI vehicles may have implications for near roadway and regional air quality.

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Poster Number: 94

Seismic Response of Electrical Equipment to High-Frequency Ground Motions in Nuclear Power Plants

Seismic hazard studies conducted by nuclear power plants indicate that in Central and Eastern United States, the ground motion response spectra contain high-frequency amplitudes. Spectral acceleration in high-frequency exceed the safe shutdown earthquake spectra considerably. Even though high-frequency ground motions do not cause damage to the structure, they can propagate through the structure and cause failure of acceleration-sensitive equipment such as relays. High frequencies interfere with the output of relays required to ensure safe shutdown of the plant during an earthquake. Hence, it is essential to determine the frequency content of motions that propagate through the foundation, the structure, the electrical control panels and serve as input to the relays. The input motion to relays depends on the dynamic characteristics of the building and electrical control panels. We start with the hypothesis that high-frequency motion would not reach the equipment because of geometric nonlinearities that exist in the system. The displacements caused by high-frequency ground motions are usually relatively small. These small displacements would, therefore, be filtered out by the geometric nonlinearities such as gaps in the control panels mounting arrangement. In this research, we explore the role of two different types of nonlinearities: (1) the gap in the connection between electrical control panel and floor; (2) sliding friction between control panel's bolt and base plate. The analysis is done by solving systems, consisting of building and control panels with different dynamic characteristics, subjected to previously recorded earthquakes containing high-frequency as well as low-frequency content. The results of the analysis showed that the high-frequency motion did not reach the relays if the maximum displacement of building floor was less than the gap. If, however, the nonlinearities are ignored, results from the conventional linear analysis show that the relays are subjected to high spectral accelerations.

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Poster Number: 130

Mechanisms of Chitosan/Interleukin-12 Immunotherapy for the Treatment of Bladder Cancer

Introduction

Bladder cancer afflicts 430K people every year globally and is plagued by recurrence rates as high as 50%. One way to mitigate the risk of recurrence is by engaging adaptive immunity. Our group has been able to direct immunity via intravesical treatment with CS/IL-12, a coformulation of Interleukin-12 (IL-12) and the biopolymer chitosan. Four twice-weekly administrations of CS/IL-12 routinely eliminate more than 90% of orthotopic bladder tumors in mice while providing life-long systemic protection from recurrence and rechallenge. The purpose of this study is to gain insights into the mechanisms underlying these results.

Methods

MB49 bladder cancer cells were implanted orthotopically in female mice. Beginning 7 days after implantation, mice were treated intravesically 2x/week for two weeks with CS/IL-12 (1 μg). The importance of the number of treatments was investigated by monitoring survival while varying the treatment number. The role of lymphocyte subtypes was investigated by monitoring survival after depleting CD4+, CD8+, or NK1.1+ cells prior to and throughout treatment or rechallenge. Cellular responses were measured in the bladder, bladder draining lymph nodes (BDLNs), and the spleen via flow cytometry.

Findings

Varying the number of treatments revealed that a single administration significantly extended survival beyond saline with 4/10, 2/8, 6/9, and 7/8 mice surviving long term after 1, 2, 3, or 4 applications respectively. Depletion studies showed a dependence on CD8+ T-cells for tumor elimination and on CD4+ T-cells for rejection of subsequent tumor rechallenge. Flow cytometry revealed fluctuations in the immune-cell populations over the course of treatment. The first treatment was characterized by a 54% increase of macrophages in the bladder and a 56% increase in the CD8:Regulatory T-cell ratio in the BDLNs. By the third treatment there was an influx of CD4+ and CD8+ T-cells in the bladder as well as increased CD8+ T-cells in the BDLNs.

Jeff Thomas
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Poster Number: 183

A Modeling Framework to Evaluate State-Level Energy Policy: A North Carolina Case Study

States across the U.S. are leading the effort against climate change as they enact a variety of policies to expand the renewable energy industry in the face of growing electricity demand and accelerating retirements of legacy power plants. However, state governments often lack the ability to evaluate policies over a long-term horizon with commercially available energy modeling software, leading to suboptimal choices. This research paper attempts to bridge this gap by evaluating several policy proposals gleaned from currently ongoing energy policy negotiations in North Carolina. Using the open-source linear programming software Tools for Energy Model Optimization and Analysis (Temoa), two policies and their design characteristics have been modeled thus far: renewable energy portfolio standards, and renewable energy tax incentives. Each policy has different design characteristics which can influence the long-term effects, which are measured using metrics such as levelized cost of electricity, total solution cost, added capacity, and generation from installed capacity. Preliminary results show that even aggressive portfolio standards have a minor impact on the cost of electricity, with per-period variations in electricity costs ranging between -6% to +7%. Tax incentives promote increased renewable generation, with a 35% tax incentive resulting in approximately a 2% increase in renewable generation compared to a 25% incentive. In addition, creating a gradual sunset period for tax incentives can reduce the cost of electricity as well as increase the generation from renewable sources by 2-3% relative to a sudden cut-off. Future work will explore additional energy policies, such as production tax credits and third-party financing of distributed solar projects. In addition, Temoa can perform stochastic optimization by embedding future uncertainties within a scenario tree. This capability will be used to examine how policymakers can hedge against future scenarios and maximize the economic benefits derived from policy.

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Poster Number: 186

Evaluating The Shape and Size Characteristics of Sweetpotatoes Using Laser Image Analysis

There are many factors that may influence shape in sweetpotatoes, such as variety and generation, soil chemical and physical properties, soil moisture, weather, cultural practices, etc. It is proposed that the shape and size of sweetpotatoes can be enhanced with certain sources of nitrogen fertilizer and application rates. The varieties Beauregard, Bellevue, Covington, Evangeline, NC 05-198 and NC 09 122 were planted in July and harvested October 26th, 2016 at the Cunningham Research Station in Kinston, NC. Each variety was treated with either CaNO3 preplant and CaNO3 layby, CaNO3 preplant and urea layby, urea preplant and urea layby at the rate of 45 lbs/acre or no preplant and no layby at 45 lb/ac rates. Each of the four applications was replicated four times. A population (n=50 to 75) of individual sweetpotato for each replication was scanned by a laser scanner to determine the length, maximum diameter, Length-to-width ratio, volume, surface area, curvature, taper, and roundness. These factors were statistically analyzed to determine the correlation between shape and nitrogen source/application in each of the six varieties. Knowing how different nitrogen sources and application affects the shape and size of different sweetpotato varieties for this Eastern North Carolina area, will allow growers to manipulate these factors to obtain a higher percentage of consumer desired sweetpotato shapes with higher grower returns while avoiding over fertilization.

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Toward Realizing a Choice-based Co-Optimizable Networking Paradigm

Backbone networks are being challenged by an explosive growth of bandwidth-consuming applications on the Internet. Optimizing existing network capabilities to allow efficient bandwidth use and dynamic resource allocation strategies has been a consistent focus for next generation networks. Collaborative Optimization (co-optimization) between stakeholders offers the opportunity for network providers to maximize their network's utilization while satisfying the customers' utility function. An area where co-optimization would be useful and quite necessary would be with optical networks, because optics are so far down the stack that any innovation in it is difficult to translate into service's benefit at the end-to-end customer consumer level. This is particularly important to address in the context of backbone networks using next generation optical techniques.

New innovative services made possible through devices with flexible optical capabilities could offer abstract services for end-system or applications. A Choice-based network architectural approach enables customers to explore marketplace alternatives and purchase the services that satisfy their requirements, thus encouraging innovative services to be offered due to competition and resource availability. Through this approach both provider and customer can simultaneously co-optimize the network's resources.

Network performance optimization has been a popular subject of research, but the approach has predominantly focused on the provider-side only. Our objective is to investigate whether we can achieve collaborative optimization of the network for both the customers and service providers through pre-grooming pricing algorithm within a choice-based network. Our pricing algorithm attempts to perform proactive co-optimatization by offering some network service choice, as more attractive than others, and thus encourage users to buy services that are in surplus instead of those which use resources that are viewed as more precious due to their scarcity. This requires that a network provider use a reasonable strategy in pricing their network resources.

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Poster Number: 195

Muscle Loading in Exoskeletal Orthotic Use in an Activity of Daily Living

An applied biomechanical study was conducted to evaluate the weight distribution of upper-extremity exoskeletal orthotics, commonly used in stroke rehabilitation, on performance of activities of daily living (ADL), perceived exertion, and muscle fatigue. Strokes are the leading cause of major adult disability. Up to 85% of stroke survivors in the U.S. experience hemiparesis. The weight distributions of three commercial or research exoskeletal orthotics were analyzed and simulated with 1.8 lbs., 2.75 lbs. and 5 lbs. to represent the devices. A 0 lbs. control condition was also tested in the ADL. Specific response measures included average surface electromyography (sEMG) signal amplitude for upper-extremity and shoulder muscles, percentage of task completion and total rest time during performance, as well as Borg CR-10 scale ratings. Biceps brachii and anterior deltoid muscle sEMG revealed device weight distribution to be a significant factor with decreasing average amplitude under decreased total weight. Both the percent task completion and the total rest time revealed weight to be a significant factor with greater completion and reduced rest under lower total weight. In regard to perceived exertion, Borg ratings revealed weight to be a significant factor with lower ratings under lower weight conditions. The pattern of results across the task activity, muscle activation and perceived exertion responses indicated higher weight upper-extremity orthotics may cause undesirable effects in terms of patient use of rehabilitation in ADLs. Post-hoc analysis suggests a total device weight should be between 1.8 and 2.75 lbs.

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Poster Number: 114

Synergistically Transcutaneous Immunotherapy Enhances Antitumor Immune Responses through Blockade of PD1 and IDO

Introduction: Despite the promising efficacy of immunoregulation in cancer therapy, the clinical benefit has been restricted by inefficient infiltration of lymphocytes in the evolution of immune evasion. Also, the immune-related adverse events have often occurred due to the off-target binding of therapeutics to normal tissues after systematic treatment. In light of this, we have developed a synergistic immunotherapy strategy that locally targets the immunoinhibitory receptor programmed cell death protein 1 (PD1) and immunosuppressive enzyme indoleamine 2,3-dioxygenase (IDO) for the treatment of melanoma through a microneedle-based transcutaneous delivery approach.[1-4] Methods: The embedded immunotherapeutic nanocapsules loaded with anti-PD1 antibody (aPD1) is assembled from hyaluronic acid modified with 1-methyl-DL-tryptophan (1-MT), an inhibitor of IDO. The solvent dialysis approach was employed to prepare the self-assembly of 1-MT conjugated HA (m-HA, MW=50 kDa) encapsulating monoclonal aPD1. To target the immune surveillance skin region at the melanoma site, we further fabricated the MN-array patch for synergistic delivery of aPD1 and 1-MT. For the MN preparation, the HA-NPs were first loaded in the tips of micromolds by centrifugation. The B16F10 mouse melanoma tumor model, which is a highly aggressive tumor model on female C57BL/6 mice was used to evaluate the efficacy of synergistic immunotherapy in a clinical relevant setting. Results: This formulation method based on the combination strategy of “drug A in carriers formed by incorporation of drug B” facilitates the loading capacity of therapeutics. Moreover, the resulting delivery device elicits the sustained release and enhances retention of checkpoint inhibitors in the tumor microenvironment. Using a B16F10 mouse melanoma model, we demonstrate that this synergistic treatment has achieved potent antitumor efficacy, which is accompanied with enhanced effective T cell immunity as well as reduced immunosuppression in the local site. This work provides an effective strategy to overcome the immune escape mechanisms and generate a robust antitumor response. Conclusions: In summary, we describe a synergistic transcutaneous immunotherapy that preferentially targets the immunoinhibitory receptor PD1 and immunosuppressive enzyme IDO to enhance antitumor response. The platform using MN as a carrier to deliver checkpoint inhibitor aPD1 and 1-MT facilitates the retention time of therapeutics in the diseased site and potentially alleviates the side effects of systematic administration of cancer immunotherapeutic. This work provides a strategy to overcome the immune escape mechanisms with a robust antitumor response. The potential of clinical studies relies on further optimization of bioavailability of the therapeutics in patch and evaluation of systemic biocompatibility of the delivery devices.

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Poster Number: 206

On-Road Visual Sign Salience, Driver Attention Allocation and Target Detection Accuracy

Prior studies have empirically assessed the effect of on-road signage on driver distraction and attention allocation through eye tracking measures and driving simulations. However, state and Federal agencies might be able to make use of simpler approaches to determining the potential visual load of on-road signs. This study compared different on-road signage (food, gas/attraction, and distance guide signs) in terms of visual salience, assessed the effect of the number of panels and logo format on signage salience, and analyzed associations between salience values for different sign types with target detection accuracy and off-road glance duration. Visual salience of signs was measured using the "Salience Using Natural statistics" (SUNs) method. For correlation analyses between sign salience, attention allocation, and detection accuracy, a sample of 120 drivers participated in two driving simulation studies. Results revealed food business signs, containing all pictorial logos, to be more salient than gas/attraction and distance guide signs. In addition, results revealed increasing the number of sign panels from six to nine significantly increased visual salience. It was also found that attraction signs including all pictorial logos were more salient than signs with text-based logos. Results did not reveal statistically significant relationships between visual salience and attention allocation. In addition, there was no significant correlation between target detection accuracy and visual salience for various sign types. Future work with a higher sign-sampling rate is needed to assess whether SUNs is a useful measure for determining if roadway sign salience is a driving factor in distraction.

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Poster Number: 207

Liquifaction Mitigation of Silty sands with Microbial Induced Calcite Precipitation

Liquefaction is a phenomenon with hazardous consequences and may result in damage of the infrastructure. Loosely compacted sands are prone to liquefaction but loosely packed silty sands have shown to be as liquefiable or more compared to clean sands. There are many conventional methods for improving the shearing behavior of silty sands such as densifying with mechanical energy, adding bonding agent such as cement, epoxy or silicates. These methods are difficult to implement successfully on silty sands therefore a natural and sustainable solution is required. A new ground improvement method has merged which uses natural biological metabolic process to improve the soil properties. Bio-mediated soil improvement has shown to be an effective method to improve the strength and stiffness of liquefaction-prone sands. The focus of this research project is to extend the use of bio-mediated soil improvement to silty sands that are more difficult to treat. Laboratory methods (Monotonic and cyclic simple shear test, permeability testing) are applied to study the effect of MICP on the behavior of silty sand and its applicability. Reduction in the excess pore water pressure ,increase in undrained shear strength and also increase in number of cycles required to reach liquifaction are the general changes observed due to application of MICP. The results indicate that the effectiveness of MICP on silty sands depends on the relative density, level of fines content, and the fabric governing the structure of the soil.

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Poster Number: 20

Effect of Physical Workload and Modality of Information Presentation on Pattern Recognition and Navigation Task Performance by High-Fit Young Males

Many occupations require both physical exertion and cognitive task performance. Knowledge of any interaction between physical demands and modalities of cognitive task information presentation can provide a basis for optimizing performance. This study examined the effect of physical exertion and modality of information presentation on pattern recognition and navigation-related information processing. Results indicated males of equivalent high fitness, between the ages of 18 and 34, rely more on visual cues vs. auditory or haptic for pattern recognition when exertion level is high. We also found that navigation response time increased with physical exertion level. Navigation accuracy was lower under high level exertion compared to medium and low levels. In general, findings indicated that use of the haptic modality for cognitive task cueing decreased accuracy in pattern recognition responses.

Xiao Zhang
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Poster Number: 29

Capacitive Micromachined Ultrasonic Transducers (CMUTs) on Glass Substrate for Next-Generation Medical Ultrasound and Beyond

Ultrasound transducer technology has been dominated by piezoelectric materials. In recent decades, capacitive micromachined ultrasonic transducer (CMUT) has emerged as an attractive alternative offering advantages such as wide bandwidth, ease of fabricating large arrays and integrating them with electronics, good acoustic impedance match, and wide selection of processing materials. Since the first demonstration of CMUTs in the early 1990s, CMUTs have been extensively researched using silicon technology for various applications. Silicon-based CMUT technology is now in the early stage of its commercialization. In recent years, fabrication of CMUTs on glass substrates has raised significant interest. Building CMUTs on a glass substrate has the following benefits. First, it eliminates the isolation steps that are required when using a silicon substrate. The parasitic resistance and capacitance as well as the process complexity could be reduced. Second, anodic bonding could be used, which is a low-temperature technique with high tolerance to surface roughness and bonding area. Third, glass substrates are transparent, which can enable photoacoustic imaging with backside illumination and flat panel display based applications.

In this context, we present three key devices fabricated on borosilicate glass substrates and illustrate their targeted applications. In the first project, we fabricated and characterized a 2D CMUT array with through-glass-via (TGV) interconnections. The targeted application is retinal stimulation with focused ultrasound. In the second project, a CMUT with improved transparency was fabricated by incorporating indium-tin-oxide (ITO) electrodes. We were able to use this transducer for experimental photoacoustic imaging. The third contribution is that we made MEMS transmit/receive switches that are embedded in a CMUT structure. The MEMS T/R switches has a fast switching speed (< 1 μs) and low-control voltage (< 5 V) and could potentially improve the ultrasound imaging system efficiency and ease the high-voltage requirements for frontend circuits.

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Poster Number: 43

Thrombin-Responsive Transcutaneous Patch for Auto-Anticoagulant Regulation

Thrombosis, a pathological hemostatic condition, has become one of the leading causes of cardiovascular mortalities and morbidities worldwide. Conventioal adminstration of anticoagulants remains difficult for precise anticoagulant regulation. Under- or over-dosage may lead to dangerous consequences due to either rapid clearance in the body or bleeding complications that may lead to spontaneous hemorrhages. Herein, we design an engineered feedback-controlled anticoagulant system based on thrombin-responsive polymer-drug conjugates. This microneedle-based patch can sense the activated thrombin and subsequently release heparin to prevent coagulation in the blood flow. This “smart” heparin patch can be transcutaneously inserted into skin without drug leaking and sustainably regulate blood coagulation in response to thrombin.

College of Humanities and Social Sciences

Arthur Berger
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Poster Number: 19

The Language of Competition in the Commercial Proposal Genre

Commercial proposals are a high-stakes genre often essential to the continued financial health of an organization. As this persuasive genre becomes increasingly competitive, many different stakeholders within an organization develop input for it. However, the effects of such competition upon the collaborative writing and proposal development process have not been covered extensively in the current literature.

This poster presentation focuses on synthesizing the current literature of competition, collaborative writing, proposal development, and industry standards for proposal development. Then, this is applied within a case study of a small business's proposal for Department of Defense contracting. In order to study the genre ecology of the proposals, 444 documents from 3 proposals and company procedures were gathered and compared against the literature. Narrowing the focus to trace the language of competition within the proposals, 60,689 words from across the 3 proposals were coded following verbal data analysis techniques. The definition of the codes was taken from the literature review, and focused on dimensions of rhetorical moves, competitive persuasion, and readability statistics. These dimensions were then compared with each other to discover if there were meaningful relationships amongst them.

From this study, stakeholders may learn how to address topics such as: Pursuit strategies and training/company policy documentation; genre analysis of various inputs to the proposal development process; roles & responsibilities of different participants; sections of a proposal that emphasize competition; and different rhetorical strategies for competitive language.

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Advisor: Toby Parcel
Poster Number: 25

Does Perception of School Safety Bolster the Effects of Family and School Social Capital?: An Examination of Educational Attainment, Running Away from Home and Violence

Children develop in the context of multiple institutions, including families and schools, suggesting that both are important for children's futures. Additionally, prior research suggests that capital investments from both contexts help promote youths' socialization and development. Yet, current research neglects to test if students' perceptions of their schools as unsafe hinder the effectiveness of family and school capital in promoting positive adolescent and young adult outcomes. Therefore, following Bronfenbrenner's (1979) ecological systems theory, I test the effects of both family and school capital and students' perceptions of schools' safety on three outcomes: (1) educational attainment, (2) running away from home, and (3) violence. Using the National Longitudinal Survey of Youth (1997), I find that higher levels of family and school capital help promote educational attainment at three time-points: 2001, 2005 and 2011. Students' perceptions of their schools as safe also prove to be important for promoting educational attainment. Findings from the interaction effects suggest that students' perceptions of schools as safe bolsters the effect of family financial and human capital and school social capital in promoting educational attainment. I also find that capital investments from both families and schools are less effective in encouraging high school graduation when students' report not feeling safe at school. Following this, I test how perception of school safety and experiences with bully victimization moderate the effect of family and school capital predicting running away from home and violence. I find that the bonds between youths and their families and youths and their schools help deter problem behaviors. However, I find that individuals' perceptions of their schools as unsafe and experiences with bully victimization may influence the process in which youths' bonds to their families and schools help prevent problem behaviors.

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Graduate Program: History
Advisor: Frederico Freitas
Poster Number: 26

Syrians in New York

Syrians have been immigrating to the United States since the 1870s. An early enclave of Syrian immigrants and culture in the United States was located in lower Manhattan and known as the Syrian Colony. By 1900, growing numbers of Syrians began relocating to the South Ferry neighborhood of Brooklyn. This physical movement of Syrians has been framed as a story of upward mobility from poverty into the middle class and assimilation into American culture. Our digital history project set out to test this narrative by exploring census records from 1900 to 1930 to compare and map the movement of Syrians in New York City. In addition, the census data allowed us analyze Syrians' employment patterns over time and to conduct several detailed case studies of Syrians from Manhattan and Brooklyn. Our findings suggest that while there is some truth in the popular narrative that as Syrians moved from Manhattan to Brooklyn they simultaneously assimilated and moved upward within the class structure, the transition was also more complex. The Brooklyn neighborhood in many ways mimicked tenement conditions in Manhattan as it became the primary Syrian community in Greater New York. While early Syrian transplants to Brooklyn likely moved to better their living conditions, the Brooklyn neighborhood also became the primary landing place for newly arriving immigrants. The move from Manhattan to Brooklyn was also likely heavily influenced by the rapid commercialization taking place throughout lower Manhattan. At the same time, case studies reveal that the Manhattan community remained important and vibrant even as the Brooklyn Syrian community grew larger.

Ekaterina Bogomoletc
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Poster Number: 27

Are we entering the Second Cold War? Media agenda and public opinion in Russia.

From 2014-2015, the number of Russians who dislike the U.S. increased from 50% to 81%. In other words, millions of people changed their views about America. What happened in this time period? In 2014, the crisis in Ukrainian government resulted in the reintegration of the Crimean Peninsula into Russia. Some scholars stated that this situation provoked media coverage of America that directly affected the way Russians perceived the U.S. Moreover, some even labeled the media agenda of 2015 as the "Second Cold War." This study investigates whether the changes in public opinion about America in Russia can be attributed to media agenda in Russia from 2012-2015. Using the method of content analysis, I examined 572 TV news stories to find out if Russian media depicted the U.S from 2012-2015 in a similar manner to the way Russian media depicted the U.S during the Cold War (1947-1991). I also analyzed if the reintegration of the Crimean Peninsula into Russia actually caused any changes in the way Russian media portrayed the U.S., i.e., if Russian news stories after Crimea differed from the media agenda before Crimea. In addition, I relied on public survey data to see if there were correlations between media agenda and public opinion about America in Russia. The analysis showed that Cold War narratives were used by Russian media in 30% of news stories to depict the U.S. However, it would be inaccurate to refer to the media coverage of the U.S. from 2012-2015 as a full-blown Second Cold War because the news media agenda also had a number of new features. In addition, the study demonstrated that a negative media framing of the U.S. correlates to more negative public opinion about America.

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Graduate Program: International Studies
Advisor: Bill Boettcher
Poster Number: 37

Military Integration and Civil Conflict: The Transition from "Them" to "Us"

Power-sharing arrangements have been utilized as a mechanism to achieve peace during civil conflicts. This often includes provisions for warring factions to integrate a portion of their combatants into the national military structure. This process is known as disarmament, demobilization, and reintegration (DDR). It has been suggested that reintegration is the most challenging aspect of DDR. A foe yesterday becomes a friend today so that they can help fight the remaining foes. Despite numerous multinational efforts that have assisted transitioning governments to regain their monopoly on force, studies on military integration remain sparse.

My research investigates the effects of international peacekeeping operations in promoting military integration during the transition from conflict to peace in Sub-Saharan Africa. This can involve the expenditure of millions of dollars and a litany of participants including NGOs, private contractors, national governments and supranational organizations. Utilizing the case studies of Democratic Republic of the Congo, Sierra Leone and Liberia, I argue that peacekeepers should be utilized to provide transitioning national militaries with the time necessary to develop institutional cohesion and individual loyalty to the state that surpasses rationales to combat it. However, without a robust peacekeeping mandate that allows for the use of force beyond self-defense, it may be necessary for the state to prematurely deploy underdeveloped military units. This has been the case in the DRC with consequences such as military atrocities against civilians, resumption of conflict against the national government and even trafficking of natural resources by soldiers.

Lindsey Chandler
Graduate Program: Foreign Languages and Literatures, Spanish
Advisor: Rebecca Ronquest
Poster Number: 40

Vowel Duration in Bilingual English-Spanish Speech

Increased contact between languages has demonstrated influence over emerging linguistic characteristics that are unique to contact varieties. In English, vowels demonstrate a lengthening effect when they precede voiced consonants over voiceless consonants. This is to say that the measured duration of a spoken vowel is longer when immediately preceding a consonant that exhibits vocal chord vibration (such as the d in bad) as compared to a consonant that does not exhibit vocal chord vibration (such as the t in bat). Although the vowels of Spanish also demonstrate this lengthening effect, the difference is not significant, as compared to English (Hualde, 2014; Zimmerman & Sapon, 1958). Previous research on bilingual speakers of English and French has shown that in French, vowels showed a lengthening effect when preceding voiced consonants over voiceless consonants, as well as an increase in overall vowel duration for bilingual, native French speakers, suggesting that a variety of French may adopt the English phonological rule of vowel lengthening (Mack, 1982). The current investigation aims to identify emergent characteristics of vowels when English and Spanish systems are in contact within the bilingual speaker.

Data was collected through recordings of word lists, and subsequently analyzed for influence of first language, voicing, and articulation of the following consonant. Preliminary analyses indicate that for speakers whose first language is English, there is a greater difference between median vowel duration when preceding voiced over voiceless consonants than for speakers whose first language is Spanish. These results suggest that although bilingual speakers whose first language is Spanish are exposed to a language that exhibits significant lengthening, their use of English does not significantly affect how they produce vowels. Additionally, English speakers who have learned Spanish do transfer the English vowel lengthening effect to Spanish.

Timothy Eggert
Graduate Program: International Studies
Advisor: Mark Nance
Poster Number: 52

Investor State Dispute Settlement (ISDS) Mechanism, Friend or Foe to The Developing World: A Comparison of ISDS Decisions between Developed and Developing States

States are obligated to participate in Investor State Dispute Settlements (ISDS) through international investment agreements (IIAs). ISDS enables an investor to sue a state if they feel that the terms of the IIA have been violated, as in the example of the seizure of an investor's private property in an industry being nationalized. This case would then be brought before a panel of arbitors that are able to make binding decisions with little room for appeal. Conceptually, ISDS was established to protect and encourage private investments worldwide, while avoiding tensions from flaring up between states whenever a dispute arises. Given the increasing concerns over lack of transparency, forum/treaty shopping, rising costs for participation and potential awards reaching the billions of dollars, ISDS are becoming an increasingly divisive area of international law. This research will explore whether or not this system favors developed states over developing states. Utilizing data provided by the United Nations Conference for Trade and Development (UNCTAD), cases decided within ISDS are analyzed using a framework of the Organization for Economic Cooperation and Development (OECD) states vs. non-OECD states, representing the developed and developing nations respectively. This study reveals that use of ISDS has increased significantly year after year, with 2015 seeing a record amount of cases brought before them. In addition, investors from developing nations are underutilizing ISDS comparative to their outward foreign direct investments. The system tends to favor investors in general, they win more cases than states successfully defend. Finally this research shows that developed states, and investors from developed states, are much more likely to win a case in comparison to developing states and investors from developing states.

Karen Eisenhauer
Graduate Program: English
Advisor: Agnes Bolonyai
Poster Number: 53

Directives in Disney and Pixar Movies: A Quantitative Analysis

Children's animated films provide ideologies about gender that are presented to children and their parents as innocent and "safe." However, construction of "goodness" in these movies often rely on normative sex-role stereotyping, especially for women (England, Descartes, & Collier-Meek 2011; Junn 1997). Studies in child development have shown that children use these films in playing with and constructing their gender identities (Baker-Sperry 2007, Coyne et al. 2016). Little is known, however, about the specific ways in which they present language as gendered, and what children who watch these movies repeatedly are drawing on as a possible model for their own stylistic performances of gender. To address this, my research focuses on applying quantitative language and gender methodology to analyze speech in Disney and Pixar films. In this study, I will focus on directives, defined by Searle (1975) as a speech act which gets a hearer to do something. Directives have been decisively correlated with intersections of gender, power, and politeness in previous studies (e.g. Aronsson & Thorell 1999; Goodwin 1980, 1983 1990, 1998; Ridgeway 2001). I will quantify directive use in these films through methodology previously used to analyze real-life speech communities, including the analysis of patterns in mitigation and acceptance/denial of requests. I will triangulate these findings by analyzing the data through a critical discourse analytical lens. The analysis suggests that Disney/Pixar heroines direct less than their male counterparts, and tend to mitigate their requests more heavily. This trend is reversed in the domestic sphere, where women are portrayed as powerful or bossy. Portrayals of women become more diverse over time, but male performances do not conversely diversify into 'feminine' styles. These findings quantitatively triangulate previous observations about sex-roles in children's films and confirm the legitimacy of using linguistic methodology to examine media artifacts.

Karl G. Feld
Graduate Program: Communication, Rhetoric and Digital Media
Advisors: James Kiwanuka-Tondo, Melissa Johnson, Stephen Wiley and Rodney Waschka
Poster Number: 60

Stimulating and Controlling Crisis; A Case Study of the German Democratic Republic's Response to Foreign Transnational Broadcasting

This paper uses crisis communication and rhetorical performance theory to understand how authoritarian governments understand and respond to the paracritical challenges (Coombs, 2015) posed by Western governments' transnational broadcasting of music. The 1983 performances of West German rock star Udo Lindenberg are used as a case study. Declassified German language documents of the East German secret police (Stasi) and digitized German language records of East German newspapers are used to determine whether the East German government's response achieved its paracrisis management goals and whether the decision-making process in an authoritarian state can be explained using theoretical models derived from research in open societies. Theories of response to reputational challenges, concepts of defensive avoidance tactics and multiple audiences, and one-way and two-way communication practices are used to examine how and why the East German government responded to Udo's performances. The Stasi archives provide a unique opportunity to look inside a authoritarian regime and test these theories for applicability to communication inside a dictatorship. The research concludes that the East German government managed crisis communication using a differentiated strategy. It communicated with internal stakeholders in ways suggested by Western crisis communication theory while using different, less optimal, communication techniques with other stakeholder groups to assert control. The tight integration of the Stasi into other parts of government gave it a unique role as a coordinating crisis management team which is different than Western governments. Generalizable conclusions can be projected to the practices of today's authoritarian governments (e.g. governments of Cuba, Iran, North Korea) in response to continuous transnational broadcasting by the West.

Godfree Gert[1], Nicole Villarreal[2] and Liwen Gu[3]
Graduate Programs: Master of Arts in Liberal Studies, North Carolina State University[1], Textile Technology Management, North Carolina State University[2], College of Fashion and Design, Donghua University, Shanghai, China[3]
Advisor: Cynthia L. Istook
Poster Number: 66

Evaluation of open-source software for use with a clothing virtual try-on system

Clothing virtual try-on (VTO) technology facilitates the effective use of improved garment purchasing and design technologies. The high return rate for clothing purchased online and the treatment of VTO as adjunct to the apparel design process, however, shows that this technology has not yet been fully adopted. This is attributed to the dominance of expensive commercial VTO systems as opposed to open-source 3D animation software coupled to more affordable 3D scanners such as Microsoft Kinect. The latter option will make VTO systems available to a wider audience and contribute to an increased adoption of the technology. This project evaluated the MakeHuman and Blender open-source software packages for application to VTO systems. The MakeHuman software uses a parametric approach to generate 3D avatars for use in animation software. These parameters may be mapped to anthropometric measurements from databases, physical measurements or 3D scanner output. This project evaluated the generation of avatars from a subset of the anthropometric measurements from the female subjects in the SizeUSA database which were acquired from several cities in the USA. These measurements were correlated to the MakeHuman macro modeling parameters through either direct mapping (e.g. SizeUSA height to the MakeHuman height parameter) or nonlinear optimization that adjusted the MakeHuman weight, muscle and weight proportion parameters until the avatar's body surface area corresponded to the body surface area calculated from the SizeUSA weight and height measurements. These avatars were then imported into Blender, a 3D graphics and animation software that contains models for garment modeling. This software's three different virtual 3D garment generation options were demonstrated: the virtual sewing option assembles the garment from 2D patterns, the direct modeling option builds the garment model by editing 3D geometry objects and the Bsurfaces approach generates the clothing mesh from hand drawn lines on the avatar.

Amanda Grier
Graduate Program: Communciation
Advisor: Joann Keyton
Poster Number: 71

Technology Use as a Relational Management Tool for First Year College Students

Emerging adults rely heavily on technology to communicate with family members and maintain relationships. However, there are few studies that help us understand the specifics of how first year college (FYC) students use communication technologies as a relationship maintenance tool to maintain parental ties. At the same time, FYC students want to avoid discussing some topics (e.g., sexual experiences, negative life experiences) with their parents. The research study was done as a two-part, multi-method study with the goal of uncovering how technology plays a role in relational maintenance. The first part of the study was an online survey given to FYC students at North Caroline State University. Survey results indicate that FYC students manage multiple technologies (e.g., phone calls, text messages, video chat, multimedia messages) to communicate with their parents, but there are clear patterns in technology use. FYC students use text messages and phone calls the most in maintaining ties with parents, but social networking sites the least. Results also indicated that FYC student's relationship closeness with their parents was significantly related to topic avoidance. Thus, the higher the perceived relationship closeness level reported by students with their parents, the more likely they will engage in topic avoidance and be motivated to engage in topic avoidance with their parent. Part two of the study expanded on the survey results during focus group discussions. FYC students use technologies differently to maintain relationships with their parents than friends, and avoid sensitive topics when using technology. This research shows the importance of topic avoidance in managing student-parent relationships, and the role technology plays in how emerging adults maintain parental ties.

Claire M. Growney and Thomas M. Hess
Graduate Program: Lifespan Developmental Psychology
Advisor: Thomas M. Hess
Poster Number: 73

Older adults' attention to self-relevant negative information: Using mood as a resource

Some research suggests that older adults have a tendency to be biased towards positive information with the goal of maintaining emotional well-being in the present moment. However, there are situations in which it is necessary or beneficial to attend to negative information, such as when considering the side effects of medications or risks involved in retirement investments. Older adults may be more willing to attend to potentially beneficial negative information under certain conditions. Following the mood-as-resource framework, one possibility is that older adults may be more willing to consider negative information when in a positive mood, with positive affect serving as a buffer to the adverse emotional consequences that may follow. In the present study, young (n=62) and older (n=65) adults completed a difficult cognitive task before completing either a positive or negative experience recall task, depending upon assigned condition. Afterwards, they rated their interest in viewing their strengths and weaknesses on the previously completed task, and then selected and viewed different types of feedback (i.e., strengths or weaknesses). Older adults in the positive condition selected more weaknesses to view, were more likely to select a weakness to view first, and spent more time viewing weaknesses than older adults in the negative condition. There were no differences across conditions in behavioral results for young adults. Ratings of interest in viewing different types of feedback did not correspond with actual feedback viewing behavior. Results highlight the importance of considering older adults' pre-existing mood before addressing self-relevant information that may be negative but important.

Madison Hissom
Graduate Program: International Studies
Advisor: Heidi Hobbs
Poster Number: 77

Strange Bedfellows: Explaining the Syrian Arab Republic's Trade with the Islamic State

Despite threats posed to one another throughout years of bitter civil war, the Syrian Arab Republic and the Islamic State have maintained trade relations with one another. The Islamic State controls up to 60% of Syria's oil fields as well as significant portions of Syria's gas reserves. Syria willingly purchases oil from the Islamic State and assists in managing gas plants within Islamic State-controlled areas. Despite the unique nature of this trading arrangement, it has not been discussed within the context of current literature on trade between belligerent states. My research objective is to explore why these states have chosen cooperation despite its inherent wartime disincentives. To discuss this situation, I use a case study methodology to analyze the trade relations between the Syrian Arab Republic and the Islamic State. I adopt Jack Levy and Katherine Barbieri's five frameworks for explaining belligerent trade in order to examine the motivations for these two entities to engage in trade. Upon examining these frameworks, I find that two offer useful explanations for this trading regime: 1) third-party considerations, in which involved states are willing to overlook adversaries' relative gains from trade with the knowledge that such gains will not be completely reflected in their adversaries' strategic actions against them, and 2) domestic political economy considerations, with the existing culture of sanctions-busting and infrastructure for smuggling oil, paired with both sides' reliance on a shared electric grid, providing the impetus for trade.

Alex Lillie Hyler
Graduate Program: Foreign Languages and Literatures
Advisor: Jim Michnowicz
Poster Number: 84

Yucatan Spanish: An Analysis of the Changing Accent

Yucatan Spanish (YS) is an understudied dialect, which is distinct from standard Spanish due to several cultural and historical factors, including possible Maya influence (Michnowicz 2015). YS is distinguished by various linguistic traits: glottal stop insertion between two vowels, more aspiration of /ptk/, use of the occlusive /bdg/, and distinct intonation and rhythmic timing (Michnowicz 2015; Michnowicz & Hyler 2016a,b). Current literature suggests that YS is undergoing rapid changes; for example, younger speakers are standardizing their use of several phonological variants in YS (Michnowicz 2015). Following previous literature, I apply several correlates of rhythm that have been used successfully in past studies: 3 correlates of vocalic duration (Vnpvi, VarcoV, %V), and two of consonantal duration (Crpvi, VarcoC). The current study includes 12 sociolinguistics speakers (6 men and 6 women), and focuses on language background (Spanish monolingual vs. bilingual in Maya and Spanish) and age. I have one speaker from Mexico City and one speaker speaking Maya that serve as the control groups. The data includes a comparison of sociolinguistic interviews collected 11 years ago along with the sociolinguistic interviews collected over the summer of 2016. Preliminary results demonstrate a changing pattern of rhythmic timing in YS. The scatterplot of VnPVI and CrPVI shows evidence of convergence for both vocalic and consonantal measures. Additionally, the intermediate values between the control groups signify that there is increased consonantism in YS. We see that younger speakers are distinguishing themselves from older speakers as well as further distinguishing themselves from the Mexico City norm, which could indicate a possible identity marker of Yucatan Spanish.

Hannah Jaffee
Graduate Program: Communication
Advisor: Kami Kosenko
Poster Number: 86

Social Support Needs and Messages In an Online Transgender Support Community

There are approximately 1.4 million transgender individuals living in the United States today, and, as the transgender population grows in numbers and visibility, key communicative questions remain regarding how social support mitigates the challenges associated with identifying as transgender. The extant literature suggests that transgender individuals might experience societal transphobia and that there is a positive relationship between social support and the overall wellbeing of transgender individuals, but there has been little research linking the two. The present research investigates what trans-specific experiences require social support and how those needs are met through the supportive messages of others. A content analysis was conducted consisting of 50 message threads from the subreddit, TransSupport. Original posts were analyzed for support need present and subsequent replies were analyzed using Cutrona & Suhr's (1992) Social Support Behavior Code to determine what types of social support were provided in the community. Following the theory of optimal matching, determinations were then made on whether the support provided suited the support need. The research presents a typology of support needs present for an online transgender community as well as a framework for how these support needs are being met through specific supportive messages.

Nupoor Jalindre
Graduate Program: Technical Communication
Advisors: Huiling Ding and Jason Swarts
Poster Number: 87

Visualizing Search Queries to Improve Information Design

As documentation is moving toward help based forums and collective intelligence, it is important to know how users perceive information presented to them and their approach in finding relevant content from the knowledge base. In short, content should be searchable. Yahoo! Answers is a forum where users post questions with the sole intention of finding solutions. This differs from web searches where the nature of questions is not specific. This research examines the patterns of language used by Yahoo! users to define and explain their problem while creating a post on the forum. The research shows which documentation components should be used, based on analyzed scenarios, in order to increase searchability and effectiveness of documents.

The research uses data collected for Yahoo! Answers, both questions and answers by account holders. Several iterations of codes were used to facilitate analysis using verbal data analysis techniques. Quantitative and Qualitative data was compiled and entered into statistical models for comparative analysis. Visualizing these data sets allows for effective interpretation of results. Innovative investigations such as this can be extended to analyze segments that include answers posted by account holders and variations in the quality of the most acceptable answers. The results from this research provide an extensive list of keywords which can be used in documents to make them more relevant to users. Most of it comes from non-technical audience who use layman terms to understand technical concepts.

The use of discussion forums is based on collaborative learning theory, which call for collaboration between participants, experimentation, and open inquiry. Analysis of collective data gives outcomes which can be linked to processes used in technical communication. What to include or not include in computer documentation involves not only investigation and testing while developing a product, but also applying principles gained through experience and research.

Arianna Janoff
Graduate Program: English
Advisor: Robin Dodsworth
Poster Number: 88

Third Dialect In Santa Barbara, California: An Examination of the California Vowel Shift

Previous research on dialects of American English has found three overarching patterns for vowels: the Northern Cities Shift (Fasold, 1969), the Southern Vowel Shift (Feagin, 1986), and a Third Dialect that encompasses the Midlands and the West. However, findings since the 1960s have shown that different areas within this non-Northern, non-Southern conglomerate are linguistically divergent. Northern California, for example, is exhibiting a lowering and backing of front lax vowels (Eckert 1986, 2008c), which means that 'him' is pronounced closer to 'hem', and 'bed' is pronounced more like 'bad'. This study examines the vowel spaces of fifteen middle class, white, 20-30 year old speakers raised in Santa Barbara, California. The data is drawn from recordings of two short reading passages that were designed by linguists to elicit the maximum number of phonetic combinations and map each speaker's vowel inventory. By completing an automated formant analysis using Praat scripting, this determines if the California Vowel Shift has spread to this speech community in Southern California homogenously or heterogeneously. The data is further examined in R with regards to gender, particularly in how males, females, and non-binary individuals are exhibiting the features of this vowel shift. Preliminary findings show that the California Vowel Shift is not spreading homogenously, and that this particular speech community is exhibiting no change in the front lax vowels but does have changes in low and back vowels. This research investigates the effects of gender identity on speech-features that occur below the level of human self-awareness. More specifically, it sheds light onto the possible social constraints of the third dialect, and whether young, white, middle-class, Southern Californian speakers exhibit this new shift in speech with their peers. And finally, it provides evidence for how dialects and vowel shifts spread from one community to another as American English continues to develop and change in the 21st century.

Nicole Jasperson
Graduate Program: Sociology
Advisor: Michael Schwalbe
Poster Number: 89

Cooling-Out Refugees: An Examination of Employment Specialists' Strategies at Refugee Resettlement Agencies

This study examines how employment specialists at refugee resettlement agencies help refugees find - and settle for - jobs in the secondary labor market. To analyze this process of aligning refugees' expectations with job market realities, I draw upon Goffman's (1952) concept of "cooling the mark out." Goffman used this concept to explain how individuals help others adapt to unexpected failures or status loss. Refugees, although not victims of con games, often arrive with higher expectations than immediate circumstances can satisfy. When employment specialists confront this problem, they use various cooling-out strategies to help refugees accept the status and opportunities realistically available to them. These strategies included stressing English proficiency, discussing financial limitations, promising future upgrades, explaining labor market competition, and encouraging refugees to be patient and persistent in their pursuit of economic betterment. Data for this study derive from interviews with sixteen employment specialists in the southeastern United States conducted between May and August of 2016. I analyzed the interviews line-by-line to discern patterns and emergent themes. This study contributes to understanding the social processes regarding refugee resettlement agencies and refugees. Cooling out can benefit both refugees and employment specialists. The strategies employment specialists used gave refugees hope that they could achieve high social status in the future. Cooling out refugees also helped employment specialists to overcome their failures and frustrations because they could get refugees to accept their reduced circumstances. My work adds an important sociological dimension to the existing literature on refugees and resettlement by examining the interactional dynamics of resettlement, the conflicts that may arise, and the strategies employed by employment specialists to manage feelings associated with reduced social status.

Robert A. Jordan
Graduate Program: Anthropology
Advisor: John K. Millhauser
Poster Number: 98

2016 Archaeological Survey of the Lake Phelps Northern Shoreline

In the mid-1980s, 24 cypress dugout canoes were discovered inundated in the waters of Lake Phelps in Washington County, North Carolina. These canoes date from the Late Archaic period (3000-1000 B.C.) to as recent as the Late Woodland period (A.D. 800-1650). Since their discovery, numerous archaeological pedestrian surveys have been conducted in the waters just off of the lake's northern and western shorelines. These projects have produced artifacts ranging as far back as the Late Paleo-Indian period (8500-7900 B.C.), showing that Lake Phelps was a place of utility and occupancy for people throughout much of prehistory. Our understanding of the changing uses of the lake for prehistoric peoples is limited, however, as there has not been any controlled survey or excavation of the inland forested shoreline for in situ material. In July, 2016 I conducted shovel test pit surveys along selected portions of the Lake Phelps northern shoreline with the goal of finding in situ materials that may help to refine our understandings of Lake Phelps's utility to prehistoric peoples and the changing forms of prehistoric occupancy at the lake. In each survey area, transects had a North-South orientation and were spaced 20 meters apart. Test pits were excavated every 10 meters along each transect. The preliminary results are promising, with one tested location producing considerable numbers of ceramic material that are diagnostic of the Early, Middle, and Late Woodland periods (approximately 1000 B.C. to A.D. 1650), indicating some degree of cultural continuity at the site. Furthermore, spatial analyses of the surveyed areas from this and prior field projects from other researchers will help to broaden our understandings of Lake Phelps's utility to prehistoric peoples through time and, more generally, prehistoric human uses of aquatic resources in changing environments.

Steven E. B. Lechner
Graduate Program: History
Advisor: David A. Zonderman
Poster Number: 108

Charting the Imperial Flow: New York City's Conquest of the Esopus and the Locals Who Contested It

Water flows pursuant to the laws of fluid dynamics. New York City's quest to capture and manipulate Catskill water during the early twentieth century, and the local resistance to this scheme, presents a peculiar case study of flow. By following the flow, in both the literal and figurative constructions of that term, this study asks whether New York City's appropriation of the Esopus Creek during the early twentieth century constituted urban imperialism. This analysis builds upon scholarship relating to rural-urban relationships by culling from this literature three discernible phases of urban imperialism: convincing (where a city makes a needs-based claim for a resource), coveting (where a city targets a particular source), and conquest (a city's deployment of superior power to control a desired resource and the degree and nature of local resistance thereto). Based on the primary source evidence, this study argues that New York City's appropriation of the Esopus Creek was an example of resource-based urban imperialism. The city's mindset and actions resemble other examples of late nineteenth- early-twentieth century resource-based imperialism. However, careful study of the reasons the city came to covet the Esopus, and the ways in which the conquest and contestation played out, are specific to this time and place. In the end, water flowed from the country to the metropolis. The Ashokan Reservoir, the Esopus project's centerpiece, currently supplies upwards of forty percent of the city's water supply. But this flow is not streamline. Local resistance to the city's scheme did not stop the flow, but produced enough drag to change its nature. The result was turbulence, which, in many ways, is as evident today as it was a century ago. This study has both general and specific utility. The synthetic model it deploys can be used to examine other claims of urban appropriation of rural resources. More specifically, this research adds depth to earlier accounts of New York City's Catskill water project, and provides a springboard for further studies relating to the social and economic consequences of the City's actions, the collective memory of these events in the Catskill region, and whether this history altered the rural-urban relationship.

Carolin Lehmann
Graduate Program: Communication
Advisor: Ryan Hurley
Poster Number: 109

Experimental Framing Effects regarding Immigration and Integrated Threat among Germans and Americans

Research on news framing consistently has shown media messages' potential to influence the attitudes, beliefs, and behaviors of those exposed; however, few studies to date have examined the effects of news framing of refugees and still fewer have considered this issue internationally. Understanding how news messages impact people's beliefs about refugees seems imperative given the current American and European refugee and migrant crises, especially considering that the most common way citizens learn about such issues is via the news media. Therefore, a 2 x 3 between-subjects experiment was designed to measure the impact of exposure to refugee versus migrant news frames on integrated threat theory's concepts of perceived realistic threat and symbolic threat. Participants in the control group took a questionnaire while those in the treatment groups were ask to read a short newspaper article exposing them to either the refugee or the migrant frame before completing the same questionnaire as the control group. German (n = 142) and American (n = 131) participants were recruited for an international comparison, with each group completing the study in their respective languages. These data suggest that different frames did evoked different threat perceptions in some cases. Findings suggest that Germans experienced generally higher threat perceptions when exposed to either frame, while Americans reported significantly higher levels of symbolic threat when exposed to the migrant frame, $t(68) = -4.18$, $p = .00$, $d = 1.0$. This is a big first step towards understanding international news framing of refugees; however, because it measured only one-time exposure to these frames and did so in only two countries there are limitations to these data. Future research should expand on the findings herein with longitudinal examinations of a larger number of countries worldwide.

Evan Marie Lowder
Graduate Program: Applied Social and Community Psychology
Advisor: Sarah L. Desmarais
Poster Number: 112

Application-Level and State-Level Predictors of SSI/SSDI Outcomes in a National Sample of Homeless Adults

Approximately half of homeless adults in the United States present with some type of disability. Disability programs—namely, Supplemental Security Income (SSI) and Social Security Disability Insurance (SSDI)—provide financial and health care benefits for at-risk populations. However, homeless adults have trouble accessing benefits for many reasons, including lack of a permanent address and disaggregated medical records. The SSI/SSDI Outreach, Access, and Recovery (SOAR) model was created to improve application outcomes among homeless adults by training case managers on the disability determination process. Applications processed through SOAR show higher approval rates (65% vs. 29%) and faster approval time (94 vs. 120 days) relative to non-SOAR applications. Yet, no study to date has examined predictors of SOAR application outcomes, including applicant or state characteristics that may attenuate the effectiveness of the SOAR model. This study employed multilevel modeling to identify application-level (e.g., consultative exam ordered) and state-level factors (e.g., SSI/SSDI award rate) associated with application outcome (approved, not approved) and application processing time (days) in a national sample of homeless adults (N=6,361). Applicant characteristics associated with more successful applications included male gender, older age, and living in an institutional setting. Components of the SOAR application process—including submission of medical records, preparation of a medical summary report, and a co-signed application—additionally predicted application success. In contrast, consultative exams predicted longer processing time and lower likelihood of application approval. Although state-level characteristics were not associated with application outcome or processing time, states with high SSI/SSDI award rates had more pronounced effects of application characteristics on application outcome and processing time. Findings suggest the need for research into why certain groups may be disadvantaged in the disability determination process and whether broader implementation of SOAR critical components could improve the efficiency of the disability determination process for all SSI/SSDI applicants.

Hannah McQueen
Graduate Program: Sociology
Advisor: Anna Manzoni
Poster Number: 120

The Student "Investor" and the Risks Associated with Higher Education Debt

The total volume of student loan debt in the U.S., estimated at $1.2 trillion at the end of 2015, is now higher than auto loans, credit card debt, and home equity loans combined. Furthermore, young adults must increasingly turn to riskier loan providers – such as private banks – in order to cover the rising costs of college. As tuition costs continue to rise and incomes remain stagnant, scholars question whether these borrowing patterns may reproduce social inequality. Therefore, I investigate two related research questions: (1) are student loan debt portfolios becoming riskier over time? and (2) do college graduates that come from less privileged backgrounds disproportionately hold larger student loan debt burdens and riskier loan portfolios? Utilizing longitudinal data from the Baccalaureate and Beyond Longitudinal Study, I compare college graduates from 1993 and 2008. First, I estimate a series of nested regression models comparing total student loan debt burden over time. I employ a series of individual and institutional characteristics in order to assess how debt may be unequally distributed. Specifically, I include race, social class, sex, age, major field of study, and institutional selectivity and sector. Second, I estimate a series of zero-one inflated beta models to explore whether these characteristics are associated with borrowing from riskier sources as well. Preliminary analyses show that members of the 2008 graduating cohort had loan portfolios that were on average 15.03% riskier than their 1993 counterparts, even after controlling for individual and institutional characteristics. I find mixed results regarding borrowing patterns across race, class, and gender lines, although African Americans borrow from relatively less risky sources than their white counterparts. However, young adults from private non-profit and more selective institutions possess riskier debt portfolios upon graduation, compared to graduates from for-profit, public, and open admission universities.

Sarah Mills
Graduate Program: Anthropology
Advisor: Nora Haenn
Poster Number: 122

Neither Partner nor Patron: The Moral Economy of Fairtrade in St. Lucia

Fairtrade is an alternative trade system challenging the inequities of conventional trade. Producers certified by the Fairtrade Labeling Organization (FLO) follow certain social and environmental standards, and are democratically organized into cooperative groups. Fairtrade certification is meant to guarantee higher prices and a livable income. This research explores whether the framework, which promotes a direct relationship between consumer and producer, is useful for transforming the trade system. By exploring the case of banana production in the Caribbean island of St. Lucia, this study examines the perspectives that producers hold about the social organization of trade. Further, it investigates important trade processes that may be obscured by Fairtrade's emphasis on producer-consumer connections.

After dealing with a declining industry for years, banana farmers in St. Lucia reached out to Fairtrade in the hopes that it would help secure their industry. While Fairtrade has arguably allowed the industry to continue, it has not brought about the social and economic change promised. By analyzing interviews carried out as part of a larger anthropological project, this study finds that the failure of Fairtrade to provide progress is a result of the different and contradictory ways of conceptualizing the roles and responsibilities of Fairtrade. While Fairtrade aims to act as an outside mediator, producers are concerned with their relationship to the organization, perceiving it to be a powerful player in the banana industry. Viewing it through the framework of their own moral economy, farmers consider Fairtrade first an equal partner, and, failing that, a patronage system. By failing to understand the importance their own relationship plays with farmers, Fairtrade sits in an ambiguous position between partner and patron. Their ignorance of how producers evaluate the industry and relationships within leads to Fairtrade violating both its own idea of equal partnership and the moral economy of banana producers.

Deniza Mulaj
Graduate Program: Cultural Anthropology
Advisor: Shea McManus
Poster Number: 128

Under the Bridge?: The Ethnographic Study of Kosovar and Serbian Youth living in the divided city of Mitrovica, Kosova

After the Kosova-Serbia war (1998 - 1999), the city of Mitrovica was divided along ethnic lines. Despite numerous conflict resolution initiatives, the Serbian and Kosovar populations remain divided between the North and the South of the city. My research examines how the youth of Mitrovica experience, rationalize, and try to overcome the division separating their city. Drawing on ethnographic fieldwork conducted among youth in both segments of the city, findings demonstrate that youth are drawn to the other side but are held back by the fear cultivated by their communities. These fears are shared by both sides that carry memories of the war into the present, which color perceptions of one another. The division is further reinforced by a militarized border guarded by international peacekeepers, and by political initiatives that work towards normalization of relations instead of local reconciliation. NGOs sponsor peace and reconciliation initiatives that are based on inaccurate assumption about the youth. Nonetheless, youth use these projects as the safest means to interact across the division and form relationships. This research shows that despite the barriers youth are able to creatively manipulate reconciliation initiatives, and they use them as a means to socialize with one another and challenge boundaries imposed by their communities.

Caroline Myrick, Jon Forrest and Michael J. Fox
Graduate Program: Sociology
Advisor: Walt Wolfram
Poster Number: 63

The Significance of Sociolinguistic Variation in the Speeches of Rev. Dr. Martin Luther King, Jr.

While Martin Luther King Jr.'s eloquence as a speaker is widely recognized and his rhetorical strategies have been extensively studied, no sociolinguistic analyses have been conducted on his language variation between speeches. By examining a speaker's pronunciation, grammar, and prosody, sociolinguistic analysis provides an extra dimension to the understanding of a speaker's construction of identity. Linguistic variants act as symbols of social background or group membership, transmitting information about the speaker. These variants can, in turn, be deployed by a speaker to make strategic identity claims to an audience.

Our study examines King's language in four different speech events: the "I Have a Dream" speech (1963), the Nobel Prize acceptance speech (1964), a TV interview with Merv Griffin (1967), and the "I've Been to the Mountaintop" speech (1968). We analyze a series of sociolinguistic variables used by King to determine how he indexed his regional, social, and ethnic identity as he accommodated to each speech contexts:

Unstressed (ING): Saying "walking" vs. "walkin'"
Medial and Final /t/ Release: Fully articulating the "t" sound in "better" or "best"
Postvocalic Rhoticity: Making the "r" sound in "father" or "fear"
Coda-final Cluster Reduction: Deleting the "k" sound in "back then" or the "t" sound in "west side"
Copula/auxiliary Absence: Saying "he a student" for "he is a student"
Vowel System: The specific pronunciations of a speaker's vowels
Syllable Timing: The rhythm of syllable stress

For each sociolinguistic variable, we utilize appropriate statistical testing for the format of the data to determine significant differences between speeches. Our analysis indicates stability across the speech events for some variables and significant variation for others. The patterning suggests that King consistently embodied his Southern-based, African American preacherly stance while fluidly shifting features that indexed performance and formality based on audience, interaction, and intentional purpose.

Ashley Pahis
Graduate Program: Foreign Languages and Literatures
Advisor: Rebecca Ronquest and Jim Michonowicz
Poster Number: 137

Acoustic characteristics of gay male speech in Spanish

In English, there exist various differences in the ways in which homosexual men speak in comparison to their heterosexual counterparts, such as differences in vowel production and voice onset time. Previous studies have shown that sexual orientation influences the ways in which men speak, as well as showing how salient these differences are to other listeners when asking to rate someone as heterosexual or homosexual. However, these findings have been severely limited solely to English. This ongoing study attempts to remedy this lack of representation and to determine if these differences exist in a previously understudied context, the Spanish language. Participants took part in sociolinguistics interviews that lasted roughly thirty minutes in which they were asked general questions about their country, their culture, and their experiences in the United States. The interviews were then transcribed and coded by hand and each interview was coded for fully realized, monophong vowels in tonic position, as well as the duration of the voice onset time of consonants /ptk/ in tonic position. Preliminary analysis shows that althought homosexual males tend to follow previously identified female patterns of higher formants, sexual orientation did not reach significance in a linear regression model. The same was found to be true for duration (in ms) of voice onset time. Country of origin did reach significance however, leading to suggest that dialectal variation has a greater influence on speech patterns than sexual orientation in the current data set.

Heather Paxson
Graduate Program: Anthropology
Advisor: D. Troy Case
Poster Number: 141

Dental Wear Trends in Late Archaic and Woodland Period Populations in Eastern US

Dental wear studies are used to draw inferences about lifestyles of past populations. Among groups living in the eastern US during the Late Archaic Period, high levels of dental wear are attributed to heavy consumption of shellfish. Recent research conducted by Nealis and Seeman, however, suggests that hot rock food preparation techniques were the main contributing factor to dental wear. The introduction of pottery in food preparation during the Early Woodland Period may have contributed more to decreasing dental wear than dietary changes. Therefore, decreasing rates of dental wear should be seen throughout the Woodland Period before the rise of large-scale maize agriculture.

To test this model, five sample populations were selected: the Late Archaic sites of Indian Knoll, Eva, and Oak View Landing; the Late Archaic/Early Woodland site of Ledbetter Landing; and the Late Woodland site of Hiwassee Island. Data for the study consists of calculated area of dentine exposure of adult maxillary second molars' occlusal surfaces, using Scott's 1979 method.

Comparisons among samples were conducted using the Mann-Whitney U test. Results showed no significant difference in rates of wear amongst the Late Archaic sample populations or between the Early Woodland sample populations when analyzed by age group. However, significantly decreased rates of wear in the Late Woodland sample population were seen compared to the Late Archaic in the young adult and middle-aged age groups. This seems to suggest that the introduction of pottery during the Early Woodland period did not immediately correspond with decreased dental wear.

Frankie Pennington
Graduate Program: English – Sociolinguistics Concentration
Advisors: Walt Wolfram and Agnes Bolonyai
Poster Number: 145

Making a Confession: Tag Questions as Manipulative Discourse Markers

Manipulative language can be manifested in a number of ways, and the implications of the use of such discursive choices, specifically in legal contexts, are multifarious (see Gaines 1998 and Biscetti 2006). Prior sociolinguistic research conducted on the topic of manipulative discourse, however, has not generally detailed the ways in which the specific discursive choices of legal professionals can lead to false confessions by defendants or witnesses involved in a crime. In this paper, I focus on how tag questions can effectively serve as a manipulative strategy for discourse, using a hybrid framework with foundations in Critical Discourse Analysis and Interactional Sociolinguistics (Fairclough 1989, Cameron 2001), using data from forensic discourse extracted from YouTube. While much work has been done in examining the social meanings of tag questions and the intonation of tag questions separately, no in-depth investigation into both of these aspects of tag questions has been conducted, particularly with respect to how the latter gives rise to the former (see Reese & Asher 2008, Moore & Podesva 2009, and Dehé & Braun 2013). The data analysis demonstrates the ways that powerful individuals in legal interactions use tag questions as tools of discursive manipulation to achieve communicative and social goals that benefit them while disadvantaging their addressee(s); specifically, culminating in a false confession. The paper will argue that tag questions can be, and frequently are, used as a means of discursive manipulation in legal settings and that the intonation with which tag questions are produced serves as an important discursive resource for uncovering (and disambiguating) speakers' goals and underlying intentions.

Laura Roberts
Graduate Program: Communication, Rhetoric, and Digital Media
Advisor: Adriana de Souza e Silva
Poster Number: 155

Mediating Publics: Attending to Form and Modality in Digital Genre Studies

Through Miller's (1984) seminal genre work, rhetoricians and technical communicators have expanded studies of genre outside their formal constraints and have focused on their pragmatic and constituting actions. While researchers have theorized genres in increasingly networked articulations to reveal the complex structures of communication among discourse communities, few studies have addressed the forms genres take outside of "text" through different modes and media that facilitate these collaborative efforts. In this paper, I posit that while the constitutive and community building actions of genres are as salient as ever, more attention should be paid to the forms these actions enact within digital media. I argue that this particularly important as forms of communication may shape both materially and virtually how interactions and engagement take place in these spaces. To explore the use of form in digital media, I examined the site PubPeer, an online journal club for post-publication peer review, where multimodal and multimedia interactions take place between scientists and members of the public in a publically visible space as they discuss published journal articles. Specifically, I rhetorically analyzed 134 comments on a controversial thread that resulted in the retraction of two stem cell articles published in Nature. Through exploring the deliberative interactions on this thread, I found different modes enable scientists and the public to discuss and negotiate highly technical scientific processes through images, hyperlinks, and cross-platform exchanges. Ultimately, I hope this research demonstrates the importance of form to genre and offers a richer view of how digital genres may enable discussion among people of different backgrounds and affiliations.

Katie Schinabeck
Graduate Program: History
Advisor: Craig Friend
Poster Number: 165

Stamp Act Newport: Digital Interactive Tools and the Small Museum

Stamp Act Newport's "Under all these Unfortunate Circumstances" does not tell participants the decisions made by historical actors during the American Revolution were complicated and contingent. They discover it on their own. This digital interactive history adventure tells the story of Newport's 1765 Stamp Act riots. Virtual visitors confront choices made by historical actors and eventually find out how those choices might have affected their life's course. The goal of the website is to help audiences understand historical contingency by seeing how their decisions might have changed their course. In doing so, it complicates simplistic narratives about Patriots and Loyalists during the American Revolution. Through this project, I explore the theoretical complications and benefits to straying from the typical historian's role and speculating on historical "what ifs." Nonlinear, gamified historical narratives are useful pedagogical tools. However, they mask a key component of historical pedagogy: the historical method. I argue that despite limits to the method, small scale gamification projects are viable endeavors for small museums, can expand our own understanding of historic events as historians, and make history more accessible and engaging to the public.

Hannah Scruggs and Lisa Withers
Graduate Program: Public History
Advisor: Alicia McGill
Poster Number: 166

Meeting in "the Middle" of Public History and Anthropology: An International Heritage Research Practicum

Anthropology students spend multiple weeks completing a field school, domestic or internationally, as part of their training. Students in public history generally complete internships and participate in local community engagement projects within the U.S. The two models overlap yet also have distinct differences. What are the pedagogical implications for future public historians participating in an international field school model? What skills do public historians bring to the experience? The project, Meeting in "the Middle" of Public History and Anthropology: An International Heritage Research Practicum, answers these questions. Under the direction of Dr. Alicia McGill, Assistant Professor of History, Hannah Scruggs and Lisa Withers spent six weeks in two Belizean Kriol communities using a mixture of anthropology and history methodologies to explore the retention of the two communities' rich history and culture. By using a blended version of the international field school and local community engagement models, the students participated in a deep cultural immersion experience to learn about, document, and share the community's heritage. Outcomes of the project included an educational outreach program at two local primary schools and an exhibit in the visitor center on the heritage and history of the two communities. The project, Meeting in "the Middle" of Public History and Anthropology, was completed in collaboration with undergraduate students and scholars from the University of New Hampshire, Belizean students from Galen University, scholars from various U.S. and Belizean institutions, and community residents.

Michelle Taub and Roger Azevedo
Graduate Program: Psychology
Advisor: Roger Azevedo
Poster Number: 180

Using Sequence Mining to assess Self-Regulated Learning and Scientific Inquiry based on Levels of Efficiency and Emotional Expressivity during Game-Based Learning

Self-regulated learning and scientific inquiry are necessary skills needed to engage in efficient hypothesis testing during learning with game-based learning environments, and can be influenced by many factors, such as affect and motivation. Although many studies have investigated SRL and scientific inquiry skills during game-based learning, few studies have investigated how both efficiency and emotions impact the sequence of behaviors involved during hypothesis testing with game-based learning. The goal of this study was to examine 59 undergraduate students' (59% female) hypothesis testing behavior during learning and gameplay with Crystal Island, a game-based learning environment that teaches students about microbiology. Specifically, we used sequential pattern mining and differential sequence mining to determine if there were unique sequences of hypothesis testing behaviors, and if the frequencies of occurrence of these sequence differed based on students' levels of efficiency at solving the mystery and levels of emotional expressivity. Results revealed that less efficient students with high levels of emotional expressivity had the most sequences, and engaged in more sequences testing for less relevant illnesses and containing less relevant food items than the other students. These results have implications for training students on how to engage in efficient self regulation, scientific inquiry, and emotion regulation processes, and developing adaptive game-based learning environments to foster effective and efficient self regulation and scientific inquiry during learning.

Cecilia Tomasatti
Graduate Program: English
Advisor: Agnes Bolonyai
Poster Number: 184

Constructing Identity among Italians at NC State

In light of globalization, mobility has brought about sweeping changes, affecting populations, borders, and people's identities. The ease with which such displacements take place today has led to a rethinking of our paradigms that used to be tightly rooted in one specific place and time toward a much more flexible yet more complicated way. In the era of Bauman's liquid modernity, academic institutions are mirroring within their contexts the general tendencies of society and are becoming a melting pot in which intercultural identities can be constructed. This paper draws on previous research on discourses of transnational migration, displacement, and diaspora to look at identity-making processes among study-abroad Italians. It is through discourse that migrants shape both the sending and receiving societies, process a critical displacement in time and place and eventually update their identity to manage the new experience. This paper addresses issues of identity construction in the context of Italian students abroad through the theoretical framework of interactional sociolinguistics and narrative analysis, along with the discursive construction of identity and spatial identities. By discursively analyzing small-group interviews of Italian students and faculty at NC State, I aim at looking whether and to what extent the chronotopic conflicts highlighted in the previous research are present in my dataset and how they are employed by Italian migrants to recall their experience in the United States. In other words, how do migrants react to a new chronotope and how does it affect the existing one? My analysis suggests that the coexistence of more than one chronotope results in a continuum-like, conflicting chronotopic framework toward which migrants establish different stances according to the events or situations they experience.

Sonya Trawick
Graduate Program: Foreign Languages and Literature
Advisor: Jim Michnowicz
Poster Number: 185

A sociolinguistic analysis of /ʔ/ insertion and retroflexed coda /r/ in Paraguayan Spanish

This study examines Spanish from Asunción, Paraguay, where the indigenous language Guaraní is widely spoken and prestigious, and the dialect has been the topic of few quantitative studies (Klee 2009). Using data from 11 sociolinguistic interviews, this study analyzes two phenomena from the region.

The phenomenon of glottalization before vowel-initial words is a likely contact effect. Methodologies for analyzing glottalization were based on Chappell (2014): tokens were coded in Praat as four types of vowel-initial realizations: creaky, occlusion, occlusion with creak, and none. Examining 415 tokens, preliminary results show a rate of 31% glottalized tokens overall. Using a Mixed Effects logistic regression (comparing the binary categories of all glottal variants), preliminary results point to Age as having a significant effect, suggesting that younger speakers are losing the regional contact dialect, or are interacting with bilinguals in different contexts. Further analysis will examine phonetic context, language dominance, /ʔ/ as a contact variant, as well as a possible variant of /s/.

A retroflex-sounding coda /r/ also appears in the dialect, largely absent in previous literature or standard Spanish. Methodologies analyze the third formant (F3) of 50 coda rhotics and 10 of each vowel of each speaker, measured in Praat and assuming Boyce & Espy-Wilson's (1997) claim that English rhotics have an F3 substantially lower than their vowels. Preliminary results show the average F3 of 2506 Hz for rhotic /r/ across all speakers, and 2741Hz for the vowel system, marking an average range of 235 Hz and a higher average F3, and therefore some but less retroflexion, than the canonical F3 of English. Further analysis will include Lobanov normalization and examine neighboring phonemes, social variables, and average F4 (for a more detailed analysis).

Laura Uribe and **Bristol Bowman**
Graduate Program: Social Work
Advisor: David Fitzpatrick
Poster Number: 32

Cameron Park Neighborhood Aging in Place Initiative: A Community Needs Assessment and Asset Mapping

Adults over the age of 65 are the largest growing age group in America, and more older adults are desiring to stay in their homes and age within their communities. The concept of aging in place is desirable to many older adults who own their own homes, have strong ties to their communities, and do not wish to relocate to a long-term care facility. Many older adults are resisting institutionalized care, and are instead relying on combination of assistance from neighbors, family, and community resources to remain in their homes as they age. Aging in place is not only financially desirable, but also increases life satisfaction by reducing isolation and fostering social relationships through inter-dependence. The Aging in Place Initiative was born out of the Cameron Park neighborhood in Raleigh, North Carolina. The Cameron Park neighborhood is a naturally occurring retirement community, with around half of the neighborhood over the age of 65. The Cameron Park research study was conducted as sequential, exploratory research using a mixed methods design. Qualitative data was collected through semi-structured interviews and a focus group, which were conducted by the researchers with residents of the Cameron Park neighborhood. This qualitative data was used to create a written and online survey, which were adjusted after a pilot launch of the survey to select neighborhood residents. The final survey was administered to the entire Cameron Park neighborhood. The quantitative data from the survey was collected and then analyzed. At this time, survey collection and analyzation is ongoing and results are forthcoming. The researchers anticipate the implications for the results will lend to a deeper understanding of the needs of the Cameron Park neighborhood's aging population, in addition to the assets that exist within that neighborhood that may allow residents to age in place.

Amanda L. Young, Nicole M. Francavilla and Joshua S. Andrews
Graduate Program: Psychology
Advisor: S. Bartholomew Craig
Poster Number: 11

Using Follower-Perceived Leader Profiles to Predict Follower Self-Report OCB, CWB, and Team Effectiveness

The person-centered approach is an underutilized methodology in the leadership literature. The variable-centered approach has provided evidence that leadership styles affect follower performance outcomes, but little is known about the interactions among discrete aspects of leadership styles or their effectiveness when present within the same leader. We used Latent Profile Analysis to create leader profiles based on followers' perceptions of the behavior of their direct supervisors. Three types of leaders emerged: Ideal Leaders (high on positive leadership styles, low on destructive and nonleadership), Undifferentiated Leaders (average levels on all styles with peaks for initiating structure, nonleadership and destructive), and Disengaged Destructive Leaders (high on destructive and nonleadership, low on all others). Results indicated that Ideal Leaders received significantly higher ratings than those of other profiles on both team and leader effectiveness. Followers of Undifferentiated Leaders reported significantly higher rates of follower counterproductive work behaviors than both other groups, and leader behavior profiles did not have a significant relationship with follower organizational citizenship behaviors.

College of Natural Resources

Jameson Boone
Graduate Program: Forestry and Environmental Resources
Advisor: John King
Poster Number: 28

The Effect of Spacing and Drought on Coppiced Sycamore grown as a Short-Rotation Woody Crop

As the global carbon concentration in the atmosphere continues to rise, the world needs sustainable solutions for energy production. Bioenergy developed from intensively managed trees is a partial solution. With most of the bioenergy research focus on food crops or high-input tree plantations, little research has focused on more sustainable low-input bioenergy tree systems in the South Eastern US. We want to investigate the productivity and energy allocation of coppiced sycamore (Platanous occidentalis) on marginal agriculture land in the Piedmont of North Carolina. The study consists of a Randomized Complete Block Design with 3 blocks, 4 different spacings, and a drought treatment, a 4x2 design. Measurements will give accurate biomass data to determine which spacing treatment of coppiced sycamore is most productive after 3 years. The drought treatment or through-fall exclusion treatment will determine if removing 20% of the rainfall from the plots will affect productivity. The original trees were cut after 4 years and allowed to coppice, producing many shoots per stool. Measurements consist of diameter at breast height (DBH) of all dominant shoots and weights of a subsample of trees for allometric equations. The equations show the resource allocation of braches to dominate stems; branches are separated in to live and dead. A subsample of the allometry braches and stems will be dried and reweighed to develop DBH to dry weight conversion. Leaf Area Index to help calculate growth efficiency comes from both leaf baskets and ceptometer measurements. Preliminarily analysis shows no productivity differences in the rainfall exclusion treatment, but differences in the spacings, with the tightest spacing having most biomass overall.

Malorey Henderson
Graduate Program: Parks, Recreation and Tourism Management
Advisor: Erin Seekamp
Poster Number: 76

History under high tides: Threatened cultural resources and community member place connections at Cape Lookout National Seashore

Cultural resources are vulnerable to climate change, particularly in coastal areas where sea level rise and storm-related flooding and erosion challenges preservation efforts. Thoughtful and culturally sensitive management is becoming increasingly imperative as adaptive strategies for historic preservation are considered. As climate change not only challenges traditional management approaches but also threatens people's connections to places, the need to examine bonds between places and people intensifies. Place meanings influence people's perceptions of environmental impacts, and impacts to resources may affect place meanings. Accordingly, informed decision-making requires an examination of the influences of climate change and possible adaptation strategies on vested community members' place meanings. In an effort to assist managers at Cape Lookout National Seashore, a National Park Service unit with two federally listed historic districts located on barrier islands, in-depth interviews with stakeholders were conducted to investigate their cultural resource values, place connections, preferences for adaptation strategies, and perceived impacts to their place meanings from climate change and potential adaptation strategies. The findings of this study indicate deep emotional bonds that form community members' individual, family, and community identities, as well as strong elements of place dependence. Participants tended to accept climate change impacts as inevitable but that climate change wouldn't impact their connections as their place meanings were already altered when the NPS acquired the land and when the leases on personal homes expired. The study also revealed that participants perceived different types of impacts to occur in different temporal contexts, and that more immediate threats should be addressed before long-term climate change threats. These findings will assist managers at Cape Lookout National Seashore, and at other similar coastal park units, better understand how climate change and adaptation strategies will affect these stakeholders' place meanings and can be used to inform future cultural resource climate adaptation planning efforts.

Matthew Jurjonas
Graduate Program: Parks, Recreation and Tourism Management
Advisor: Erin Seekamp
Poster Number: 100

Rural Coastal Community Resilience: Developing and Testing a Framework for Evaluating Climate Change Vulnerabilities and Adaptive Capacities in Eastern North Carolina

Sea level rise threatens coastal regions globally. Rural coastal communities however, have unique vulnerabilities to the associated flooding and saltwater intrusion impacts compared to coastal urban areas that have growing populations, increasing property values, stronger industries, and extensive infrastructure. In contrast, the Albemarle Pamlico Peninsula, a rural coastal region in eastern North Carolina, has a local economy that is dependent on traditional livelihoods like farming, logging, commercial fishing, and eco-tourism businesses. These industries have started to realize decline as rural flight, rising startup costs, agriculture abandonment, salinization of soils, and increased environmental change make it more difficult to maintain a rural way of life. Further, compared to the nearby Outer Banks that have a strong tourism industry and high property values, the region has unique planning challenges created by a smaller tax base to finance planning and mitigation strategies. To address these vulnerabilities, this research engaged stakeholders with semi-structured interviews, focus groups, and a residential survey to better understand local perceptions of vulnerabilities and needs for building adaptive capacity. This outreach and a review of resilience research developed the Rural Coastal Community Resilience (RCCR) framework. The RCCR framework balances community resilience and vulnerability to coastal hazards and climate change with five pairs of opposing indicators that address local livelihoods, economic prosperity, sustainable development, community cohesion, and both governmental rigidities and community agency for implementing adaptation strategies. Results support the conceptualization of the RCCR framework, and highlight the APP communities' strong attachment to the rural way of life, concern about an aging population, and perception that residents have always been adapting to coastal hazards but that hazard-planning workshops are needed for enhancing the system's resilience. Furthermore, our study highlights the utility of the RCCR framework in engaging citizens and community leaders to begin necessary conversations for building community climate readiness.

Laurel Kays
Graduate Program: Forestry
Advisors: Robert Bardon and Dennis Hazel
Poster Number: 102

Economic Growth Potential of Western North Carolina Forest-Based Sectors

Economic Growth Potential of Western North Carolina Forest-Based SectorsThe 32 counties of Western North Carolina contain 5.7 million acres of forestland covering 66% of the region's land area. The same region significantly underperforms in many key economic metrics such as median and per capita household income, where its regional numbers are the lowest among all 7 regions of the state. This combination of ample forest resources and economic need make Western North Carolina well suited for analysis focusing on sustainable economic development.

Analyzing net linkages of forest-based sectors, or the ability of those sectors to generate exogenous economic growth, is one such way to gauge the real potential of forest resource based economic development.Using 2014 data from economic impact analysis software IMPLAN, net linkages were constructed and evaluated for each of the 28 regionally present forest-based sectors for value added, and employment. These 28 sectors represent 4 major categories of forest-based industries: forestry and logging, wood products manufacturing, paper manufacturing, and wood furniture manufacturing.

Results indicate that forest-based industries are well-positioned to generate exogenous economic growth in Western North Carolina. The value-added and employment net linkages of 21 out of the total 28 sectors were stronger than the regional average. Value added net linkages ranged from .193 to 2.291, while employment net linkages ranged from .189 to 2.95. The paperboard mills sector had the highest value added and employment net linkage. Overall, paper and furniture manufacturing sectors tended to have higher linkages than sectors in wood products manufacturing or resource and logging. These same general trends remain when sectors are filtered to only include those above the median regional output.

Allie McCreary
Graduate Program: Parks, Recreation and Tourism Management
Advisor: Erin Seekamp
Poster Number: 117

Attributes, activities, & meanings: Exploring climate impacts to nature-based tourism through the lens of "place"

Nature-based tourism (NBT) is an economic driver for amenity-rich locales transitioning from resource extraction (e.g., timber, mining) to resource conservation industries (e.g., outdoor recreation). While NBT provides economic, environmental and social benefits, NBT is threatened by climate change, influencing both the supply of (environmental conditions) and demand for (visitor behavior) tourism resources. In response, NBT providers must consider their readiness to address climate change. For the past three decades, managers have used place-based frameworks in outdoor recreation planning efforts. This study builds on these efforts by analyzing three components of place (physical attributes, pluralistic meanings, and common activities) to facilitate climate adaptation planning on the "North Shore" of Lake Superior (Minnesota, USA). Study objectives were to: (1) explore the physical attributes of place through images of the North Shore, (2) assess visitors' place meanings in relation to past climate-related impacts and future climate-related risk perceptions, and (3) understand how future recreation activities (i.e., recreation substitution) may be influenced by climate change on the North Shore. A multiple-methods approach included thematic analysis of Instagram posts with "#MyNorthShore" (objective 1) and statistical analysis of on-site visitor survey data (objectives 2 and 3). Findings reveal key attributes of the North Shore destination image (i.e., natural resources, built infrastructure, and human subjects). Additionally, visitors' place meanings are (a) significantly related to how they cope with climate-related impacts and (b) mediate their intention to temporally or spatially substitute recreation experiences in response to changing conditions. However, general climate concern drives visitors' risk perceptions of the North Shore and their future trips. These findings can be used to inform place-based management and marketing by leveraging visitors' place meanings and climate concern to overcome negative climate change impacts to NBT regions, such as decreased fish stocks and increased fire danger projected for Minnesota's North Shore.

Teresa L. Penbrooke
Graduate Program: Parks, Recreation and Tourism Department
Advisor: Michael B. Edwards
Poster Number: 144

Positioning local parks and recreation agencies as preventive public health providers: a Delphi study and case study approach

Public health (PH) evidence has increasingly pointed to community parks and recreation (P&R) resources as being one of the critical behavioral settings for potentially promoting health in communities. Based on growing evidence, addressing desired PH outcomes and addressing health equity issues among diverse populations is a growing focus for many P&R agencies. Contributing factors have been studied by many researchers, however many of the studies completed are approached from differing theoretical bases from differing disciplines, including varying theories from P&R research and PH realms. The global research question is shifting from one of asking IF P&R agencies can positively affect PH factors, to HOW they can best do so with limited resources and prioritization needs.

The continuing challenge at the local level is knowing which health factors are modifiable and the highest priority for a specific local P&R agency to address. Community-specific youth data on these various health factors are not readily available, and it is likely different in each community. Agencies often have limited information and evidence from which to inform implementation. Most national programs for PH interventions focus on individual or interpersonal change, while P&R agencies, by their governmental structure and funding mechanisms, are often focused on community/societal-level interventions and evaluation. Using systems thinking, an integrative thematic literature review, a Delphi study of 17 national agency key informants, and case study methodologies, this research explored how local P&R agencies can and are positioning themselves as preventative PH providers, with a focus on middle school aged youth, through systematic approaches to prioritize addressing health outcomes given limited resources.

Charles W. Sanders II, Christopher S. DePerno and Colleen Olfenbuttel
Graduate Programs: Fisheries, Wildlife, and Conservation Biology
Advisor: Chris DePerno
Poster Number: 163

Reproduction of the North American River Otter in North Carolina

The North American River Otter (Lontra canadensis) is native to all regions (Coastal, Piedmont, and Mountains) of North Carolina, but was extirpated from the Piedmont and Mountain regions by the end of the 19th century. While otters in the Piedmont recovered naturally, efforts were taken to reintroduce otters to the Mountains in the early to mid-1990s. By 2010, trapping seasons were open to all regions with no special restrictions.

Several states have found that otters in reintroduced populations have higher fecundity rates than traditional populations. In NC we have three distinct regions with unique histories where fecundity can be compared. Our question was whether or not there was any difference in otter fecundity across the state.

Between November 2009 and February 2016, we collected carcasses of harvested river otters from licensed trappers across all regions of North Carolina. We necropsied the collected otters and preserved samples for multiple tests. We used cementum annuli analysis to determine age from the lower canine tooth. We analyzed female reproductive tracts, specifically presence/absence and counts of corpora lutea for an estimation of reproductive rates.

Between November 2009 and February 2016, we collected 823 otters including 447 from the Coastal Plain, 54 from the Mountains, and 322 from the Piedmont regions. Harvested otters ranged between ¾ and 12 ¾ years of age. Males comprised 63% of the specimens. Approximately 82% of females displayed active corpora lutea. Our sampled parameters suggest that North Carolina has a healthy and robust otter population throughout the state.

Henrique Ferraco Scolforo
Graduate Program: Forestry
Advisor: Joseph Roise
Poster Number: 171

Grouping Eucalyptus clones subject to different environmental conditions in northeastern Brazil

The planting of Eucalyptus is expanding in many regions of Brazil, however, much of the area under cultivation has limitations to plant productivity, notably with different levels of water stress. Eucalyptus plantations are primarily clonal, and these clones are adapted for each of these regions, due to the strong genotype x environment (GxE) interaction. This results in more complex decisions when selecting suitable genotypes for different environmental conditions. It is necessary to identify the most promising genetic clones for each situation, i.e., those that are best adapted to abiotic and biotic stresses of each locality. Therefore, one of the goals of the study is to identify and group 11 eucalyptus clones, into two or more groups based on similar growth rates. The database was derived from the “Clonal Eucalyptus Tolerance to the Hydrous and Thermal Stresses” – TECHS, which is a project developed to investigate with greater accuracy the main environmental stresses to Eucalyptus (water and heat) in order to identify the matching of genotypes to different climate and soil conditions. Therefore, inventory and climate data between 2012 and 2016 were collected to assess the growth behavior for each of the 11 clones, with 90 plots. The relationship between eucalyptus clones, age and climate with annual dominant height growth and survival rate were assessed by linear mixed effects modeling. Three groups were defined, where one group seems to be plastic, the second group seems to be more dependent on water and the third group seems to always display a worse productivity, being inappropriate for the region. The successful matching of genetics (grouping clones) to local growth conditions improves eucalyptus growth for different Brazilian regions. Finally, the outcome permits the creation of clonal zoning and allocation of eucalyptus clonal material to appropriate sub-regions. Grouping these clones assist geneticists with the determination of good potential characteristics for new clones.

Rachel E. Szczytko[1], Kathryn Stevenson[1], M. Nils Peterson[2], Sarah Carrier[3] and Renee Strnad[4]
Graduate Programs: Parks, Recreation, and Tourism Management[1], Fisheries, Wildlife, and Conservation Biology[2], Science Education[3], Forestry and Environmental Resources[4]
Advisor: Kathryn Stevenson
Poster Number: 179

Impacts of environmental education on students with emotional and behavioral disabilities

There are over 3.7 million students in the U.S. with emotional and behavioral disabilities; many have individualized education plans (IEPs) which traditionally include medication and special education techniques. Environmental education (EE) includes three key elements often associated with improved outcomes for children with IEPs: green space, physical activity, and inquiry-based learning. In this study, we test whether nature-based EE can decreased student behaviors that challenge learning and improve educational outcomes for children with IEPs in North Carolina, U.S.A. through a quasi-experimental evaluation of the Muddy Sneakers' EE program. This program takes fifth grade students on six to ten field trips to natural areas annually and integrates immersive EE with national science curriculum standards. We surveyed both students and their classroom teacher to measure the changes in behavior, attention, connection to nature, science efficacy, and science knowledge before, during, and after an environmental education program in the 2016-17 school year. Both treatment (n = 950) and control (n = 450) students take the survey three times over the school year. Results will be analyzed in terms of locale, gender, race, and outdoor activity level. Results from the 2015-2016 school year revealed that over the course of four months, students with IEPs significantly improved their attitudes and decreased disruptive behaviors while in the program (t-test, n = 132, $p < 0.05$). Further, these students significantly increased their science efficacy (n = 132, $p < 0.05$). We will present updated findings based on a mid-year examination of the 2016-17 school year. This evidence illustrates that consistent EE can provide viable practices for decreasing the negative behaviors of students with IEPs while also helping students catch up to their peers' science efficacy. This suggests that EE could lessen the need for medication and specialized education in IEPs.

Pegah Tayeb and Lokendra Pal
Graduate Programs: Forest Biomaterials
Advisor: Lokendra Pal
Poster Number: 181

Biomaterial Polymer Blends for Material Extrusion 3D Printing

There is a renewed interest in replacing fossil-derived synthetic plastics with renewable polymeric materials due to increased environmental concerns and end-of-life disposal challenges. This can be achieved through the control of the feedstock, chemical, and physical structures of polymer materials during extrusion process. We investigated the effect of biomaterials (cellulose and lignin) blending with acrylonitrile-butadiene-styrene (ABS) and polylactic acid (PLA) to maximize the use of biomaterials in composites. We produced composites of cellulose nanocrystal (CNC)- acrylonitrile-butadiene-styrene (ABS) and lignin- PLA through a melt blending process via twin-screw extruder at T=160 ºC and T= 150 ºC respectively in a screw rate of 100 rpm. A set of experiments were performed and the produced polymer composites were analyzed using multiple techniques. SEM images of the polymers in both surface and cross-section views showed significant enhancement in polymer morphology when a 20 wt% CNC and 5 wt% lignin was added to the ABS & PLA composite respectively. TGA also showed different behaviors of thermal degradation curves for nanocomposites in comparison to pure ABS and PLA. This difference gets clearer by increasing the CNC content. For example, there are two steps in ABS/CNC20 composite curve, first step (250ºC to 300ºC) was appeared by the low thermal stability of CNC and second step (300ºC to 450ºC) showed the degradation temperature range for ABS. It was used to confirm the role of cellulose in reducing the thermal degradation temperature from 350ºC in ABS to 265ºC in ABS/CNC20. More studies about the internal strengths of the filaments showed that the addition of 20% CNC could significantly increase the mechanical properties such as 3 point bending, DMA and tensile indices to a significant extent. This approach can be very beneficial since extrusion process is considered an economical method for making filaments on a large scale especially for 3D printing, yet the presence of cellulose makes it more sustainable.

Preeti Tyagi, Lokendra Pal and Martin Hubbe
Graduate Program: Forest Biomaterials
Advisor: Lokendra Pal
Poster Number: 187

Sustainable Bio-based Barrier Coatings Using Nanocellulose Crystals

With an increase of environmental and sustainability issues, the food packaging industry has been encouraged to search for bio-based barriers packaging systems produced from renewable sources. There are various research projects going on bio-based barrier coatings and packaging films including proteins, starch and nanocellulose. In recent years, nanocellulose containing films have been found to be excellent oxygen and grease resistant due to the high surface area, crystallinity, tunable chemistry and mechanical strength properties of nanocellulose. However, a big gap still exists to make nanocellulose films primarily consisting of CNFs or CNCs due to their hydrophilic character. Furthermore, only a few studies demonstrate nanocellulose application as coatings on paper or recyclable materials. Our research introduces additives such as high-aspect ratio nanoclay, kaolin clay, alkylketene dimer (AKD), and protein into the nanocellulose formulation in order to prepare a uniformly-distributed coating layer. Formulations with nanocellulose and additives with specialized functionalities were obtained in the laboratory and applied on three different packaging papers using a Mayer rod. Coated paper samples were characterized to determine surface, barrier, and mechanical properties. Nanocellulose barrier coatings prepared with montmorillonite and other components showed a significant reduction in water absorption (up to 71% compared to surfaces with no coating and up to 27% for surfaces with a CNC only coating), moisture vapor transmission rate (up to 35% compared to surfaces with no coating), and resistance to air permeation (up to 88% compared to surfaces with no coating and up to 44% for surfaces with a CNC only coating). The Kit test for oil and grease resistance showed a rating of 6 for the surface with a multi-component CNC barrier coating, while a sample with a CNC only coating and another without any coating failed for kit test number 1. Stiffness also increased by 20% compared to surfaces without coating.

Ashish Virmani
Gradaute Program: Fiber and Polymer Science and Forest Biomaterials
Advisor: Lucian Lucian and Richard Kotek
Poster Number: 191

Use of polyethylene waste for catalytic production of linear low molecular weight products at low temperatures

Use of polyethylene waste for catalytic production of linear low molecular weight products at low temperaturesThe most widely used synthetic polymer in our daily life polyethylene, is considered as the most common polymer to cause environmental pollution because it is hard to recycle in the conventional ways by which we recycle natural materials. However, its annual production is so high because of its high usage as packaging material for food and other industries. As, polyethylene has very good chemical resistance and gas barrier properties so food can stay fresh for months and does not get highly affected by the outside moisture. It high usage also makes it one of the most problematic and most visible environmental hazard. The packaging is discarded to end up in land fill, incineration or sometimes recycling because of its highly production. However, catalytic degradation can be done for monomer recovery or transformation of waste into other useful chemicals which can be used by other industries or as fuel. Catalytic degradation is the finest route by which the polyethylene waste can be converted in to linear low molecular weight product with the help of catalyst, temperature and pressure. The reaction starts with the addition of polyethylene waste, phenol, alumina/silica mixture as catalyst in the reactor at ambient temperature and then reactor is sealed and heated at 300 – 330 °C for 1 hour. The addition of phenol will act as hydrogen donator and evidently leads to the formation of linear low molecular weight product. The gaseous, liquid and solid products will be collected at the end of reaction and tested by gas chromatography/mass spectrometry. As polymer waste is the major source of pollution, our new approach can benefit society by reducing the polymer waste and producing valued products. Subsequently, this research is of great importance to us to achieve a more sustainable environment and to make polymer sustainable.

Guizhou Wang, Perry Peralta, Phil Mitchell and Ilona Peszlen
Graduate Program: Forest Biomaterials
Advisor: Perry Peralta
Poster Number: 151

Fire Performance of Edge Gluing Cross-Laminated Timber

Due to advantages such as cost effectiveness, superior seismic performance, and excellent strength and stiffness properties, the use of prefabricated cross-laminated timbers (CLT) has been increasingly popular in low- and mid-rise residential and commercial constructions. One main concern regarding the utilization of CLT as building material is fire safety. Though there have been several studies to develop the design model and investigate the effects of various factors on the fire performance of CLT panels, there are still many issues that remain to be solved. Previous unpublished research has shown that early smoke penetration could occur when there are open paths for air. With the aim to solve this issue, this study proposed edge gluing method to fill in the open paths within each layer by using melamine formaldehyde (MF), phenol resorcinol formaldehyde (PRF) and polyurethane (PU) . A simplified fire test based on PS 1-09 was first performed to study the effect of edge gluing in small-scale. Then, thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC) were utilized to evaluate the thermal properties of the adhesives. Lastly, intermediate-scale horizontal fire tests based on ASTM E119 were conducted in a full factorial design with face adhesive and edge adhesive as variables. Small-scale fire test showed that PRF-glued samples had no delamination, while MF had little if any and PU had severe delamination. This was confirmed by thermal studies which revealed that MF and PU had substantial degradation at around 250 ºC while PRF was relatively stable even at 400 ºC. By applying linear char rate model, data from the intermediate-scale test fitted surprisingly well and proved the statistically significant effect of edge gluing on fire performance. Visual examinations also suggested that edge gluing could have positive effect.

College of Sciences

Maria E. Adonay
Graduate Program: Bioinformatics
Advisor: Ross W. Whetten
Poster Number: 3

Using results from model organisms to inform research on non-model organisms: an exploratory analysis

Conducting genomic research in forest trees could lead to better practices in the management, breeding, conservation, and restoration of natural populations. Loblolly pine, Pinus taeda, is an economically and ecologically important tree in the southeastern United States. While research on gene regulation within model organisms such as Arabidopsis thaliana has been extensive, much is still not known regarding the structure and function of P. taeda's genome due to its complexity. The goal of this research is to inform future studies by determining if there exist groups of putative genes in P. taeda that are notably similar in structure to families of known genes in A. thaliana, and if so, to describe the degree of similarity. To accomplish this goal of identifying putative genes between the two organisms, A. thaliana and P. taeda were first compared based on sequence similarity. The A. thaliana - P. taeda combinations that were deemed as sufficiently similar were then narrowed to those that most-likely correspond to actual homologous relationships between A. thaliana genes and true P. taeda genes by employing a series of filtering techniques. This approach is being developed as a pipeline for future comparisons of functional genomic data between model and non-model organisms with complex genomes, such as that of P. taeda. Preliminary analyses have shown that many A. thaliana genes show comparable levels of similarity to multiple different putative P. taeda genes. Efforts to elucidate those relationships are ongoing.

Megan M. Amanatides and Erin L. Hestir
Graduate Program: Marine, Earth and Atmospheric Sciences
Advisor: Erin L. Hestir
Poster Number: 9

Evaluating the carbon balance of Arctic wetlands: A synthesis

The study of carbon dioxide (CO2) exchange from Arctic wetlands is a top research priority as our climate continues to change. High latitude wetlands hold vast amounts of carbon due to their cold and wet soils. Thus, they act as an important sink in the global carbon cycle by removing CO2 from the atmosphere. However, there is increasing uncertainty regarding how the carbon balance of these ecosystems will respond to climate change. Our understanding of CO2 dynamics in these ecosystems is critical in order to accurately estimate future CO2 exchange. Using newly released data from an integrated network of CO2 sensors, my results provide a new synthesis for this region, allowing for a more holistic analysis across Arctic wetlands than ever before. I analyzed changes in CO2 flux, or the exchange of CO2 between the ecosystem and the atmosphere, and then investigated the potential influence of numerous meteorological and ecological variables on CO2 flux using a combination of near-surface remote sensing data and satellite observations across ten sites located in Arctic wetlands. I found that at one of four sites with long-term data records, the wetland is becoming a stronger sink for atmospheric CO2 over time, while at the other three sites there was no significant trend. However, I also found that based on current variability, a longer time series of data is needed in order to detect a trend. To analyze the influence of environmental variables, a machine learning algorithm was used to identify which factors were most important in determining CO2 flux. Changes in CO2 flux are mainly being driven by changes in vegetation cover, greenness, shortwave radiation, and temperature. This research allows us to better understand the underlying processes affecting CO2 flux in Arctic wetlands which can be used to improve models predicting future greenhouse gas emissions.

Jordan Baker
Graduate Program: Marine, Earth and Atmospheric Sciences
Advisor: Viney Aneja
Poster Number: 12

Ammonia on the Delmarva Peninsula from Agricultural Practices: A Study of Concentrations and Deposition from a Broiler CAFO

Ammonia is released into the atmosphere in many forms, both natural and anthropogenic, with anthropogenic sources being the most important for environmental concerns. Ammonia is increased due to the production of animal waste in agricultural practices (which accounts for 80% of anthropogenic nitrogen production). Anthropogenic nitrogen emission has become a major issue on the Delmarva Peninsula. The primary concern is deposition into tributaries that filter into the Chesapeake Bay. In this area excess nitrogen deposition from ammonia creates large algal blooms that deplete oxygen from the water. This study seeks to analyze ammonia concentrations and deposition in the vicinity of a broiler-producing CAFO. Employing the EPA-developed air quality dispersion model, AERMOD, the study simulates values of concentration and deposition around a representative broiler CAFO (treated as an area source) in Wicomico County, MD for 2012. On average, the highest concentrations occur during the summer at all distances from the source, however some of the most extreme concentrations occur during the winter months within 50 meters of the housing facility. An overall hourly-maximum of 5,905µg m-3 (7.874 ppm) is calculated in the month of December during the morning hours. It is believed that these extreme concentrations are due to shallow boundary layer conditions or thermal inversions in the lower troposphere. Deposition is also calculated in the simulation using a deposition velocity of 1.0cm s-1 for agricultural sites. The simulation finds that total nitrogen deposition from a single CAFO is 15.1 kg NH3-N per year. There is evidence that a single poultry facility can have a large effect on both the environment and nearby residents. Further model simulations suggest an inclusion of the bi-directional flux in conjunction with increased sources.

Jordan Bakerman
Graduate Program: Statistics
Advisor: Alyson Wilson
Poster Number: 13

Twitter Geolocation: A Hybrid Approach

Twitter has grown to 300 million active users monthly and more than 500 million tweets daily since its inception in 2006. The popularity of twitter has spawned copious research efforts to use the social media service as a tool for event monitoring and event detection. However, approximately only one percent of tweets are geotagged with latitude and longitude coordinates. This research leverages both tweet content and user friendship network information to predict the origin of tweets. These are two approaches currently living in different research domains. We create a hybrid method that uses Twitter content and network information jointly as model features. To do so, we use Gaussian mixture models to map the raw spatial distribution of model features to a predicted field. This approach is scalable to large data sets and provides a natural representation of model confidence. Our method is tested against other approaches and we achieve greater prediction accuracy. The model also improves both precision and coverage.

Michele Balik-Meisner[1], Elizabeth Scholl[1], Lisa Truong[2], Robert L. Tanguay[2] and David M. Reif[1]
Graduate Programs: Bioinformatics, North Carolina State University[1], Sinnhuber Aquatic Research Laboratory, Oregon State University[2]
Advisor: David M. Reif
Poster Number: 14

Population Genetic Diversity in Zebrafish Lines and Its Implications for Toxicological Research

Toxicological and pharmacological researchers have seized upon the many benefits of zebrafish, including the short generation time, well-characterized development, and early maturation as clear embryos. A major difference from many model organisms is that standard husbandry practices in zebrafish are designed to maintain population diversity. While this diversity is attractive for translational applications in human and ecological health, it raises critical questions on how interindividual genetic variation might contribute to susceptibility differences in response to chemical exposure and introduce variability between labs. Findings from pooled samples of zebrafish support this supposition of diversity yet cannot directly measure allele frequencies for reference versus alternate alleles. Using the Tanguay lab Tropical 5D zebrafish line (T5D), we performed whole-genome sequencing on a large group (n=276) of individual zebrafish embryos. Paired-end reads were collected on an Illumina 3000HT, then aligned to the most recent zebrafish reference genome (GRCz10). We found median chromosomal identity of 98.8% between T5D and GRCz10. We also built a custom assembly for the T5D line. These data were used to compare the T5D genome to the zebrafish reference build as well as the popular zebrafish lines WIK, TU, TL, and AB. Even with strict filtering parameters and inclusion only of sites in nonrepetitive regions of the genome, we found more than twice as many single nucleotide polymorphisms (SNPs) in T5D than have been reported in SNP databases for any of the WIK, TU, TL, or AB lines. We hypothesize that some subset of the novel SNPs may be shared with other zebrafish lines but have not been found in other studies due to the limitations of capturing population diversity in pooled sequencing strategies. Our observations suggest that interindividual genetic diversity within laboratory populations may be higher than currently estimated and may have implications for differential susceptibility observed in toxicological studies.

Patrick Barry[1], Chueng-Ryong Ji[1], Nobuo Sato[2] and Wally Melnitchouk[2]
Institutions: Physics, North Carolina State University[1], Theory Center, Thomas Jefferson National Accelerator Facility[2]
Advisor: Chueng-Ryong Ji
Poster Number: 16

Quark Structure of the Pion from Lepton-Pair Creation

The proton is more complex than a collection of three valence quarks. We realize that an abundance of “sea” quarks and gluons is crucial to understanding the mass and internal structure of the proton. The pion is intimately related with the proton as analyses indicate an effective pion cloud exists around the core valence structure. In the Drell-Yan (DY) process, two hadrons (such as protons or pions) collide, one donating a quark and the other donating an antiquark. The quark-antiquark pair annihilate, forming a virtual photon, which creates a lepton-antilepton pair. By measuring the cross-section of the dilepton pair, we obtain rich information about the parton distribution function (PDF) of the hadrons. The PDF is the probability of finding a parton (quark, antiquark, or gluon) at a momentum fraction of the hadron, x, between 0 and 1. Experiments performed at Fermilab such as E866 and SeaQuest collect data in the DY process. Determining the pion PDFs from the DY process stems from understanding the abundance of sea quarks. Complementary to the DY process is deep inelastic scattering (DIS). Here, a target nucleon is probed by a lepton, and we investigate the pion cloud of the nucleon. The experiments H1 and ZEUS done at HERA at DESY collect DIS data. Both DY and DIS processes can measure small and large x depending on kinematics. Numerically, we have implemented the DY cross-section and have obtained the result consistent with (Becher, et al. 2008). Now, we perform a double-Mellin transform on the hard-scattering kernel to easily evolve the PDFs over energy scales as in (Stratmann and Vogelsang, 2001). We aim to perform a full NLO QCD global analysis and a state-of-the-art fitting technique to all available data as in (McKenney, et al. 2016) to determine pion PDFs more accurately in all x regions.

Daniel Irving Bernstein
Graduate Program: Mathematics
Advisor: Seth Sullivant
Poster Number: 22

Recovering a rank-2 matrix from partial information

Let M be a matrix of some low rank r. If you can only observe a subset of M’s entries, is it possible to compute the entries you cannot observe? What are the minimal subsets of observed entries that allow you to recover what is missing? For rank 1 matrices, the answer to this question is well-known and quite simple. For higher ranks, this question is more difficult. We provide an answer for rank 2. Practical applications exist but this poster will focus exclusively on the mathematics.

Natalie M. Clark[1,2], Alun Lloyd[2] and Ross Sozzani[1,2]
Graduate Programs: Plant and Microbial Biology[1], Biomathematics[2]
Advisors: Alun Lloyd and Ross Sozzani
Poster Number: 44

Gene regulatory networks controlling stem cell identity and maintenance in the Arabidopsis thaliana root

Development in multicellular organisms requires not only the production of specialized cell types but also mechanisms of coordination among them. Stem cells are ultimately the source of all cell types, and the balance between self-renewal and differentiation of their progeny regulates organ growth. Transcription factors and cell-to-cell signaling have a key role in coordinating these processes; however, how these transcriptional networks and signaling pathways control plant development is not completely understood. Thus, we aim to predict Gene Regulatory Networks (GRNs) important for stem cell identity and maintenance in the Arabidopsis thaliana root. We obtained a transcriptomic profile of all of the stem cell populations in the root using Fluorescence Activated Cell Sorting (FACS) coupled with RNA sequencing (RNA-seq). We then identified genes specifically expressed in one stem cell population as well as genes expressed in all or most of the stem cell populations. We hypothesized that the genes expressed in only one stem cell population have a role in stem cell identity, whereas genes expressed throughout the stem cell niche have a role in stem cell maintenance. To investigate how these identity and maintenance genes interact, we developed a computational pipeline that can infer GRNs from transcriptomic data. This pipeline combines spatial clustering, regression tree inference, and a directionality algorithm to predict the relationships between genes. We then used motif analysis to identify the most important genes in the network for biological validation. Our computational pipeline reveals genes and networks that are important for stem cell and, consequently, root development.

Gabrielle Corradino, Joanna Kinsey, Chris Osburn and Astrid Schnetzer
Graduate Program: Marine, Earth and Atmospheric Sciences
Advisor: Astrid Schnetzer
Poster Number: 47

Nanoflagellates: Species Characterization and Trophic Interactions in the Microbial Loop

Nanoflagellates play a pivotal role in energy transfer and in the cycling of nutrients and organic matter throughout marine microbial food webs. Mixotrophic flagellates have the ability to use combinations of photosynthetic and heterotrophic methods for their nutrient uptake. While the importance of these minute protists as primary producers (nanoalgae) and primary consumers of bacteria (nanograzers) has been recognized, there is limited empirical data on species-specific growth and grazing due to limitations in characterizing these microbes via traditional light microscopy. The use of complementary molecular tools has begun to provide insight into how species-rich and diverse flagellate communities are and allow for further research into taxa-specific trophic strategies. We have isolated a group of nanoflagellates repeatedly detected in association with varying bloom-forming diatoms from the coastline of North Carolina. I will provide information on the species characterization for this group based on microscopy and molecular data and will share preliminary data on the organism's trophic capabilities (phototrophy versus heterotrophy) derived from growth and grazing experiments. Deciphering these trophic interactions will advance our understanding of the role that mixotrophic protists play in carbon transfer within the microbial loop and energy flow up to higher trophic levels.

Katherine S. Duke[1], Alexia J. Taylor[1], Mark D. Ihrie[1], Kelly A. Shipkowski[1], Erinn C. Needham[2] and James C. Bonner[1]
Graduate Programs: Toxicology[1], Chemical and Biomolecular Engineering[2]
Advisor: James C. Bonner
Poster Number: 51

STAT1 Regulates Pulmonary Fibrosis in Mice after Exposure to Multi-walled Carbon Nanotubes Through Suppression of TGF-ß1 Production and Signaling

Multi-walled carbon nanotubes (MWCNT) are a potential risk for pulmonary fibrosis due to their fiber-like shape; other physico-chemical features such as rigidity could also confer fibrogenicity. The signal transducer and activator of transcription-1 (STAT1) is an important anti-fibrogenic transcription factor that promotes fibroblast growth arrest. STAT1 deficient (Stat1-/-) mice are susceptible to pulmonary fibrosis. In this study, we hypothesized that Stat1-/- mice or primary Stat1-/- lung fibroblasts exhibit a differential fibrogenic response to tangled (t-) vs. rigid (r-) MWCNT above that seen with wild-type (Stat1+/+) mice or Stat1+/+ lung fibroblasts. Methods: Primary mouse lung fibroblasts (MLF) were isolated from Stat1+/+ or Stat1-/- mice, exposed to a t- or rMWCNT (10 mg/ml) and analyzed for protein expression of fibrogenic mediators by Western blot. Stat1+/+ and Stat1-/- mice were exposed to t- or rMWCNT (4 mg/kg) via oropharyngeal aspiration and lung tissues were collected after one and 21 days to measure mRNA and protein levels of fibrogenic mediators. Results: rMWCNT caused mucous cell metaplasia, epithelial cell proliferation, increased fibrosis and larger granulomas in the lungs of mice compared to tMWCNTs. Both MWCNTs induce acute neutrophilia, however only rMWCNTs induce chronic neutrophilia. Stat1-/- mice exhibited higher serum levels of IgE and higher levels when treated with rMWCNTs. Stat1-/- mice treated with rMWCNT had higher TGF-β1 protein levels in bronchoalveolar lavage fluid, increased TGF-β1 signaling activation, and airway collagen deposition after 21 days than Stat1+/+ mice. Conclusions: r- and tMWCNT induce different pulmonary fibrogenic responses that are exaggerated by STAT1 deficiency, emphasizing the importance of tube rigidity and genetic susceptibility. The mechanism of STAT1 susceptibilty to MWCNT-induced fibrosis appears to be through dysregulated TGF-β1 production and signaling.

Stephanie A. Eytcheson
Graduate Program: Toxicology
Advisor: Gerald A. LeBlanc
Poster Number: 57

Hemoglobin Levels Modulate Toxicity of Nitrite

Environmental nitrogenous compounds, such as nitrate and nitrite, can bind to the heme moiety of hemoglobin resulting in toxicity. We hypothesized elevated hemoglobin levels can increase the tolerance of daphnids (Daphnia magna) to nitrite by sequestering the nitrite yet providing ample unaltered hemoglobin to meet the oxygen transport needs of the organisms. We investigated this by evaluating the change in tolerance of daphnids to the toxicity of nitrite following the elevation of hemoglobin levels by exposure to pyriproxyfen and following depletion of hemoglobin levels using small interfering RNA (siRNA). Pyriproxyfen exposure increased hemoglobin levels as evidenced by increased hemoglobin (hb1 and hb2) mRNA levels and increased red coloration of the organisms. Pyriproxyfen exposure also increased the tolerance of daphnids to the acute toxicity of nitrite. Feeding daphnids siRNA that specifically targeted hb1 and hb2 mRNA significantly attenuated the induction of hemoglobin by pyriproxyfen and the tolerance of these organisms to nitrite toxicity. The suppression of hemoglobin expression was monitored throughout the experiments by noting the reduced red coloration of the daphnids and was confirmed at the end of the experiments by quantitative real-time PCR. Results support the hypothesis that the induction of hemoglobin serves to protect daphnids from the toxicity of some environmental chemicals. Further, results of this study demonstrate that feeding of siRNA is an efficient, non-invasive means to knock down specific gene products in Daphnia magna.

Brian R. Gaines[1] and Hua Zhou[2]
Graduate Programs: Statistics, North Carolina State University[1], Biostatistics, University of California, Los Angeles[2]
Advisors: Hua Zhou and Eric Chi
Poster Number: 65

Algorithms for Fitting the Constrained Lasso

We compare alternative computing strategies for solving the constrained lasso problem. As its name suggests, the constrained lasso extends the widely-used lasso to handle linear constraints, which allow the user to incorporate prior information into the model. There are several examples of this in the literature, but each time a new algorithm is derived for the application-specific constraints of interest. We instead focus on a general formulation of the constraints to alleviate this problem and make it much easier for researchers to impose constraints when estimating the lasso coefficients. In addition to quadratic programming, we employ the alternating direction method of multipliers (ADMM) and also derive an efficient solution path algorithm. Through both simulations and real data examples, we compare the different algorithms and provide practical recommendations in terms of efficiency and accuracy for various sizes of data. Our results indicate that the novel solution path algorithm outperforms the other methods in terms of estimation time, without sacrificing accuracy. We also show that, for an arbitrary penalty matrix, the generalized lasso can be transformed to a constrained lasso, while the converse is not true. Thus, our methods can also be used for estimating a generalized lasso, which has wide-ranging applications. Code for implementing the algorithms is freely available in the Matlab toolbox SparseReg.

Brandon Hollingsworth and Alun Lloyd
Graduate Program: Biomathematics
Advisor: Alun Lloyd
Poster Number: 78

Divorce Effect: Evaluating Post-control Dynamics in Disease Systems

For many endemic human diseases vaccinations can be difficult to develop and prohibitively expensive to employ. Control of these diseases often works by minimizing transmission of the infection; e.g. minimizing contact with infectious individuals, treatments that cause people to be less infective, or targeting some vector of the disease. These control programs require ongoing effort and are often subject to sudden interruptions. While the dynamics of disease control programs are well studied, the period following the end of a control is not well understood. To address this, we simulated the dynamics of a disease system in which a successful control is suddenly stopped and compared the results to what would be expected in the endemic setting. We show the non-intuitive result that over time, there are periods in which the population experiencing the control measure will see more cases of the disease than if no control was implemented. We show that this result – which we term the divorce effect – is caused by the buildup of susceptible individuals in the population during the application of certain control measures, leading to spikes of disease outbreaks after control. Further, we find this effect is present in many disease systems that allow for a buildup of susceptible individuals. Our current work is focused on better understanding the conditions that allow for this divorce effect and to find control plans that would be able to mitigate the risk of such an effect. These non-intuitive post-control disease dynamics, their causes, and possible solutions are becoming an ever more pertinent subject as many of the disease controls currently employed are beginning to fail due, amongst other things, to the rise of antibiotic and insecticide resistance.

Kathleen Hudson
Graduate Program: Genetics
Advisor: Michael Cowley
Poster Number: 81

Epigenetic Responses to In Utero Cadmium Exposure

Cadmium (Cd) is a toxic heavy metal found ubiquitously in the environment and is of increasing concern to human health. Developmental exposure to cadmium is associated with reduced birth weight, essential trace element deficiencies, reproductive system impairments, fetal malformations, and increased risk of metabolic disease. However, the mechanisms behind these physiological changes are unclear. Despite the inefficient transfer of cadmium across the placenta, maternal cadmium exposure is associated with altered DNA methylation in the fetus. Preliminary data from a collaborative study have identified over 600 differentially methylated regions in newborn children exposed to high levels of Cd in utero, some of which are significantly enriched near imprinted genes. Epigenetic mechanisms regulating imprinted genes may be more susceptible to environmental exposures during in utero development due to their unique DNA methylation dynamics. To test this, we have established a mouse model of in utero Cd exposure. Our preliminary data show that in utero Cd exposure significantly reduces birth weight, fetal length, and kidney weight, while significantly increasing blood glucose levels and the sizes of the heart, brown adipose tissue, and brain. We will perform whole genome bisulfite sequencing (WGBS) using newborn livers to provide an unbiased view of global DNA methylation changes as a result of maternal Cd exposure. Because we are using two divergent inbred strains of mice to generate hybrid offspring, we will be able to identify the parental origin of the WGBS reads, facilitating our analysis of the effect on imprinted gene DNA methylation. We will compare DNA methylation changes in mice to those found in newborn children to validate our model. Finally, we will determine the functional consequences of methylation changes on gene transcription and phenotypic outcome. Results from these studies will give insights into potential mechanisms through which developmental exposure to Cd causes adverse health effects.

Joel A. Johnstun, Frances S. Haire, Trudy F. C. Mackay and Robert R. H. Anholt
Graduate Program/Institution: WM Keck Center for Behavioral Biology, Program in Genetics, Department of Biological Sciences
Advisor: Robert R. H. Anholt
Poster Number: 95

Subfunctionalization and Neofunctionalization of Drosophila Odorant Binding Proteins

The functions of most Drosophila odorant binding proteins (Obps) remain unexplored, and many exist in tandem arrays throughout the genome. As these genes most likely arose through recent duplication, genes within a cluster likely have partially redundant or pleiotropic functions. Here, we used the CRISPR-Cas9 system to generate two knock-out lines, the first lacking the four paralogs of the Obp56a-d cluster, and the second lacking the single Obp56h gene, another possible paralog of the Obp56 cluster. Various phenotypic tests on these knockout lines demonstrate significant functional overlap and novel pleiotropic functions. Both lines shared decreased viability in early development, development time, and copulation latency, while the Obp56a-d KO line uniquely showed decreased height of pupation. The Obp56h KO line showed increased copulation duration and decreased aversion to 2-heptanone. Reinserting the Obp56a-d genes one-by-one and in various combinations in a PhiC31 integration site engineered in their original location during CRISPR-Cas9 excision will enable reconstruction of their functional evolutionary history. Supported by NIH grant GM059469.

Megan Knuth
Graduate Program: Toxicology
Advisor: Seth Kullman
Poster Number: 105

Is there a role for vitamin D in metabolic syndrome?

Vitamin D (1α, 25-dihydroxyvitamin D3) is a steroid hormone traditionally associated with mineral ion homeostasis; however, accumulating evidence suggests a wider biological role for vitamin D and its importance in immune function, xenobiotic metabolism, cell differentiation and neurodevelopment. Like other members of steroid hormones, the biological effects of vitamin D are mediated through the binding of 1α, 25-dihydroxyvitamin D3 (ligand) to its hormone receptor, VDR. In recent years, the vitamin D signaling axis has been implicated in metabolic control, where low systemic vitamin D levels are associated with obesity and metabolic disorders falling under the umbrella of dyslipidemia and adiposity. To investigate the role of vitamin D/VDR in lipid metabolism we have established three dietary cohorts of zebrafish placed on engineered diets: a standard lab diet (1.4 iu/g) as a control, a vitamin D null diet (0 iu), and a vitamin D enriched diet (400,000 iu/g). We have found that zebrafish placed on a vitamin D deficient diet at 2 months of age develop grossly swollen abdomens by 6 months of age. This phenotype is attributed to significantly elevated levels of visceral and subcutaneous fat compared to controls. In concordance, preliminary gene expression data shows an overall upregulation of adipogenic and lipogenic markers, and preliminary proteomics data demonstrates differential regulation of proteins specific to lipid metabolism. Current work is being done utilizing RNA-Seq to elucidate the primary pathways being differentially regulated by vitamin D and to better understand the whole metabolic impact of vitamin D deficiency.

John Lagergren, Amanda Reeder, Franz Hamilton, Ralph Smith and Kevin Flores
Graduate Program: Mathematics[1]
Advisor: Kevin Flores
Poster Number: 106

Hybrid Modeling of Chaotic Systems with Uncertainty Quantification

Traditionally, modeling (parametric) and model-free (non-parametric) techniques are used for prediction, however it is uncommon for the two to be incorporated together. We compare the forecast accuracy of a Bayesian parametric methodology (DRAM) and a non-parametric approach (SSR) against each other as well as against a hybrid composed of the two on a chaotic coupled dynamical system. We apply our hybrid approach on an age-structured population system using data from cannibalistic flour beetles, in which it has been observed that the adults preying on the eggs and pupae results in chaotic population dynamics.

Cindy Lebrasse, Christopher L. Osburn, Ruoying He and DelWayne R. Bohnenstiehl
Graduate Program: Marine, Earth and Atmospheric Sciences
Advisor: Christopher L. Osburn
Poster Number: 107

The Influence of Water Circulation on Dissolved Organic Matter Dynamics and Export from Bald Head Creek, NC

Dissolved organic matter (DOM) is an important component of the flux of carbon (C) from land to sea. In coastal environments, such as tidal creeks draining salt marshes, significant knowledge gaps remain regarding the quantity and quality of the DOM that tidally exchanges between salt marshes and their adjacent estuaries or coastal waters. Uncertainty in quantifying these fluxes lies in the challenge of modeling these complex and dynamic environments. DOM export in response to tide-induced water circulation was studied in Bald Head Creek, a tributary to the Cape Fear River estuary in eastern North Carolina, using field investigations, laboratory measurements, and numerical modeling. Water samples were collected at three locations along the creek (upstream, midway and near the creek mouth) over four tidal cycles between March and August 2016 for analysis of dissolved organic carbon (DOC) concentration and light absorption by chromophoric DOM (CDOM). These measurements showed that DOM characteristics differed substantially over the tidal cycle during all four months, with a similar pattern of higher CDOM and DOC concentration at low tide compared to high tide at all three sites, suggesting greater export of carbon from the marsh to the estuary during ebb tide. DOC fluxes were computed using a numerical hydrodynamic model, based on the strong linear inverse relationships between CDOM, DOC concentration, and salinity from field observations. Model predictions estimate an annual net export of DOC at 228 g C m-2 y-1 from the marsh into the adjacent estuary, nearly 100-fold greater than the mean export of 15 major US rivers. Overall, results suggest that estuarine OM dynamics in tidal creeks are strongly controlled by the circulation of water and by tidal pumping, which leaches DOM from salt marshes and exports it to adjacent waters at magnitudes much greater than larger river systems. This work demonstrates the need to quantify the importance of these tidal wetland systems in the ocean's coastal C cycle.

Jami J. Mulgrave
Graduate Program: Statistics
Advisor: Subhashis Ghoshal
Poster Number: 129

Bayesian inference in nonparanormal graphical models

Gaussian graphical models, where it is assumed that the variables of interest jointly follow multivariate normal distributions with sparse precision matrices, have been used to study intrinsic dependence among several variables, but the Gaussianity assumption may be restrictive in many applications. A nonparanormal graphical model is a nonparametric generalization of a Gaussian graphical model for continuous variables where it is assumed that the variables follow a Gaussian graphical model only after some unknown smooth monotone transformation. We consider a Bayesian approach in the nonparanormal graphical model by putting priors on the unknown transformations through a random series based on B-splines where the coefficients are ordered to induce monotonicity. A truncated normal prior leads to partial conjugacy in the model and is useful for posterior simulation using a Hamiltonian Monte Carlo sampler within Gibbs. On the underlying precision matrix of the transformed variables, we consider a spike and slab prior and use an efficient posterior Gibbs sampling scheme. The results support the use of the Bayesian approach for developing graphical models and finding important conditional dependency structures.

Jamie Nosbisch[1], Krithika Mohan[2], Timothy Elston[3], James Bear[4] and Jason Haugh[2]
Graduate Programs: Biomathematics Graduate Program, North Carolina State University[1], Chemical and Biomolecular Engineering, North Carolina State University[2], Pharmacology, University of North Carolina School of Medicine[3], Cell Biology and Physiology, Lineberger Comprehensive Cancer Center, University of North Carolina School of Medicine[4]
Advisor: Jason Haugh
Poster Number: 134

A reaction-diffusion model explains amplification of the phospholipase C/protein kinase C pathway in fibroblast chemotaxis

During the proliferative phase of cutaneous wound healing, dermal fibroblasts are recruited into the clotted wound by a concentration gradient of platelet-derived growth factor (PDGF), together with other spatial cues. Despite the importance of this chemotactic process, the mechanisms controlling the directed migration of slow-moving mesenchymal cells such as fibroblasts are not well understood. To address this issue, we developed and analyzed a reaction-diffusion model of phospholipase C (PLC)/protein kinase C (PKC) signaling, which was recently identified as a requisite PDGF gradient-sensing pathway, with the goal of identifying mechanisms that can amplify its sensitivity in the shallow external gradients typical of chemotaxis experiments. We have found that phosphorylation of myristoylated alanine-rich C kinase substrate (MARCKS) by membrane-localized PKC constitutes a positive feedback that is sufficient for local pathway amplification. The release of phosphorylated MARCKS and its subsequent diffusion and dephosphorylation in the cytosol also serves to suppress the pathway in down-gradient regions of the cell. By itself, this mechanism only weakly amplifies signaling in a shallow PDGF gradient, but it synergizes with other feedback mechanisms to enhance amplification. This model offers a framework for mechanistic understanding of PLC/PKC signaling in chemotactic gradient sensing and can guide the design of experiments to assess the roles of putative feedback loops.

Stephanie B. Proano, Lindsey Kunz and John E. Meitzen
Graduate Program: Zoology
Advisor: John E. Meitzen
Poster Number: 148

Intrinsic Electrophysiological Properties of Nucleus Accumbens Core Medium Spiny Neurons Do Not Differ by Sex in the Adult Rat

The nucleus accumbens core is an important structure within the striatum involved in the processing of motor function associated with reinforcement and reward. It has been documented that there are sex differences and hormone influences on cognitive and sensory motor behaviors mediated by the nucleus accumbens, including neurological disorders such as, drug addiction and Hutchinson disease. Previous studies have shown that the excitatory synaptic properties of adult medium spiny neurons (MSNs) in the nucleus accumbens core differ by sex. However, it is unknown whether sex differences are present in the intrinsic electrophysiological properties of these neurons. This is critical knowledge given that intrinsic properties are what determine how a neuron responds to excitatory synaptic input. Thus, the purpose of the present study is to test if the intrinsic electrophysiological properties of MSNs differ by sex. To test this hypothesis, whole-cell patch clamp recordings of MSNs in acute brain slices obtained from the nucleus accumbens core of male and female gonadectomized adult rats were performed. Analysis of intrinsic electrophysiological properties show that there are no differences detected between male and female MSNs. Further analyses need to be conducted to elucidate the role of circulating estradiol in gonad intact animals, as well as the effects of acute exposure to the hormone estradiol.

Eric Benjamin Randall[1], Jesper Mehlsen[2] and Mette Olufsen[1]
Graduate Programs: Department of Mathematics, North Carolina State University[1], Coordinating Research Centre at Frederiksberg Hospital, Frederiksberg, Denmark[2]
Advisor:
Poster Number: 150

Using mathematics to elucidate specific neurological differences between normal and abnormal patients

The human papillomavirus (HPV) vaccine has been available for over ten years and has decreased the prevalence of cervical cancer in women. However, similar to other vaccines that induce various side effects, such as Guillain-Barre syndrome induced by the influenza virus, the HPV vaccine has been linked to various side effects, such as fibromyalgia, chronic fatigue, and postural orthostatic tachycardia syndrome (POTS), which have common symptoms, such as headaches, dizziness, fatigue, widespread pain, and syncope (fainting). These autonomic nervous system (ANS) disorders are classified as functional somatic syndromes (FSS). Clinicians currently do not understand the underlying causes of FSS, but with the help of mathematical modeling, we can elucidate the physiological mechanisms that produce these side effects.

This study focuses on the mathematical modeling of blood pressure (BP) and heart rate in response to the Valsalva maneuver, a clinical procedure characterized by forced expiration against a closed airway. Using a closed-loop model of the cardiovascular system including a sub-model of the baroreceptor reflex (baroreflex) mechanism, we have successfully reproduced the dynamics for both the normal and abnormal cases. Following the convention imposed by Palamarchuk et al. (2016), the abnormal BP cases were classified qualitatively into the M, N and V categories. Furthermore, we hypothesized potential causes for the various anomalies and categorized them in the following fashion: M – overactive sympathetic and parasympathetic responses, N – significantly delayed sympathetic response, and V – little to no sympathetic response. Using POTS data obtained by Mehlsen to verify these hypotheses, we tested and validated them against our model based on the parameter sets. Changing specific parameters in regards to the sympathetic nervous system produced the desired effect in our model and corroborated that the M, N, and V categories were indeed due to these various ANS responses.

Nicholas E. Rothfuss[1], Aleksandra Marsh[2], Jonathan P. Reid[2] and Markus D. Petters[1]
Graduate Programs: Marine, Earth, and Atmospheric Sciences[1], School of Chemistry, University of Bristol, Bristol, UK[2]
Advisor: Markus D. Petters
Poster Number: 158

A Model Temperature- and Humidity-Dependent Phase Diagram for Amorphous Organic Aerosol: Characterization and Potential Atmospheric Implications

Atmospheric particulate matter influences climate through direct interactions with radiation and by affecting the formation and composition of clouds. Organic aerosol (OA) forms a considerable fraction of all atmospheric aerosol. The climatological influence of OA varies with size and chemical composition, which in turn are modulated by uptake of water vapor and/or reactive chemical species. These processes may be inhibited in particles of more solid-like viscosity. Prior work suggests highly viscous OA is characterized by a large number of oxygenated, hydrogen-bonding functional groups. Thus sucrose, which has eight hydroxyl (OH) groups, is a common laboratory proxy for such aerosol. A proposed phase diagram for amorphous sucrose aerosol in the presence of water vapor across the range of atmospherically relevant temperatures has been constructed by combining a modified Vogel-Fulcher-Tammann equation for the temperature dependence of viscosity, the Gordon-Taylor mixing rule for the relative humidity dependence of glass transition temperature, and an empirical mass-based water activity parametrization. Fitted parameters for this model were derived from a series of new measurements of dry sucrose aerosol viscosity performed in our lab via a novel coalescence timescale-based method and existing literature bulk glass transition data. Modeled viscosities are consistent with a series of additional viscosity measurements not utilized in the training set. Possible implications of this diagram for condensational growth in atmospheric aerosol are discussed in context of a series of condensational kinetics experiments performed using an electrodynamic balance. Possible implications for ice nucleation and scale dependence of particle viscosity are discussed in the context of existing literature.

James Russell, Anantha Aiyyer, Dylan White and Walter Hannah
Graduate Program: Marine, Earth and Atmospheric Science
Advisor: Anantha Aiyyer
Poster Number: 159

Revisiting the Connection between African Easterly Waves and Atlantic Tropical Cyclones

The strongest Atlantic tropical cyclone (TC) of 2016, Matthew, recently caused an estimated 1000 fatalities and $15 billion in damage in the Carribean islands and along the U.S. east coast. Hurricane Matthew formed in the western Atlantic Ocean from a disturbance known as an African Easterly Wave (AEW). Prior research has shown AEWs to be the atmospheric disturbance that precede a majority of Atlantic tropical cyclones. The goals of this paper are two-fold; to update the statistics on the relationship between AEWs and TCs (previously published in the 1990's) and to investigate how TC formation varies with three-dimensional AEW activity (only previously addressed from a one-dimensional perspective).

By combining previous statistics with an additional 21 years of data from U.S. National Hurricane Center TC reports, this study shows that sixty-one percent of TCs originate directly from AEWs. Indirectly, AEWs are implicated in the formation of an additional eleven percent of TCs.

To investigate the three-dimensional AEW-TC relationship, AEW activity is quantified by eddy kinetic energy (EKE). The correlation between seasonal mean EKE and TC formation is maximized in the lower atmosphere below the southern AEW storm track, instead of in the mid-levels where the canonical AEW is maximized. Therefore, mid-level AEW activity is a poor predictor of TC genesis, whereas its lower tropospheric circulation exerts stronger control. In most seasons, AEW activity is supercritical, and therefore, EKE is only a controlling factor in seasons when the low-level EKE is weak. Therefore, predicting low-level EKE below the southern AEW track may be useful for seasonal TC prediction.

Keith D. Sherburn
Graduate Program: Marine, Earth and Atmospheric Sciences
Advisor: Matthew Parker
Poster Number: 172

Advancements in the understanding and prediction of high-shear, low-CAPE tornadoes

Environments characterized by low convective available potential energy, or CAPE, and large magnitudes of vertical wind shear are responsible for a large fraction of cool season severe thunderstorms and tornadoes, particularly during the overnight hours. Due to inherent attributes that limit their predictability, tornadoes and tornado warnings occurring within these high-shear, low-CAPE (HSLC) environments have traditionally been associated with low probability of detection and high false alarm rate, respectively. The purpose of this presentation is to document recent advancements in our knowledge of HSLC tornadoes and the environments that produce them, from identifying key features that discriminate between severe and nonsevere convective environments in the days or hours preceding the events to the storm-scale precursors leading up to tornadogenesis. In particular, by compositing reanalysis fields from severe and nonsevere HSLC events, it will be shown that a favorable thermodynamic and kinematic environment coupled with strong synoptic-scale forcing for ascent is generally necessary for severe HSLC convection to occur. Additionally, it will be demonstrated that vertical wind shear in the lowest 1 km is the most important variable in discriminating between tornadic and nontornadic HSLC convection in high-resolution idealized simulations. These findings will augment existing guidance for operational meteorologists in both forecast and warning operations associated with HSLC convective events.

Charles J. Stapleford[1], Daavid J. Väänänen[1], James P. Kneller[1], Gail C. McLaughlin[1] and Brandon T. Shapiro[2]
Graduate Programs: Physics, North Carolina State University[1], Physics, Brandeis University[2]
Advisors: Carla Fröhlich and Jim Kneller
Poster Number: 175

Nonstandard Neutrino Interactions in Supernovae

Neutrinos are tiny, ghost-like particles that only weakly interact with the matter around them. Study of these particles is driven by their ability to reveal new information about the Universe such as Neutrino flavor oscillation, which is not predicted by the standard theory of particle physics. Other Nonstandard Interactions (NSI), as they're known, between neutrinos and matter could significantly alter neutrino flavor evolution in supernovae with the potential to impact explosion dynamics, nucleosynthesis, and the neutrinos' signal. In this presentation we explore, both numerically and analytically, neutrino flavor transformation effects in supernovae over a range NSI and find new, heretofore unseen transformation processes can occur. These new transformations can take place with NSI strengths well below current experimental limits. Within a broad swath of NSI parameter space we observe Symmetric and Standard Matter-Neutrino Resonances (MNRs) for supernovae neutrinos, a transformation effect previously only seen in compact object merger scenarios. In another region of the parameter space we find the NSI can induce neutrino collective effects in scenarios where none would appear with only the standard case of neutrino oscillation physics. Finally, in a third region the NSI can lead to the disappearance of the high (H) density Mikheyev-Smirnov-Wolfenstein (MSW) resonance. Using a variety of analytical tools we are able to describe quantitatively the numerical results allowing us to partition the NSI parameter according to the transformation processes observed. Our results indicate nonstandard interactions of supernova neutrinos provide a sensitive probe of Beyond the Standard Model physics complementary to present and future terrestrial experiments.

Desireé M. B. Unselt, Logan J. Everett, Tatiana Morozova and Trudy F.C. Mackay
Graduate Program: Genetics
Advisor: Trudy F.C. Mackay
Poster Number: 190

Extreme QTL Analysis of Lifespan in an Advanced Intercross Population of Drosophila

Understanding the genetic mechanisms affecting variation in lifespan in natural populations is crucial for understanding the genetic basis of age-related diseases. Lifespan is known to vary in natural populations due to the segregation of multiple genetic factors as well as to exposure to different environmental conditions. Further, many pathways associated with lifespan, such as the insulin-like signaling pathway, are evolutionarily conserved between humans and model organisms. Drosophila melanogaster is a powerful model for assessing naturally occurring genetic variation in lifespan because of the ability to perform genomic analyses on a large scale while effectively monitoring genetic backgrounds and controlling environmental conditions. The D. melanogaster Genetic Reference Panel (DGRP), a population of inbred, sequenced lines, facilitates mapping the effects of natural genetic variation on phenotypically variable traits, including lifespan. We developed an outbred advanced intercross population (AIP) using 37 DGRP lines that were maximally genetically divergent. We selected flies at random as well as the longest 10% surviving flies and sequenced the pools to identify variants with significant changes in allele frequency between the longest lived and control pools (extreme QTL mapping). We identified 363 (458) single nucleotide polymorphisms (SNPs) in 263 (328) candidate genes in females (males) (P-value ≤ 0.05). We have also collected samples of flies at weekly intervals and dissected heads, reproductive organs and carcasses for gene expression analysis. We plan to map SNPs to transcriptional start and end sites of genes whose expression changes with age to infer novel genetic networks associated with variation in aging. Since basic biological processes, such as aging, are evolutionarily conserved, these studies will also provide candidate genes for investigation in other species, including humans.

Longshaokan Wang[1], Eric Laber[1] and Katie Witkiewitz[2]
Graduate Programs: Statistics, North Carolina State University[1], Psychology, University of New Mexico[2]
Advisor: Eric Laber
Poster Number: 192

Sufficient Markov Decision Processes with Alternating Deep Neural Networks

Advances in mobile computing technologies have made it possible to monitor and apply data-driven interventions across complex systems in real time. Markov decision processes (MDPs) are the primary model for sequential decision problems with a large or indefinite time horizon. Choosing a representation of the underlying decision process that is both Markov and low-dimensional is non-trivial. We propose a method for constructing a low-dimensional representation of the original decision process for which: 1. the MDP model holds; 2. a decision strategy that maximizes mean utility when applied to the low-dimensional representation also maximizes mean utility when applied to the original process. We use a deep neural network to define a class of potential process representations and estimate the process of lowest dimension within this class. The method is illustrated using data from a mobile study on heavy drinking and smoking among college students.

Samuel J. Widmayer, Connor D. McKenney and David L. Aylor
Graduate Program: Program in Genetics, Biological Sciences
Advisor: David L. Aylor
Poster Number: 196

Age-dependent hybrid male sterility in the mouse

The establishment of reproductive barriers between diverging groups is a key component of species formation. Hybrid male sterility (HMS) is a unique form of partial reproductive isolation that restricts gene flow between species. HMS occurs in a natural hybrid zone of two subspecies of mice, Mus musculus musculus and M. m. domesticus. Crosses between inbred strains derived from these subspecies can recapitulate HMS in the lab. Only two loci have been previously linked to HMS: the gene encoding a histone H3K4 methyltransferase Prdm9, and an uncharacterized region on Chromosome X Hstx2. Preliminary breeding studies have demonstrated a role for age in the development of HMS in certain hybrids. Here, we tested the hypothesis that genetic background variation and aging drive variation in the phenotypic manifestation of HMS. We collected reproductive phenotypes across a genetically diverse panel of hybrid mice at three age points: 8 weeks, 20 weeks, and 35 weeks of age. We also directly tested fertility in a subset of these hybrids by outcrossing to fertile females and measuring breeding performance. PWKxdomesticus males exhibited significantly impaired testis weight, total sperm count, and seminiferous tubule morphology compared to fertile domesticusxPWK reciprocal hybrids. Despite these general patterns, three PWKxdomesticus hybrids with displayed distinct patterns of HMS over time: complete sterility, complete fertility, and age-dependent sterility. These hybrids carry identical Prdm9 and Hstx2 genotypes, demonstrating the existence of at least two undiscovered HMS loci segregating among inbred mouse strains. These results provide strong support for significant gene-by-age interactions in the development of HMS in the mouse.

Jaime A. Willett
Graduate Program: Physiology
Advisor: John Meitzen
Poster Number: 198

Estrous-Dependent Sex Differences in Rat Dorsal Striatal MSN Excitability

The neuroendocrine environment in which the brain operates is both dynamic and differs by sex. How this unstable neuroendocrine state affects neuron properties has been significantly neglected in neuroscience research. Behavioral data across humans and rodents indicate that natural changes in steroid sex hormone exposure affect sensorimotor and cognitive function in both normal and pathological contexts. These behaviors are critically mediated by the dorsal striatum: a well-conserved constituent of the basal ganglia that is instrumental for forebrain function, various forms of learning, and sensorimotor performance. In the dorsal striatum, medium spiny neurons (MSNs) are the predominant and primary output neurons. As such, MSNs are fundamental components of the circuits which underlie striatal-mediated behaviors. Importantly, MSNs express membrane-associated estrogen receptors and demonstrate estrogen sensitivity. However, the effects of cyclical hormone changes across the estrous cycle on the basic electrophysiological properties of MSNs have not been investigated. Here, I test the hypothesis that dorsal striatal MSN intrinsic excitability is a dynamic property that is modulated in adult females across the estrous cycle via the associated changes in steroid sex hormone levels. I performed whole-cell patch clamp recordings on male, proestrus female, and diestrus female MSNs in acute brain slices obtained from adult rat dorsal striatum. Assessment and analysis of the electrophysiological properties is ongoing, with a particular emphasis on intrinsic excitability and miniature excitatory synaptic currents (mEPSC). Preliminary results indicate that proestrus female MSNs in the dorsal striatum exhibit greater intrinsic excitability than both diestrus female and male MSNs. Increasing the sample size and further analysis are needed to both bolster and further inform these results. Overall, given the estrous-dependent sex differences in the normal and pathological behavioral output of circuits involving the dorsal striatum, understanding the nature of neuroendocrine modulation of MSN function is an important research goal.

Karlan Wolfkill[1], Alina Chertock[1] and Alexander Kurganov[2]
Graduate Programs: Applied Mathematics, North Carolina State University[1], Mathematics, Tulane University[2]
Advisor: Alina Chertock
Poster Number: 200

An All-Flow Confluence Condition for 1-Dimensional River Systems

Simulation of two-dimensional river system models can become very complex. We consider reducing this complexity in a region containing the confluence of a river and a tributary. In each uninterrupted stretch of river, one may reduce the model to a one-dimensional flow model without sacrificing accuracy. It is not obvious, however, how to model the confluence if one does this. We wish to mathematically connect the river and the tributary in a way that 1) Reflects the river junction geometry and bottom topography; 2) Captures sub- and supercritical flow; and 3) Does not increase the complexity of the model. We achieve these goals by defining a two-dimensional confluence region at the river junction. Numerical examples illustrate the ability of our model to handle a variety of junction geometries and flow regimes.

Yang Zhao
Graduate Program: Operations Research
Advisor: Tao Pang
Poster Number: 70

Estimation of Expected Shortfall for A Sample of Losses

In the traditional model building approach, the normal distribution is determined by matching its mean and variance with the sample mean and sample variance. Thus, the whole data set is covered even though we only use tail of the distribution when calculating the Value-at-Risk (VaR) or Expected Shortfall (ES) by denition. Due to such fact, our ES estimation method devises a 'tail-fitted' normal distribution to approximate the extreme observations for a sample of losses. To enhance the estimation accuracy, ES of that normal distribution is then adjusted through a corresponding regression model related to tail wight of the sample itself. Compared to the commonly-used ES estimator, arithmetic average of exceedances, our method considers relatively more observations and achieve a less varied estimator. We also investigate the adjusted errors and backtest results of our estimates to further validate the proposed estimation method.

College of Textiles

Advait Bhagwat
Graduate Program: Textile Engineering
Advisor: Martin W. King
Poster Number: 23

Chitosan based scaffolds for bone tissue engineering

The most common approaches for tissue engineering substitutes for living tissue consist of: 1. Living cells, 2. Signal molecules and 3. Polymer scaffolds. The scaffolds provide a temporary framework to host the living cells and a mechanism for the controlled release of the signal molecules. Naturally derived scaffolds are desirable because of their chemical and biological similarities to natural tissues. Chitosan is especially desirable because chitin, the source of chitosan is one of the most common organic molecules on earth and it can be engineered in relatively mild conditions. Previous work with chitosan films has shown it to be a reliable scaffold for cell culture. The novelty in this work comes from a stacked three-dimensional structure, similar to paper-based cultures, that will allow us to observe the growth of the tissue and have greater control over its microenvironment, namely the composition of the extracellular matrix. This will also give us the chance to vary the degree of deacetylation of the chitosan to control the rate of degradation of the scaffold. Based on previous work, films of chitosan will be seeded with human osteoblast-like cells, stacked, and cultured in an incubator for 24, 48, 72 or 120 hours after which they will be disassembled and examined for cell proliferation and scaffold integrity. Stacking multiple cell-laden scaffolds is expected to improve oxygen distribution and nutrition and provide better environments for cell culture.

Yavuz Caydamli
Graduate Program: Fiber and Polymer Science
Advisors: Alan E. Tonelli and Richard J. Spontak
Poster Number: 39

Revealing Nanoscale Secrets behind the Diverse Macroscopic Phase Behavior in Substituted Isobutyl-POSS/Polymer Blends

Incorporation of polyhedral oligomeric silsesquioxane (POSS) molecules into polymer matrices presently constitutes a significant and convenient means by which to prepare hybrid organic/inorganic polymer blends possessing a wide range of interesting and useful properties. In this study, we systematically compare the phase behavior of monofunctional isobutyl POSS molecules possessing different surface chemistry with that of non-functional octaisobutyl POSS in the presence of poly(ethylene oxide) (PEO). At some concentrations of octaisobutyl POSS, macroscopic surface features previously reported for POSS covalently bonded to different polymers are observed for the first time with non-covalently bonded POSS. Complementary calculation of interaction energies from ab initio computer simulations is utilized to elucidate the molecular-level mechanism responsible for such observations. Each of the monofunctional POSS molecules with either allyl, aminopropyl or maleamic acid substitution exhibits distinctly different phase behavior in PEO, as discerned from both polarized light microscopy (PLM), laser-scanning confocal microscopy (LSCM) and scanning electron microscopy (SEM) conducted in both planar and cross-sectional views. As above, each of these systems is further analyzed by molecular simulations to permit quantitative comparison and explain their noticeably different behavior in PEO. To establish important structure-property relationships for these unique blends, their thermomechanical properties have been likewise measured and related to their phase behavior. A surprising result from this study is that the surface topography of the blends is largely governed by the viscosity of the POSS/PEO solution prior to casting, irrespective of the polymer molecular weight. This result opens a new and unexplored avenue by which to fabricate POSS-containing polymers with tunable phase behavior and bulk properties.

Xiaolu Guo
Graduate Program: Textile Chemistry
Advisor: Stephen Michielsen
Poster Number: 75

Remove Arsenic from water using Surface-Functionalized fabrics

In this research work, we utilized surface-functionalized fabrics to absorb arsenic from water. The fabrics were cotton based and modified with poly(acrylic acid), chitosan and copper. Poly(acrylic acid) grafts were attached on the surface of cotton fabrics by immersing them in aqueous solutions followed by heat treatment in a curing chamber. When the fabrics with poly(acrylic acid) was washed and air dried, chitosan was added by dissolving chitosan in acetic acid and then immersing the fabrics in followed by heat treatment in a curing chamber. Copper was attached to fabrics by immersing them in aqueous solution overnight when chitosan was attached. Adsorption test was carried out through gamma counter. The carboxylic acid content on the surface was measured and the average amount attached was found to be 2.652 mmol accessible –COOH groups per 1 gram fabrics. Also, the amino group was measured and the average amount was found to be 10.841 mmol per gram fabric. Adsorption test was carried out through gamma counter. The results showed when the ratio of copper to chitosan equaled to 0.3 and concentration of acetic acid to dissolve chitosan was 2%, the fabric can adsorb more than 90% of the arsenic in 48 h.

Yihan Huang
Graduate Program: Textile Engineering
Advisor: Martin W. King
Poster Number: 79

The Anchoring Performance of Polyvinylidene Fluoride Barbed Sutures in Porcine Patellar Tendon Tissue

The patellar tendon plays an important role in walking and running. When it ruptures, it needs surgical treatment, or it will result in a systemic injury. All traditional tenorrhaphy techniques require knots, but knots are potential weak points in attached surgical sutures, and will limit the extent of active flexion because of the enlarged cross-sectional area with the knots. Therefore, there is a need to invent knotless sutures that could be used in tendon repair. One of the most common used non absorbable suture materials is polypropylene. But the increasing dissatisfaction with its long term biostability and premature failure points to the need for an alternative suture material that has similar biomechanical properties but less iatrogenic trauma. At the present time, there are no reports in the literature focused on using polyvinylidene fluoride (PVDF) knotless sutures to repair tendons. The purpose of this study was to evaluate the anchoring performance of PVDF barbed sutures when inserted in patellar tendon tissue. Porcine forelimb patellar tendons were harvested and separated into 8 groups, comparing PVDF with polypropylene. Different sizes of sutures (Sizes 0 and 2-0) were used to repair tendons with the cross-locked cruciate suturing technique comparing barbed knotless sutures and with knotted regular suture controls. The ex vivo biomechanical properties were measured by means of a suture/tissue anchoring test. The 2-mm-gap formation force and the maximum load to failure were measured and the mode of failure was recorded.

Rahim Jindani
Graduate Program: Fiber and Polymer Science, Textile Chemistry Engineering and Sciences
Advisors: William Oxenham and Behnam Pourdeyhimi
Poster Number: 91

Novel Multifilament Yarn Structures and Scaffolds for Tissue Engineering Applications

Nanofibers afford the major advantage of potentially enabling the creation of structures with high surface area which offer great opportunities for various technical applications. Nanofibers are typically extruded using various electrospinning techniques which usually restrict productivity. Additionally current techniques for the creation of structures, such as nanofiber yarns, do not realize the potential of high surface area with accessible porosity which is a key factor when using yarns for tissue engineering applications. The present research has developed a novel technology which facilitates the creation of micro and nanofibers with bidirectional fiber arrangement in a yarn. This allows the achievement of nanofiber twisted yarn structures with accessible pores. The research project will analyze the accessible pores in yarn structures and optimized yarns will be utilized to create various knitted structures. These knitted structures will provide an architecture that is resilient to stretching and can be functionalized using biomolecules such as peptides, proteins, collagen and other biomaterials required for tissue engineering and healing. Orthopedic injuries such as “chronic rotator cuff Injuries” have a high clinical failure rate which can potentially be reduced utilizing knitted scaffolds structures created using such bidirectional fiber arrangement in multifilament yarn structures.

Wenbo Liu
Graduate Program: Fiber and Polymer Science
Advisors: Stephen Michielsen and Jon Rust
Poster Number: 110

Enhanced Comfort and Faster Drying Textile Finish

In recent years, there has been great progress in the development of active sports fabrics which aim to achieve more comfort. The sophisticated technologies are used in technical textile to produce sportswear, which provide properties such as light weight, ultra-breathable with fast drying and high heat and moisture management abilities. Fabrics with good moisture management property can keep the body dry by keeping moisture away from the body surface in vapor and/or liquid form, and thus gives us a better comfort feeling. In this research, a new moisture management strategy and system has been successfully developed and applied to commercial knit sportswear fabric. The basic concept for the project is to make the fabric surface hydrophilic but make the interior of the yarns hydrophobic, the different hygroscopic properties for inner and outer regions of the yarns leads to lower water pick up so that the fabric could dry faster and also have a dry look. The process consists of two stages but can be combined into one step for operation. In the first stage, a multifunctional polymer, Poly (acrylic acid), is permanently attached to the knit fabric. In the second stage, a non-fluorochemical hydrophobic agent, stearyl alcohol, is bonded to the multifunctional polymer. This step renders the inside of the yarns hydrophobic, thus reducing wet pickup. With the measurement of wet pickup and dry rate, which indicated that a moisture management system has been created, that retains approximately 60% of the water that the original fabric holds and dries faster. Meanwhile, a hydrogel based copolymer, P(NIPAM-co-AEMA), has been synthesized and grafted on the treated fabric successfully.

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Graduate Program: Textile Engineering
Advisor: Martin W. King
Poster Number: 131

The Development of a Textile Wound Dressing for Vacuum Assisted Wound Therapy

The use of vacuum assisted closure (VAC) or negative pressure wound therapy (NPWT) has become a preferred treatment for various wounds such as burn injuries, skin grafts, diabetic ulcers, pressure ulcers, thoracic and abdominal injuries as well as fasciotomy wounds. This technique involves the application of a suction pressure of about 125 mm Hg under ambient conditions through the medium of an open-cell foam or filler material. This filler, usually a 1 inch thick polyurethane foam, ensures the uniform distribution of pressure, and protects the wound from physical tissue trauma and necrosis. But, in cases such as the treatment of diabetic foot ulcers, folding the foam over the toes is difficult due to its high flexural rigidity and limited ability to bend. Also, some clinical studies have reported complications due to the growth and infiltration of granulating tissue into the foam, which leads to wound trauma at the time of dressing removal and retention of foam pieces in the wound bed. To overcome such complications, this research proposes to replace the filler material in VAC with a knitted textile spacer fabric, which has superior compression resistance, increased flexibility, high porosity and excellent liquid adsorption capacity. Based on the perceived requirements of VAC wound dressings, prototype polyester (PET) spacer fabrics are being compared to demonstrate their superior performance over commercially available polyurethane foams. Properties of all the prototype and control samples, such as tensile strength and elongation, compression resistance, total porosity, pore size distribution, flexural rigidity, liquid adsorption and retention capacity, are being evaluated to determine the validity of the hypothesis.

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Advisor: Cynthia Istook
Poster Number: 147

Consumer Acceptance of 3D Body Scanning and Virtual Try-on in Everyday Life

Two of the greatest challenges in the apparel industry are understanding the human body and how to best develop clothing that will fit all body types. Three-dimensional (3D) technology is rapidly advancing and being implemented to help solve these problems. Three-dimensional body scanning technologies allow users to scan a person using laser or white light and extract precise measurements, as well as a 3D representation of his or her body. Virtual try-on technologies use body scan data or a virtual avatar to try clothing on a 3D body, potentially improving consumer shopping experience and enabling more rapid product development. While the efficacy of these technologies has been widely researched and use has been adopted by industry, limited research has been conducted into consumer acceptance and perception of them. This study focuses on generating an understanding of how consumers will accept the use of 3D body scanning and virtual try-on in their everyday lives. In this research, an informational video about these technologies was developed and shown to participants. After viewing the video, participants completed a survey about acceptance of both body scanning and virtual try-on. By examining factors such as gender, body type, and religiousness, we hope to establish some of the factors that might mediate a consumer's acceptance or use of these 3D technologies. Thus far in the research, we have found that the educational materials provided greatly increased participant's acceptance of the technologies, and those who are likely to accept one 3D technology are more likely to accept the other. Furthermore, we have found that participants of all ages indicated they would readily adopt 3D body scanning and virtual try-on technologies in their everyday lives. Additional research, including the analysis of more participant responses, will further establish the degree to which individual factors influence 3D apparel technology acceptance.

Jialong Shen
Graduate Program: Fiber and Polymer Science
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Poster Number: 170

Glass Transition Temperatures and Dynamic Fragilities of Isotactic-, Syndiotactic-, and Atactic Poly(methyl methacrylate)s (PMMA)s and their Relationships with Their Single Chain Conformational Characteristics (Rotational Isomeric State Models)

The nature of the glass transition is widely accepted as one of the most complex and interesting unsolved problems in condensed matter physics. Both glass transition temperature (Tg) and fragility play a vital role in the selection and use of glassy materials including amorphous polymers. Relationships between chemical structures and their resultant Tgs and fragilities, and the correlation between the two parameters have attracted much effort in the past and remain a topic of open discussion. Three PMMAs with different tacticities offer the possibility to evaluate possible conformational contributions to their Tgs and dynamic fragilities. Due to their identical monomeric structure, qualitative comparisons of their structures and Tgs fail. However, it is well-known that the tactic forms of PMMA have different Tgs; isotactic (i) PMMA's Tg is the most peculiar at 60-70K lower than that of the chemically identical syndiotactic (s) and atactic (a) PMMAs. A similar trend for their fragilities was recently reported (Ngai, K. L.; Gopalakrishnan, T. R.; Beiner, M. Polymer 2006, 47, 7222–7230), where data acquired from several different studies were analyzed on the same Angell's plot and found fragility indices, m, of 181 for s-PMMA and 147 for i-PMMA. On the other hand, a-PMMA has m values reported in the literature ranging from 103 to 145. Because of these inconsistencies, due most likely to the differences in instrumentation, new dynamic fragility measurement were conducted using differential scanning calorimetry (DSC) to provide reliable comparisons for the three tactic PMMAs. Their Rotational Isomeric State (RIS) conformational models were used to offer realistic accounts of the possible conformational contribution to Tgs and dynamic fragilities.

Julie Wiegand
Graduate Program: Textiles
Advisor: Yingjiao Xu
Poster Number: 197

Evaluation of Engagement on Social Media Among Millennial Consumers with Fashion Brands

Creating and establishing positive consumer engagement on social media is a complex paradigm. The focused segment of this study is young consumers, characterized by the industry as digital mavens, who require continuous engagement and the fostering of one-on-one relationships with brands. The purpose of this study is to evaluate engagement on social media among Millennial consumers with fashion brands. With the Millennial generation being the largest demographic in the United States and on social media, it is of strategic importance for fashion brands to understand the engagement behaviors of this generation.

This research investigates social media usage among young consumers and the factors that impact their level of engagement with fashion brands. To gain a comprehensive understanding of these engagement behaviors, the following factors were explored: social media usage, perceptions of brand-related activities, motivational factors, fashion consciousness, and consumer demographics.

Empirical data was collected via an online survey from a convenience sample of 273 subjects recruited through social media. Majority of the respondents were in the age range of 18-30. The results indicated that, in general, most respondents portrayed themselves as heavy users of social media and they accessed social media via smartphone devices. Facebook and Instagram ranked highest in account ownership and usage of respondents. However, in general, respondents were more reactive (instead of proactive) in engaging with fashion brands on social media. Both intrinsic and extrinsic motivations were identified for consumers to engage with brands on social media. Significant relationships were also found between consumers' demographics as well as fashion consciousness and their engagement with fashion brands on social media. Implication of the findings of this study is also discussed.

Jiaying Wu
Graduate Program: Textile Chemistry
Advisor: Stephen Michielsen
Poster Number: 204

Impact Spatter Bloodstain Patterns on Textiles

Bloodstain pattern analysis is an important field of forensic science. DNA analysis can give the profile of the criminal suspect, but it can't answer the questions about how were the crimes committed. The first methodical study in BPA was introduced in 1895 by Dr. Eduard Piotrowski. Thereafter more researches have been done in this area. However, most BPA studies were conducted using hard substrates such as wood or steel. Only a limited number of the researchers focused on textiles materials, which is one of the most common components present in the crime scene. This research pays attention to the differences of impact spatter bloodstain pattern presentation on knit fabrics and on paper substrates. Impact blood spatters were created by a modified rattrap to mimic the medium velocity impact spatter patterns. A physical beating typically causes this type of spatter and this kind of behavior is frequently involved in malefactions. The rattrap device was carefully designed and customized, and the stability and repeatability of the device were tested. Three kinds of single jersey knit fabrics with different constructions used in this study were made of ring spun yarns. The fabric and paper were mounted on an embroidery hoop and the whole device was placed in a glove box to prevent intensive cleaning of the blood residues. We are trying to verify that there will be less visible blood spatters on the surface of knit fabrics rather than on the paper surface because some of the blood wicks into the yarns and disappeared from the surface. Meanwhile, some of the blood drops with smaller diameter could go through the loops, which will cause the bloodstain patterns less productive compared to the one performed on the paper.

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Advisor: Cynthia L. Istook
Poster Number: 74

Comparison of Body Measuring Techniques: Whole Body Scanner, Handheld Scanner, and Tape Measure

Body measurements have primary been used for pattern generation and size determination in the apparel industry. Before the 1990s, body measurements were mostly captured manually with anthropometers and tape measures. The manual process is usually time consuming and has low consistency. Three-dimensional (3D) body scanners were developed in the middle 1990s. Because of their great performance on accuracy, efficiency, and reliability, they were quickly adapted in anthropometric surveys to collect body dimensional data. Common light source used in today's whole body scanners are laser light and infrared light. Laser scanner technology tends to be more accurate but is also more expensive. Infrared scanner technology, on the other hand, offers less accuracy but is more cost effective. However, neither technologies can be easily accessed by consumers who may need to capture their body measurements at home. The developments of handheld scanners and Kinect technology offer the potential to fulfill the need. However, some research has shown that Kinect can't generate body measurements that can replace manual measuring. Little research has been conducted on low cost handheld scanners in terms of capability of measuring the body. Therefore, this research focused on applying Occipital's structure sensor on body scanning and comparing its performance with other techniques. A mannequin was chosen as the scan subject because it maintained the same measurements all the time. It was measured using 1) a commercial infrared whole body scanner, 2) a handheld scanner with structure sensor, and 3) a tape measure. Fifteen measurements were extracted and compared. It was found that 1) the handheld scanner had the least consistency, 2) both scanners performed badly at locations where measurements were hard to define using the computer, 3) measurements between scanners at clearly defined locations were close enough, and 4) circumference measurements from both scanners tended to be bigger than manually measured results.

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Advisors: Melissa Pasquinelli and Nelson Vinueza
Poster Number: 208

Flame Retardants: New Approaches to Reduce Exposure

In 2013 the National Fire Protection Agency reported 1.24 million fires, which attributed to 3,200 deaths, 15,925 injuries and $12 billion in property damage. Flame retardants (FRs) play a significant role in fire protection by delaying the ignition or spread of a fire. These chemicals tend to be either organohalogenated or organophosphorous based compounds, which some studies have indicated can cause adverse health effects, such as osteoporosis, cancer, and obesity. A main challenge with conventional FR compounds is that they are added mechanically and thus are not permanently bonded to the material. One thought is that FR compounds can be encapsulated, which may enable the FRs (1) to be chemically bound to natural materials or melt extruded with synthetic materials; (2) to have enhanced long-term stability within the substrate; (3) to still remain effective as a FR; and (4) to be safer since they will not be released from the substrate with time. It was recently demonstrated that a common FR, triphenyl phosphate (TPP), can form an inclusion complex (IC) with β-cyclodextrin (BCD). The goal of our work is to use a combination of experiments and molecular modeling to characterize these ICs, such as the binding affinity between the FR and BCD, the solubility in a series of solvent systems, the crystalline form(s) of the ICs, the ratio of FR to BCD, and the impact on the flame retardancy of the substrate. We are currently focusing on developing approaches using high resolution mass spectrometry and collision-activated dissociation (CAD), for quantifying the formation and overall stability of ICs. The results so far correlate well with what is known from other experimental approaches as well as from molecular modeling. In addition, we are working to identify other potential FRs that can form ICs with BCD and other CDs.

Runqian Zhang
Graduate Program: Textile Chemistry
Advisor: Martin W. King
Poster Number: 58

Chimney Technique for Endovascular Aneurysm Repair: Accelerated Fatigue Tests Using 3D Printed Phantom of Particular Patient

Abdominal and thoracic aortic aneurysms (AAA and TAA) are the leading causes of death for men over age 70. Endovascular aneurysm repair (EVAR) is the intervention that uses endovascular stent grafts (EVSGs) as conduits inside the aneurysm allowing the blood to flow while shielding the defective vessel wall from the blood pressure. The chimney technique in EVAR (C-EVAR) is designed to repair complex aneurysms by deploying multiple stent grafts and covered stents in the same aorta so as to provide extra access and blood flow to adjoining vessels. However, multiple grafts deployed next to each other in the same vessel may lead to complications, such as endoleaks, graft migration, abrasion and wear of the textile graft, and possible stent failure due to the continuous pulsatile motion of the blood flow. Thus it's necessary to evaluate the long-term stability and clinical performance of EVSGs which are expected to function for at least 10 years inside the human body. To investigate the clinical performance of C-EVAR we made a 3D-printed mold from the Dicom image of a particular patient's aortic arch aneurysm that had previously been treated with C-EVAR. From this mold we were able to fabricate a 3D polyurethane phantom of the patient's aneurysm. Then we deployed a tapered EVSG device and a chimney covered stent into the phantom to mimic the C-EVAR treatment the patient had received clinically. The phantom was attached to an in vitro accelerated pulsatile fatigue tester at 50 Hz to mimic the mechanical fatigue and inter-device abrasion of the two stent grafts for 100 and 200 million cycles. Evaluation of the graft's performance included measuring changes in the shape factors, dimensions of the gutter, visible evidence of abrasion, porosity and water permeability of the graft fabric during 100 million and 200 million fatigue cycles.

College of Veterinary Medicine

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Advisor: Ke Cheng
Poster Number: 5

Circulating Tumor Cell Clusters Extravasate Through Angiopellosis Leading to Increased Secondary Tumor Formation

Preventing the ability of metastasizing tumor cells to travel through circulation as aggregates is a promising area of focus when pertaining to metastasis treatments. Circulating tumor cell (CTC) clusters are known to have higher metastatic capability and increased resistance to anticancer therapies. We hypothesized that CTC clusters are able to extravasate while maintaining their multicellular phenotype through a recently discovered mechanism of extravasation known as angiopellosis.

To test this, we used an in vivo transgenic zebrafish larvae model, tg(fli1a:gfp), in which blood vessels exclusively fluoresce. We infused fluorescent tumor cells directly into the circulation of the larvae and used intravital imaging to observe the circulating tumor cells in real-time. Next, using an RNA silencing approach, we knocked down the cell adhesion-related protein plakoglobin, and determined the effect of varying conditions on CTC cluster migration and extravasation in vivo.

CTCs that aggregated in circulation had an increased ability to resist shear stress forces caused by blood. We also observed that CTCs had an increased ability to migrate in the circulation when cell-adhesion molecules were silenced, due to decreased ability to adhere to both the endothelium and other tumor cells. Finally, we discovered that CTC cluster did indeed possess the ability to utilize angiopellosis to extravasate as a group, increasing their ability to proliferate once in the surrounding tissue.

The data implicate a more important role for cell adhesion-associated molecules as mediators of tumor cell extravasation during metastasis. The results also suggest that CTC clusters are the main cells involved in secondary tumor formation, and exploiting their ability to travel and extravasate as clusters could potentially be used a target for preventative therapies.

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Advisor: Lauren V. Schnabel
Poster Number: 21

TGF-β2 downregulates constitutive and IFN-γ-induced MHC surface expression on equine bone marrow-derived mesenchymal stem cells

Mesenchymal stem cells (MSCs) are a promising cell therapy for the treatment of musculoskeletal injuries in horses and humans. Allogeneic therapy would allow for immediate treatment at the time of injury, but is currently hindered by recipient immune recognition of mismatched-Major Histocompatibility Complex (MHC) molecules expressed on the donor MSCs. Our hypothesis was that culturing MSCs with TGF-β2 would decrease constitutive MHC I and MHC II expression and block IFN-γ-induced MHC expression without affecting the viability or immunomodulatory properties of the cells. Bone marrow was aspirated from the sternum of twelve healthy horses and MSCs were isolated via Ficoll gradient centrifugation. MSCs were cultured with TGF-β2 before MHC I and MHC II surface expression was analyzed via fluorescent activated cell sorting (FACS). Cell yield and viability were measured at each passage. To determine if TGF-β2 blocked IFN-γ-induced MHC expression, untreated and TGF-β2-treated MSCs were stimulated with 1 ng/ml IFN-γ for up to 72 hours before FACS analysis. TGF-β2 treatment significantly reduced MHC I and MHC II surface expression on unstimulated MSCs and partially blocked IFN-γ-induced MHC I and MHC II surface expression. TGF-β2 treatment also significantly increased the number of viable cells obtained at each passage compared with untreated MSCs. There was no significant difference in the secretion of TGF-β1 from untreated or treated MSCs, indicating that TGF-β2 does not appear to alter the immunomodulatory properties of the cells. These results demonstrate that TGF-β2 treatment has significant promise for reducing recipient immune recognition of MHC-mismatched molecules on allogeneic MSCs, but further work is needed to block IFN-γ-induced expression and determine the immunogenicity of treated MSCs.

Caroline Johnson
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Advisor: Troy Ghashghaei
Poster Number: 92

Phosphorylation of Sp2 regulates its function in cell divisions of the developing cortex

Proper formation of the cortex relies on symmetrically dividing Neural Stem Cells (NSC) undergoing a coordinated spatiotemporal switch into Neural Progenitor Cells (NPCs) that produce neurons via asymmetric divisions. Concurrent with this switch is a lengthening of the cell cycle, specifically G1, which may promote neurogenic signaling. Previous work in our laboratory showed that conditional deletion of transcription factor Specificity Protein 2 (Sp2) in NPCs causes mitotic arrest and reduces production of neurons. Here, we show that conditional deletion of Sp2 in NSCs results in precocious expression of neurogenic markers and increases mitotic cells. Live imaging of NSCs in cortical tissue conditionally deleted for Sp2 in combination with the Mosaic Analysis with Double Markers on chromosome 11 (MADM-11) system revealed that this was not due to lengthened mitosis. Screening of bioinformatics data revealed two sites within Sp2, S78 and T549, are potentially phosphorylated in a cell cycle-specific manner. Sp2 constructs containing phosphor-mimetic and phosphor-null substitutions at these sites were generated by site directed mutagenesis. Transfection of these constructs into HEK cells reveals dominant-negative effects on mitosis. In utero electroporation of these constructs into developing mouse cortices revealed perturbations to cell distribution and differentiation. Our study reveals previously unknown roles of Sp2 in NSCs and a potential post-translational dependent mechanism for its different roles in symmetric and asymmetric divisions.

Mandy Womble
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Poster Number: 201

Pitx2c is Required for Left-right Asymmetric Liver Development

Many internal organs of the body are left-right asymmetric in both anatomical location and organ morphology including the liver. As many as 1 in 10,000 humans are born with defects in left-right asymmetry that often involve severe anomalies in liver laterality including hepatic duct and biliary tree malformations, yet the mechanisms underlying the development of left-right asymmetries in the liver are unknown. In other asymmetric organs like the heart, lungs, and gastrointestinal tract, left-sided expression of Pitx2c, a homeobox transcription factor, is required for left-right asymmetric organogenesis. However, it is unknown whether Pitx2c is required for asymmetrical liver development. Using the model frog, Xenopus laevis, we sought to determine whether Pitx2c is required for liver development and to undercover downstream morphogenetic mechanisms. Immunohistochemistry, in situ hybridization, and microinjection manipulation using morpholino knockdown and ectopic expression studies were used to determine the role of Pitx2c in asymmetric liver development. We found left-right asymmetries in cell shape and epithelial character in the liver diverticulum as left-sided cells were rounder and less apically constricted than cells on the right. The epithelium of the left side thickens with multiple nuclei layers while the epithelium on the right involutes into single layered liver cords and sinusoids. These asymmetries are perpetuated by Pitx2c. We found that Pitx2c is necessary and sufficient to induce left-sided epithelial characteristics as Pitx2c causes cells to become less apically constricted and rounder in morphology as the number of nuclei within the epithelial layer increases. This study is the first to demonstrate cellular level differences in liver morphogenesis. These results advance our understanding of how asymmetries develop in all left-right asymmetric organs and gives us insight into the etiology of birth defects involving laterality.

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