11th Annual Graduate Student Research Symposium

ABSTRACTS

Wednesday
March 23, 2016
1:00 to 5:30 pm
McKimmon Center

NC STATE UNIVERSITY

Eleventh 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 (2015-2016)

Jessica Nash, Materials Science and Engineering (Co-Chair)
Desiree Unselt, Genetics (Co-Chair)
Rangeen Basu, Electrical and Computer Engineering
Ria Corder, Chemical & Biomolecular Engineering
Christiane Sommer Demasceno, Communication, Rhetoric, & Digital Media
Gabriel Firestone, Physics
Wen Lin, Forestry and Environmental Resources
Sean Lund, Chemistry
Megan Miller, Plant Pathology
Lauren Pellegrino, Educational Research and Policy Analysis
Sugandha Singh, Civil, Construction & Environmental Engineering
Sadie Wisotsky, Genomic Sciences

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. Jacob Majikes, 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	Rooms 2A & 2B
	Dr. Warwick Arden, Provost and Executive Vice Chancellor	
	Dr. Maureen Grasso, 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

Anirudh Akula
Graduate Program: Biological and Agricultural Engineering
Advisor: Michael D. Boyette
Poster Number: 6

Development, Field Evaluation and Economic Impact Assessment of Mechanical Aids for Harvesting Sweetpotatoes

Almost all sweetpotatoes for freshmarket use are still hand harvested. The problem lies in the growth structure of sweetpotatoes at the time of harvest wherein the storage roots are firmly attached to the central stem and their skin is very delicate, making them difficult to be harvested mechanically without causing damage. Increase in sweetpotato production and their market demand over the last 15 years coupled with the reduced availability of farm labor and ever-increasing farm wages call for complete mechanization of the sweetpotato harvesting process. Pre-harvest vine-root separation methods such as 'de-vining' have been known to aid the harvesting process by reducing the amount of vines and the mechanical handling required during harvesting. Yet, none in literature have been able to build a viable and sustainable harvesting aid which would enable mechanical harvesting of sweetpotatoes without causing root damage. This research aims to perfect a robust pre-harvest 'vine-snatching' machine which will separate individual roots from the central stems enabling mechanical harvesting of sweetpotatoes and also quantify the machine's economic impacts on the entire production process. Field Testing and Performance Assessment of the machine done thus far involved designing and fabrication of the machine, improving machine functionality for continuity and consistency, optimizing machine design and part speeds relative to ground speed, measuring the central stem-root separation efficiencies in a variety of crop and soil conditions and observing the machine's impact on hand-harvesting and mechanical digging of the roots compared to a conventional pre-harvest mowing operation. We were able to achieve separation efficiencies ranging from 60% to 90%, observed that the machine increases the farmworker efficiency during harvesting and also reduces the amount of vine and soil in harvest bins. Further testing of the machine and an economic impact analysis are planned for the next phase of the project.

Luis F. A. Artioli[1], Philipe Moriel[1], Matthew H. Poore[1], Rodrigo S. Marques[2], and Reinaldo F. Cooke[2]
Graduate Programs: Animal Science, North Carolina State University[1]; Eastern Oregon Agricultural Research Center, Oregon State University[2]
Advisor: Philipe Moriel
Poster Number: 8

Decreasing the frequency of energy supplementation to beef steers impairs growth and antibody production against bovine viral diarrhea
virus 1b

We evaluated the effects of decreasing the frequency of energy supplementation on growth performance and measurements of innate and humoral immune response of preconditioning beef steers. At weaning (d −7), Angus steers (n = 24; BW = 221 ± 31 kg; age = 177 ± 19 d) were allocated to a single drylot pen with free-choice access to fescue hay. On d 0, steers were stratified by BW and age, and randomly assigned to 1 of 8 drylot pens (3 steers/pen). Steers were provided daily ad libitum access to ground fescue hay (17% CP and 58% TDN; DM basis) and similar weekly concentrate offer (12 kg/steer) from d 0 to 42. Treatments were randomly assigned to pens (4 pens/treatment) and consisted of dividing and providing the weekly concentrate offer either 3 (S3; 3.8 kg on Mondays, Wednesdays and Fridays) or 7 times (S7; 1.7 kg daily) per week. Supplements included 50% soyhulls a nd 50% corn gluten feed (17% CP and 72% TDN; DM basis). Steers were vaccinated using the SelectVAC protocol (Zoetis) on d 7 and 21. Shrunk BW was obtained on d 0 and 42, and blood samples from jugular vein collected on d −7, 0, 7, 8, 9, 10, 14, 21, 22, 23, 24, 28, 35 and 42. Although BW did not differ from d 0 to 42 (P ≥ 0.33), S7 steers had greater mean ADG (1.3 vs. 1.0 ± 0.07 kg/d; P = 0.01), mean hay DMI (2.8 vs. 2.2 ± 0.08 kg/d; P < 0.01) and total DMI from d 0 to 42 (190 vs. 165 ± 4 kg; P = 0.02), but similar G:F compared with S3 steers (P = 0.14; 0.29 vs. 0.26). Plasma concentrations of glucose, insulin, cortisol and ceruloplasmin did not differ (P ≥ 0.33) between treatments. However, S3 steers had greater plasma haptoglobin concentrations on d 8 (1.95 vs. 1.20 ± 0.13 mg/mL; *P* < 0.01) and 10 (1.39 vs. 0.84 ± 0.13 mg/mL; *P* < 0.01), and less mean serum bovine viral diarrhea virus-1b (BVDV1b) titers than S7 steers (1.5 v s. 2.5 ± 0.31 log 2 base; P = 0.03). Therefore, decreasing the frequency of energy supplementation from 7 to 3 times weekly during a 42-d preconditioning period decreased hay and total DMI, growth and antibody production against serum BVDV-1b, and increased plasma haptoglobin concentrations of beef steers.

Maria Balcazar Tellez[1] , Edward Kick[2], John J. Classen[1], Gretchen Thompson[3]
Graduate Program: Biological and Agricultural Engineering[1]; Agricultural Resource Economics[2]; FHI360, Raleigh, NC[3]
Advisor: John J. Classen
Poster Number: 11

Food Security, Economic Development and the Environment: A Cross-National Analysis of Competing Interpretations

Treatments of sustainability outcomes such as food security, economic development and environmental degradation typically have adopted monocausal approaches. For instance, many have argued for substantial increases in world meat production as the panacea to global food insecurity. We use global and national synthetic explanations and a path analytic approach to examine sustainability outcomes for 115 nations during the modern period. We find strong direct or indirect links between global geography, global power and national capitals, as well as warfare and military expenditures, and a dependent variable of central focus to us, economic development. In turn these factors are differentially predictive of the other key measures of sustainability we attend to –food sources, such as cereals and meat, which relate to food security and threats to the environment. We bemoan unrelated groups of research traditions that in their singular approaches are apt to miss the "big picture," of global and local, as well as direct and indirect connections that determine the singular but related outcomes that are so central to contemporary and future human life.

Anne L. Ballou
Graduate Program: Functional Genomics
Advisor: Matthew Koci
Poster Number: 12

Impact of Diet and Probiotic Supplementation on the Intestinal Microbiome

Many studies have demonstrated the impact of diet on the gut microbiome, but these studies generally involve very disparate diets; high vs low fat, total calories, or fiber. If diet can influence microbial diversity, how different must diets be to have an effect? Can even nutritionally similar diets produce distinct microbial populations, and can these differences be minimized with the addition of a bacterial feed supplement? To begin to address this we examined the intestinal microbial diversity of animals fed two representative, nutritionally complete diets of similar but not identical composition, with and without the addition of probiotic supplementation. Following treatment with two corn-soybean based diets, fed alone or supplemented with approximately 3x105 CFU bacteria (Lactobacillus acidophilus, Lactobacillus casei, Enterococcus faecium, and Bifidobacterium thermophilus)/g feed, we evaluated the gut microbiome of 28-day old broiler-type chickens at 5 gastrointestinal locations. Microbial DNA was isolated and sequenced using Illumina MiSeq technology. Principal coordinate analysis (PCoA) revealed that samples cluster by location, diet, and bacterial supplementation. While all the feed samples were composed overwhelmingly of Streptophyta and Rickettsiales, the microbiome responds to them differently, suggesting the influence of different sources of nutrients such as proteins, fats, and carbohydrates, rather than the influence of different microbial profiles. While the addition of probiotics to the diet does impact the composition of the microbiome, it did not appear to stabilize the microbial community; probiotic-treated samples are not more similar between diets than non-treated samples. Together these data provide insight into the avian gut microbiome revealing key players present across treatments and locations, and highlighting more variable or transient populations susceptible to changes in the diet.

Sean Bloszies[1], Chris Reberg-Horton[2] and Shuijin Hu[1]
Graduate Programs: Plant Pathology[1]; Crop Science[2]
Advisor: Shuijin Hu
Poster Number: 18

The Role of Reduced Tillage and Organic Agriculture in Soil Nitrous Oxide Emissions

A majority of the world's anthropogenic nitrous oxide emissions come from agricultural soils. Because emissions levels depend on a combination of factors including soil organic matter (SOM) levels and mineral N availability, it is not clear how farm management strategies may affect net production of this potent greenhouse gas. Furthermore, it is vital to understand which of several diverse SOM pools is driving N2O emissions. The objectives of this study are to examine different rotations for their impact on soil N2O emissions, and moreover, to elucidate the soil C and N dynamics driving these differences. Both organic and conventional annual cropping systems have been managed since 1999 in the Coastal Plain of North Carolina using reduced-till (RT), clean till (CT), or a 3 year rotation with pasture (LR). Data collected from field soil (0-15cm) include microbial biomass carbon and nitrogen (MBC/MBN), and dissolved organic carbon (DOC). Laboratory incubations were also conducted to quantify N2O emissions, soil respiration, and N mineralization from the same samples. Preliminary results indicate that the farming systems differ in the size of the flush of N2O that occurs following rewetting soils (70% WFPS) collected in early spring and at soybean harvest, but not during the growing season. Conventional CT soil N2O emissions exceeded organic LR and CT at both time points. MBN of organic LR also exceeded that of conventional CT in early spring, while organic RT MBN was higher than that of conventional NT at harvest. No differences were found in MBN or DOC

Jessica A. Brown
Graduate Program: Plant Pathology
Advisors: Tim L. Sit, George G. Kennedy
Poster Number: 23

Variation in Transmission of Tomato spotted wilt virus from Thrips tabaci is not Solely Influenced by Virus Titer Within Individual Thrips

Tomato spotted wilt virus (TSWV) is one of the most damaging plant viruses in the world. TSWV is exclusively transmitted by several thrips species in a persistently propagative manner. Thrips tabaci has been shown to vary in the ability to transmit different isolates of TSWV compared to other vector species. The objective of this study is to determine if the virus titer in individual T. tabaci influences the variation in transmission of TSWV from previously established T. tabaci isofemale lines collected from several locations in North Carolina. These isofemale lines were previously tested for their ability to transmit various TSWV isolates collected from the same locations as the thrips. The virus isolate-thrips line combinations were in sympatric pairings and allopatric pairings and were grouped as low, moderate, or high transmitters based on the percentage of progeny transmitting TSWV to Emilia sonchifolia leaf discs. Quantitative real-time PCR was done on individual T. tabaci from 12 selected virus isolate-thrips line combinations for transmitting and nontransmitting individuals to quantify virus titer. These findings would then reveal whether the variation in transmission previously observed among these T. tabaci populations was due to differences in virus titer. The results from this study show no association between TSWV titers and transmission efficiency from individual T. tabaci. This is in contrast to findings with other TSWV thrips vectors where virus titer was directly correlated with transmission efficiency. This suggests that T. tabaci transmission may be determined by the genetics of both the virus and the thrips, and their interaction rather than by the virus titer alone.

Bin Cheng, Lingjuan Wang-Li
Graduate Program: Biological and Agricultural Engineering
Advisor: Lingjuan Wang-Li
Poster Number: 80

Secondary Inorganic $PM_{2.5}$ and NH_3 Emissions from Animal Feeding Operations: Spatial Correlation in North Carolina

Fine particulate matter ($PM_{2.5}$) is an important air pollutant, which can cause health-related issues and visibility degradation. Secondary inorganic $PM_{2.5}$ ($iPM_{2.5}$) is formed through partitioning of gas phase NH_3 and particle phase NH_4^+. As $iPM_{2.5}$ constitutes a significant part of total $PM_{2.5}$, it is important to establish a holistic understanding of the spatial distributions of $iPM_{2.5}$ so that the regional impact of $PM_{2.5}$ may be fully understood. Furthermore, knowledge about the correlation between precursor gas emissions and $iPM_{2.5}$ will lead to identification of causes to the regional spatial variations of $iPM_{2.5}$ and total $PM_{2.5}$ concentrations. This research aims at filling the research gap in holistic understanding of $iPM_{2.5}$ spatial distribution and the causes of such spatial variation. The research will use the existing $PM_{2.5}$ mass concentration and chemical speciation measurement data under EPA's ambient air quality monitoring network and chemical speciation network to investigate the spatial distribution of $PM_{2.5}$ and $iPM_{2.5}$ concentrations over last ten years in NC. In addition, precursor gas data from EPA's monitoring network will be used to develop the spatial correlation of ambient $iPM_{2.5}$ precursor gas concentrations using statistical spatial modeling approach. The research will qualify and quantify the contributions of precursor gas, specifically NH_3 emission from the primary source, animal feeding operations, to the formation of secondary $iPM_{2.5}$. Findings of this research will provide insights into the regulation and reduction of $PM_{2.5}$.

Thomas L. Devine, Joseph C. Mackey, Gregory L. Shaeffer, Matthew H. Poore, and Daniel H. Poole
Graduate Program: Animal Science and Poultry Science
Advisor: Daniel H. Poole
Poster Number: 44

Hair coat phenotype in heifers alters physiological responsiveness to ergot alkaloids commonly found in endophyte-infected tall fescue.

Fescue toxicosis impacts cattle consuming endophyte-infected tall fescue (Festuca arundinacea) resulting in substantial economic losses annually to the beef industry. Symptoms of this disease include increased respiration and body temperature, retained winter hair coat and vasoconstriction. Originally identified in Senepol cattle, the slick gene creates for short, slick hair and cattle with superior thermoregulatory ability. Therefore, the objective of this study was to determine if cattle expressing the slick phenotype have increased tolerance to physiological symptoms associated with ergot alkaloids from endophyte-infected tall fescue. Angus X Senepol heifers (n=15) were blocked by weight and hair type, (Slick; S or Normal; N), placed in Calan gates and received an endophyte-infected fescue haylage (E+) for 63d. Weekly measurements were collected to monitor physiological responses during exposure to ergot alkaloids. Data were analyzed using repeated measure in the PROC MIXED procedure of SAS. Average daily gain was decreased in E+N heifers (0.48 kg/d) compared to E+S heifers groups (P<0.05; 0.63 kg/d). Body condition scores were greater for E+S (5.7) compared to E+N (5.5; P<0.05) heifers. Hematocrit values were lower (P<0.05) for the E+N heifers compared to E+S heifers. No differences were observed in caudal vessels or blood pressure (P>0.05) while respiratory rate, heart rate and rectal temperatures were also similar between hair type groups (P>0.05). Although no rectal temperature differences were observed during weekly collection days, daily fluctuations in body temperature varied. Skin surface temperature was increased E+N heifers (38.1oC) compared to the E+S heifers (P<0.05; 37.1). Hair coat scores (1-5 scale) were significantly lower for E+S (2.2) compared to E+N (3.1; P<0.05). Additionally, shedding scores were lower for E+S (2.2) compared to E+N (2.6; P<0.05). Based on these data, incorporating the slick hair phenotype in to cattle may be advantageous to help offset some of the negative effects associated with fescue toxicosis.

Jacob Dums, Heike Sederoff
Graduate Program: Plant Biology
Advisor: Heike Sederoff
Poster Number: 45

Sustainable Biofuel Production from Marine Microalgae using Nitrogen Cycling

Synthetic nitrogen fertilizer is an expensive and energy intensive component for agricultural crop production. Marine microalgae like N. oceanica are a promising biofuel feedstock because they do not compete with land or freshwater for feed or food agriculture. Biofuel production represents a rising demand for nitrogen fertilizers in an already nutrient-demanding agriculture system. Organic nitrogen sources harvested from biofuel waste biomass such as amino acids could reduce synthetic nitrogen fertilizer competition and thus increase the implementation and feasibility of biofuels. However, utilization of organic nitrogen sources is dependent on an organism being able to transport and metabolize these nitrogenous compounds. Amino acid transporter proteins are often used to take up amino acids from the environment, especially when scavenging for scarce nitrogen resources. These transporters are important membrane proteins used in the intracellular and intercellular transport and sensing of amino acids. Very little is known about amino acid transport or metabolism in algae, and nothing is known for the marine algae Nannochloropsis oceanica. Analysis of the N. oceanica genome revealed 27 potential amino acid transporters from several transporter families. The distribution and quantities of which are different than seen in green algae. Utilization of all 20 proteinaceous amino acids as a sole nitrogen source was tested for N. oceanica, and a limited number of amino acids were found to be utilized. While this limitation may be discouraging in a biofuel production sense, it is an opportunity to discover which transporter(s) are allowing for the uptake of specific amino acids from the environment. Additionally, genetic modification of N. oceanica with amino acid transporters from other organisms could allow for increased utilization of amino acids. Manipulation of amino acid transporters has the potential to decrease the synthetic nitrogen input in algal biofuel systems. This work was funded by NSF EFRI #1332341.

Shanelle Ebanks
Graduate Program: Youth, Family, and Community Sciences
Advisor: Kimberly Allen
Poster Number: 46

Integrating Soft Skills into Afterschool Programs through Community Engagement

Soft skills are essential to the holistic development of youth and their personal and professional success throughout the course of their lifetime. However, many of today's youth are lacking these critical skills. This study seeks to gain insight of best practices of providing soft skills education in the out of school time (OST) space, facilitated by partnerships with various community groups. This study examines 1) how OST programs can help close the soft skills gap and 2) opportunities for communities to take an active role in supporting the acquisition of soft skills. Through a case study of two leaders in the OST space, Citizen Schools and Boston After School & Beyond (BASB) findings suggest that quality programming with mission integration, staff training, supportive environment, youth-adult partnerships, and opportunities to practice soft skills are integral to incorporating soft skills into the OST space. This quality soft skills instruction highlights an opportunity for a greater infusion of support and resources in the OST space. To address this resource need, largely of staff or volunteers to assist with the acquisition of soft skills in youth, community engagement should be employed. There are groups within the community that need to be activated to assist with OST programs and on a greater scale, the holistic development of youth. OST providers must take care to foster and nurture these relationships. Steps include clearly defined roles, effective communication, consistent expectations and standards, community-driven approaches and solutions, and developing a culture that nourishes partnerships. Implications include directing additional resources, including support and funds to OST programs to enhance soft skills education, laying the groundwork for successful personal and professional lives for today's youth.

Fallon E. Fowler[1,2] and Bradley A. Mullens[2]
Graduate Programs: Entomology[1], University of California, Riverside, CA[2]
Advisor: Wes Watson
Poster Number: 52

Dividing the Pie: Differential Dung Pat Size Utilization by Sympatric *Haematobia irritans* (Diptera: Muscidae) and *Musca autumnalis* (Diptera: Muscidae)

Horn flies (Haematobia irritans) and face flies (Musca autumnalis) are heavily-studied and notorious cattle pests; even so, little is known about how these species interact with one another despite possessing overlapping life histories. Specifically, both species almost exclusively require fresh bovine dung for oviposition and larval development, thereby possibly favoring competition between these fly species. Thus, our objective was to document the result(s) of and mechanism(s) behind dung resource sharing between the face fly and horn fly. Cattle dung pats (summer, n=350) were core-sampled over a 2-year period in a dry, southern California habitat. Surface areas and estimated weights were recorded for each whole pat and the emerging flies from cores were identified. Exactly 42.0% of cores yielded neither species, 29.7% yielded only horn flies, 12.9% yielded only face flies, and 15.4% yielded both species. Fly-positive pats (n=203) revealed that face fly-only pats had a greater surface area and mass than horn fly-only pats, while horn and face fly occupied pats were of intermediate surface area and mass. Horn flies per positive dung core were unaffected in the presence or absence of face flies, while less than half as many face flies emerged from pats shared with horn flies. However, dung pats were also sampled (n=28) during each fly's seasonal windows; these windows provided a view into the behavior and dung range limits of each fly in the absence of other fly. Horn flies on average occupied 13% wider and 24% heavier pats during this seasonal window, while face flies occupied pats similar to those occupied in summer. This indicates that horn flies tolerate a much lower dung moisture content than face flies, which likely allows horn flies to colonize more pats and a greater range of dung pat sizes and masses than face flies in an arid, desert habitat.

Kristen A. Hopperstad
Graduate Program: Entomology
Advisor: Michael H. Reiskind
Poster Number: 75

The Population Structure of Aedes aegypti in the Southeastern United States

Adaptation of invasive species to novel environments is a major topic of study, but their influence on native population dynamics is less well understood. The range of the naturalized yellow fever mosquito, Aedes aegypti, declined in the United States in response to competition by the invasive Asian tiger mosquito, Aedes albopictus, in the 1980s. Today, A. aegypti persists intermittently in urban areas, and anecdotal resurgences of A. aegypti have been reported in Florida and Louisiana. Localized populations of A. aegypti are subject to mutation, genetic drift, and selection, potentially leading to genetic differentiation; gene flow counteracts such processes. Changes in gene flow, possibly due to biological barriers like competitive A. albopictus, can influence the evolutionary trajectory of A. aegypti. To characterize gene flow and the population structure of A. aegypti, we genotyped F0 and F1 adult A. aegypti mosquitoes from 12 localities across the southern United States using microsatellite markers. Results and implications will be presented.

Zachary Lentz
Graduate Program: Biological and Agricultural Engineering
Advisors: John Classen, Praveen Kolar
Poster Number: 89

Gasification: a prospective swine manure solution for North Carolina

North Carolina's swine industry growth has led to increased manure production. Manure represents potential threats to environmental and human health, as well as opportunity to add value to pork production. Technologies for treating swine manure safely while generating products to offset costs are part of an expanding field of research centered around sustainable food production in the face of our growing population. Gasification, a time-tested thermochemical conversion process capable of treating swine manure while generating a combustible gas, has unrealized potential for treatment of swine manure.

Gasification has traditionally been utilized for low-moisture feedstocks since excess moisture removes heat which would otherwise fuel further feedstock decomposition. However, recent advances ingasification technology indicate that utlizing a pressurized system may be more suitable for high-moisture feedstocks including swine manure; this is known as hydrothermal gasification. Concurrently, the practice of separating solid and liquid fractions of the manure is on the rise as it allows for concentration of carbon and phosphorus in the solids and nitrogen in the liquid, and thereby treatment options tailored to a more homogeneous feedstock than the whole manure slurry.

The development of hydrothermal gasification and this shift in manure handling practices both represent changes which may allow for a gasification and swine manure to pair better, whether it is due to a system more appropriate for high-moisture feedstocks or by reduced feedstock moisture content. Furthermore, policy resulting from manure handling controversies and a growing interest in generating sustainable energy will impact the development and utilization of swine manure gasification. This review will 1) expand on biomass gasification technology, 2) explain its relevance and potential for swine manure treatment and renewable energy generation, and 3) discuss the policy issues which may aid or inhibit this technology as a sustainable swine manure treatment solution for North Carolina's pork industry.

A. Llanes, WB Knox, CE Farin
Graduate Program: Animal Science
Advisor: Char Farin
Poster Number: 94

Comparison of CIDR-Based and Progesterone-Free Methods for Ovulation Synchronization and Timed Artificial Insemination of Goats

A controlled internal drug release (CIDR) synchronization program is used for ovulation synchronization and timed artificial insemination (OvSynch-TAI). The objective of this study tested the efficacy of reusing CIDRs for OvSynch-TAI compared to a progesterone-free OvSynch-TAI protocol (NCS) or breed by estrus detection (ED) protocol. Animals were randomized among five treatments: (1) ED (n=18), (2) NCS (n=18), (3) CIDR6-New (n=17), (4) CIDR6-1X (n=17), and (5) CIDR6-2X (n=17). Does in the ED group received two 15mg doses of PGF2α at a 10d interval and bred 12h after the onset of estrus following the second injection. The NCS group received 15mg PGF2α on D0, 50µg GnRH on D8, 15mg PGF2α on D15 and 50µg GnRH on D18, concurrently with TAI. The CIDR groups received a P4 device for a 6d period, 15mg PGF2α at CIDR removal, and given 50µg GnRH 48h later at TAI. Reused CIDRs were cleaned with diluted Novasaln solution and refrigerated until time of use. All does were inseminated with a single dose of frozen semen using a non-surgical technique. Daily blood samples taken in all treatment groups to monitor concentrations of serum progesterone (P) until time of breeding. Pregnancy determined by ultrasonography at 50 and 80 days of gestation. Mean P differed ($P<0.001$) with treatment (5.3 ± 0.8^{bc}, 3.5 ± 0.8^{c}, 7.0 ± 0.8^{ab}, 7.9 ± 0.8^{a}, 6.2 ± 0.8^{ab} ng/ml for ED, NCS, CIDR6- New, CIDR6-1X and CIDR6-2X, respectively; lsmean ± SEM). Pregnancy rates for the ED, NCS, CIDR6-New, CIDR6-1X and CIDR6-2X treatment groups were $39 \pm 11\%^{bc}$, $22 \pm 11\%^{c}$, $64 \pm 12\%^{ab}$, $77 \pm 12\%^{a}$ and $57 \pm 12\%^{ab}$, respectively. In conclusion, reused CIDRs were effective at attaining satisfactory pregnancy rates. TAI using a once-used CIDR was more effective for establishing pregnancy than ED and NCS treatments.

J. Chris Mackey, Thomas L. Devine, Paige M. Kennedy, Amy M. Tyson, Matt H. Poore, Daniel H. Poole
Graduate Program: Animal Science
Advisor: Daniel Poole
Poster Number: 98

Impact of progesterone supplementation on pregnancy rates following timed AI or embryo transfer in beef cattle consuming endophyte-infected fescue

Most tall fescue (Festuca arundinacea) is infected with a fungal endophyte (Epichloë coenophiala) that produces ergot alkaloids; hindering reproductive success by decreasing pregnancy rates and suppressing progesterone (P4) concentrations. The objective of this study was to determine if progesterone supplementation following timed artificial insemination (TAI) or embryo transfer (ET) increases pregnancy rates (PR) of cattle consuming endophyte-infected fescue. Cattle were maintained on stockpiled endophyte-infected fescue during this study and were inseminated or received an embryo following estrous synchronization. Seven days post breeding or at embryo transfer, cattle were randomly assigned to receive either a CIDR containing P4 or a CIDR blank (control). Pregnancy was determined by ultrasonography at day 30 of gestation. Data was analyzed using a PROC GLIMMIX procedure of SAS and significance was determined at $P<0.05$ and a tendency at $0.05<P<0.10$. There was no difference in PR with supplemental P4 compared to controls in multiparous (21.1 vs. 31.6%, respectively) or nulliparous (41.7 vs. 41.7%; respectively) cattle. However, PR in heifers receiving P4 supplementation tended to differ by location (location1- 43.3% vs. location2 - 71.7%). There was a significant effect of year ($P<0.05$) for ET groups, therefore yr 1 and 2 were analyzed independently. In yr 1, P4 supplementation increased PR in ET cattle compared to controls (84.6 vs. 60.1%, respectfully; $P<0.05$). Additionally, supplemental P4 improved PR in cattle >7 yrs old compared to controls (98.7 vs. 57.2%; respectfully) and increased embryo retention in cattle receiving a frozen embryo (96.7 vs. 59.7%; $P<0.05$). In yr 2, there was no difference in PR with supplemental P4 compared to controls (36.8 vs 34.5%; respectfully). While progesterone supplementation significantly increased PR in cattle receiving embryos in year 1, it did not show significant impact in year 2 or following TAI in cattle consuming endophyte-infected tall fescue for both years.

Robert D. Mitchell[1], Andrew Wallace[2], Ernest Hodgson[2], Anirudh Dhammi[1], R. Michael Roe[1]
Graduate Program: Entomology[1]; Toxicology[2]
Advisor: R. Michael Roe
Poster Number: 106

Global Molecular Impact of Environmental Chemicals (DEET and Fipronil) on Human Health

New paradigms for human health risk assessment of environmental chemicals emphasize the use of molecular methods and human-derived cell lines; thus it seemed imperative to examine the impact of such chemicals on a human cell type. The examples chosen were the effects of the insect repellent DEET (N, N-diethyl-m-toluamide) and the phenylpyrozole insecticide fipronil (fluocyanobenpyrazole) on primary human hepatocytes. These chemicals were tested individually or, since interactions are of critical importance, together. RNA-Seq showed that although DEET is a potent inducer (transcript levels higher for 108 genes and lower for 64), fipronil (2,246 transcripts up-regulated and 1,428 repressed) is considerably more effective than DEET. The combined treatment of DEET and fipronil showed interactive and synergistic effects (3,017 transcripts up-regulated and 2,087 repressed). The genes affected were primarily involved in catalytic activity and binding while the principal pathway affected was the steroid hormone biosynthesis pathway.

DurreShahwar Muhammad, Rosangela Sozzani, Terri A. Long
Graduate Program: Plant Biology
Advisor: Terri A. Long
Poster Number: 111

Elucidating the Molecular Mechanism of Protein Movement Involved in Plant Iron Homeostasis

Iron 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 dissolving 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 response 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 tackle the mechanism by which it functions in iron homeostasis. This knowledge has potential for downstream application, 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 of POPEYE mRNA and protein expression pattern in specific root cells. We used two approaches to address this concern; (1) scanning fluorescence correlation spectroscopy microscopy with the transgenic line expressing GFP-POPEYE to examine if there is inter-cellular protein movement in responses to iron deprivation, and (2) analysis of double transgenic lines expressing both GFP-POPEYE and chemically inducible callose lines driven by root cell-type specific promoters to assess the effects of GFP-POPEYE when symplastic transport is blocked. Using these approaches has shown that POPEYE transcript is induced in the pericycle under iron deficiency and moves symplastically to the outer cell types. This new finding explains why we see differences between mRNA and protein expression, which will allow us to elucidate the importance of POPEYE function in specific root cells.

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Advisor: Peter S. Ojiambo
Poster Number: 117

A model for predicting within–season infection risk of downy mildew in cucumber

Downy mildew caused by Pseudoperonospora cubensis is considered the most damaging disease of cucurbits globally. Following initial infection, risk of disease spread depends on weather variables such as temperature and relative humidity. Multiple field experiments were conducted from 2012 to 2014 in Clayton, NC and Charleston, SC, where cucumber plants were exposed to prevailing environmental conditions and naturally occurring inoculum over a 24- and 48-h period. Disease severity was assessed 7 days after exposure, and weather variables during exposure were recorded. Distributions and correlations of 67 and 128 defined weather variables for the 24- and 48-h period, respectively, with disease severity were examined to identify variables favorable for disease development based upon data collected in NC. Binary logistic regression models with periods of relative humidity >80% and average daily temperature over the 24- and 48-h period had greater predictive ability. Based on a probability threshold of 0.5, final models had correct classification rates >80%, while sensitivity rates were >88%. Specificity rate was high for the 24-h model with a value of 65%. Data collected in SC was used to externally validate the models, resulted in correct classification rates >70%. Sensitivity and specificity rates for model validation were 69% and 86%, respectively, for the 24-h model, and 84% and 100%, respectively, for the 48-h model. Optimal decision thresholds can be used to reduce costs associated with a single fungicide application and crop loss by roughly 60% when current disease proportion is 20% in the field.

Dorothy N. Newman, Nichole L. Huff
Graduate Program: Family, Life, and Youth Development
Advisor: Nichole L. Huff
Poster Number: 118

Impact of Sentencing Guidelines in Adolescent Criminal Recidivism

Criminal recidivism in youth and young adults is of growing concern, as approximately 75% of juvenile offenders reoffend within five years. Extant research correlates specific variables such as race/ethnicity, socioeconomic status, mental health, and traumatic experiences with criminal behavior, however a paucity of research exists that examines the relationship between sentencing guidelines and recidivism rates. The purpose of this study is to examine the impact of sentencing guidelines (i.e., dismissal, community service, probation, incarceration) on recidivism rates in adolescent offenders. Arrest records from 2012 of adolescents age 18-22 (N= 283) were examined to determine if any repeat offenses were documented since the original sentencing. Findings suggest adolescents who were sentenced to community service or probation after their first offense were less likely to reoffend than those who were incarcerated or whose charges were dismissed. Implications of both punitive and restorative sentencing are discussed.

Chinmayee Panda
Graduate Program: Plant Biology
Advisor: Xu “Sirius” Li
Poster Number: 125

Mutation in GIR1, an importin β like protein, rescues the dwarf phenotype of a lignin deficient Arabidopsis mutant

Production of biofuels from lignocellulosic biomass is a promising approach to reduce our reliance on non-sustainable and environment-harmful fossil fuels. One of the major obstacles for this process is the difficulty in accessing the sugars embedded in cell wall due to the presence of lignin, a phenylpropanoid polymer. Past studies have been successful in attempting to manipulate lignin for substantial enhancement of cell wall digestibility. However, lignin modification came with a cost of significant plant growth reduction and loss of biomass. To understand the mechanism underlying this lignin-modification-induced dwarfism (LMID), we have carried out a suppressor screen with an Arabidopsis lignin mutant, reduced epidermal fluorescence 8 (ref8). In this mutant, a defect in p-coumaroyl shikimate 3′-hydroxylase (C3’H) leads to low levels of sinapoylmalate accumulation and reduced lignin content. This mutant is severely dwarf and sterile as well. This screen allowed us to isolate several suppressor mutations in which normal growth was restored. The goal of this work is to characterize one of these ref8 suppressors to understand how the mutation in this new gene might be involved in rescuing the ref8 dwarf phenotype. Using bulked segregant analysis and next -generation sequencing, we have identified a candidate growth inhibition relieved (GIR) gene, GIR1, which has been previously reported to encode an importin beta protein that mediates protein transport from the cytosol into the nucleus. We confirmed that this is the causal gene by generating double mutants of ref8-1 and an independent t-DNA knockout allele (gir1-t) and also by a genetic complementation test. The growth reduction associated with lignin deficient plants has previously been attributed to impaired water transport resulting from collapsed xylem, which in wild-type plants is highly lignified and is subjected to strong negative pressures during water transport. However, isolation of suppressors such as gir1 indicates the presence of genetic pathways that may mediate dwarfism upon phenylpropanoid pathway perturbation. GIR1 has not been shown to impact lignin deposition or xylem structure and function, however, works from other groups has shown that mutation in GIR1 has pleiotropic effects, including increased ABA sensitivity, enhanced UV-resistance, reduced trichome number, and enhanced miRNA acitivity. We are currently studying how mutation in GIR1 is involved in alleviating the dwarf phenotype of ref8 to understand the link between phenylpropanoid metabolism and plant growth.

Smriti Pehim Limbu
Graduate Program: Soil Science
Advisor: Alan J. Franzluebbers
Poster Number: 130

Dry matter yield response of tall fescue to late summer N fertilization as affected by biological soil quality

Applying nitrogen in late summer has benefits of higher biomass accumulation for stockpiling tall fescue for the winter season. However, applying nitrogen without knowing the nitrogen supply capacity of soil may not be an economically sound practice. Our hypothesis was that biologically active soil nitrogen would alter tall fescue yield response to late summer nitrogen fertilizer application. Twenty pastures with diversity in management in North Carolina and Virginia were selected for evaluation of our hypothesis. Each field had four treatments (0, 45, 90 and 135 kg ha^{-1}) with four replication arranged in a randomized complete block design (16 plots, 3×6 m each). Soils were sampled at 0-10 cm depth in August 2015 by compositing 8 cores (4 cm diameter) from each of the four replicate blocks. Soil nitrogen applying capacity was assessed through aerobic respiration at 25^0C for 24 days, as well as from a short- term soil assessment of soil carbon mineralization. Urea fertilizer was applied in early September 2016. Forage was allowed to grow till mid January 2016, at which time plots were harvested for yield analysis. Biologically soil activity varied from 40 to 240 mg $kg^{-1}24$ day^{-1}. Cumulative carbon mineralization was highly related to net nitrogen mineralization. We expected soil carbon and nitrogen mineralization to relate to yield response to nitrogen fertilizer but relationships were weak. Loss of nitrogen fertilizer could have occurred in the field due to heavy precipitation and nitrogen immobilization could have been extensive. Soil testing for nitrogen mineralization remains a challenge.

Whitney D. Phillips, Darren H. Touchell, Thomas G. Ranney
Graduate Program: Horticultural Science
Advisor: Thomas G. Ranney
Poster Number: 131

Segregating Chimeras: Optimizing Somatic Embryogenesis to Isolate Color Mutations in 'Royal Burgundy' Flowering Cherry

'Royal Burgundy' flowering cherry (Prunus serrulata) arose as a somatic mutation (branch sport) from the popular cultivar 'Kwanzan'. 'Royal Burgundy' has desirable reddish-purple foliage color, but appears to be a chimeral mutation and periodic adventitious shoots frequently revert to green foliage. Regenerating plants from a single or small number of cells through somatic embryogenesis has the potential to isolate this desirable mutation in a homogeneous condition. The objective of this study was to develop a somatic embryogenic protocol for P. serrulata 'Royal Burgundy' and to regenerate plants that are stable for purple foliage. Induction of embryogenic callus from leaf tissue was investigated using Murashige and Skoog medium supplemented with auxins 1-naphthaleneacetic acid (NAA), 2-4-dichlorophenoxyacetic acid (2,4-D), indole-3-acetic acid (IAA), or picloram at concentrations of 1.25, 2.5, 5, 10, or 20 µM.

Somatic embryogenesis was obtained from all auxin types with 2.5 – 10 µM 2,4-D producing the greatest number of somatic embryos per plate (~1-3 embryos). In a second study, the effect of 2,4-D and the polyamine putrescine on embryogenic callus and embryo formation was investigated. Murashige and Skooge medium was supplemented with a factorial combination of 2,4-D (1.25, 2.5, 5, and 10 µM) and putrescine (0.125, 0.25, 0.5, and 1.0 µM). There was a significant interaction between 2,4-D concentration and putrescine concentration where the combination of 2.5 µM 2,4-D and 0.5 µM putrescine produced the highest number of embryos per plate (~6 embryos). Somatic embryos were grown, elongated and rooted in vitro before being transferred to the green house. Recovered plants are being evaluated for expression and stability of purple foliage.

Karen Randle
Graduate Program: Family, Life, and Youth Development
Advisor: Kim Allen
Poster Number: 134

Parent Coaching

Coaching is a strengths-based approach to help families achieve success through the use of family-set goals. The role of a family coach is to collaboratively work with families to offer resources, models, and other necessary supports. Family coaches use techniques such as questioning, offering feedback, assessing, evaluating goals and actions, and offering nonjudgmental accountability.

Parental involvement in children's academic lives is a common indicator for children's success in school. Children's academic performance is impacted by parental perceptions, attitudes, and beliefs about schools and achievement. If parental involvement is crucial to student academic success, the question presents itself how to best support parents of struggling students. One answer may lie in the concept of coaching.

This study will measure how coaching parents on their approach to their adolescent's academic achievement impacts their child's academic success. Families at a middle school in North Carolina were asked to create goals centered around their student's academic performance or behaviors, and then create action plans designed to reach those goals. Parents and students were asked to reflect how coaching has impacted academic performance and behaviors.

Natalie Ross
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Poster Number: 142

Development and Application of a Continuous Flow-Through Chamber Technique to Measure Nitrous Oxide Emissions from Agroecosystems in the Southeast

Release of nitrous oxide (N_2O) from agricultural soils exhibits temporal and spatial variability, both of which contribute to uncertainty in quantifying cumulative N_2O emissions. The objective of this study was to decrease uncertainty due to temporal variability in cumulative soil N_2O emissions estimates. A monitoring system was used to record an index of the N_2O temporal emissions curve in a no-till, conventional agroecosystem in the Southeast. Quantitative flux measurements were obtained using non-steady state static chambers. The continuous system operated continuously and unattended in the field, and it used an infrared gas analyzer and several flow-through chambers. Individual chambers (n=4) were sampled for 30-minute intervals. Ambient N_2O was measured every 2 hours. During the study, most of the N_2O flux occurred during one peak emissions event. Cumulative flux was estimated three ways, with the first approach using linear interpolation of the static-chamber flux measurements and integration under the curve (LII). The temporal curve from the continuous system was then used to inform adjustments to the LII approach by defining the start of a flux event (LIIS). Finally, N_2O flux decay constants (n=4) were derived from continuous measurements and averaged (RSD = 12.3%). Using the decay constant, an exponential decay curve was applied to the static chamber measurements in conjunction with the LIIS approach to estimate cumulative flux. The cumulative N_2O flux values from the LII, LIIS, and LIISD methods were 1009 ± 827, 609 ± 379, and 768 ± 540 mg N_2O m^{-2}, respectively. In this study, the LII approach over-estimated the cumulative N_2O flux. Correcting the tendency to over-estimate flux using the LIIS approach by adding in an estimate of the start in enhanced N_2O emissions led to an inherent underestimation in flux. This tendency to underestimate cumulative flux using the LIIS approach was corrected with the LIISD approach.

Rozalynne Samira, Devarshi Selote, Terri A. Long
Graduate Program: Plant Biology
Advisor: Terri A. Long
Poster Number: 143

Characterization of the role of an iron-binding protein in seed development

Iron is an essential mineral nutrient for growth and development of all living organisms. Plants-based diets are the primary source of iron nutrition for animals and humans. Therefore, it is necessary to understand the molecular mechanism(s) involved in regulating the concentration of iron in the edible parts of the plants, specially the seeds, to improve nutritional values of crop plants. Plants have evolved various mechanisms to facilitate iron uptake from the soil, mobilization from root to developing shoot, and finally loading into the reproductive tissues for proper seed development. However, excess iron loading can cause lethality of the developing embryo possibly due to generation of damaging reactive oxygen species (ROS). Hence, a tight regulation of iron is essential for the normal growth cycle of plants. Previously, we have identified a novel iron-sensing protein BRUTUS (BTS), which plays an important role in the iron deficiency response in roots. BTS encodes a protein with three iron-binding hemerythrin motifs and an E3 ligase RING domain. In this study, we focused on the role of BTS in maintaining iron homeostasis in developing A. thaliana seeds. The knock-out mutation in BTS leads to complete embryo lethality. The partial loss of expression of BTS leads to insensitivity to iron deficiency, but causes 5-10 % embryo lethality as compared to wild-type plants. High BTSprom-GUS expression is observed in developing siliques especially in the funiculus. Embryo lethality of the knock-down BTS mutants along with heterozygous knock-out BTS mutant is correlated with the high accumulation of iron in the developing embryos. These findings will help us understand the role of BTS in regulating the seed Fe homeostasis and to design strategies for fortified crops where seed iron content is elevated for human consumption without causing loss in yield due to excess iron-induced embryo lethality.

Tyler Sowers, Andrew Whitaker, Megan Andrews, Matt Polizzotto, Owen Duckworth
Graduate Program: Soil Science
Advisor: Owen Duckworth
Poster Number: 159

Arsenite and Arsenate Sorption to Biogenic Iron (Oxyhydr)oxides formed in Natural and Laboratory Environments

Arsenic (As) is a widespread and problematic pollutant that can be derived from natural or anthropogenic sources. Iron (oxyhydr) oxides readily sorb arsenic and thus they play critical roles in arsenic cycling in terrestrial environments; however, little is known concerning the affinity and mechanism of As(III/V) sorption by biogenic iron (oxyhydr)oxides formed in natural hydrological environments. To investigate this, we conducted adsorption isotherm and kinetics experiments to compare As(III) and As(V) sorption to synthetic 2-line ferrihydrite and those harvested from circumneutral pH waters. Inductively coupled plasma mass spectrometry (ICP- MS) was used to quantify both As(III) and As(V), whereas X-ray adsorption spectroscopy (XAS) was utilized to obtain As and Fe spectra for As(V) sorbed to environmental and laboratory Fe(III) biominerals. Current results suggest that environmental Fe(III) biominerals have higher affinity for As/mmol Fe compared to synthetic 2-line ferrihydrite. This study helps to improve our understanding of the sorption reactivity of biogenic iron (oxyhydr)oxides for environmentally relevant As species (III and V) and is critical to understanding As cycling in natural systems while also having the potential to improve As remediation systems.

Joseph Taylor, Robert Austin, Joshua Heitman, Deanna Osmond, Carl Crozier
Graduate Program: Soil Science
Advisor: Joshua Heitman, Robert Austin
Poster Number: 164

Testing Capabilities and Applications of Small Unmanned Aircraft Systems in Detecting Plant Nitrogen Status in Wheat and Corn

Small Unmanned Aircraft Systems (sUAS) have emerged as a remote sensing platform able to collect aerial imagery at resolutions, costs, and frequencies previously unimaginable. In agriculture, timeliness of information is critical to effectively manage crop health. In order to test sUAS capabilities in nitrogen management, this project aims to i) validate relationships between data collected from a sUAS and in-situ field measurements of plant nitrogen (N), ii) quantify temporal and spatial variations of within-season plant reflectance captured using both a sUAS and ground-based sensors (Trimble GreenSeeker and field spectrometer), and iii) compare a vegetative index between aerial and ground-based measurements. Both a fixed-wing (FourthWing – Vireo) and rotary (DJI – Inspire) platform were used to collect visible and multi- spectral imagery over N-rate field trials of winter wheat (Triticum aestivum L.) and corn (Zea mays) in Plymouth, North Carolina. Three treatments were replicated four times in a RCBD. The wheat trial included starter N at planting (0, 15, 30lbs N ac^{-1}) followed by a spring side-dress application (0, 75, 150lbs N ac^{-1}). The corn trial included starter N at planting (0, 100, 250lbs N ac^{-1}) followed by a top-dress application at V7 (0, 100, 250lbs N ac^{-1}). GreenSeeker measurements, tissue samples, and spectrometer readings were taken to correspond with flights. Sampling was done on a bi-monthly schedule before and after N application.

Correlations between indices derived from aerial images and ground-based measurements were used to identify the optical response to differing tissue N concentrations. Estimates of current crop N were calculated using the normalized difference vegetative index (NDVI).

Statistical analysis indicated significant correlations between NDVI and tissue N for wheat at stages Z31 and Z32 and corn at stage V12. No significant relationships were identified between sUAS imagery and tissue N for wheat at Z37 and corn at V7.

Laura Villegas Ortiz
Graduate Program: Agricultural Economics and Resources
Advisor: Tamah C. Morant
Poster Number: 171

No Train No Grain: Impacts of Increased Demand for Rail Services in the Oil Sector on Wheat Prices

Rail service is the most cost-effective alternative for shipping agricultural commodities in the Upper Midwest where farm lands are distant from inland waterways and markets. The recent energy boom experienced in North Dakota has created new competition for the use of shipping services in the state's surrounding region. As oil has taken up freight space on railways, it has become more costly for farmers in North Dakota and adjacent states to reach grain markets, resulting in economic losses of millions of dollars. By some estimates, the annual lost farm revenue in North Dakota due to delayed deliveries and increased transportation costs was as much as USD $150 million in 2014 (Olson, 2014).

I study three particular effects of increased competition for rail services from the energy sector. First, I use national measures to study the impact of track congestion on wheat basis (the difference between spot and futures market prices). Then, I examine how the sudden expansion of the energy sector may have resulted in different changes to prices received by wheat producers in North Dakota and farmers in the Gulf Coast region. Finally, I investigate whether the construction of new regional liquid pipeline networks is linked to regional wheat bases.

The results are consistent with theoretical predictions. Furthermore, they indicate that oil nearby prices consistently have a negative and significant effect on wheat basis. The effect of a USD$ 1 increase per barrel of oil ranges from 1 to 8 cents per bushel at the national level, from 0.1 to 0.5 cents within the Midwest region, and it is fairly stable at a 0.1 cent decrease in the Gulf Coast region. A 1 to 8 cents decrease in the basis translates into an annual decrease between $20 and a $170 million in revenue from sales at local markets.

Emma C. Wallace, M. Quesada-Ocampo
Graduate Program: Plant Pathology
Advisor: Lina M. Quesada-Ocampo
Poster Number: 174

The population structure of Pseudoperonospora cubensis on commercial and non-commercial cucurbits in North Carolina determined by Simple Sequence Repeats (SSRs)

Pseudoperonospora cubensis, the causal agent of cucurbit downy mildew, is an airborne, obligate, oomycete pathogen that causes foliar destruction of all major cucurbit crops in the United States (US). Since the resurgence of this pathogen in 2004, P. cubensis causes yield losses in cucumber-producing regions, particularly North Carolina (NC) where all major cucurbits are grown including cantaloupe, pumpkin, squash, and watermelon. P. cubensis has approximately 60 host species, all of which are in the Cucurbitaceae family. Many of these species are grown on a small scale in NC or occur in the wild as weedy plants. Little is known about the contribution of wild and non-commercial cucurbits to the yearly epidemic. As it has been previously shown that P. cubensis has relatively high genetic diversity in NC, and genetic differentiation exists by cucurbit host, this study aimed to use molecular markers to determine the genetic structure of P. cubensis on commercial and non-commercial cucurbits in NC. In silico approaches were used to design 2,088 Simple Sequence Repeat (SSR), or microsatellite, markers from the predicted transcriptome of P. cubensis. Eleven informative markers were identified after a subset of these primers were screened and evaluated for reliability and informativeness. These markers were applied to isolates from six commercial and five non-commercial cucurbits from three locations across NC. Population analyses revealed genetic differentiation by host genera, which supports the concept of host-driven differentiation. The lowest genetic differentiation occurred between isolates from Citrullus lanatus versus isolates from Momordica spp.

Furthermore, the highest genetic differentiation occurred between isolates from Cucumis versus Citrullus and Momordica hosts. These findings suggest the wild and non-commercial cucurbits are playing a role in P. cubensis diversification, and possibly contributing inoculum for Citrullus lanatus.

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Graduate Programs: Physiology[1], Animal Science[2]
Advisor: Charlotte E. Farin
Poster Number: 175

Evaluating the Role of Pregnancy Specific Protein B in Fetal Development as a Biomarker for Predicting Total Kid Birth Weight and/or Total Number of Kids in Goats

Monitoring maternal hormone concentrations throughout gestation can be an important diagnostic tool for determining pregnancy status and for assessing fetal development during gestation. The study objectives were to (1) evaluate ovulation synchronization protocols for breeding goats by timed artificial insemination and (2) assess maternal concentrations of the placental protein, Pregnancy Specific Protein B (PSPB), in pregnant female goats as a predictor of total kid birth weight and number of kids. Experiment 1: a total of 74 does were randomly assigned to one of four synchronization protocols: (1) BBE (control, n= 17), (2) CIDR6N (C6, n= 20), (3) NC.Synch (NCS, n=20), and (4) Modified NC.Synch (NCSM, n=17). Four experimental replicates were conducted. In each replicate, does were artificially inseminated (AI, Day 0) using a non-surgical, transcervical technique with frozen semen from commercial sires. Pregnancy data were analyzed by ANOVA with a model that included treatment, replicate, and their interaction. Experiment 2: For does pregnant to AI (n=32), peripheral blood samples were monitored for PSPB concentrations on Days 30, 50, 80, and 100 post-AI. Pregnancies were confirmed using ultrasonography at Days 50 and 80 of gestation. Plasma PSPB concentrations were analyzed by ELISA (BioPRYN, BioTRACKING LLC, Moscow ID). At kidding, individual kid birth weight and total number of kids born were recorded. PSPB data were analyzed by ANOVA with models that included either number of kids born, day of gestation and their interaction or total kid weight at birth, day of gestation and their interaction. Means were separated by Duncan's test. In Experiment 1, pregnancy rates did not differ ($p>.05$) between the BBE, C6, NCS, and NCSM treatment groups (53%, 30%, 50%, and 41%, respectively). For Experiment 2, PSPB samples at Days 30, 50, 80, and 100 of gestation are currently being analyzed and will be presented at the Graduate Research Symposium.

Mary Theresa D. Williams, Helen T. Kraus, Elizabeth D. Riley
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Advisor: Helen T. Kraus
Poster Number: 180

Amending Pine Bark with Swine Lagoon Compost: Is Poo the Answer?

Pine bark has been the primary potting media of the horticultural ornamental plant industry for decades but, with quantity and quality becoming unpredictable, growers are seeking alternative amendments such as composted swine lagoon waste. In North Carolina, swine production comprises $26,419,703 of the state's $420,145,646 farm cash receipts. The waste produced by hogs is stored in lagoons which have the potential to impair water sources. Using swine lagoon waste as an amendment to pine bark has the potential to benefit not only the horticulture industry, but also the hog producers. A study was designed to evaluate the impacts on plant growth of pine bark amended with varying rates (10,20,40,60, or 80% by volume) of swine lagoon compost. The lagoon solids were dredged and pumped into a geotextile bag to dewater. The bagged waste was composted for two years, resulting in swine lagoon compost (SLC). The SLC was removed from the bag, dried for a week, and then ground to 2mm before blending with pine bark (PB) in increasing ratios (10:90, 20:80, 40:60, 60:40, and 80:20 SLC:PB). Musa velutina, ornamental banana, was potted in the substrate blends. Low volume spray stakes irrigated twice daily, but no fertilizer or lime was added. Substrate solution was collected regularly to monitor electrical conductivity (EC) and pH. After six weeks, shoots were removed and roots were washed free of substrate; dry weights of both were determined by oven drying at 60°C for four days and used for growth comparison. A reduction in growth was seen in both roots and shoots in substrates containing greater than 10% SLC (10:90 SLC:PB). Root growth was likely reduced by high EC in substrate solution which could have damaged the plant.

College of Design

Mohsen Ghiasi Ghorveh
Graduate Program: Design
Advisor: Robin Moore
Poster Number: 57

Street Design and Route Choice: Examining the Association between Micro Spatial Attributes of Built Environment and Transit Users Wayfinding

To counteract with the reduction of physical activity and for understanding the walkers' preferences about the streets scape quality, the investigation examined, what are the attributes of route choice that may attract a commuting pedestrian to choose one route over another? This is novel methodology that eliminates the self-selection bias and also provides variations in settings. Until now, studies of the association between street attributes and route choice have mixed results. Some suggest that walkers consider the shortest route to minimize distance or walking time. Other studies found route quality to be a predictor of route choice. No studies have been identified that included both physical features and perception to achieve a clear transaction between environmental attributes and walking behavior.

The focus of this case-control study (i.e., the case is the route taken, and those not taken are controls) is on micro-level street segments to explore how the urban design qualities of streets associated with transit users' preferences in choice of routes. The primary data collected in light rail stations in Charlotte, NC. The subjective data gathered through an online survey questionnaire and the objective data gathered by using Pedestrian environmental data scan inventory tool.

The study compared the number of times the segment was walked or picked by participants in survey. The betweenness value, which is a weighted accessibility measure, for this pair of segments was similar, but they could differ based on other attributes (i.e., predictors of conceptual framework like sidewalk width, the presence of certain land uses, and average set back). By observing how these systematic differences affect usage, for a given level of betweenness and walkability level, the findings reveal a strong positive correlation of shortest route with selecting route. Also, the primary findings imply that pedestrians will choose streets with the high level of attributes.

Allison McCulloh Karas
Graduate Program: Graphic Design
Advisor: Deborah Littlejohn
Poster Number: 82

Externalizing Interpretation: Visualization Studies for Qualitative Research in Interdisciplinary Design Teams

Design problem spaces are increasingly complex, which calls for a shift in expert mindsets and research methods. Generative design research (GDR) is one of those methods: it involves endusers in the design process alongside other disciplines because they are the experts in the experience wherein the problem is located and can contribute towards the benefit of the project. GDR methods give endusers the means to articulate feelings, ideas, and perspectives through processes of making, saying or doing, all of which generate diverse forms of qualitative data, such as 3D models, audio recordings, or sketches. User-generated qualitative data (UGQD) is interpreted, analyzed, and evaluated by design teams to identify opportunities for design, constraints for action, or justifications for additional research. The speculative, ambiguous nature of UGQD is valuable, as the diverse backgrounds that comprise interdisciplinary teams form a rich knowledge base, however interpretations of UGQD may also yield trite assumptions, oversimplification, and missed opportunities for pattern identification. Currently, a team member's interpretation is internalized; my research explores strategies to externalize interpretation in GDR. I developed an ideal scenario and personas, based on information gathered from semistructured interviews and surveys of design researchers that design with their enduser. I conducted three visual studies organized around three different forms of UGQD within this scenario. Each study addresses affordances and attributes specific to the form and explores the potential for a digital visualization tool to: 1) induce pattern recognition; 2) identify meansend relationships of events and actions within the problem space; and 3) incorporate alternative media into the interpretation process. This research concludes that visually externalizing the interpretation of UGQD by means of a digital visualization system requires new approaches for coding data within interdisciplinary design research teams.

Byungsoo Kim
Graduate Program: Industrial Design
Advisor: Sharon Joines
Poster Number: 85

Interaction Design Guidelines for Drivers

The Sharing Economy keeps growing and is estimated to increase to half of the whole rental economy in 2025. According to the trend, Car-sharing systems also become one of the most common transportation methods and is anticipated to keep growing in the future. People who use car sharing systems, such as Zip Car, generally rent a car for just for a short amount of time and they do not have enough time to learn the function and controls of a car that they are not familiar with. However, since current vehicles provide more functions and information than before, and each vehicle company applies different interaction design methods and locations of the controls into their cars, it becomes harder for the drivers who use car-sharing systems to control the functions that they need. These situations might distract the drivers who use car sharing systems and end up causing traffic accidents.

The purpose of this study is to gain a better understanding of the user experience while driving in order to develop universally applicable interaction design guidelines for designers regarding secondary car controls. Specifically, this study is focusing on the distraction/interaction of the driver with secondary controls in the car such as the radio, and heat / AC to inform the development of car interiors for car sharing systems.

Abraham Shaun Kurian
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Advisor: Patrick Fitzgerald
Poster Number: 87

Jimmy's Ghost: A Virtual Reality Study in the Digital Humanities

Historically, the spectatorial design of cinema has been a disembodied experience through a willing suspension of disbelief. Contextualized by the mise-en-scéne in each narrative frame and the juxtaposition of these frames through Eisensteinian montage, we semi- consciously transport ourselves into the constructed reality on the screen. But as André Bazin elucidated many decades ago, this phenomenology of the cinematic experience is not enough to achieve total immersion into the narrative because of the ontological separation between the spectator and the image. Over the course of cinema history, from Abel Gance's Napoléon (1927) to the Montréal World Exposition (1967) to the re-emergence of Virtual Reality (VR), there has been a slow and steady push to reduce this existential space between the spectator and the image. Jimmy's Ghost is a VR cinema study that dramatizes a selection from the literary and rhetorical prose of the prolific American essayist and orator James Baldwin, who was a voice of conscience and empowerment during the civil rights movement of the 1960s.

The implications of this interactive study will be threefold. First, it will expand the spectacle of cinema into both narrative time and space. Within this redefinition of the cinematic language, the construction of the visual narrative will move away from Eisensteinian concepts, and move towards the compositional film theory of Andrei Tarkovsky. Secondly, the physical act of immersing in the hyper-mediated VR space through the Oculus Rift glasses will create authentic feelings of being present in the narrative space. And thirdly, as precedent research indicates, the interactivity of the medium will create more empathy and engagement with the spectators, and will deliver a proof of concept for future initiatives in the digital humanities.

Mingyu Liu
Graduate Program: Industrial Design
Advisor: Sharon Joines
Poster Number: 93

Food, Sharing, and Meals Sharing

While many contemporary individuals lives are hectic and meal preparation falls to the bottom of their priorities, in the meantime some other people want to cook but have nobody to share with. My objective is to design a new service through answering the researchable questions, knowing people's real demands, and considering feasible ways to solve their food issues, then make a dreamland for the "lone wolves", bring them in communities. In the project I've identified the segment by implementing market reviews and primary researches, moreover I have been doing pilot work for couples of month. I found that sharing meals with strangers is feasible, and design can make problems of that soluble. There is a need of new ways that help them eat more healthy, feel more satisfactory, and utilize well the resource gotten from communities. After making business strategy I created a genuinely potential and creative service. It will be a meals sharing service which helps people having different problems with meals sit together, benefit from the food sharing economy. They would participate in dinners with their new friends, have joyful meals, and feel family anywhere.

Payod Panda
Graduate Program: Graphic Design
Advisor: Derek Ham
Poster Number: 126

Introducing Designers to Programming via the Design of a Three-Dimensional Visual Programming Language

Today more than ever, there is a need for designers to learn programming to expand their existing toolset to allow them to design for future applications of technology. However, the way in which programming is typically introduced using syntax based instruction has not proven to be as effective for designers. As visual thinkers, design students are more comfortable with working in space rather than a text-only environment. This thesis aims to lower the barrier of entry to programming for designers and visual thinkers. The investigation explores the design of a Three Dimensional Visual Programming Language (3D VPL) that introduces college-level design students to programming. This 3D VPL lets them manipulate code blocks in three dimensional space to build their application. Ways of defining mathematical functions in space are also explored. Serving as the teaching assistant for an introductory programming class for designers, I was able to observe design students tasked with learning programming. This observation served as a guide for my explorations and studies. These explorations also establish much of their foundations from research through design and making. During classroom activities, a visual approach to explaining programming concepts was met with a better response than a text based or oral approach. Conversations with the students in this class indicate positive outcomes of using a visual approach to introduce programming, and the design of the system is under way dependent in part upon a continual interaction with the students.

Vaidehi Patil
Graduate Program: Graphic Design
Advisor: Denise Gonzales Crisp
Poster Number: 128

Designing Visuo-Spatial Strategies for Novice Fiction Writers as a Medium to Capture and Manipulate Ideas Throughout the Writing Process

Writing is a complex process that involves juggling numerous constraints, setting goals, and moving back and forth between producing ideas and producing text for those ideas. Text generation is a highly codified process compared to idea generation. Cognitive scientists including Linda Flower, John Hayes and Peter Wason have suggested that novice writers often confuse idea manipulation with text manipulation, which results in rules of text generation interrupting idea generation at an early stage. This interference results in chaotic plans and incoherent first drafts. Externalizing ideas and structuring them into a plan is an important strategy for novice fiction writers, who often do not have a developed process for writing or concept development that they can depend on. Many novice writers discover early on that in spite of applying all the learnt techniques correctly, the vivid story in their mind becomes a washed-out version on paper. Further, fiction is a large category within creative writing consisting of various genres, forms and styles. Current writing tools facilitate text generation more than capturing and manipulation of ideas, when both are equally important components. This study aims to investigate the idea generation component of writing through the use of visuo-spatial strategies. These visuo-spatial strategies as part of an interface are intended to allow creation of intuitive and flexible plans, based on common attributes of fiction such as temporal and causal relationships between ideas. The strategies will manifest through digital writing tools that aid in facilitating visual manipulation of captured ideas, as well as provide customizable functionalities that allow sorting and testing ideas through iteration.

Jennifer Peavey
Graduate Program: Industrial Design
Advisor: Sharon Joines
Poster Number: 129

A Process for Informing Strategy with Design and Forecasting

The further a company is from the final user in the value chain, the harder it is for a company to view their products in connection with the final user. It can also mean a company does not understand the brands who seek to connect with the final user. This is particularly true for raw material suppliers who are near the beginning of the value chain. The company's ability to continually innovate could be limited without knowing the value proposition to the final user. The inability to communicate the value of the company's products could make a meaningful discussion with partners and customers difficult, make credibility challenging to establish and lead to missed opportunities.

Therefore, the use of industrial design and forecasting methods could be a means of sparking purposeful discussions with those who make strategic decisions inside and outside of a company. Specifically, the study will demonstrate the need for being informed directly by the final user when the company wants to engage with a brand. Since raw material suppliers need time to develop solutions, understanding the final user's needs will be used to develop forecasts. The study then will demonstrate how to translate knowledge into information useful for technology, material and business strategy. Lastly, the study will demonstrate how industrial design can help strategists to sell their ideas and reach the market through tangible prototypes, research insights, and product experiences. Thus far, the study has determined initial user research is needed to meaningfully define the questions to be answered by the material solutions developed. It was also found that analysis of the insights and translating into forecasting should be given more space and time within project planning to create a robust problem statement. Lastly, artifact design should focus on a material experience being demonstrated through a product abstraction.

Scott Reinhard
Graduate Program: Graphic Design
Advisor: Denise Gonzales Crisp
Poster Number: 138

Expanding upon "Interaction Gestalt" Research in Designed Contexts

Up to this point in interaction design, the focus of attention has been on usability and the built structure of the digital artifact. Aesthetics often are viewed with lesser importance as a surface component. The literature in HumanComputer Interactions is moving towards the idea that aesthetics aren't just the way that something looks or behaves, but is important to how users understand and experience a product or artifact. More specifically, HCI researchers have developed theories where combinations of interaction attributes, for example movement speed, concurrency, and expectedness, come together to form an Interaction Gestalt. This combination of attributes as a gestalt forms emotional qualities to the user. These qualities are inherent to interaction, and aren't possible with physical artifacts. For this reason, both study and practical implementation of Interaction Gestalt has remained in a more neutral, clinical setting of HCI research. The research that I am doing seeks to take the principles of interaction gestalt and apply realworld content and graphic design principles to see how these theories hold up in actual use. Coming out of the research, the aim is to have a series of case studies that are clear and usable for future practicing interaction designers to apply. My research methods are mainly through research by design where I am building usable prototypes of data visualizations obtained from Tate Museum Collection Data and systematically applying the interaction attributes as variables that could potentially create emotional qualities to the visualizations. At this point, early findings are that combinations of interaction attributes are a useful way of creating emotional qualities in interactive visualizations. My continuing studies will look at how affecting various elements of the interaction and the degree to which I affect the variability of the attributes changes the feeling that is created in an interactive experience.

Fabio Andres Tellez
Graduate Program: Design
Advisor: Meredith Davis
Poster Number: 165

Human Centered Design As A Strategy To Promote Empathy In The Design Studio

This poster presents partial findings of a study that explores how empathy is expressed and developed by undergraduate students exposed to two different industrial design studios during an academic semester at a public research university.

In the Design field, empathy—the ability to feel, recognize, and understand another's thoughts and feelings—is considered essential for designers to acquire a deep understanding of the users in order to develop design solutions that meet their needs, and expectations. However, it has been reported that since the year 2000 there has been a decline in empathy among American college students. Additionally, despite the importance of this ability in the design field, there is a lack of empirical research exploring how empathy is approached and promoted in design education.

As a consequence, the purpose of this study is to understand how empathy is expressed and developed by undergraduate industrial design students, through the exploration of the methodological, pedagogical and curricular conditions to which they are exposed in two different instances of design education.

A total of 33 industrial design students in two different design studios participated in this study, which was conducted using a simultaneous mixed methods design driven by its qualitative component (QUAL+quan). From a qualitative approach, this study implemented an ethnographic strategy. Data was collected using non-participant observation, semi-structured interviews, discourse analysis, document analysis, and artifact analysis. From a quantitative approach, the study implemented quasi-experimental and correlational strategies. Data was collected using questionnaires and surveys. For data analysis, a combined strategy was implemented, utilizing techniques such as transcriptions, coding, memoing, correlations, and analysis of variance.

This poster reports a section of the findings, where it is shown how the use of human-centered design methods in the design studio plays an important role in promoting the expression and development of students' empathy.

Sally Van Gorder
Graduate Program: Art + Design
Advisor: Cecilia Mouat Croxatto
Poster Number: 168

Dust and Power: an Autobiography Documenting Energy and Entropy in Domestic Space

Historically, representations of motherhood and home tend to privilege events having the status to be remembered (birthdays, first days of school, holidays, etc.) How the self is portrayed and mediated in this context is often associated with domestic roles and connected to cultural expectations. This research explores the less visible elements of those representations by examining domestic dust and debris as autobiographical narrative. Using household erosion as primary subject matter, an installation of photography, printmaking, video and sound will be produced to communicate a self-story addressing motherhood, personal history and power. The research conducted to frame the creative work was guided by the following questions: What aspects of autobiography can emerge through visual depictions of domestic dust? How does the unwanted breakdown and waste of everyday life generate insight into personal history? In what ways can the collection and archive of domestic erosion reveal an understanding of a larger whole? How can the gathering and organization of dust in the home express autobiography and attribute power to the storyteller? A methodology for examining erosion in the household was established by exploring the practices of artists whose work addresses domestic maintenance and care-giving, examining scientific methods of visualization and investigating systems of collection, documentation and classification.

This research contributes to current dialogues regarding the experimental documentary form of visual autobiography, the relationship between artistic process and scientific method, hybrid digital and handmade production processes, and domestic social structures.

Alek Walker
Graduate Program: Industrial Design
Advisor: Sharon Joines
Poster Number: 173

Helping Honey Bees through Design: An Educational Approach to Help Beginner Beekeepers

In 2006 the term “Colony Collapse Disorder” (CCD) was coined to describe the disappearance of western honeybee (Apis Mellifera) colonies in North America. Recent studies have calculated that more than 10 million hives were lost to CCD from 2006-2013. One of the major causes of this behavior is the Varroa Mite, an external parasitic mite that attacks and causes diseases to honeybees.

This project is intended to look at how we can alleviate the decline of the western honeybee through educational community efforts, scalable hive designs, and focusing on the removal of Varroa Mites within the beehives. It’s imperative to understand and engage the experience of the beekeeper to develop guidelines for community participation and acceptance of beehives locally. By understanding how a colony works together and supports a certain amount of space the project will work to create scalable hive designs for breadth and compactness. Out of 107 people surveyed, 70% stated that they would want to own a bee hive to help with the Colony Collapse Disorder. However 52% of the people said that they would not want to own a bee hive because they are not educated on keeping bees. This is a great opportunity for design to relieve the stressful process of keeping bees and adhere to the education of beekeeping; a market of great potential. By focusing on the user experience of the beekeeper this design project will translate the expert’s process to guide a beginner user from start to finish on the process of beekeeping.

Meredith West
Graduate Program: Art + Design
Advisor: Cecilia Mouat
Poster Number: 177

Contemporary Technology as a Tool for Honoring the Handmade Mark in Textile Design

Handmade textiles have been produced for centuries, reflecting place, people and culture, but they have not always been accessible to consumers. A distinctively imperfect mark of the hand with the desire to produce unique originals inspires utilitarian goals to research and explore production techniques for printed and woven textiles. Achieving high aesthetic function coupled with utility and thoughtful reproducibility is the main focus of this project, addressing the question: as a contemporary practice, how can traditional hand processes merge with the rapid digital age to honor cultural techniques?

The creative process motivates the exploration of simple shapes to create complex textile designs, combining handmade techniques with contemporary technologies, such as digitally manipulating scanned motifs for repeat pattern translation. The outcome is the development of a process that begins with the creation of handmade marks both painted and stamped onto cotton fibers with a clay paste resist before the first dip in an indigo natural dye vat. Simplistic forms through successive dips in the vat produce depth of color and reoccurrence of shape, and yield an illusion of transparency through layering. A series of these textile designs are then digitally manipulated in order to create industrial textiles that look like handmade creations.

College of Education

Osman Aksit, Eric Wiebe
Graduate Program: Science Education[1]
Advisor: Eric Wiebe
Poster Number: 5

Investigating Student Learning through Writing and Drawing: Implications for Multimodal Science Assessment

This study investigated fourth grade students' conceptual understanding of a physical science topic by examining how evidences of student learning were revealed in their writings and drawings. Students used an electronic science notebook called the CyberPad which was specially developed for upper elementary grade students to support inquiry learning through virtual and physical lab activities. The CyberPad provides students with built-in tools and scaffolds to support learning through writings and drawings. The evidence-centered design (ECD) framework was used for systematically analyzing the existing assessment model in the CyberPad and generating a rubric to evaluate the students' writing and drawing artifacts. The sample (N=98) for this study was a subset of a larger sample of students from 42 schools which implemented the CyberPad in 2013-2014 and 2014-2015 school year. A hierarchical multiple regression test was conducted to analyze how student knowledge revealed across multiple writing and drawing artifacts predict their post-test performance. The first model using only drawing scores significantly predicted approximately 36% of the variance in the post-test scores while the second model containing both drawing and writing scores significantly predicted approximately 48% variance in the post-test scores. In another test of the utility of this ECD approach to characterize student knowledge, a Latent Profile Analysis (LPA) clustering technique was run on students' drawing and writing scores, and showed that a 3-class model was the best fitting model. These three classes (clusters) can be characterized as high-performing (15%), average-performing (53%) and low-performing (32%) groups. Except for the low-performing group, the mean scores of students' writings for each science concepts were lower than the mean scores of their drawings. Considering the rise in the popularity of electronic science notebooks and computer-based learning environments, this study is particularly important in understanding of how to leverage different kinds of tasks for assessing student learning.

Shanita Brown
Graduate Program: Counseling and Counselor Education
Advisor: Sylvia Nassar-McMillan
Poster Number: 24

Intersections of Race, Spirituality, and Domestic Violence: The Counternarratives of African American Women Survivors

Intimate Partner Violence (IPV) is a social problem of global proportions (Drumm et al, 2013). According to results from the National Intimate Partner and Sexual Violence Survey (NISVS) (2014), 1 in every 4 women in the United States (24.3%) has experience domestic violence in her lifetime, translating to nearly 29 million women. NISVS has also found that 43.7% of African American women experience domestic violence compared to 34.6 % of White women, and about 2.5 times the rate of women of other races. Researchers have proposed that as a result of historical oppression, present day racism and the importance of spirituality among this population as explanations for higher incidents of domestic violence. However, there is a lack of research on the role of spirituality among African American women survivors and its impact on the process of leaving the volatile relationship.

The purpose of this qualitative study is to explore the domestic violence experiences of African American women survivors and the role of spirituality through narrative inquiry. This study utilized Critical Race Theory and Relational Cultural Theory as frameworks to design the study, collect data and analyze the data. Key findings included: (a) intersectionality-related discrimination, (b) strategies of disconnection for survival, (c) relational images of abuse, (d) spirituality as a barrier, and (e) spirituality as a source of strength. The significance of the findings has implications for practice, policy, theory and future research.

Sarah E. Cannon
Graduate Program: Curriculum and Instruction
Advisor: Ruie J. Pritchard
Poster Number: 29

Balancing the Scales: An Exploration of the Conflict of Standardization and Diversity in Assessment of Pre-Service Teachers

The edTPA, a nationally scored performance-based assessment of pre-service teachers, was developed by the Stanford Center for Learning and Assessment Equity (SCALE) in response to an increasing trend towards accountability and standardization in teacher preparation programs. Field tested in 2012, this assessment is now in use to some extent in 35 states and the District of Columbia. This rapid growth and the assessment itself have been met with much controversy, largely from multicultural educators and those approaching the profession from a social justice perspective. However, because of the relative newness of this assessment, few studies have been conducted to examine the validity of these critiques. This exploratory study seeks to examine the relationships among multicultural education, social justice, and standardized assessment. Using a qualitative content analysis methodology, this study analyzes 36 edTPA work samples to explore how pre-service teachers incorporate multicultural education in their edTPA lesson plans and how they talk about students in the pre-service teachers' written reflections. The researcher used deductive codes based on Banks's (2004) five dimensions of multicultural education and Valencia's (1999) operationalization of deficit thinking.as well as inductive codes based on multiple readings and analysis of the work samples. Preliminary findings show much variety in how pre-service teachers identify and apply multicultural perspectives in their classrooms.

Vandna Gill
Graduate Program: Curriculum and Instruction
Advisor: Jessica DeCuir-Gunby
Poster Number: 58

Race in Cyberspace: Moral Identity and Engagement with Race-Related Issues on Social Media

Given the incredible power of social media and students' incessant use of it outside the classroom, educators need to be thoughtful about how they are preparing students for these virtual spaces, which are constantly in flux and lack established precedents about moral behavior. Social media can provide students and educators with a forum to engage in discussions on challenging topics such as societal inequities, racism, and prejudice. However, we must also consider how anonymity and highly public spaces can impact students' moral thinking and how we can help them become responsible digital citizens. This quantitative study explored social media usage among emerging adults, focusing on their engagement with race- related issues online and examining whether this engagement was related to moral identity.

Using a series of multiple regression analyses with data from 47 White and 43 Black college students, the following trends were found: (1) race was a significant predictor of engagement with race-related issues via social media; (2) having a greater sense of belonging in social media communities was a strong predictor of more frequent social media use; (3) greater frequency of social media use was a significant predictor of engagement with race-related issues online; (4) symbolization of moral identity was a significant predictor of engagement with race-related issues via social media when combined with race as a predictor, though internalization of moral identity was not; and (5) Black college students who used social media frequently felt more inclined to engage with and comment on race-related incidents than White college students who used social media frequently. This study has the potential to help students and educators recognize ways in which moral identity and social media use may be facilitating or impeding race relations online. It could also provide useful data in examining racial climate on college campuses.

Rebecca Hite
Graduate Program: Science Education
Advisor: M. Gail Jones
Poster Number: 72

Students' Perceptions of Virtual Presence in 3-D, Haptic-Enabled, Virtual Reality Science Instruction

Educational technology is rapidly advancing with the use of 3-D, haptic-enabled (HE) virtual reality (VR) systems where users may actively explore science phenomena within an immersive virtual world. The efficacy of these devices hinges on adolescent learners' perceptions of computer-generated representations as authentic or comparably authentic to traditional forms of science instruction. Hyper realistic detail coupled with interactivity implies this technology has potential to induce presence, the psychological perception of being (involved and immersed) in a virtual environment despite being physically situated in reality. Four factors comprise presence: sensory engagement, control, realism, and distraction. Research literature indicates that perceptions of presence varies among adults and children in identical virtual environments, suggesting children may experience greater presence due to an inability to self-evaluate stimulated environments in relation to physical reality. The goal of this research was to examine relationships between cognitive development and perceptions of presence among middle grade and high school students' experiences with 3-D, HE VR technology. A mixed-methods methodology was employed with 75 sixth and 76 ninth grade students who participated in a learning module about cardiac anatomy and physiology using a 3-D, HE VR technology system. Prior to instruction, participants were given a pre-assessment on the heart and an inventory of Piaget's developmental tasks. Upon completion of the learning experience, a presence survey and post-assessment were given. Data was analyzed by comparing 6th and 9th grade groups, evaluating pre and post assessment scores and correlating Piagetian subject areas to the four factors comprising presence. Analysis showed there were significant gains in both groups on test scores. Although presence was not significantly different between grade levels, 6th grade students had significant positive correlations between their cognitive abilities in spatial rotation and angular geometry with perceived control. Distraction was negatively correlated to 6th grade students' scores in spatial perspective.

Shea N. Kerkhoff
Graduate Program: Curriculum and Instruction
Advisor: Hiller A. Spires
Poster Number: 84

Designing Global Futures: A Mixed Methods Study to Develop and Validate the Teaching for Global Readiness Scale

Our world is increasingly interconnected economically, environmentally, politically, technologically, and socially. In response to globalization, leaders have called for more global education in our K-12 schools. Current global readiness frameworks put forward by the US Department of Education, Partnership for 21st Century Skills, and others are widely used; however, they are not empirically grounded. This study took steps towards an empirically validated construct of teaching for global readiness.

A sequential exploratory mixed methods design (QUAL $\rightarrow$ quan) was utilized to operationalize and validate the construct teaching for global readiness. Mixed methods enabled both comprehensibility and generalizability. Data collection and analysis was grounded in educational cosmopolitanism (Hansen, 2008; Wahlström, 2014) and pedagogy of multiliteracies (New London Group, 1996; Cope & Kalantzis, 2009). After defining teaching for global readiness through exploratory qualitative analysis of 24 expert teacher interviews, an instrument was developed and administered to K-12 classroom teachers across the US. Based on EFA and CFA results using split-half samples from 630 respondents, teaching for global readiness was interpreted as a multidimensional construct with four factors. The first factor represented integrated global learning, the second situated practice, the third factor critical framing, and the fourth factor transactional experiences. The end product was a measurement model and scale of teacher practices relating to global readiness instruction. By defining and validating the construct, this study provides empirical foundation for future work in advancing evidenced- based theories, policies and practices for global readiness education.

Francemise S. Kingsberry
Graduate Program: Educational Administration and Supervision
Advisor: Lance Fusarelli
Poster Number: 86

Protective Factors and Resiliency: A Case Study of how African American Women Overcome Barriers en route to the Superintendency

An underrepresentation of African American women in the superintendency exists in K-12 public schools. There is also a lack of research on their leadership and experiences in education. Although the number of women superintendents has increased over the years, the superintendency remains a male-dominated field and African American women remain in the minority. Consequently, African American female superintendents have to overcome many obstacles including race, gender, negative stereotypes, and limited opportunities. Further, African American women seeking the superintendency have to prove they are worthy to hold the position. In general, superintendents face numerous challenges due to the nature of the position itself, without having to account for race and gender.

The purpose of this case study was to understand and describe the ways in which African American women superintendents have been resilient in attaining and maintaining the superintendency despite their underrepresentation in the position and in the literature. Protective factors in resiliency theory (Henderson & Milstein, 2003) has been used as a framework to analyze ways in which African American women superintendents have dealt with challenges in their position and overcome them.

This study was a qualitative, multiple case study. Four current African American women superintendents from urban and rural school districts in a Southern state were interviewed; field notes were taken and the interviews were recorded and later transcribed. The researcher analyzed the data to derive themes.

Various themes were evident in this study related to barriers in obtaining the superintendency. They included the intersection of race and gender, negative perceptions of women and African Americans, the lack of opportunity afforded to African American women, culture, and discouragement from others. Themes centered on challenges within the superintendency were balancing between work and her family, stress, negative perceptions of African American women, and unforeseen challenges.

Participants used both Internal and Environmental Protective Factors to overcome their barriers. Within the strategies utilized to overcome hardship, the following themes were displayed: Promoting shared responsibility, employing interpersonal skills, being direct, nurturing relationships with the Board, finding viable solutions, navigating through politics, being fair, knowing who the gatekeepers are, utilizing site-based management, seeking input from mentors, and making own decisions. The emergent themes derived from the overall data were: Having faith, having confidence, having a strong support system, and being prepared.

Mona D. Nour
Graduate Program: Counseling and Counselor Education
Advisor: Raymond Ting
Poster Number: 121

Exploring Sense of Belonging and Perceived Heritage Community Language Proficiency as Predictors of Bicultural Identity Integration in U.S. Society

The recent influx of immigration to the United States has naturally led to a population increase of U.S. born children with immigrant parents. These bicultural individuals undertake the complex task of constructing identities drawn from dual, and sometimes multiple, cultural foundations. This study examined sense of belonging and perceived proficiency in the heritage/community language as predictors of bicultural identity integration (BII) level in bicultural adults who were born in the US to parents who emigrated from other countries. Data was collected from 314 participants in a web-based nationwide survey. Instruments administered to participants were the Bicultural Identity Integration Scale-2 (BIIS-2R; Huynh & Benet-Martínez, 2010), the Sense of Belonging Inventory (SOBI; Hagerty & Patusky, 1995), and the Perceived English Proficiency Scale (PEP; Wei, Tsai, Chao, Du, & Lin, 2012), which was adapted to each participant's heritage/community language. Data was analyzed utilizing hierarchical multiple regression, analyses of variance, and descriptive statistics. Additional analysis examined interaction regression models testing age and hometown size (i.e., urban, suburban, rural) as moderators. Results indicated that sense of belonging and perceived proficiency in the heritage/community language predicted some aspects of BII. Analyses of variance indicated higher BII levels for individuals of European backgrounds, as well as biculturals with parents from English-speaking countries. Although hometown size did not moderate regression models, participant age did shift the association between the independent and dependent variables. Implications for counseling and counselor educators are shared.

Meetal Shah
Graduate Program: Mathematics Education
Advisor: Jere Confrey
Poster Number: 151

Middle Grades Students' Interpretations Of Addition Of Fractions Using An Interactive Number Line

Research shows that students often have trouble with fraction addition and subtraction, especially when they have different denominators. When introduced to the concept of adding and subtracting fractions with different denominators, they will often question why they cannot just add the numerators and denominators. Studies indicate that this is because students are using whole number reasoning. Further, when teachers use fraction representations such as pie charts it may not be clear to students what the fixed unit is. For example, if I ate ⅔ of my pizza and my friend ate ¼ of his pizza and we were asked to find the fraction of the pizza that was leftover, it may not be clear that the pizzas could have been of different sizes. What does addition of fractions mean to students and how does it relate to the number line as emphasized in CCSS-M? This study investigated how seven middle grades students solved problems that involve the addition and subtraction of fractional magnitudes using an interactive number line and coordinated the context and the features of the digital tool in doing so. Students were given a brief demo of the features of the digital number line and then interviewed separately using a pre-designed set of tasks presented in digital form on a tablet. The interviews were conducted as clinical interviews, and the researcher allowed participants to solve the problems at their own pace. Results provide insight into how students' understandings of fractions evolve from simple abstractions they make using a representational model such as an interactive digital number line to more sophisticated understandings of fractions with different denominators. The results also indicate that the students' use of the technological affordances also evolved as their understanding evolved.

Brooke Shurer
Graduate Program: Educational Research and Policy Analysis
Advisor: Audrey J. Jaeger
Poster Number: 156

Expectations and Experiences of U.S. Semester Study Abroad Students in British Universities: A Longitudinal Phenomenology

More U.S. college students study abroad in the U.K. than any other destination in the world (Institute for International Education, 2015). Unfortunately, there is a significant gap in empirical knowledge about their experiences. This is likely due to a common assumption that students within culturally similar contexts should enjoy easier transitions abroad (Paige, 1993). However, recent scholarly opinion papers have questioned this assumption and have called for the international education community to take notice of U.S. study abroad students in the British Isles (Edwards, 2000; Gristwood & Woolf, 2011; Ireland, 2010, 2012). Therefore, the purpose of this qualitative study was to describe the expectations and experiences of adjustment for U.S. semester study abroad students in British universities. Through a longitudinal design, interviews were conducted pre-departure, while abroad, and post-return with 12 U.S. students in direct enrollment programs within nine institutions throughout England, Scotland, and Wales. Supplemental interviews were also conducted with six advisors and faculty in the U.S. and Britain. Designed and analyzed through the lens of phenomenology, this study explored the socially constructed experiences of students within an important life transition (Merriam, 2002). Two theoretical frameworks, which address expectations and experiences in U.S. study abroad, informed this research: Pitts's (2009) descriptive model of expectations, talk, and identity in short- term sojourner adjustment and Martin et al.'s (1995) modified expectancy violations theory. Findings suggest that U.S. students in direct enrollment programs within Britain encounter multiple significant and unexpected challenges within academic, cultural, and social adjustment during a semester abroad. Findings also reveal discrepancies between study abroad student experiences and faculty/advisor expectations. By providing new information that contradicts long- held assumptions within the international education field, this study offers significant implications for intercultural theory development, higher education policy, and practical intervention.

Jason Wornoff
Graduate Program: Curriculum and Instruction
Advisor: DeLeon L. Gray
Poster Number: 182

Fitting In and Standing Out at School Predicts Adaptive Cardiovascular Patterns among College Students

Students' social experiences consistently predict negative affect, and are typically examined by linking perceptions of fitting in (connectedness) to reports of psychological distress (Flook, Repetti, & Ullman, 2005; Wentzel, 1998; Totura, Karver, & Gesten, 2014). Optimal Distinctiveness Theory (Brewer, 1991) suggest that humans are driven to both fit in and stand out (Leonardelli, Pickett, & Brewer, 2010). This study advances research in this line of inquiry by examining how perceptions of fitting in at school—but also how perceptions of standing out (uniqueness)—predict psychological distress. Forty-three undergraduates enrolled in Educational Psychology courses at a large public university in the South completed items measuring the satisfaction of students' desires to stand out and fit in at school. We later recorded heart rate variability (HRV)—an established biomarker of psychological distress.

Regression analysis revealed the satisfaction of students' desires to stand out and fit in predicted higher HRV. Standing out predicted higher HRV for males, but not females. Our findings contribute to research on students' perceptions of their school's social environments which, until now, has rarely assessed affect beyond self-report. The physiological importance of fitting in at school is often inferred through social psychological research on belonging (e.g., Baumeister & Leary, 1995), but not directly examined. Our findings suggest that for males in particular, both standing out and fitting in are linked with adaptive cardiovascular activity.

College of Engineering

Diego A. Aguirre Realpe, Mervyn J. Kowalsky, James M. Nau, Mohammed Gabr, Gregory Lucier
Graduate Program: Civil Engineering
Advisor: Mervyn J. Kowalsky
Poster Number: 3

Impact of Soil Stiffness on Seismic Behavior of Reinforced Concrete–Filled Steel Tube Pile-Columns

Reinforced concrete-filled steel tube (RCFST) pile-columns are structural elements commonly used in bridge supports; however, their seismic performance, considering soil stiffness, has not been studied yet. In this research project, the behavior of RCFST pile-columns is examined based on experimental tests and inelastic soil-structure interaction analyses. A total of twelve half-scale tests are conducted in the soil-structure interaction facility at North Carolina State University, Constructed Facilities Laboratory (NCSU-CFL). The facility consists of a 20-foot (6.10 m) deep, 10-foot (3.05 m) diameter pit that can be filled with different types of soil in which foundation systems can be embedded, allowing for physical testing of soil-structure systems under a variety of loading conditions. The pile-column specimens consist of pipes with diameter- to-thickness (D/t) ratios ranging from 48 to 95, which are filled with reinforced concrete. Different levels of soil stiffness are induced in the sand soil by using a soil-sandwich approach, which allows for modifying the soil stiffness profile by means of applying a surcharge on the soil surface. Cyclic lateral load is applied by means of a 100-kip (45 ton), 70-inch (1.78 m) stroke hydraulic actuator, supported on a braced steel frame, and pin-connected to the pile-column head ensuring that the plastic hinge (damage) develops below-ground. Experimental results show that failure of the pile-columns is controlled by the tensile strain in the steel tube and it is caused by a combination of pipe local buckling and pipe fracture. Moreover, it has been observed that as the soil stiffness increases, the plastic hinge develops closer to the soil surface and the spread of inelastic action shortens due to an increase in the moment gradient. It is expected that outcomes of this research will result in a significant contribution to current design recommendations of reinforced concrete filled steel tube pile-columns embedded in soil media.

Byron Beddingfield
Graduate Program: Electrical Engineering
Advisor: Subhashish Bhattacharya
Poster Number: 14

Design of Series DC Coupled Transformer

The medium voltage DC test platform described by the US Navy's next generation integrated power system for future warships requires strict steady state and transient voltage ripple control. Similarly, high slew rates are required during voltage transitions.

The Navy is asking for this highly-controllable DC source for the purpose of testing medium-voltage DC system technologies in shipboard applications. In our proposal, a series DC coupling transformer is an integral component required for both steady-state and dynamic voltage injection. This transformer provides the coupling betweenthe DC active filter and the DC bus that is supplied by a thyristor rectifier.

Design of this transformer is non-trivial as significant DC current flows through the primarywinding of the transformer. This work provides guidelines for optimization of the transformer construction. The balance between mitigating saturation through an air gap and core volume is explored. This balance has direct implications for the physical size of the transformer as well as the comparison of core and copper losses. This work provides a design map that allows engineers and practitioners a pathway for transformer design that achieves maximum efficiency provided arbitrary spatial and material constraints.

Loss models and DC active filter simulation results are evaluated in a 6 kVA, 400 Vdc laboratory-scale amplifier test-bed. Both static and dynamic performance requirements are verified through a range of loading conditions.

This work extends into other power electronics topologies that utilize isolated magnetics. The non-sinusoidal flux injected by the majority of power electronics convertersand machine drives presents similar issues to the series DC transformer. As such, this work has a broad impact in the field of medium and high frequency magnetics for power electronics applications.

Vikas Chauhan
Graduate Program: Electrical Engineering
Advisor: Brian A. Floyd
Poster Number: 34

Code Modulated Interferometric Imaging System using Phased Arrays

Millimeter-wave (mm-wave) imaging provides compelling capabilities for security screening, navigation, and even biomedical applications due to its capabilities to see through clothes, fog, dust/snow storms, clouds, etc. Traditional scanned or focal-plane mm-wave imagers are bulky due to their use of external optics and costly due to their reliance on custom hardware. In contrast, phased-array hardware developed for mass-market 60-GHz wireless communications and 77-GHz automotive radar promise to be extremely low cost. In this work, we present techniques which can allow low-cost phased-array receivers to be reconfigured or repurposed as interferometric imagers, removing the need for custom hardware and thereby reducing cost. Since traditional phased arrays power combine incoming signals prior to digitization, orthogonal code-modulation is applied to each incoming signal using phase shifters within each front-end and four-level (or two-bit) codes. These code-modulated signals can then be combined and processed coherently through a shared hardware path. Once digitized, visibility functions can be recovered through squaring and code-demultiplexing operations. The squaring operation results in a summation of complex code-multiplexed visibilities. Provided that codes are selected such that the product of two orthogonal codes is a third unique and orthogonal code, it is possible to demultiplex complex visibility functions directly. As such, the proposed system modulates incoming signals but demodulates desired correlations. In this poster, we present the operation of the system, a validation of its operation using behavioral models of a traditional phased array, and a benchmarking of the code-modulated interferometer against traditional interferometer and focal-plane arrays.

Hana Chmielewski
Graduate Program: Operations Research
Advisor: Ranji S. Ranjithan
Poster Number: 38

A Hybrid Decision Making Approach for Multi-objective Infrastructure Planning

Decision makers in water utilities are faced with challenges at multiple levels: local budget constraints, regional water policies, and state and federal regulations. Water management decisions that satisfy one objective may have unforeseen consequences, such as risks to public health or reliability of service. The purpose of this research is to investigate the trade-offs between the capital and operational costs and the risk of water service disruption due to the selection and timing of decisions in a groundwater pumping and treatment case study problem. Investment selections are subject to growing water demand and uncertain future water quality regulations over a 30 year planning horizon. One of the challenges of tackling a long-term infrastructure investment problem is selecting a solution approach to handle discrete decision variables with nonlinear interactions. A solution approach will be proposed based on computational complexity studies of several alternative methods: a dynamic programming (DP) formulation, as well as an integer programming formulation solved with generalized reduced gradient (GRG) and evolutionary algorithm (EA) approaches. From preliminary analyses of computational complexity, the DP formulation requires significantly more computation time, but provides more reliable convergence than the conventional GRG and EA implementations.

Further development of the risk objective, improvements in the efficiency of the DP formulation, and subsequent benchmarking of a custom GA framework with DP will facilitate the development of a final solution strategy. The solution approach developed will be generally applicable to long-term, multi-objective investment planning problems. The problem formulation will also allow an analysis of the effect of decision-making processes (e.g., planning horizons, decision staging) on multi-objective performance in infrastructure strategic management.

Inchul Choi[1], Kyle A. Bond[2]
Graduate Programs: Industrial and Systems Engineering[1]; Electrical[2]
Advisor: Chang S. Nam
Poster Number: 35

Hybrid BCI-Controlled FES System Towards Rehabilitation for Stroke Patients

Brain-computer interfaces (BCIs) can help people with severe neuromuscular impairments to communicate and control their limbs by bypassing peripheral nerves and muscle pathways.

Utilizing Functional Electrical Stimulation (FES) can help these individuals control their limbs by stimulating their muscles directly, bypassing their damaged nerve pathways. Furthermore, there are many potential advantages by combining Motor Imagery (MI)-based BCI with FES to rehabilitate through neuroplasticity, as well as to restore motor functions.

However, there are three main issues with current MI-based BCIs for FES control: 1) They require relatively longer training and show lower classification accuracy than visual-based BCIs, such as Steady-State Visual Evoked Potentials (SSVEPs). 2) MI features cannot be utilized during passive hand-motions induced by FES due to movement artifacts. 3) Most MI-based BCIs do not have criteria to stop FES by voluntary intentions. In this study, we tried to address these limitations by applying a hybrid BCI paradigm.

Five subjects were recruited, and asked to don an EEG cap with 16 electrodes to measure brain activity, and a set of 8 FES electrodes over the muscles in their right forearm to induce hand motions. Each subject was asked to imagine grabbing a tennis ball, and when the MI and alpha-band features were detected via EEG, the FES unit was activated to stimulate the muscles in the subject's forearm to initiate hand motions. After initiating, the user could either control hand motions via FES or turn it off by decoding SSVEP and alpha-band features.

The outcome of the experiment showed that it was possible for subjects to control their right hand to perform grabbing and releasing motions by using their thoughts alone, which may prove helpful for rehabilitation for stroke patients or other populations who have lost volitional control of their hands.

Stephanie G. Cone[1], Lynn A. Fordham[2], Jorge A. Piedrahita[3], Jeffrey T. Spang[4], Matthew B. Fisher[1,4]
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Advisor: Matthew B. Fisher
Poster Number: 40

Age-Dependent Anatomical Changes in the Porcine Anterior Cruciate Ligament

With recent increases in youth sports participation in the United States, incidence rates for sports-related injuries in skeletally-immature patients have been rising at an alarming rate. Many of these school-aged injuries involve the knee, and anterior cruciate ligament (ACL) tears represent a high proportion of these injuries. In a clinical setting, the approach to treating ACL tears in skeletally-immature patients is extremely similar to the approach for adults. However, recent studies have shown that the ACL geometry (shape, size, and orientation) undergoes significant changes throughout skeletal growth. In order to design appropriate clinical treatments for this dynamic environment, it is necessary to identify a translational large animal model with similar anatomical properties. As such, this research was designed to investigate the geometrical changes of the porcine ACL throughout skeletal growth. Hind limbs from female Yorkshire pigs aged 1.5 months (n=6), 3 months (n=6), 6 months (n=6), and 18 months (n=5) (representative of juvenile through late adolescent growth stages in humans) were collected and the stifle joints (knees) were isolated. The joints were imaged near full extension (30º in the pig) in a Siemens Magnetom 7.0 Tesla Magnetic Resonance Imaging (MRI) system at the Biomedical Research Imaging Center at the University of North Carolina – Chapel Hill using a double echo steady state sequence (DESS, flip angle: 25º, TP: 25ms, TE: 2.56ms). Image series were processed using commercial software (Simpleware) and angular orientations of tissues were collected. The angular orientation of the ACL relative to the tibial plateau increased significantly between each age group in the coronal plane, while significant increases occurred in the sagittal plane only up to 6 months of age. These changes in the growing porcine model reflect trends found in female human skeletal growth, strengthening the case for using porcine models to study pediatric ACL injuries and treatments.

Robert Dacus
Graduate Program: Nuclear Engineering
Advisor: Paul J. Turinsky
Poster Number: 43

Development of Adjoint Multiphase Capability in OpenFOAM

The multiphase computational fluid dynamics utility boilEulerFoam constructed within OpenFOAM by Dr. Nam Dinh and his research group was investigated as a potential platform for steamwater subcooled nucleate boiling multiphase adjoint development. BoilEulerFoam is advantageous due to its open source nature and the fact that its multiphase flow solver has greater numerical stability than the original multiphase flow solver contained within OpenFOAM. Base case runs found that boilEulerFoam predicts flow behavior consistent with expectation for axisymmetric pipe geometry and for wall void fraction concentrations that do not reach dry out.The boilEulerFoam code was converted to adjointEulerFoam, an adiabatic multiphase solver that ignores interphase mass transfer and temperature dependent densities and viscosities. A general form of the discretized adjoint equations was derived and the method of both approaches made consistent.The Jacobian matrix of the forward system of equations is required in order to implement an adjoint capability within OpenFOAM. Automatic differentiation tools were examined, and the FadOne capability as implemented by Dr. Hrvoje Jasak was used to construct a Jacobian. FadOne utilizes templating and operator overloading in order to automatically return derivatives and fields of derivatives for given state variable vectors. Such a method takes full advantage of the encapsulation of the linearized system of equations according to OpenFOAM's C++ methodology. Subsequent adjoint methods can determine first order predictions of sensitivities for a variety of physical parameters.

Saba Emrani
Graduate Program: Electrical Engineering
Advisor: Hamid Krim
Poster Number: 47

Topo-Geometric Frameworks for Data Mining

Approaching data as a point cloud is an efficient way for analysis as it arises in many applications. We proposed to use time-delay coordinate embedding as a tool to first construct point clouds from time series. I exploited two-dimensional delay embedding of time series to detect almost harmonic underlying patterns. Detecting periodic patterns in time series can disclose significant information about the behavior and future trends of the represented entity. We were able to detect the presence of periodic structures in the data using topological tools for the analysis of the delay embedding point clouds. Since we describe the global topological structure of the point cloud rather than their local geometric behavior, our approach is robust to missing data points, time varying sampling rates and noise. In the next step, we added one dimension to the point cloud and utilized three-dimensional delay embedding for spectral clustering of highly transient data. Many waveforms with almost periodic structures fail the state of the art formulation because of their inherent non-stationarity. Thus, we proposed a new framework for estimating different frequencies in piece-wise periodic signals with time varying amplitude and phase. We applied this framework to the problem of wheeze detection and frequency estimation and developed an accurate, robust and highly efficient algorithm for analysis of lung sounds for a battery free wearable health monitoring device for asthmatic patients. After using delay embedding for analyzing time series individually, we furthered this framework application to multiple time series for extraction of their causal interactions. Our particular interest here is the analysis of neural connectivity for understanding the functioning of the brain. We could decode natural and artificial visual stimuli using the connectivity maps by constructing a comprehensive map of the causal interactions using multivariate delay embedding of recorded brain data obtained using MEG sensors.

Shakiba Enayati
Graduate Program: Operations Research
Advisors: Maria Mayorga, Osman Ozaltin
Poster Number: 48

Improving Emergency Medical Service with Fair Workload for EMS Providers by a Real- Time Ambulance Redeployment Approach

Providing maximum possible coverage in their service area is one of the primary concerns of Emergency Medical Services (EMS) managers. As emergency calls arrive into the EMS system, some ambulances become unavailable. Redeployment deals with a dynamic relocation of available ambulances so as to compensate for the loss in coverage due to busy ambulances. Haphazard redeployment can impose extra indefensible workload and result in unnecessary fatigue for EMS personnel. This study develops a dynamic approach to maximize the coverage with minimum possible total travel time, considering accumulated workload restrictions for personnel in a shift. While in the past real-time redeployment has been hindered due to computational issues, we find a solution to this problem by combining two smart, yet simple models in a framework that is computationally inexpensive. The proposed approach requires only knowledge of the current status of the system in a real-time manner and, due to very short run time, is applicable in practice. The performance of our real-time approach is evaluated by an event-driven simulation designed for a large real dataset and is compared with a static policy. The results show statistically significant improvement in average coverage and average response time, while assuring accumulated workload for personnel, including service, would not exceed 85% of the shift due to the recommended redeployment moves.

Jinyong Feng
Graduate Program: Nuclear Engineering
Advisor: Igor A. Bolotnov
Poster Number: 49

Evaluating Bubble-Liquid Interaction through virtual experiments

The widespread occurrence of turbulent two-phase bubbly flow in natural and engineering systems, e.g. boiling heat transfer in power plants, makes the understanding of this phenomenon important. Some critical issues in the model development are the poor understanding of mechanisms in which the existence of bubbles alters the turbulence in the liquid phase. Recent improvements in computer performance and numerical algorithms allow the use of direct numerical simulation (DNS) for solving these problems. As first-principle based high fidelity simulation, DNS numerically solves the fluid flow equations without any turbulent closure model and provides full information on instantaneous 3D flow field. While some research studies previously evaluated the net change in turbulence intensity for bubbly flow, detailed studies on how individual bubbles contribute to the turbulence are rare. In the presented research, we evaluate the interaction between individual bubble and homogeneous turbulent flow using DNS approach. The homogeneous single-phase turbulence is numerically generated as inflow condition for two-phase simulation. We utilize a proportional-integral- derivative (PID) controller to apply a variable force on the bubble to balance the drag and lift forces, thus ensuring the statistically steady state bubble position and allowing the detailed study of the turbulent field around the bubble. The effects of bubble deformability, the turbulent intensity and relative velocity on the quantity of energy transferred are investigated separately. The existence of bubble creates new vortices and the enhancement of turbulence is observed in the region behind the bubble. The results show that the magnitude of the turbulence enhancement would increase as the bubble encounters larger liquid turbulent intensity. The more deformable bubble would increase the magnitude of turbulence enhancement behind the bubble. This research provides insight on the interaction between bubble-liquid interaction and is important for multiphase computational fluid dynamics model development.

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Poster Number: 55

Semiconductive Properties of Metal-Oxide Passive Films on Bare and Coated Stainless Steel for High-Level Nuclear Waste Storage

Several coatings have been proposed to increase the resistance of stainless steel spent nuclear fuel storage canisters to corrosion, mechanical wear, and hydrogen diffusion. These coatings include TiN, ZrO2, TiO2, Al2O3, and MoS2 to be deposited as multilayer, composite coatings on the outer surface of the stainless steel canister for nuclear waste dry cask storage. The primary failure mechanism for stainless steel dry cask canisters is stress-corrosion cracking resulting from localized breakdown of the passive film coupled with sufficient stress - usually residual stress from welding. In order to discern how film breakdown may lead to macro-scale failure, the composition and growth mechanisms of the film must be understood. This study investigates the semiconductive properties (donor/acceptor density and flat band potential) of the passive film formed on bare and singly-coated stainless steel in sodium chloride solution. Semiconductive properties are gathered from electrochemical impedance spectroscopy measurements using Mott-Schottky analysis to determine the effective capacitance of the passive film. Preliminary results show that the passive film on stainless steel in NaCl solution is composed of two layers: an inner layer behaving as a p-type semiconductor and an outer layer behaving as an n-type semiconductor. These two behaviors have been attributed to Cr2O3 and Fe2O3, respectively. Semiconductive behavior of the coated steels depends primarily on the thickness of the coating. Thinner coatings show very similar behavior to bare steel, whereas thicker coatings with longer deposition time display film compositions unique to the metallic portion of the coating. This gives good indication that the selection of these coatings will provide an isolation of the substrate from the environment.

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Advisors: Blair D. Sullivan[1,2], Travis S. Humble[2]
Poster Number: 61

Optimizing Quantum Program Compilation using a Graph-Theoretic Framework

Quantum computing has evolved in recent years from a purely theoretical field into an immensely practical area, a change sparked by D-Wave System's quantum annealing hardware. These multimillion-dollar quantum annealers can solve optimization problems tens of millions of times faster than classical computers, prompting research teams at Google, NASA and Lockheed Martin to study how these computers can be used in complex real-world applications like the Mars Explorer Rover Mission. Unfortunately, the problem of embedding (compiling) a quantum program into the annealing hardware is itself a difficult optimization problem and a major bottleneck currently preventing additional applications. On a theoretical level, recognizing whether a program can fit into the hardware is computationally difficult (NP- hard). However, even if the program can theoretically fit, researchers still lack a generalized method for obtaining an embedding that uses minimum hardware resources.

In order to address these problems, we introduce a graph-theoretic virtual hardware to act as an intermediary between the quantum program and the annealing hardware. We attempt to embed the quantum program by breaking it into smaller pieces using an odd cycle transversal (OCT) decomposition and embedding each piece into the virtual hardware. We then use heuristics to shuffle the embedding order on the virtual hardware, minimizing the resources used when the embedding is expanded onto the physical hardware. Our initial findings show that the OCT decomposition can embed programs potentially twice as large as the previous benchmark.

Experimentally, we also show that our heuristics successfully introduce a natural scaling mechanism missing from previous algorithms – the amount of hardware required is now proportional to the program's connectivity structure. Finally, to encourage the reuse and extension of these techniques, we also provide efficient implementations of the virtual hardware, the new embedding algorithms and our experimental results in an open source embedding suite.

Nicholas J. Hanne[1], Andrew J. Steward[1], Elizabeth D. Easter[2], and Jacqueline H. Cole[1]
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Advisor: Jacque Cole
Poster Number: 67

Investigating Obesity-induced Vascular Changes within Bone

In addition to cardiovascular problems (e.g., peripheral artery disease, ischemic stroke), individuals with obesity and metabolic disease experience increased limb fracture rates despite greater bone mass than healthy individuals. We hypothesized that vascular changes with obesity are systemic and, because vascular function is critical for bone development and repair, changes to vasculature within bone contribute to decreases in bone health with obesity. Further, exercise stimulates vascular growth and performance and may be an effective intervention to ameliorate chronic changes in bone vasculature. We aim to correlate changes in bone health with changes in bone vasculature due to obesity and exercise.

We induced obesity in male C57Bl/6J mice using a highfat diet for nineteen weeks. The effect of treadmill exercise (initiated 10 weeks into the study) on these parameters was examined:

- Fasting glucose and glucose tolerance
- Intraosseous circulation (laser Doppler flowmetry, LDF)
- Bonevascular crosstalk (histology and serum concentrations of bone and vasculature anabolic signal proteins)
- Bone microarchitecture (microcomputed tomography and histology)
- Bone material properties (bending test)

Five weeks of exercise improved glucose tolerance in obese mice by 39% relative to sedentary obese mice but did not persist after 9 weeks of exercise. LDF measurements at the end of the study detected increased tibial blood flow with both treadmill exercise (exercise vs. sedentary) and diet (obese vs. control). Relative to sedentary, exercise increased perfusion in both control (+38%) and obese (+21%) mice. In sedentary mice, dietinduced obesity increased perfusion 24%.

These results indicate treadmill running may hinder the progression of metabolic disease in obese mice and may increase bone blood flow. Ongoing collaboration with NC A&T will allow us to create nanoscale threedimensional maps of intraosseous capillaries. Future analysis will determine changes in osteovascular architecture and crosstalk between bone and endothelial cells to assess the therapeutic potential of exercise.

Shadi Hassani Goodarzi
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Advisor: Julie S. Ivy
Poster Number: 70

Modeling Ductal Carcinoma In Situ (DCIS)

Ductal Carcinoma In Situ (DCIS) is arguably a direct precursor of Invasive Breast Cancer (IBC). Approximately 14%–53% of DCIS turn into IBC, after long follow-up periods ranging from 18 to 30 years (Bayraktar 2013i). So about 47%-86% of the DCIS cases are over diagnosed and as a result, treatment can only cause harm for these patients. This framework will allow us to study the progression of DCIS into IBC more clearly and as a result, aiding both patients and doctors in decision making.

In the simple form of our analytical model we assume that there are two distinct DCIS Markov chains but we do not know which DCIS chain the patient's breast cancer inhibits. The first chain contains a DCIS that has the potential to turn into Invasive Breast Cancer (IBC) eventually, if not treated, although this might not happen due to death from other causes before the transformation happens. The second chain contains the DCIS that is going to remain non-invasive if left untreated. So if we had perfect information about which DCIS the patient has, the optimum decision would be to treat for the DCIS belonging to the first chain and to wait for the DCIS belonging to the other chain.

We used a model inspired by partially observable Markov decision process with Bayesian elements to model DCIS and developed a dynamic programming in Python to solve this decision problem, assuming that the set of states includes DCIS I, DCIS II, local IBC, distant IBC and death from other causes and the set of observations includes change in tumor, no change in tumor, observing IBCs and death.

• i Bayraktar, Soley, Banu Arun, and Stefan Glück. "Ductal carcinoma in situ: how should we treat it?." Breast Cancer Management 2, no. 3 (2013): 245-256.

Seokyong Hong
Graduate Program: Computer Science
Advisor: Ranga R. Vatsavai
Poster Number: 74

High Performance Computing Analytics over Spatio-temporal Data

Spatio-temporal data analysis is a fundamental method for data scientists, companies, and officials to retrieve knowledge from spatial and temporal data. It traditionally deals with heterogeneous data, ranging from text data to graphs and vector/raster images. The volume of such data along with their complexity has been drastically increasing due to the emergence of new technologies, applications, standards, and data models. Several recent high performance computing (HPC) platforms can be considered as promising engines for complex spatio-temporal data analytics. However, selecting optimal platforms for given workloads and developing and optimizing individual analysis operations being aware of their underlying processing models, data models, and programming interfaces are on-going challenges for maximizing the performance of spatio-temporal analytics. In order to tackle such challenges, we proposed several important spatio- temporal data analysis operations optimized over different data models, programming interfaces, and processing platforms. Those operations include (1) a probabilistic change detection algorithm for very high resolution (VHR) satellite imagery which scales on modern multi-core architectures, (2) a set of graph mining operations optimized on triplestores compatible with the W3C's RDF and SPARQL standards, and (3) a spatial DBSCAN clustering algorithm optimized on triplestores that comply with the Open Geospatial Consortium (OGC)'s GeoSPARQL standard. We also compared several HPC platforms with two important graph analysis workloads: graph pattern patching and graph mining.

Anup K. Kalia
Graduate Program: Computer Science
Advisor: Munindar P. Singh
Poster Number: 81

Computing Team Performance Measures from the Structure and Content of Broadcast Collaborative Communications

In an organization, teams work in collaborative environments where information and decision requirements change quickly and are exacerbated by time criticality. Example domains include stock trading, incident command, military operations, and critical healthcare. Advancements in our ability to assess the dynamic foundations of team performance in situations is crucial to understanding, predicting, and augmenting team successes and failures. Rather than focusing on performance outcomes which do little to prescribe reasons for success or failure, our contribution advances assessment methodologies by focusing on team performance measures such as group dynamics or processes.

Based on Kozlowski and Ilgen's Input-Mediator-Output-Input (IMOI) framework, team performance measures depends on affective, behavioral, and cognitive processes. Existing approaches to compute these measures are primarily based on survey ratings, semantic classification of communications, and social network analyses. Although existing approaches reveal important information about team performance, they face specific limitations. Survey methodologies are in general unreliable, biased, and not dynamic; communication classifications are often a-theoretical; and social network analytics ignore the meanings of messages. Accordingly, we develop a better-defined, formal, empirical approach for team performance metrics.

Our contribution builds on existing work in semantic classification of messages in broadcast communications and proposes a general set of meanings of messages for team performance. Using the meanings of messages, we propose formal approaches to compute team performance measures. We evaluate these measures using a military dataset and find the following: (1) our text mining approach to infer meanings of messages significantly improves over the bag of words approach and yields macro and micro average F-measures of 70% and 80%, respectively, and (2) compared to baseline measures such as degree centrality, behavioral and cognitive processes remain significantly stable with time whereas affective processes significantly increase with time.

Yang Liu
Graduate Program: Nuclear Engineering
Advisor: Nam Dinh
Poster Number: 4

Analysis of Boiling Heat Transfer at High Heat Fluxes

In nuclear reactors, boiling may occur in nominal and accident scenarios. In both cases, critical heat flux (CHF) governs the safety margin. Prediction of CHF in departure from nucleate boiling (DNB) presents a formidable technical challenge. In order to accurately predict DNB, the detailed physics of nucleate boiling is required. In our research, a method to identify and characterize nucleation and the corresponding boiling heat transfer is developed based on processing of heater surface temperature and local cooling/heating rate. This method is applied to a select dataset of infrared thermometry imaging. The nucleation behavior, including nucleation temperature, nucleation site distribution, nucleation rate, as well as the neighboring nucleation site distance was analyzed. Moreover, the wall heat flux distribution towards the coolant were obtained by solving transient conjugate heat transfer of heater substrate given the heater surface temperature data as boundary condition.

The extracted data are used to benchmark fundamental modeling assumptions used in current treatments of nucleation and bubble dynamics, particularly for their applicability in high heat flux conditions. Furthermore, the obtained heat flux data was used to validate against state-of-art wall boiling model with micro-layer hydrodynamics assumption. Good agreement was found between the model prediction and data for conditions away from the critical heat flux (CHF). Experimental data strengthen the notion of burnout caused by the irreversible hot spot due to failure of rewetting. The observation forms a basis for a detailed modeling of micro-layer hydrodynamics under high heat flux. Our observation also suggested a stochastic, dynamic treatment of the nucleation behavior. This scoping study also provide suggestions on design of validation experiments and data processing procedures that enable assessment of model form uncertainty in wall boiling models at high heat fluxes.

Catalina Lopez-Velandia[1], Detlef Knappe
Graduate Program: Environmental Engineering[1]
Advisor: Detlef Knappe
Poster Number: 95

1,4-Dioxane in the Cape Fear River watershed: Occurrence, sources, and treatment options

Data collected as part of USEPA's third unregulated contaminant monitoring rule show that six of the twelve highest 1,4-dioxane (1,4-D) concentrations in the US occur in drinking water derived from the Cape Fear River (CFR) watershed in NC. 1,4-D is a likely human carcinogen, and an excess 10-6 cancer risk is associated with the lifetime consumption of drinking water containing 0.35 µg/L 1,4-D. Objectives of this research are to 1) determine 1,4-D sources, 2) establish temporal and spatial variability of 1,4-D concentrations, and 3) assess the effectiveness of water treatment processes for 1,4-D control.

Over 50 sampling points were strategically selected across the CFR watershed to bracket possible sources. Monthly samples were collected for one year. Results showed that the discharge of three wastewater treatment plants was primarily responsible for high 1,4-D concentrations. An analysis of industries in the three communities suggests that plastics (PET products, thermoplastic, plastics recycling) and textile industries are possible sources.

Daily composite raw and finished water samples were analyzed and collected over a period of 2 months at three drinking water utilities. Results for two conventional water treatment plants showed that 1,4-D concentrations were not attenuated. Average 1,4-D concentrations exceeded the one in-a-million cancer risk level by a factor of 25 in a small community and by a factor of 7 in a larger community located further downstream. Results from the third utility, which employs raw and settled water ozonation, showed that 14-D concentrations in the finished water were ~35% of those measured in the raw water.

To evaluate POU treatment devices, two commercial pitcher filters, a custom pitcher filter containing a tailored adsorbent, and one refrigerator filter were tested. The refrigerator and the two commercial pitcher filters exhibited poor 1,4-D removal while the pitcher filter containing the tailored adsorbent showed promise.

Michelle Luo
Graduate Program: Chemical and Biomolecular Engineering
Advisor: Chase L. Beisel
Poster Number: 16

Repurposing CRISPR-Cas bacterial immune systems for programmable gene repression

CRISPR-Cas systems offer powerful and versatile biomolecular tools with many applications including genome editing, gene regulation, antimicrobials, and imaging. Because these RNA- directed immune systems are found in most prokaryotes, an opportunity exists to harness the endogenous systems as convenient tools in these organisms. We report that the Type I-E CRISPR-Cas system in the bacterium Escherichia coli can be co-opted for programmable transcriptional repression. Deletion of the signature cas3 gene converted this immune system into a programmable gene regulator capable of reversible gene silencing of heterologous and endogenous genes. Furthermore, expressing multi-targeting CRISPR arrays can generate complex phenotypes. Utilizing this platform, we were able to address unanswered questions in CRISPR biology. For example, we discovered that the length of CRISPR RNA molecule is not fixed and can be extended while maintaining functionality. Interestingly, altering RNA length can also enhance transcriptional silencing, but only for particular target locations. Overall, our simple approach of converting endogenous CRISPR-Cas systems into transcriptional regulators allows us to probe the fundamental mechanisms of CRISPR biology, expands the available toolkit for CRISPR-mediated genetic control, and generates new opportunities for genome-wide screens and pathway engineering.

Sha Luo, Shu-Cherng Fang, Russell E. King
Graduate Program: Industrial and Systems Engineering
Advisors: Russell E. King, Shu-Cherng Fang
Poster Number: 96

A Supplier Pricing Game When the Retailer is Bounded Rational

Bounded rationality takes into account that human decision makers are prone to biases and mistakes. General wisdom suggests that people fail to reap the highest level of benefits when they are not perfectly rational. In this study, we consider a supplier-wholesale-pricing game when the retailer is not a perfect optimizer, and find that the retailer can benefit from her bounded rationality. The decision model of bounded rationality is derived from the classical logit model. We apply the concept of Nash equilibrium to predict the rational outcome of the pricing game when two suppliers submit their wholesale prices simultaneously. It is found that when the retailer's bounded rationality level is low, the suppliers reduce their wholesale prices to attract the retailer. However, the suppliers will raise the price when they think the retailer is quite irrational and lack basic discernment. Bounded rationality can be advantageous to the retailer when it results in lower wholesale prices under equilibrium. We investigate the range of bounded rationality level that forces the suppliers to mark down.

Ahmed A. Mahmoud Gomaa
Graduate Program: Chemical and Biomolecular Engineering
Advisor: Chase Beisel
Poster Number: 60

Sequence-specific antimicrobials for treating multidrug-resistant infections

Once considered a revolution in modern medicine, antibiotics are becoming obsolete. On one hand, multidrug-resistant infections are increasingly being reported, where many resistance mechanisms can be readily passed between unrelated bacteria. On the other hand, traditional antibiotics are broad-spectrum, decimating the multitude of beneficial bacteria in the human body and leaving us susceptible to opportunistic infections and chronic illnesses. These challenges demand novel approaches to treat multidrug-resistant infections while discriminating between pathogenic and symbiotic bacteria. Here, we report a targeted strategy for treating ranging bacterial infections that relies on CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats)-Cas (CRISPR associated) systems. These RNA-directed defense systems are naturally employed by bacteria and archaea to recognize and cleave the DNA of foreign invaders. Small CRISPR RNAs bind their complementary sequences in the foreign DNA directing cleavage or degradation by Cas proteins. By designing and expressing synthetic genome-targeting CRISPR RNAs, we reprogrammed CRISPR-Cas systems to induce bacterial cell death.

We found that this strategy could achieve potent and sequence-specific killing of multidrug- resistant bacteria regardless of the type or location of the targeted region and using either imported or native CRISPR-Cas systems. Additionally, we were able to distinguish between even highly related strains as well as between commensal and pathogenic bacteria.

Currently, we are developing delivery methods using broad-host range bacteriophages. By engineering broad-host bacteriophages, the phage particles would deliver the CRISPR-Cas- encoding DNA to a variety of bacterial strains. However, only the strains targeted by the CRISPR RNAs would be eradicated.

We envision using this strategy to develop “smart” non-antibiotic treatments capable of circumventing common modes of resistance while readily distinguishing between pathogens and symbiotic bacteria. Such “smart” treatments may provide a solution to the escalating dilemma of multidrug resistance, and can be employed as tools to probe complex microbial communities.

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Graduate Programs: Operations Research[1], Industrial Engineering[2]
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Poster Number: 101

A Logistics Planning System for Military Expeditionary Operations

Logistical considerations are a critical part of mission planning for expeditionary operations but must be necessarily completed under tremendous uncertainty. Based on challenges that negatively affected logistical support to the warfighter, a 2005 RAND study called for the development of a planning tool to support expeditionary operations and rapidly determine capability requirements for these operations. To answer this call, a form of (near real-time) adaptive (goal-seeking) discrete event simulation is used to forecast the logistic system performance supporting the planned operation. The system is designed to integrate naturally with the existing military decision making process. Model validation is conducted against actual performance during Operation Iraqi Freedom (2003 invasion of Iraq). Mission-based forecasting is used to generate sustainment demand for the simulation. Furthermore, the US Army has spent $4 billion implementing an SAP-based Enterprise Resource Planning (ERP) system on what is the largest supply network in the world. When complete, military planners and decision-makers will have unprecedented access to real-time data on requisitions traversing the network. The intent is that this logistics planning tool is run as an app using supply requisition data from this ERP system. A demonstration of the tool is conducted to test its ability to forecast and evaluate a proposed operational plan. Forecasted network performance is used to adjust the planned logistical capabilities until the mission can be properly supported and the logistics support structure is resilient enough to tolerate unforeseen disruptions to the network.

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Advisor: Shu-Cherng Fang
Poster Number: 119

An effective conic approach for solving discrete quadratic programming problems

A discrete quadratic programming (DQP) problem is a mathematical optimization problem that has many real applications in engineering and system sciences, such as the filtered approximation in signal processing. The DQP problem minimizes a quadratic objective function with variables limited to discrete sets. It is known that DQP is nondeterministic polynomial-time hard (NP-hard) in general: practical methods are still rare and ineffective. Commonly used heuristic techniques are capable of dealing with large-size DQP problems; however, they are restricted to specific subclasses with special structures. Our research goal is to develop an effective convex relaxation for proving lower bounds and solutions to general DQP problems in an efficient way. As a recently developed technique, the linear conic approach may pack all difficulties of a quadratic programming problem into a convex cone in a higher dimensional matrix-space and then relaxes the convex cone to a well-structured one. In this way, a polynomial-time solvable relaxation problem is constructed. We extended this approach to propose a linear conic programming relaxation for our problem DQP. By exploring the structure of proposed relaxation, we derived a special sufficient condition for explicitly generating optimal solutions to DQP, which extended the scope of previously known results. We also conducted numerical experiments on randomly generated DQP instances. The numerical results confirmed the high quality of lower bounds obtained from the proposed relaxation problem. This study not only verifies the effectiveness of the linear conic relaxation approach for approximating DQP problems, but also discovers a novel property of the relaxation problem for explicitly generating optimal solutions of DQP.

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Graduate Programs: Civil Engineering, North Carolina State University[1]; Civil and Environmental Engineering, Florida International University[2]; OHL School of Construction, Florida International University[3]
Advisor: Edward J. Jaselskis
Poster Number: 122

Metrics that Matter: Improving Progress and Performance Assessment in Construction Projects

Assessment of project progress and performance is of critical importance to the successful delivery of capital facility projects. Most construction projects fail to meet their authorized budgets and schedules within an acceptable margin. Often, project managers are misled in their perceptions of project performance until the project nears its end. However, previous work has failed to address major challenges due to the lack of consistent, reliable, and objective metrics, and appropriate interpretation of the data. This research aims to improve project controls in construction industry through (1) identifying core progress and performance assessment metrics; (2) establishing recommended practices for interpreting these metrics; and (3) developing guidelines for improving the reliability of these core metrics to remove as much subjectivity as possible so that standardization can be achieved across the industry. The research methods include a broad literature review to identify progress measurement, performance assessment, and performance forecasting metrics. An extensive survey has been conducted to collect data on metrics and reliability techniques that are used on completed projects in industry. Subsequent case studies have provided more in-depth analysis of some of these projects. This has been followed up by a Delphi session with subject matter experts who evaluated and validated the findings. The research identifies key metrics for project progress and performance assessment and produced, (1) a metric typology; (2) a classification of metrics; (3) a guideline for interpretation of core metrics; (4) an assessment of the impact of project characteristics on core metrics; and (5) a set of critical factors for improving reliability of project controls. From these findings, three implementation resources are created for providing a more standardized and systematic way of assessing a project's progression and performance. Results of this research provide the industry with a better use and understanding of metrics for improving their project delivery.

Reza Rashetnia
Graduate Programs: Civil Engineering
Advisor: Mohammad Pour-Ghaz
Poster Number: 135

A new method for estimating prestress loss due to corrosion using impact resonance acoustic spectroscopy technique

Corrosion of prestressing strands is a major durability concern in prestressed concrete elements. The corrosion of strands results in microcracking, deterioration of bond between strands and concrete, and therefore, results in the loss of prestressing force. The loss of prestressing force, consequently, alters the linear and nonlinear vibration of the element. In this study, we investigate whether the loss of prestressing force can be estimated in prestressed beams by studying vibration response of the beam. For this purpose, a system identification approach is developed that utilizes the free vibration responses of an Euler-Bernoulli beam. Due to the ill-possedness of the identification problem and the presence of random and systematic errors, Tikhonov regularization method is used. Results indicate that using dynamic vibration response, it is feasible to estimate the loss in prestressing force due to corrosion. The effect of corrosion on nonlinear behavior of prestressed beams is also studied and nonlinear parameters are correlated to the damage and the loss of prestressing force.

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Graduate Program: Electrical Engineering
Advisor: Salah Bedair
Poster Number: 146

Challenges and NCSU progress towards achieving 50% solar cell efficiency

Multi-junction solar cells are the most efficient solar cells ever developed with demonstrated efficiencies above 45%. This work describes several potential paths towards next-generation solar cell devices. We present the challenges in achieving these high efficiencies and a review of our recent results towards achieving the 50% efficiency goal. Specifically, quantum well structures fabricated in this work hold tremendous potential in taking next step beyond current photovoltaic structures in achieving solar conversion efficiencies beyond 50%. We fabricate novel p-i-n InGaP solar cells incorporating InGaAsP/InGaP strain balanced multiple quantum wells (SBMQWs) to tune the absorption threshold beyond the In0.49Ga0.51P cut-off (~ 1.85 eV). The compressive stress in the InGaAsP wells is balanced by the tensile stress in the InGaP barriers using a zero-stress balance model. Thin layers of InGaAsP have been grown thermodynamically stable with compositions within the miscibility gap for the bulk alloy. Spectral response and light I-V measurements reveal that SBMQW structures exhibit absorption beyond InGaP band-edge with wavelengths approaching 780 nm accompanied with enhanced light absorption in solar cells with improved short circuit current density. The proposed SBMQWs allow more flexibility in the design of current multi-junction solar cells and future cells with more than four junctions. The promising results in this work provide an alternative path for realizing 1.5-1.8 eV subcells in next-generation multi-junction solar cells.

Tim Shay
Graduate Program: Chemical and Biomolecular Engineering
Advisor: Orlin D. Velev, Michael D. Dickey
Poster Number: 188

Hydrogel-Enabled Microfluidic Sweat Sequestering for Novel Wearable Human-Device Interfaces

Two of the largest growing markets are in wearable electronics and healthcare. Wearables such as the Fitbit attempt to monitor the user's health. But with only accelerometers, gyroscopes and possibly heart rate sensors, only a few health metrics can be observed. To get a full picture of the body's health, a biochemical workup is preferred. The most common commercial biochemical device used right now is the glucose monitor for diabetes testing. While these devices work great, they cause discomfort to the user and only collect discrete data points throughout the day. Therefore, we are looking to combine these biochemical test methods with wearables by creating devices that can non-invasively sequester sweat for sensing purposes. Sweat contains many of the same biomarkers as blood, such as glucose, cortisol, lactate, sodium, potassium and chloride ions. This would allow for a more user-friendly experience while continually collecting data while the user carries on with their activities.

We are creating a soft biomimetic interface with the body that will enable non-invasive biosensing of sweat. We will use hydrogels to interface the body with the ability to collect sweat and passively pump it through a microfluidic network. The pumping is based on principles of osmosis, which is the basis for how the body excretes sweat. Hydrogels doped with sodium chloride and glycerol have shown the ability to passively pump fluid in our devices. Flowrate can be controlled by modifying the composition or geometry of the hydrogel used. Sensing has been demonstrated on a lab scale for both a fluorescent fluid and glucose, a biologically relevant fluid. A variety of biochemical sensors can then be embedded in this network to provide noninvasive continual biosensing. This hydrogel based device will therefore serve as a platform that enables multimodal biosensing.

Danny Smyl
Graduate Program: Civil Engineering
Advisor: Mohammad Pour-Ghaz
Poster Number: 157

Visualizing Moisture Flow in Cement-Based Material Using Electrical Methods

Deterioration mechanisms in concrete structures, such as freeze-thaw, corrosion of reinforcement, and ingress of aggressive chemicals occur due to the presence of moisture in the material. Such processes have led to estimated repair costs of $34 billion for concrete infrastructure in the U.S. and Western Europe annually. Despite this, no method of visualizing moisture flow in concrete structures exists that provides adequate information and resolution. Common methods of visualizing moisture flow in cement-based material are based on electromagnetic radiation (e.g., neutron tomography). Such methods may be invasive, monetarily expensive, provide low resolution images, and/or are limited to small geometries.

Alternatively, electrically-based methods are non-invasive, relatively inexpensive, and provide high-resolution images. In this work, Electrical Impedance Tomography (EIT), an electrically- based method, is developed to address the shortcomings of current methods of visualizing moisture flow in cement-based materials and structures. Herein, EIT is used to visualize moisture flow in undamaged and cracked cement-based material. Both qualitative and quantitative EIT strategies are developed; these strategies are robust to rapidly reconstruct images of moisture flow and provide real distributions of moisture content in three dimensions. To corroborate EIT, numerical simulation of unsaturated moisture flow and X-Ray Computed Tomography (CT) are used. Current results indicate that EIT well captures moisture flow in material with and without cracking. Furthermore, EIT is shown to accurately image low levels of moisture saturation that are not captured by X-Ray CT.

Francisco Suarez, Viswanath Ramesh, Mehmet C. Öztürk
Graduate Programs: Electrical Engineering
Advisor: Mehmet C. Öztürk
Poster Number: 161

Wearable Thermoelectric Generators for Self-Powered Electronics

Thermoelectric generators (TEGs) offer the potential for wearable electronics to become self- powered by capturing and converting the human body's heat into electricity. In order for TEGs to be compatible with wearables, they must have a form factor that allows the device itself to be also be wearable. A wearable TEG requires flexible form factor in order to be comfortable and conform to the human body. There have been many great efforts on creating flexible thermoelectric generators, however techniques that utilized commercially available and as well as state of the art bulk thermoelectric materials have not be yet utilized. In this work we aim to understand how to optimize a TEG worn on the skin and the design challenges faced in making the device flexible. It was found that leg geometry and material properties, especially the thermal conductivity of the material are the most important, even at a sacrifice at the total Figure of Merit ZT. Replacing the air in between the thermoelectric elements with PDMS for flexible TEGS also proved to may be an advantage by relaxing the usual mechanical restraint of high fill factors, leading to a possibility that flexible TEGs could outperform their rigid counterparts. We then propose methods for fabricating a flexible TEG using thermally conductive polyimides and traditional thermalcompression bonding methods that are standard in commercial fabrication as well as new techniques involving stretchable silver nanowire and liquid metal (E-GaIn) contacts. A functional device is demonstrated using PDMS filling and liquid E-Gain devices incorporating bulk thermoelectric legs.

Jennifer Tsan, Kristy Elizabeth Boyer, Collin F. Lynch
Graduate Program: Computer Science
Advisors: Collin F. Lynch, Kristy E. Boyer
Poster Number: 166

How Early Does the CS Gender Gap Emerge?
A Study of Collaborative Problem Solving in 5th Grade Computer Science

Elementary computer science has gained increasing attention within the computer science education research community. We have only recently begun to explore the many unanswered questions about how young students learn computer science, how they interact with each other, and how their skill levels and backgrounds vary. One set of unanswered questions focuses on gender equality for young computer science learners. This paper examines how the gender composition of collaborative groups in elementary computer science relates to student achievement. We report on data collected from an in-school 5th grade computer science elective offered over four quarters in 2014-2015. We found a significant difference in the quality of artifacts produced by learner groups depending upon their gender composition, with groups of all female students performing significantly lower than other groups. Our analyses suggest important factors that are influential as these learners begin to solve computer science problems. This new evidence of gender disparities in computer science achievement as young as ten years of age highlights the importance of future study of these factors in order to provide effective, equitable computer science education to learners of all ages.

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Graduate Program: Electrical Engineering
Advisor: Prof. Alper Bozkurt
Poster Number: 167

Towards Injectable Sensors for Physiological Monitoring of Animals

Near-infrared optical sensors are used in medical practice to noninvasively monitor changes in parameters such as heart rate and arterial oxygen saturation. However, in veterinary research these sensors have been only used during surgeries by connecting pulse oximetry clips on the tongue or ear of anesthetized animals. Continuous monitoring of such parameters on awake and moving animals would create new opportunities for medical and veterinary research. We are developing injectable capsules that operate wirelessly to overcome some of the challenges of the current wearable devices, such as hair removal, proneness to detachment, and limited mobility. We created a prototype comprising a surface-mount LED and photodetector pair to perform photoplethysmography measurements and a coil wound around a ferrite rod to test the inductive coupling link for power transmission. The capsules were fabricated using glass tubes and medical grade epoxy, and a custom injector was manufactured to accommodate the capsule during the injection procedure by fitting a 3D printed syringe with a 6 gauge needle. Experiments demonstrated the feasibility of the sensor under different absorption conditions using tissue mimicking phantoms, and also its capability to monitor heartbeat related hemodynamic changes in a human subject. We also proved the feasibility of using the inductive link to power the LED by measuring the light output from the capsule while being submerged in saline solution. Improvements on the power link to reduce the intensity of the magnetic field below the exposure limit and encapsulation material optimization are an ongoing effort. Different materials are being considered, and tested using accelerated aging with the goal of reducing overall capsule size without compromising the sealing of the electronic system.

Ali Vaziri
Graduate Program: Civil Engineering
Advisor: Murthy N. Guddati
Poster Number: 169

Novel Algorithms for Characterizing Layered Media and Application to Near-Surface Geophysics, Nondestructive Testing, and Biomedical Imaging

Estimating the medium properties of layered media using wave propagation is widely used in various fields of science and engineering. Examples include characterization of stratified soil deposits, nondestructive testing of composite laminates and pipes, and ultrasound imaging of biological structures. The process involves exciting at a point on the surface, and examining the waves guided along the layers. The wave propagation characteristics are quantified with the help of frequency-dependent wave velocities, presented in the form of dispersion curves. These experimental dispersion curves are then inverted to estimate the layer depths and material properties. Named guided wave inversion, this process involves iteratively estimating the layering properties until a good match is obtained between the measured and computed dispersion curves.

Guided wave inversion has two computationally intensive steps: (a) forward modeling, i.e. computation of dispersion curves, which is done by using finite element method, and (b) computing the derivatives, i.e. change in the dispersion curves with respect to medium parameters, which is often done by using finite difference approximation. This study includes improvements in both venues, leading to an orders of magnitude reduction in computational cost. For forward modeling, we develop a rather unconventional technique to bend the finite element mesh into complex space, and obtain the dispersion curves with far fewer elements than regular finite elements. For derivative computation, we derive a new analytical formula that requires a fraction of computational cost when compared to finite differences, yet resulting in higher accuracy.

In addition to theoretical development, we illustrated the methods' effectiveness through application to real data for geotechnical site characterization, nondestructive testing of plates, and biomedical imaging of arterial stiffness. These experiments indicate that the proposed approach results in more accurate estimates of the medium characteristics, at a fraction of the cost of existing methods (less than 0.5%).

Binbin Yang
Graduate Program: Electrical Engineering
Advisor: Jacob J. Adams
Poster Number: 102

Systematic Design of Optimal Planar MIMO Antennas Using Characteristic Mode Theory

Multiple-Input-Multiple-Output (MIMO) systems enable a linear increase in wireless communication capacity as the number of transmit/receive antenna increases, and is an essential element in many wireless communication standards, such as WIFI and 4G LTE. However when it comes to implementation, one difficulty involved is the multi-port antenna design. As the form factors of most devices become smaller and smaller, it becomes difficult to put in multiple antenna elements without introducing strong mutual coupling between them and thus undermining the capacity performance. Therefore, the multiple antennas must be designed as one single multi-port antenna, whether physically connected or not.

Characteristic mode theory (CMT) is a theory to calculate the eigenmodes of an antenna aperture. Any response of the antenna can then be expanded in terms of these eigenmodes. Our recent study of the modal behavior of arbitrary antennas indicates that there is a fundamental limit on the number of broadband and efficient eigenmodes, and thus a limit on the MIMO capacity performance, particularly for compact devices.

To find the optimal antenna that reaches the optimal performance, we have come up with a systematic approach for planar MIMO antennas design using CMT and an iterative genetic algorithm (GA). First, the optimal antenna aperture is iteratively searched without considering any physical feeds; Second, the optimal feed positions are then located on the optimized geometry based on a characteristic-eigenfunction-based circuit model. An example two-port MIMO antenna is designed within a given aperture and verifies our design approach. To the best of our knowledge, this is the first shape optimization of a MIMO antenna without pre-specifying feeds, and our aperture-first-feed-next approach significantly reduces design complexity.

Jicheng Yu
Graduate Program: Biomedical Engineering
Advisor: Zhen Gu
Poster Number: 185

Microneedle-Array Patches Loaded with Hypoxia-Sensitive Vesicles for Rapid Glucose- Responsive Insulin Delivery

Diabetes mellitus is a group of metabolic diseases characterized by failure of blood glucose level regulation mechanisms, which currently affects 415 million people worldwide. The traditional care for people with diabetes often requires monitoring of blood glucose and insulin injections to maintain normoglycemia. However, such self-administration is associated with pain and often inadequate glucose control. Here we report a novel glucose-responsive insulin delivery device based on the microneedle-array patches integrated with hypoxia-sensitive polymeric vesicles containing insulin and glucose oxidase (GOx). In the presence of high blood glucose, the dissolved oxygen was rapidly consumed due to the glucose oxidation catalyzed by GOx, which led to a local hypoxic environment. Then, the glucose-responsive vesicles (GRVs) rapidly dissociated and subsequently released insulin. To achieve ease of administration, we further loaded the GRVs into a microneedle-array-based patch for painless insulin delivery. The amphiphilic hypoxia-sensitive polymer can assemble into the GRVs with a diameter of 118 nm. In vitro studies demonstrated the insulin release rate from GRVs was effectively correlated with the glucose levels. Moreover, the release rate was remarkably faster when compared to pH- sensitive based glucose-responsive nanoparticles previously reported in parallel. In in vivo experiments, the blood glucose in the diabetic mice transcutaneously treated with GRV-loaded microneedle (MN) patch quickly declined to a normoglycemic state in 0.5 h. In addition, the GRV-loaded MN patch could efficiently avoid potential risk to hypoglycemia. This “smart insulin patch” with a novel trigger mechanism is able to achieve closed-loop delivery of insulin in a fast glucose-responsiveness, pain-free, and safe manner.

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Graduate Programs: Chemical and Biomolecular Engineering, North Carolina State University[1]; RTI International[2]; Edgewood Chemical Biological Center[3]; Materials Science and Engineering, Georgia Institute of Technology[4]
Advisor: Gregory N. Parsons
Poster Number: 114

Functional Metal-Organic Framework Thin Films Enabled by Atomic Layer Deposition

Metal-organic frameworks (MOFs) are crystalline porous materials with ultra-high surface area and good adsorption capacity. Thin films of MOFs could simplify the deployment and enable new MOF-based composites and novel applications. However, previously methods are not generally applicable to a wide variety of substrate materials. The slow process rate also hinders the industrial implementation and commercialization.

Taking advantage of ALD Al2O3 nucleation layers, we have successfully grown conformal Cu-BTC MOF coatings onto polypropylene fibers using both solvothermal and layer-by-layer methods. Compared to previous reports, our approach significantly enhances MOF mass loading and greatly improves the growth uniformity of MOF thin films. MOF functionality is fully maintained after integration, as indicated by high BET surface area and large adsorption capacity for hazardous gases such as NH3 and H2S. Through an extensive investigation for the effect of different ALD nucleation layers, we discovered an ultra-fast reaction path for Cu-BTC formation at room temperature using ZnO. We find that hydroxy double salt (HDS) formed in situ from ZnO particles or thin films is the key intermediate that enables room-temperature formation of Cu-BTC in less than 1 minute. Our space-time-yield reaches over 3 x 104 kg·m-3·d-1, which is at least one order of magnitude greater than any prior report. We also demonstrate the generality of our synthetic strategy for other MOFs and MOF-based composites.

The synthesis routes we have developed represent a breakthrough in the deployment of MOFs for technical applications. We have provided a platform technology that is very promising to enable new MOF applications in gas adsorption and storage, membrane separation, catalysis and chemical sensing.

Yijia Zhao, Lingjuan Wang-Li
Graduate Program: Biological and Agricultural Engineering
Advisor: Lingjuan Wang-Li
Poster Number: 68

Spatial and Temporal Variations of Precursor Gases to Secondary Inorganic PM2.5 in NC

As a criteria pollutant regulated under National Ambient Air Quality Standards (NAAQS), fine particulate matter (i.e., PM2.5) has great impacts on human health and it contributes to the degradation of atmospheric visibility. As a base gas in the atmosphere, ammonia (NH3) may react with acidic gases, e.g. SOX, NOX, to form secondary inorganic PM2.5 (iPM2.5). In order to fully understand the dynamics of ambient iPM2.5 formation, it is critical to establish a comprehensive understanding about its precursor gases (NH3, NOX, and SOX). Animal feeding operations (AFOs) are major sources of NH3 emissions and have caused great concerns in the US. Significant increases in atmospheric NH3 emissions have been reported in the areas of intensive animal farming. While NH3 emission from animal agriculture has become an environmental problem, the impact of NH3 emissions from AFOs on the formation of secondary iPM2.5 has not been systematically assessed. Understanding the spatial and temporal variations of the precursor gases to the iPM2.5 will advance our knowledge about spatial and temporal variations of iPM2.5 in atmosphere. This reported project investigates spatial and temporal variations of the major emission sources of NH3, NOX, and SOX in NC. Spatial distribution maps are being developed to identify potentials of iPM2.5 formation using GIS modeling/ mapping and statistically spatial modeling approaches. The resultant maps may be used to identify hot spots of iPM2.5 formation in NC. Temporal analyses on precursor gases are being performed using emission inventories and process-based model simulation. Up to date, the preliminary results of this project have revealed that Fayetteville and Wilmington Regions are two hot spots with the highest farm densities and NH3 emissions. The spatial distribution of AFOs is strongly correlated with the geospatial distribution of NH3 emissions.

College of Humanities and Social Sciences

Ross M. Anderson
Graduate Program: History
Advisor: Julie Mell
Poster Number: 7

The Effect of Factionalism on Jewish Persecution: How the Conflict between Bernard of Clairvaux's Cistercian Order and Peter Abelard's Scholasticism Reclassified Jews as Heretics.

For the first half of the Middle Ages, European society largely afforded Jewish populations a unique degree of acceptance, a privilege not shared with pagans, heretics, or other non-conformists. On the eve of the twelfth century, however, Jews became the victims of massacring crusaders and increasingly dehumanizing polemics, traditionally blamed on the Church's irrational theology and Jews' financial role in society. Historians have since determined more valid reasons for the rise in anti-Jewish hostilities, such as the expansion of Gregorian Reform, the crusading ethos, the advent of Scholasticism, and a narrowly defined insistence on devout monasticism. The latest research from Berger (1972-2011), Abulafia (1998), Cohen (1982-2004), Chazan (1997-2013), and Elukin (2007) permits an up-to-date analysis of the debate between the two strongest twelfth-century church movements as a strident factor in anti-Jewish persecution. These two popular movements of Cistercian apostolicism and Scholasticism's primacy on rationalism stand as examples of factionalism. As both offered feuding epitomes of the ideal ecclesiastic model and permitted no allowance for differing views, the result was deleterious, especially for religious minorities. The build-up to the climactic meeting between the spokesmen of both movements (Bernard of Clairvaux and Peter Abelard) reinforced a growing hostility toward those who did not meet the ideal of either movement. The result was a narrowing window of what it meant to be Christian—a binary world shaped by demands of the strongest Church movements of the age. The direst consequences related to Jews, who did not meet the requirements of either faction: one's intellect, salvation, even humanity were called into question, and left one subject to charges of heresy. The contribution of this study is to present the intellectual war within the twelfth-century Church and its damning effect on Jews, how this alienation of the rival philosophy reclassifies the Jew as a heretic, and how endemic this conflict between factions is in the history of Christendom.

Grace Beeler
Graduate Program: International Studies
Advisor: Heidi Hobbs
Poster Number: 15

Land Titling in Brazil: a Road out of Poverty?

The highly influential economist Hernando de Soto argues that land titling is the key to development and poverty reduction worldwide. The poor are much richer than we think he argues; those living in informal situations hold "dead capital". If they can enter the formal system legally owned property will give millions access to credit which can be used to start businesses and improve their homes. Because of the success of de Soto's ideas, issuing titles for land to the poor has become a popular development strategy around the globe. This paper examines the successes and failures of titling programs in both rural and urban Brazil. While titling programs are better than previous regimes of slum eradication and rural serfdom, bringing people into the formal system quickly and without protection can simply lead to the displacement of the poor and greater concentrations of land held by the wealthy. Where the rural poor are allowed to buy land, they are saddled with the least productive, unwanted land which makes loan repayment difficult and resale nearly impossible. When they are able to occupy abandoned land with the intention to petition for title, as is allowed by the Brazilian constitution, the process is slow and often favors large landowners' interests. With urban slum upgrading, issuing title to homeowners can mean rapid gentrification, with the poor selling their property and moving to less desirable areas farther from their places of employment, often recreating the same slum conditions elsewhere. Titling does nothing at all to help the poorest of the slum dwellers: renters are simply displaced.

Arthur Berger
Graduate Program: Technical Communication
Advisor: Huiling Ding
Poster Number: 17

Project Title: A study of a commercial contracting proposal

Focusing on a successfully funded Department of Defense (DoD) task order (TO) submitted by a local small business, this project explores (1) how the features of a commercial proposal (e.g., genres, roles, communication network, writing process) compare with the literature on academic grant writing and (2) what practices a technical writer can use to negotiate these features in order to produce useful technical writing in a commercial setting. Through ethnographic research, the author has compiled a data set consisting of 18 genre templates, 6 proposals comprising 554 documents, 13,871 words of technical writing, and 68 communication nodes of emails, telephone records, and other exchanges that the proposal participants engaged in during the process. This project takes a social- cognitive approach that views genre as social action (see Miller 1984) in order to situate the proposal within the conditions surrounding its creation, including a communication network analysis, genre ecology analysis, and proposal verbal data analysis of the change between successive drafts and reviews of technical writing. While the overall findings show many similarities between academic and commercial proposals, the profit-based and competitive nature of a commercial proposal is identified as a potentially important difference that technical communicators should be aware of. Additionally, a role's level of communication may assist in developing collaborative technical writing, especially for virtual workers. The project identifies potential best practices for technical writers, including: communicating early and often with collaborators, researching the technical topic (triangulating through Internet, articles, users, and subject matter experts), reviewing and revising collaboratively, and balancing the demands of a competitive commercial environment by being cost-conscious and customer-focused.

Christine Shahan Brugh, Candalyn B. Rade
Graduate Program: Psychology
Advisor: Joseph Simons-Rudolph
Poster Number: 26

Investigating Community Attitudes toward Prisoners: The Effects of Prison-Based Programming

Every year, 700,000 inmates are released from prison (West & Sabol, 2007). Negative community attitudes toward prisoners can create barriers to successful reentry (Wakefield & Uggen, 2010). Research suggests that employment, housing, and social support are key elements of successful reentry (James, 2015). In the prison system, rehabilitative and skill building programs show mixed success at improving offender reentry outcomes, including reducing recidivism. However, less is known about public attitudes toward offenders participating in these programs. The results of two studies on the effect of prison-based programming on attitudes toward prisoners are presented. Study 1 (n=500): In study one, participants completed the Attitudes Toward Prisoners Scale (ATPS) (Melvin et al., 1985) and a modified social distance scale (Penn et al., 1994). Participants were randomly assigned fictitious descriptions of an inmate that differed by race and type of prison programming. Participants repeated the ATPS and social distance scale, prompted to think about the inmate description. Results showed significant differences on scores on the ATPS between males and females but not on prison- based programming or race of prisoner. Results also showed significant differences in social distance score depending on race and type of program of the inmate in the description. Study 2 (n=550): Study two hypothesized that participants gave very similar responses on the scales in study one because they were taken within 15 minutes. Participants were randomly assigned a fictitious inmate description and then completed the ATPS and social distance scales. Results showed males had significantly higher scores on the ATPS and there were significant differences in scores on the ATPS between the nine conditions controlling for gender. No significant differences in social distance were found. The implications of these findings for survey methodology, prison-based programming, and directions for future research on connections between public attitudes and behaviors are discussed.

Susan Camilleri
Graduate Program: Public Administration
Advisor: G. David Garson
Poster Number: 28

The ACA Medicaid Expansion and Hospital Uncompensated Care: An Early Analysis

The Patient Protection and Affordable Care Act (ACA), signed into law in March of 2010, introduced dramatic new changes to the US health care system. The comprehensive health care reform has several goals, including expanding coverage to the uninsured, controlling rising health care costs, and improving the quality of health care delivered in the US. One aspect of the reform involved expanding Medicaid, the US public health insurance program for the poor, in an effort to reduce the amount of free or reduced cost care provided by hospitals by covering more low-income individuals. The objective of this study is to estimate the effect of the ACA Medicaid expansion on hospital provision of uncompensated care. This study uses a difference-in-differences analysis of data from a balanced panel of short-term, general, non-federal, Medicare-certified hospitals obtained from the Centers for Medicare and Medicaid Services (CMS) Healthcare Cost Report Information System (HCRIS). The differences in the pre- and post-treatment changes in the outcome are measured for hospitals in states that expanded Medicaid and a control group of hospitals in non-expansion states. The results from this study indicate that the Medicaid expansion did not result in reduced hospital provision of uncompensated care when all hospitals were considered in the analysis. However, the analysis provides evidence that hospitals in the treatment group that treat a disproportionate share of low- income patients did see a significant reduction in provision of uncompensated care relative to similar hospitals in the control group. The results of this study have several policy implications for state-level policy makers still considering expanding Medicaid, federal policymakers considering the appropriate level of DSH payments, and state officials charged with enrolling newly eligible individuals.

Chen Chen
Graduate Program: Communication, Rhetoric and Digital Media
Advisor: Chris Anson
Poster Number: 36

Discipliniography of Rhet/Comp on Social Media: What Are We Doing in Our Facebook Groups?

Many scholars have surveyed the discipliniography of Rhetoric and Composition, tracing the discipline's past, discussing its present, and envisioning its future (Goggin 2000; Mueller 2012; Tirrell 2012). While these studies focus primarily on the scholarship in the field, I argue that scholarly investigation also needs to examine how scholars within a disciplinary community communicate with each other in less formal spaces, now often afforded by digital technologies such as social media platforms.

The goal of this project is to explore how the communicative practices in professional groups on Facebook (FB) contribute to and affect the disciplinary identity of Rhet/Comp through a content analysis of members' activities on three representative FB public groups: Council on Basic Writing; PRE/TEXT: A Journal of Rhetorical Theory; Material Rhetorics. The results indicate that these groups perform more than just professional but also social purposes. This poster presents an analysis of all the posts and comments from these groups in 2014 to learn their functions as well as the interactions and relationships among members who participated in these posts and comments. Upon analyzing the relationships of the members using Granovetter's concept of weak ties (1983) and Haythornthwaite's latent tie theory (2005), I will show how members of the group maintain their professional identity through the content and the style of their participation and how their communicative practices demonstrate the collective identities of the groups.

The discipline of Rhet/Comp has always celebrated its selfreflexivity. This study will not only paint a picture of scholars' communicative practices on FB groups to argue their contribution to disciplinary identity but also inspire discussions on how we may further reflect on our professional and social use of social media to develop our disciplinary community, reinventing and reconstructing our discipline.

Claudia Cortes
Graduate Program: Foreign Languages and Literature
Advisor: Jim Michnowicz
Poster Number: 191

English Discourse Markers in Salvadoran and Mexican Spanish in Raleigh, North Carolina

Discourse Markers are “multifunctional particles” that surface in native and nonnative speech such as so, well, like, you know and I mean (Torres, 2011:493). Previous studies in the major Hispanic populations in the southwest of the US have found that most bilingual speakers insert various English and Spanish DMs in their speech (Lipski, 2005;Torres,2002;Torres and Potowski,2008). However, this issue has not been explored yet in North Carolina, where Latino populations have experienced one of the fastest rates of growth in the country, 394% (Learn NC). Taking into account that Mexicans and Salvadorans are part of the largest Hispanic origin groups in North Carolina, the present study gains importance and hopes to provide valuable information about this community. Through a quantitative study, we examined the frequency of use of English DMs produced in the Mexican and Salvadoran Spanish to know if there was a significant effect of the sociolinguistic factors in the production of English DMs. Thirty interviews were coded from the Corpus del español de Raleigh-Durham (CERD) (Michnowicz & Ronquest 2015), to identify the most salient English DMs and to consider the language of the word that emerged after to figure out whether they trigger a codeswitch (Aaron, 2004:172), and thereby contributing to the discussion in the literature of whether these expressions are instances of codeswitching or of borrowing (Torres 2002). The preliminary results showed that even though younger heritage speakers favored the use of English DMs, the rate of English DMs is much lower than expected: 7.4% vs 50% and 24.7% respectively (Torres 2002, Flores-Ferran N, 2014). Based on these results, we might say that Mexicans and Salvadorans in North Carolina do not show a strong tendency to use English DMs. Data from more speakers will be included and further conclusions will be discussed.

Cristiane S. Damasceno
Graduate Program: Communication, Rhetoric, and Digital Media
Advisors: Deanna P. Dannels, Melissa Johnson
Poster Number: 158

Experts and novices in promotional videos for MOOCs

This paper investigates the roles of experts and novices in the 30 most viewed course overview videos displayed by Coursera, edX, and Udacity on their YouTube channels. Debates on the challenges and opportunities of these platforms have been so great that The New York Times called 2012 “The Year of the MOOC” (Pappano, 2012); however, there are no studies analyzing how messages of YouTube overviews inform these debates. For this reason, this study conducts a critical visual analysis (Rose, 2012) of these promotional videos because they are one of the first materials users have available before enrolling into a course. Preliminary results reveal that they present an embodied view of learning in which students only have voice when giving testimonies of their experience with the offline version of courses. The videos focus on experts and they play the roles of traditional lecturers, situated experts, hosts, and practitioners. These findings reveal a misleading message that do not translate users’ engagement with MOOCs. In addition, the visual content also contradicts the messages from these projects’ websites that emphasize peer-learning and collaboration. Thus, the results corroborate the body of literature that points out the inconsistency of the pedagogical foundation in these open educational initiatives. For this reason, this paper suggests that the democratization of education needs to be thought beyond purely access to content, but also in terms of the learning experience that students’ will encounter. This qualitative shift will necessarily involve more clear roles for both students and experts. For this reason, this paper suggests that MOOCs should detach these courses from the figure of the expert, and incorporate more opportunities for remix, user production, and local appropriation of activities.

Pappano, L. (2012). The Year of the MOOC. The New York Times, 2(12), 2012.
Rose, G. (2012). Visual methodologies: An introduction to researching with visual materials. Sage.

Casey Fleming
Graduate Program: Public Administration
Advisor: Jerrell D. Coggburn
Poster Number: 51

Public Employees and Bureaucratic Rules: Determinants of the Pro-Social and Destructive Rule-Breaking of Street-Level Bureaucrats

Public administration scholars and practitioners have long been interested in bureaucracy as a system of organization. Formal rules are widely held as its defining characteristic. However, few studies explore the unintended behavioral consequences of formal rules, in particular rule- breaking. This research investigates the rule-breaking of front-line public employees, making novel distinctions between the underlying motives of non-compliant attitudes and workplace behaviors. Specifically, traditional conceptualizations of the solely self-interested, utility- maximizing worker found in theories such as agency and transaction cost economics are contrasted with a view of the worker whose goals are not always incongruent with those of the organization. Pro-social rule-breaking (e.g., "I break the rule to better assist a client or coworker") and destructive rule-breaking (e.g., "I break the rule to lessen my workload") are approached as distinct phenomena, with differing implications for management and workplace rule development. The influences of individual, relational, and organizational predictors associated with workplace deviance in various literatures are investigated. Child welfare social workers of a state government agency in the Southeastern US were surveyed using an original questionnaire (n=288; 45% response). Preliminary data analysis indicates public employees report favorable general attitudes toward workplace rule-breaking at higher levels than actual rule-breaking behaviors. Further, multiple regression analysis suggests classic deterrence mechanisms (certainty of detection, severity of punishment) are the most important factors influencing pro-social rule-breaking, whereas destructive rule-breaking is largely influenced by relationships with coworkers and direct supervisors.

Sherrie K. Godette
Graduate Program: Public Administration
Advisor: Branda Nowell
Poster Number: 59

Food Deserts, Local Food Markets, and Government Intervention

The existence of food deserts has emerged as a critical public issue as research increasingly supports links between food consumption and health outcomes. The federal, many state governments and communities across the U.S. have been developing strategies and policies to mitigate the so-called food desert problem. One prominent strategy advocated over the last twenty years is local food system development. Research suggests that the presence of local food markets may facilitate greater fruit and vegetable consumption in food deserts, however there is limited evidence that local food markets are actually being developed in these areas across the nation. In addition, there are few studies that evaluate the role of government and policy in contributing to greater local food market availability in food deserts. To address these gaps, this study used multivariate regression analysis to test the county level variation in farmers' market availability among food deserts compared to non food deserts adjusted for demographic, socioeconomic, geographic, and production capacity characteristics, stratified by county metropolitan status. This study also examined the link between government intervention in local food system development and farmers' market availability in food deserts compared to non food deserts. The results suggest there are significant differences between food desert and non food desert farmers' market availability in some geographic areas, however not in others. In addition, the findings suggest that government intervention may be contributing to direct increases in farmers' market availability overall, however government assistance was found to be associated with less market availability among food desert compared to non food desert counties. These findings intend to inform local food, health, and economic development policy as a means to improve the health and well-being of disadvantaged communities suffering from food access issues.

Rachael Graham
Graduate Program: Technical Communication
Advisor: Huiling Ding
Poster Number: 62

Shifting Spaces: The Role of Technical Communication in Augmented Reality Systems

In today's information-saturated world, emergent communication technologies are breaking down the barriers between virtual and physical spaces. This includes augmented reality (AR), which layers visual information onto a user's view of her physical surroundings. AR is proving instrumental in a number of fields where technical communicators presently work—in procedural documentation, training and instruction, organizational communications, technical support, and tour or museum guidance. However, because AR is such a novel technology compared to other information outputs, many of the features that make it so useful are also the ones that are least well understood or successfully addressed by technical communicators—the professionals who will be managing AR-facilitated information environments.

In an effort to educate and prepare technical communicators, a literature review was conducted to investigate the upcoming challenges and opportunities for designing and crafting content for AR output. Several studies of AR programs prototypes reveal issues of streamling information delivery, as visual information overload can potentially increase users' cognitive workload.

Additionally, during AR-guided task completion, users can become dependent on instruction augmentation due to its embedded nature and constant availability. Nevertheless, many qualitative articles advocate implementation of strict information architectures and simple user interfaces to effectively address these issues. Future studies on user research methodology may help technical communicators more accuractely support user task according to physical context, thus giving meaning to interactions embedded in an enhanced information environment.

Juan David Gutierrez
Graduate Program: Foreign Languages and Literatures
Advisor: Jim Michnowicz
Poster Number: 64

Sibilant Voicing in Colombian Spanish

Colombian Spanish, particularly the highland variation in Bogota, evidences consistent sonorization of [s] at the end of words and codas which resist any process of aspiration and elision (Lipski, 2014). While previous research has drawn attention to the allophonic variation in the Spanish sibilant fricatives, none has analyzed this case of the Colombian highland variation in depth. Some studies include /s/ voicing in Ecuadorian Spanish (Lipski, 1989; Colina, 2009), intervocalic /s/ voicing in Spain, intervocalic /s/ and voicing in highland Ecuadorian Spanish (Garcia, 2013) and intervocalic /s/ voicing in Panama, Mexico, and Colombia (Flores, 1973; Torreblanca, 1983). Thus, research on sonorization of [s] in highland Colombian Spanish still remains an underexplored area which serves as a point of departure for this study. This research project aims to characterize the sociological and linguistic variables that influence the process of sonorization and voicing in highland Colombian Spanish, specifically in Bogota by analyzing 800 tokens coming from eight sociolinguistic interviews from eight Spanish native speakers living in the Southeastern United States. The research questions that lead this project are (1) Is there intervocalic /s/ voicing in Bogotano Spanish? (2) What are the social factors that influence such sonorization? (2) What are the linguistic variables and other segmental features that influence the sonorization of [s]?

Preliminary results from the sonorization analysis suggest that [s] is unvoiced in initial tonic syllables showing the intrinsic relation of the position in the word and the tonicity. In addition, in the present results consisting of younger speakers only, gender does not seem to have an impact in the realization of [s] and the level of education apparently implies an influence in this linguistic variable.

Grant Harned
Graduate Program: Communication
Advisor: Melissa Johnson
Poster Number: 190

Examining Crisis in a Digitally Networked Community: A Case Study of Reddit

With the widespread adoption of social media, it has become increasingly important for crisis communicators to assess crisis responses in highly participatory digital environments. This case study analysis investigated the crisis communication of Reddit in response to the moderator "Blackout" protests of 2015 following the dismissal of a beloved employee and increasing user frustrations over policies. Using Coomb's (2015) Situational Crisis Communication Theory and Martin and Boyton's (2005) interpretation of Stakeholder Theory, this study sought to uncover how Reddit responded to this crisis both on the Reddit platform and in newspapers via content analysis. Ultimately, Reddit used a combination of bolstering and diminishing postures to address the participatory expectations, uncertainty and outrage of users on the platform. In newspaper coverage, Reddit was portrayed negatively with just as many Reddit user quotes as company executive quotes reported.

Rachel Jacobson
Graduate Program: Public History
Advisors: Matthew Booker, Craig Friend
Poster Number: 152

Greenways: Offering a Green Solution to an Infrastructural Problem

Raleigh was a pioneer in developing an extended greenway system. This poster examines key points in Raleigh's history that led to the creation of the greenways, and explains why they succeeded at a particular moment in history. To tell this story I draw from important archival sources from the William L. Flournoy, Jr. Papers at NCSU Libraries Special Collections. During the decades following World War II, economic growth and booming population drove suburban development across the United States. Development led to sprawl in many areas, including Raleigh. Vast expansion around Raleigh dramatically increased impenetrable surface area, which caused frequent flooding. In the early 1970s, William L. Flournoy Jr. offered a green solution to this problem. Since floodplains are usually the last areas to get augmented, creating greenways along streams allows this land to remain penetrable, in a relatively natural state, and prevents buildings from getting built in flood zones. Flournoy's Capital Area Greenway System was not the first plan in Raleigh's history that suggested a way to preserve the floodplains. In 1951 a plan was introduced calling for "public corridors" along the City's streams. In 1969 a plan called "Raleigh: The Park with a City in it" proposed a similar idea. Why was Flournoy's plan the one that got implemented? My research shows that this was partially due to timing.

The 1970s were a time in which a plan, promising to make "natural areas" more accessible, would be especially popular because postwar expansion caused anxiety over the disappearance of nature. The Capital Area Greenway System offered an ecologically sound solution to an infrastructural problem while making Raleigh a more livable place.

Riku Kawaguchi, Nicole M. Jasperson
Graduate Program: Sociology
Advisor: Patricia L. McCall
Poster Number: 76

Do "Good" Local Institutions Matter? Predicting Lower Neighborhood Violence

This study examines the effects of "good" local institutions on neighborhood violent crime in Seattle. Criminological theories posit that local institutions matter in either controlling crime or producing criminal opportunities. While some institutions—such as bars and public housing— may attract crime by creating opportunities conducive to crime, other institutions—such as coffee shops and churches—may reduce neighborhood crime by facilitating efficacious interactions among residents and effective informal social control. Although previous studies have identified "bad" institutions that predict higher violent crime incidents, they cannot agree on what institutions are "good" due to insufficient theorizing and mixed findings. The task of this project is to clearly identify which institutions are "good" using theories, and empirically test whether they predict low crime in neighborhoods. Using the National Neighborhood Crime Survey 2000 merged with ReferenceUSA Historical Business data and census data, we examine whether several theoretically "good" local institutions predict lower neighborhood robbery and assault incidents at the census tract level within Seattle City limits. The preliminary results using negative binomial regression models with spatial lag indicate that some theoretically "good" local institutions, such as coffee shops, predict lower neighborhood violence, while a few, such as civic organizations, did not have a statistically significant influence on crime.

Sarah Soleim, Abigail Jones
Graduate Program: Public History
Advisor: Craig Thompson Friend
Poster Number: 79

History à la Carte: Taking the Museum to the People

Acquired by the City of Raleigh Museum in 2012, the M.T. Pope House was built by Manassa T. Pope, an African American physician, veteran, politician, and father, in 1901. Pope passed in 1934; however, his daughters, Evelyn and Ruth lived and maintained the home until their deaths in 1995 and 2000. Currently, the City of Raleigh Museum administrators are considering ways to share the Pope family's story with the community. Because of its inconvenient location, the Pope House Museum has struggled to attract visitors and compete with the many other historic sites in Raleigh.

This summer, museum administrators and interns worked to bring the museum to visitors. Interns inventoried and catalogued Pope House Museum artifacts and developed a museum cart based on twentieth century medicine. The museum cart is designed to attract passersby in front of the City Raleigh Museum in the heart of downtown Raleigh. The cart relates to the City of Raleigh Museum's work at the Pope House through discussions of twentieth century health and medicine. Through the cart, museum staff brings the Pope family's story outside of their home and into the community.

Recent scholarship encourages museum professionals to rethink interpretations at historic houses and their relationships with the public, but museum professionals must also consider how historic houses can transcend their physical space. Lesser-known museums, like the Pope House, instead of waiting for the public to visit, need to proactively take the museum to the community. By considering the Pope House Museum outside of its tangible significance, the City of Raleigh Museum is re-envisioning how they can attract visitors to the Pope House. Our hope is that the museum cart will provide one solution to historic house museums that struggle to attract audiences and encourage historic house museums to push their physical boundaries.

Rebecca Levy, Rahma Hida
Graduate Program: Psychology
Advisor: John Begeny
Poster Number: 90

International Prevention and Intervention Research in School Psychology

School psychology is an international discipline, with practitioners in more than 80 countries. Like researchers and practitioners within the U.S., school psychologists internationally express a desire for intervention research from their home country to be completed and published. This presentation reports on the first systematic evaluation of international intervention and prevention research published in school psychology. Key characteristics of school psychology research—compiled across eight journals, 12 years, and 3,057 articles—will be presented and discussed. Some key findings include: (a) a small percentage of school psychology research is being conducted on samples outside of the U.S., (b) the methodological rigor of studies being conducted outside the U.S. is relatively weak, and (c) multinational collaboration is rare.

Marisa Linton
Graduate Program: Communication
Advisor: Joann Keyton
Poster Number: 91

Activism, Credibility, and Pigs: Measuring Public Perceived Credibility of the Pork Industry

Pork is the most widely consumed meat in the world, and America is a leading producer of pork, but the industry has dealt with a great deal of criticism regarding their practices by the public and more specifically activist groups. Which groups are perceived as more credible by the public is a question that has not yet been answered. There is a gap in literature, and this project aims to fill this gap by providing a unique perspective of the pork industry. This research explores how levels of activism relates to perceived credibility of the pork industry. A quantitative experiment methodology was implemented by using an online survey. Participants in this experiment saw either positive or negative portrayals of the pork industry in news releases, and examined if these portrayals influence participants' perceptions of the message and source credibility. The experiment also examined if levels of activism act as a moderator on source and message credibility. Finally, a participant's knowledge of the pork industry and their consumption of pork was measured to determine if this affected perceived credibility. Conducted in the top pork producing states in America, Iowa and North Carolina, the study encompasses a varied demographic to explore how participant's perceptions may differ based on what county they reside. Further analysis of data should give more insight into the relationship between activism levels and perceived credibility. It is hypothesized that those who do not eat pork will perceive the pork industry more negatively as a credible source. In addition, it is expected that there will be a difference in perceived credibility between Iowa and North Carolina.

Kaitlin Moore, Ann H. Ross, Chelsey A. Juarez
Graduate Program: Anthropology
Advisor: Ann H. Ross
Poster Number: 108

Frontal Sinus Development and Juvenile Age Estimation

Development is an important component of age estimation in juveniles. One area that has not been fully investigated as a possible aging method is the development of the frontal sinus. The predictable growth cycle of the frontal sinus could make it a useful parameter for age estimation. The frontal sinuses form when the ectocranial table of the frontal bone separates from the endocranial table forming an air pocket in the bone. The endocranial table ceases growth with the brain, while the ectocranial table is displaced anteriorly as the facial bones continue growth.

In order to examine the utility of the frontal sinuses for age estimation, 392 radiographs were examined (♀=159 and ♂=233) from the Juvenile Radiograph Database at North Carolina State University and the Patricia Database from Mercyhurst University. The sample included individuals who range in age from 0 to 18 years old. Anteriorly positioned radiographs were examined and were then grouped based upon their presence or absence of the frontal sinus. Individuals were divided into four age categories.

A one-way ANOVA was run, and then a Tukey adjustment was used to examine the differences in age range between the four groups. Results show that only three of the four groups were significant ($p<.0001$): individuals with no development (0-5 years), individuals who showed the first signs of sinus development (6-8 years) and individuals with fully developed frontal sinuses (9-18 years). These results indicate that the development of the frontal sinuses can be utilized as a potential method of estimating age.

Kasey Orvidas[1], Jeni Burnette[1], Joyce Ehrlinger[2]
Graduate Programs: Psychology, North Carolina State University[1]; Experimental Psychology, Washington State University[2]
Advisor: Jeni Burnette
Poster Number: 123

Predicting Caloric Intake: Mindsets Matter

A large body of research indicates that growth mindsets, or beliefs that traits are malleable, increase the likelihood of behavioral changes relative to fixed mindsets, or beliefs that traits cannot be changed. The current studies examined the implications of growth mindsets regarding body weight for health-related outcomes—specifically, nutritional self-efficacy and caloric intake. In Study 1, we hypothesized that individuals with growth mindsets regarding body weight would eat healthier than those with fixed mindsets, operationalized as consuming fewer calories from high fat foods. First, the researcher primed participants with either a growth mindset or fixed mindset. Next, participants completed a "taste-test" in which they sampled a high-fat (M&Ms) and low-fat (raisins) snack. The researcher instructed participants to eat as much of each as they would like. Consistent with our prediction, participants in the growth mindset condition consumed fewer calories from M&Ms than did those in the fixed mindset condition. Study 2 sought to determine the mechanism for this effect. Specifically, given that previous research has demonstrated that growth mindsets are associated with greater self- efficacy, we hypothesized that nutritional self-efficacy would mediate the association between growth mindsets and reduced caloric intake from high fat foods. Participants completed questionnaires assessing implicit theories of weight, nutritional self-efficacy, and food consumption. Consistent with our prediction, participants who reported stronger growth mindsets regarding body weight also reported greater nutritional self-efficacy, which in turn predicted a lower self-reported percentage of caloric intake from fat. These findings suggest that interventions aimed at reducing body weight could benefit from targeting individuals' mindsets in order to teach them that their weight is changeable and controllable.

Cecilia Paoppi
Graduate Program: Foreign Languages and Literatures
Advisor: Greg Dawes
Poster Number: 127

Kirchnerismo: the confrontation of intellectuals in defense of a model

Kirchnerismo is the name for the political movement that governed Argentina for the last twelve years. Starting with Néstor Kirchner, from 2003 to 2007, and followed by his wife with two terms, 2007 to 2015, the K era has its ideological basis in what was called a popular and national model. The defense of human rights, the enactment of social policies, a strong cultural promotion, the rejection of neoliberal policies, and the partnership with players such as Cuba, Venezuela, Ecuador and Brazil, were part of their core policies.

During this era different voices were raised in favor and against the model, as a discursive confrontation was developed between politicians, intellectuals and citizens. Us or them, Peronists or oligarchs, the working class against the farmers, and the national versus monopolies, were some of the dichotomies that circulated in the discourse during the last decade causing division and confrontation. The political and intellectual discourses were a constant backing to the past, to a previous moment in the history of Argentina when the divisions were more important than the goals. Kirchnerismo revived old disputes and this fissure was transferred to the society.

The present work aims to analyze the role of the intellectuals during kirchnerismo. Who were the most prominent voices? Who were the intellectuals in favor of the kirchnerista model and who were against? What did they publish? José Pablo Feinmann, Ricardo Foster and Horacio Verbitsky were some of the prominent intellectuals and journalism who raised their voices in favor of the model, as they never before had done. On the other hand, people like Beatriz Sarlo, Santiago Kovadloff and Fernando Iglesias showed opposition to kirchnerismo and their policies. Twelve years with many achievements but also an era of dispute, division and struggle for power will be the focus of this study.

Leelynn Pinion
Graduate Program: Social Work
Advisor: Alan Ellis
Poster Number: 132

Through the Eyes of Youth: Evaluation of Staff in a Restitution Program for Court- Involved Youth

Juvenile delinquency is a concern in Wake County. 1,977 complaints related to the juvenile population were filed in 2014 according to the North Carolina Department of Public Safety Data Book. The Juvenile Court seeks to address crime in youth to prevent placement in a more restrictive setting or future adult court involvement. Programs pursue these goals through employment, therapy, wilderness camps, and community- based activities. While research has examined program outcomes, there is limited research focused on youth perceptions of staff or on staff effectiveness. The current study addresses youth perceptions of staff in a community-based restitution and community service program. I am conducting separate surveys of youth participants and staff. Staff members answer questions on their personality, experience, and job satisfaction. Youth participants answer questions about the staff member they worked with and that person's strengths in the position, along with questions about the qualities that make an effective staff member. I will analyze the survey data to identify relationships between staff characteristics—personality, past experiences, and job satisfaction—and the perceptions of the court-involved youth. Results of this study could help community-based programs make future hiring decisions and become more knowledgeable about the perceptions of their youth participants.

Vannessa Quintana Sarria
Graduated Program: Foreign Languages and Literatures
Advisor: Jim Michnowicz
Poster Number: 133

The Use Of Vos, Tú, and Usted: Subject Pronouns in Cali-Colombia

The term voseo is used to recognize the preference, by some Spanish speaking communities, for the use of the second person of singular vos, with its respective conjugation different from the form tú. In the different varieties of Colombian Spanish the pronominal forms tú and vos are used equally to refer to the second person singular. Therefore the purpose of this study is to explore the attitudes towards such forms in a sociolinguistic environment in the city of Cali-Colombia. Few studies have investigated this topic in Cali-Colombia which is one of the cities that uses the voseo more openly, in a country where "tú" forms dominate and are considered standard. Therefore this project will provide more insight about the influence and the attitudes the participants have of the four competing pronouns forms. In the present study the data collection was done through 800 online surveys, shared on social networks (email, Facebook and twitter) in which the participants indicated the pronoun form that fitted better according to the interlocutor that was given, and the verbal forms that were more used according to the pronouns studied. Preliminary results from the statistical study suggest that different social factors like: interlocutor, gender, and age have an important effect in the attitudes towards the voseo. However this study offers new findings, in which is possible to observe that the upper class shows a meaningful difference in the way they accept to use the pronominal form associated with the voseo, in comparison with the lower class. Both classes use the form but according to the data they accept to use it in a different way. Suggesting that the voseo from Cali is no longer a stigmatize form by the people from Cali.

Gwendolynne Reid
Graduate Program: Communication, Rhetoric, and Digital Media
Advisors: Carolyn R. Miller, Chris Anson
Poster Number: 136

Citizen Science: Shifting the Rhetorical Landscape of Scientific Communication

Traditional models of scientific communication tend to maintain a particular rhythm: internal communication within the scientific community occurs first; transmission and popularization of scientific findings for the public occurs second. This distinction and rhythm, however, has been increasingly questioned (e.g. Lewenstein, 1995; Bucchi, 1998; Trench, 2008; Kelly & Miller, forthcoming). This poster reports on data collected in the first year of an ongoing ethnographic case study of a biology lab's writing and communication, focusing on the lab's use of citizen science to engage the public during rather than after a study's completion. Specifically, the study asked how this shift in the timing of scientific communication with the public affected the lab's writing and communication more generally, including communication of findings with other scientists. Using techniques from grounded theory, the study identified a number of perceived goals for the lab's communication with citizen scientists, some of which are in tension with the timing and stakes of scientific communication with the scientific community. For example, while goals like "engaging the public with science," "educating the public," "showing the public that science is hard," and "enlisting the public's help in collecting data," do not seem to be in tension with other communication, goals like "giving back the data to the community," and "sharing our findings" can be in tension with the goals of scientific journal publication, a process that certifies scientific knowledge and that often privileges being first in publishing findings in order to maximize "high impact" journal ratings. These preliminary findings suggest, then, that shifts in scientific communication with some stakeholders has the potential to impact scientific communication with other stakeholders, including the scientific community more broadly. These findings are important for those engaged in or teaching scientific communication.

Megan Schwalenberg
Graduate Program: Anthropology
Advisor: Troy Case
Poster Number: 148

Analysis of Frailty in the Lower Illinois Valley During the Transition to Agriculture Through Periosteal New Bone Formation

This study investigates the health of the people of the Lower Illinois Valley during the transition to agriculture by analyzing mortality patterns and observing any interaction between age-at- death and stage of periosteal new bone formation. Periosteal new bone formation is one of many skeletal non-specific indicators of stress used by bioarchaeologists to assess health patterns. While often utilized in paleopathological studies, little work has been done on differentiation between the stages of periosteal new bone formation - active, mixed, and healed
- and any association with differential mortality and frailty. Previous studies on Black Death individuals have suggested that active lesions are associated with individuals with high frailty while healed lesions are associated with individuals of lower frailty. A total of 348 adult individuals from three Middle Woodland period (50 BCE – 400 CE) sites and three Late Woodland period (400 – 900 CE) sites were analyzed. Age-at-death was estimated using transition analysis and the presence and stage of periosteal new bone formation on the tibiae was noted. These data were analyzed using Kaplan-Meier survival analysis and preliminary results suggest a similar pattern as seen in previous research of healed lesions being associated with individuals of lower frailty. Assessing lesions and mortality in this way could provide a clearer understanding of mortality patterns during the transition to agriculture in general, as well as specifically within the Lower Illinois Valley.

Lesa Sexton
Graduate Program: International Studies
Advisor: Heidi Hobbs
Poster Number: 150

CCT Programs: Too Good to be True?

International development is a field riddled with trends, from structural adjustment plans and debt forgiveness to microfinance and food aid reform. One of the more recent trends in aid is conditional cash transfer (CCT) programs, wherein money is given to individuals or families for meeting certain criteria such as attending school or getting vaccinated. Initial results have been positive, leading to rapid expansion of these programs throughout Latin America. But are they really destined to succeed where all previous initiatives have failed?

Despite all the hype, millions of people in Latin America are still living in poverty and in many areas the status quo still holds. With aid being a multi-billion-dollar industry, it is worth questioning whether this money is being spent wisely. In my research I use case studies from Mexico and Brazil's national CCT programs to investigate the weaknesses of this model. For Mexico I focus specifically on educational outcomes and find a lack of consistent data regarding cognitive improvements in students. For Brazil I focus on the difference between rural and urban settings and find results are mixed in the latter. Both of these outcomes suggest that there are limits to CCT program effectiveness. In my paper I argue that CCT programs target superficial measures and do not go far enough in addressing the underlying issues causing poverty. While still a useful strategy, these programs cannot be used in isolation to solve the problems of the Global South and stem the intergenerational transmission of poverty.

Dina Shehata
Graduate Program: International Studies
Advisor: Akram Khater
Poster Number: 154

The Consequences of the Arab Spring: Diverging Paths in Tunisia, Egypt, and Syria

The world watched as protests erupted across the Middle East. Tunisians began this domino effect by revolting against their government after Tunisian vendor Tarek al-Tayeb Mohamed Bouazizi set himself on fire in an act of hopelessness. While uniformly focused on overthrowing corrupt regimes, subsequent uprisings across the Arab world, "The Arab Spring," followed different trajectories with distinct outcomes. This research aims to explain this diversity of paths and outcomes among the countries involved in the Arab Spring. The case studies which will be examined include Tunisia, Egypt, and Syria. Tunisians and Egyptians were able to oust their leaders but Syrians were unsuccessful in removing President Bashar al-Assad. Tunisia made the most complete transition to a democratic government, while in Egypt a counter-revolution brought back an authoritarian government through an orchestrated military coup. My research, then, asks why is it that Tunisia has been able to move forward with their fairly elected President Beji Caid Essebsi? What has led to Syria's bloody civil war? What led to a military coup in Egypt? While there are multiple factors (political and economic) which help to explain the divergence of paths and futures, my research argues that the major factor in determining the outcomes was the role of the military and civil society, and their relationship to each other.

These are very important questions that will lead to broader generalizations about the Arab Spring and revolutions across the world. Examining the Arab Spring will allow us to understand what aspects of society help and hinder revolutions.

Adriana Szabo
Graduate Program: Anthropology
Advisor: Tim Wallace
Poster Number: 162

Community Development and Tourism in San Pedro la Laguna, Guatemala

Tourism in Guatemala has been a part of the economy for decades, but the development of tourism has been uneven. A good example of this is among the communities surrounding Lake Atitlán. The gateway community of Panajachel has been a part of tourism since the 1930's, but directly across the lake, tourism development in San Pedro la Laguna has been rapid and uncoordinated, especially over the last two decades. For 8 weeks during the summer of 2014, I completed ethnographic data collection, including pile sorts, photo elicitation and focus groups, as well as 30 in-depth interviews with local residents and a questionnaire survey from 30 tourists, aimed at understanding the connections between community development and tourism.

My data analysis indicates that San Pedro la Laguna residents, unsatisfied with local government efforts, believe that tourism should and can play a greater and more comprehensive role in the development of their town.

The study focuses on how local people understand their role and the role of local and national authorities in the process of redesigning the touristic model in San Pedro la Laguna with the aim of leveraging the power of tourism to improve local livelihoods, alleviate poverty and empower under resourced micro-entrepreneurs who are cast out of the main stream tourism business.

In this presentation I discuss the future and sustainability of their desires to invest tourism revenues in education, health services and infrastructure that will result in local benefits for the citizens as well as a more attractive destination for upscale tourists.

Anne-Lise Knox Velez
Graduate Program: Public Administration
Advisor: Branda L. Nowell
Poster Number: 152

From Agenda Setting to Local-Level Policy Change: A Grounded Theory Study of Drivers and Barriers of Change after Hurricane Sandy

We know how natural disasters gain attention in the U.S. (Birkland 2006), but not much about factors that lead to local post-disaster policy changes, or about local-level disaster planning processes in general (ex. Farley et al., 2007; Scavo et al., 2007). Birkland's (1997) theory of focusing events posits natural disasters gain attention, and in some circumstances may focus public and decision-maker attention on particular problem or policy areas, helping create conditions that can potentially lead to changes in agenda or policy. Several models exist to explain the policy making process at the national level. Kingdon' s (1984; 2011) streams metaphor, Baumgartner and Jones' (1993; 2009) Punctuated Equilibrium Theory, and Sabatier and Jenkins-Smith (1998; 2014) Advocacy Coalition Framework have been used to explain the agenda setting and public policy making process. However, scholars are still unable to adequately explain features of natural disasters as focusing events that constrain or drive changes in public conversation or policy change, especially at the local level. Changes in local disaster policy and historic and cultural preservation policies are of particular interest because they are examples of policy areas "without a public" (May, 1991), as they are technical and there is little public mobilization around the policy issues.

This study uses grounded theory, exploring communities affected by Hurricane Sandy to examine the local level post-disaster policy change process, addressing a gap in literature around local-level disaster planning. Explicitly, this paper asks: What are the forces that constrain or drive local post-disaster changes in public conversation, procedures, or policy? It also examines factors explicitly related to post-disaster changes in publicly-driven conversation, procedure, or policy addressing historic resources. Seven explanatory hypotheses were developed. These explanatory hypotheses are compared to national-level policy process theories to compare areas in which the national and local-level policy processes are similar.

Dwiyatna Widinugraha
Graduate Program: Communication, Rhetoric, and Digital Media
Advisor: Melissa A Johnson
Poster Number: 178

The Marketing of Separatist Group: Classification on Separatist Movement Categories

Many articles and studies recently discussed the emergence of terrorist groups in the Middle East as separatists to form new and fearful countries. However when we looked at other separatist cases in other regions, such as the Scottish Independence in Europe or Free Papua movement in South East Asia, problems occurred when we tried to classify them all in the same groups of separatists. This study employed comparative analysis on separatist groups marketing activities to draw classifications on the 21st century separatist groups categories: the ethnic separatist, the political separatist and the terrorist separatist. The findings challenged previous studies by Clifford (2005) that argued insurgent group looked for international support in order to develop the organization. While the ethnic separatists followed the same conclusion, this study found the reverse evidence on the political separatist groups and the terrorist separatist groups. In addition, this taxonomy could serve as an extended description of Asal et al.'s (2014) model of the separatist's activity by comparing the separatist marketing activities. More importantly, communication researchers will broadly learn about how the minority-rebellion groups employed the marketing activities new media from this study.

Eric Wilbanks
Graduate Program: English
Advisor: Jeff Mielke
Poster Number: 179

"SHtriking" Change in Raleigh's Speech: Acoustic Analysis of (str) Retraction

The phenomenon of (str) retraction is an ongoing sound change in English in which /s/ retracts towards [S] in the context of a /str/ cluster (i.e. "street" sounds like "shtreet"). This change appears to be quite widespread, having been reported in Ohio (Durian, 2007), Philadelphia (Labov, 1984; Gylfadóttir, 2015), Oklahoma (Rutter, 2014), and Georgia (Phillips, 2001), among others. Beyond the US, it has been observed in the UK (Altendorf, 2003; Bass, 2009; Glain, 2014), New Zealand (Lawrence, 2000; Bauer & Warren, 2004; Gordon & Maclagan, 2004), and in some communities in Newfoundland (Clarke, 2004). Since the /str/ clusters which condition this sound change can occur word-initially, word-medially, and across word-boundaries, (str) retraction represents an opportunity to study to interaction of morphemic boundaries and coarticulation in the progression of sound change.

The current project examines the status of this sound change in the Raleigh, NC corpus of sociolinguistic interviews (Dodsworth & Kohn, 2012). Acoustic analyses of 84,575 /s/ and /S/ tokens from 82 speakers born in Raleigh were carried out and a series of linear mixed effects models were fit to the data. Unlike previous sociophonetic analyses carried out by Durian (2007), Hinrichs et al. (2015), and Gylfadóttir (2015), I find a significant sex-effect, with (str) retraction being led by young women, but only word-medially. In addition, older men from the corpus (born in the 20s-40s) already have the retracted (str) variant, but male (str) becomes less retracted over time. These data demonstrate that an identical phonetic variant [in this case retracted (str)] can be implicated in separate sound changes within a community, each sound change with its own unique history and trajectory of change.

Charlena Wynn
Graduate Program: Liberal Studies
Advisor: Cecilia Mouat
Poster Number: 183

Space and Authority: An Analysis of Museum's Influence on Shaping the Body and National Identity

The culture of displaying and collecting art and material culture existed long before the modern art museums of today. World Fairs, Biennials, Salons, and parlors are a few the spaces used to exhibit art, artifacts, and cultural objects from personal travels and conquests. The culture surrounding collection yielded power for explorers; and objects were used as conversation pieces and evidence of wealth and intellect. These large exhibitions allowed Western countries to gather and explore technology, science, and aesthetic to elucidate their colonial powers, national identity and interpretation of the Other. This research explores the art museums' role in constructing ideas about the body and it's connection to citizenship and nationhood. Museum architecture and culture, curatorial design, industrialization and the rise of the nation-state, colonialism, and the curriculum of art studies have greatly influenced the body and national identity by way of the art museum. These spaces operate as a visual language about nationhood and citizenry, which are embodied through its patrons. Analyzing scholarship on visitor performance within museums, the relationship between the national identity and collecting, the language of Western and non-Western collections and exhibits in Western museums, and the culture of museums confirms that art museums replicate hegemonic ideas and functions as a monument of nationalism. Nation building and the museum can be located in the national identity formation of Poland, Greece, Denmark and Asian and African countries such as China and Ghana as well as the United States, which is the focus of this research. Through this research, it was concluded that because of its emphasis on national identity, museums are spaces to explore nationhood and place-specific social constructs. Therefore, space becomes an authority on how the body performs and the embodiment of nationalism.

Laura Zdanski
Graduate Program: Technical Communication
Advisor: Huiling Ding
Poster Number: 187

Information Flow Modeling in Hurricane Risk Communication

Hurricane related risk is unique in extreme weather events since hurricane season occurs annually and storms approach with warning. This allows hurricane risk communication strategies to be prepared in advanced, but still requires adaptability for each unique storm. Using the framework for risk communication analysis criticism proposed by Grabill and Simmons, a literature review was conducted to determine the current objectives of hurricane and flood risk communication and model the flow of information from technical experts to the public. The literature review showed that while hurricane risk communication is conceptualized and treated as a linear information flow, it actually functions in a non-linear and networked manner. Many articles emphasize the need to experimentally assess the role of affect and narrative in risk communication as well as the usability of hurricane warning communications to account for the networked communication process. Research in this field is still at a stage where it cannot make concrete objectives in improving risk communication, but rather recommend a focus for ongoing studies. These descriptive studies assess past or current problems with risk communication instead of experimental studies to make prescriptive recommendations for improvement. For future quantitative analysis, studies with economic-centered focus such as discounting and willingness to pay for flood protection, evacuation infrastructure, or improved storm warnings may add to verbal analysis of risk communication and perception.

Olga Zielinska
Graduate Program: Psychology
Advisor: Christopher B. Mayhorn
Poster Number: 192

How Phish Evolve Over Time: Examining the Persuasion Principles Present in Phishing Emails Across a 5-year Span

Phishing is a social engineering technique that manipulates internet users into divulging sensitive information such as usernames, passwords, and social security numbers, among other things. Previous research has focused on personality and demographic characteristics that could make users more susceptible to phishing and training programs to equip users against phishing attacks; however, as phishing emails continue to infiltrate user inboxes, the focus should shift from the user to the email. Eight hundred eighty-seven phishing emails from Arizona State University, Brown University, and Cornell University were assessed by two reviewers using a coding scheme based on Cialdini's six principles of persuasion: scarcity, reciprocation, liking/similarity, commitment/consistency, social proof, and authority. A correlational analysis of email characteristics over time illustrated that the persuasion principles of commitment/consistency and scarcity have increased over time, while reciprocation and social proof have decreased over time. Authority and liking/similarity have revealed mixed results with certain characteristics increasing and others decreasing. Results from this study can inform user training of phishing emails and help cybersecurity software to become more effective.

College of Management

Seyyed Ali Zeytoon Nejad Moosavian and **Alexandra Naumenko**
Graduate Program: Economics
Advisor: Tamah Morant
Poster Number: 116

An Atlas of Economics: Teaching Tools for Navigating the "Big Picture"

The plurality and variety of concepts, variables, diagrams, and models involved in economics can be a source of confusion for many economics students. However, reviewing the existing literature on the importance of providing visual "big pictures" in the process of learning suggests that furnishing students with a visual "big picture" that illustrates the ways through which those numerous, diverse concepts are connected to each other could be an effective solution to clear up the mentioned mental chaos. As four practical examples, this poster introduces several visual "big pictures" that can be used as good resources in intermediate macroeconomics and advanced microeconomics classes. These four visual aids represent the "big pictures" of general equilibrium in the IS/LM/AS/AD model in macroeconomics, as well as the wheel of duality in consumer theory and wheel of relationships in production theory. In her book called "Teaching at its Best", Nilson (2010) states that "structure is so key to how people learn and has such far-reaching implications for teaching." She mentions "without structure there is no knowledge." She believes "information" is nowadays available everywhere; however, what it is not so available everywhere is organized bodies of "knowledge". In a sense, the present poster is an attempt to take the latter approach to the teaching of economics in order to teach economic "knowledge", as opposed to economic "information", so that students can readily grasp the logical order of the concepts and the underlying complex structure of the theoretical material being discussed in the aforementioned courses. There is enormous potential with visualization to improve the quality of teaching and learning in economics which has not yet been fully employed. This poster displays the visualizations of the various facets of economics we have come up with to contribute to this cause.

Fabio Gaetano Santeramo
Graduate Program: Economics
Advisor: Barry K. Goodwin
Poster Number: 145

Trade, Storage and Transaction Costs in Price Transmission Analysis

Arbitrage is "the possibility to make a profit in a financial market without risk and without net investment of capital" (Delbaen and Schachermayer, 2006). It implies that different prices for the same commodity converge to a single price (Law of One Price). Despite a solid theoretical foundation, empirical tests found several violations to the the Law of One Price. However, several scholars (Goodwin, 1990; Barrett, 2001, among others) have repeatedly warned on the importance to test for the validity of the LOP by integrating price analyses with information on trade flows, storage and transaction costs. Such warning has been largely underrated. I explore the importance of transaction costs, trade and storage in price transmission with a rich dataset of weekly data on grain commodities, from 2004 to 2014. Freight rates, trade flows and stock levels are included as well. The empirical analysis has been conducted through an exogenous threshold asymmetric vector error correction model. By interacting the error correction terms with trade and storage regimes I am able to infer on the role of the arbitrage forces. The results are relevant and promising. First, I clarify the relationships between prices deviations from the equilibrium and the presence of trade and net storage. Second, I show how the adjustments toward the equilibrium are affected by the direction of trade and the location of storage.

Understanding price transmission is key to conclude on the degree of market efficiency, the scale and the relevance of sectoral/national policies, and the impacts of price fluctuations at micro and macro level. Enriching our toolkit to study price transmission is therefore of primary importance for economists. Practical and policy implications are also discussed.

College of Natural Resources

Kaitlin Burroughs[1], Yu-Fai Leung[1], Roger Moore[1], Jeff Marion[2], Gary Blank[1]
Graduate Program: Natural Resources, North Carolina State University[1], Natural Resource Recreation, Virginia Tech[2]
Advisor: Yu-Fai Leung
Poster Number: 27

Assessing and Evaluating the Effectiveness of Human-Created Trail Drainage Features

Managers constantly face recreation trail degradation issues commonly caused by environmental factors related to water. Water impacts are addressed by constructing and maintaining trail drainage features (TDFs) and trail sustainability depends on how effective water runoff is controlled and diverted from trail surfaces by TDFs. This study aimed at developing and testing a multi-parameter tool for assessing the characteristics and effectiveness of TDFs in the field.

This study was part of a larger trail impact assessment project on the Appalachian National Scenic Trail (AT). Data reported in this presentation was collected from the northern one-third portion of the AT during the summer of 2015. Twenty-one segments at five kilometers each were chosen using a generalized random tessellation stratified (GRTS) sample design.

Every fifth TDF in each sampled segment was assessed, resulting in a sample size of 120 TDFs. The assessment tool contained five characteristic categories; TDF characteristics, sediment characteristics, trail characteristics, maintenance and effectiveness. The TDF characteristics measured included material type, feature length, and feature angle to tread. Sediment characteristics measured included trench extension, and material build-up while trail characteristic measurements included trail grade and canopy cover.

This presentation will illustrate this multi-parameter TDF assessment tool and present descriptive assessment results. Additionally, results from a regression analysis (using logical and ordinal) will be highlighted to provide a better understanding of the factors which were most significant in determining the overall effectiveness of TDFs.

Ana C. Castillo
Graduate Program: Forestry and Environmental Resources
Advisor: Barry Goldfarb
Poster Number: 31

Genetic Variation of Water-Use Efficiency in Longleaf Pine

Longleaf pine (Pinus palustris Mill.) was once the most common tree in the coastal plains of the Southeastern United States, but less than 3% of the original longleaf pine ecosystem area remains today. Extensive efforts to restore longleaf pine ecosystems in the U.S. Southeast were initiated due to its high biodiversity value and potential resilience to climate change-related disturbances. One strategy to maximize the resilience of this system is to grow trees that exhibit high growth and moderate water loss, i.e. high water-use efficiency (WUE).

Our study assesses genetic variation and control of WUE, and growth-WUE relationships in longleaf pine, which is a first step towards determining the potential for breeding for high WUE in this species. We measured δ13C – a commonly used proxy for WUE – from 108 resin- extracted longleaf pine cores representing nine genetic families. We explore relationships between δ13C, height, and D.B.H growth among genetic families and age periods 7-17, 18-30, 31-40 representing early, intermediate, and later growth. This research is the first to examine genetic variation and control of WUE in mature longleaf pine trees. The ability to select and breed for traits such as high WUE could increase success in restoration of longleaf pine in the future.

Alexander C. Fish
Graduate Program: Fisheries, Wildlife, and Conservation Biology
Advisors: Christopher E. Moorman, Christopher S. DePerno
Poster Number: 50

Juvenile songbird survival, habitat selection, and movement in the southeastern United States: a Bachman's sparrow case study

Many species of songbirds have exhibited long-term population declines, yet the specific vital rates driving the declines are largely unknown. Most demographic research has focused primarily on adult survival and nest survival, while ignoring juvenile survival. Juvenile survival is as important as nest success for population growth, and recent advances in micro-radio-transmitter (<0.5 g) technologies allow for description of survival, habitat selection, and movement of juvenile songbirds. Bachman's sparrows are a species of concern across their range and have exhibited long-term population declines of 3% per year, making them an ideal study species. Therefore, we attached radio transmitters to juvenile Bachman's sparrows immediately after leaving the nest to monitor survival, movement, and habitat selection during the post-fledgling period. Preliminary results indicated that juvenile survival is lower than for many other songbird species, but similar to other grassland birds. Juvenile movement was constrained to within the adult territory, and juveniles selected areas with greater vertical density of woody shrubs and greater cover of forbs and ferns. Our results highlight the importance of managing for patches with a mix of woody shrubs and herbaceous vegetation, which may influence juvenile survival. These habitat features must be available on small spatial scales within the territory.

Consuelo Fritz[1], Carlos Salas[1], Hasan Jameel[1], Orlando Rojas[1,2]
Graduate Programs: Forest Biomaterials, North Carolina State University[1]; Forest Products Technology and Centre of Excellence on "Molecular Engineering of Biosynthetic Hybrid Materials" (HYBER), Aalto University[2]
Advisors: Hasan Jameel, Orlando Rojas
Poster Number: 54

Synthetic and natural amphiphiles for enhanced lignocellulose bioconversion

Several biochemical platforms are proposed to convert lignocellulosic biomass into biofuels and other valuable materials. A better understanding of the interactions between the main components of lignocellulose and proteins is critical for the design of related process strategies. The minimization of the nonproductive binding between lignin and enzymes is critical in these efforts. Amphiphilic molecules are known to reduce this negative binding by affecting hydrophobic effects and also by bonding (H-bonds) with lignin. Nonionic surfactants have been proven to be most effective to improve enzymatic hydrolysis, whereas soybean proteins have been shown to irreversibly bind to lignin modifying its surface. We propose the use of nonionic surfactant and soy proteins as amphiphiles to enhance the enzymatic hydrolysis of lignocellulose. The main hypothesis is that they can block the lignin avoiding the unproductive enzyme binding. We monitored molecular-level events of cellulolytic enzymes in-situ and in real time onto lignin and cellulose thin films by using quartz crystal microgravimetry. Different lignin substrates relevant to the sugar platform in biorefinery efforts were considered. The results indicated a high affinity between the lignins with both, monocomponent and multicomponent enzymes. More importantly, the addition of nonionic surfactants at concentrations above their critical micelle concentration reduced remarkably (by over 90%) the nonproductive interaction. This effect was hypothesized to result from the balance of hydrophobic and hydrogen bonding interactions. Adsorption of nonionic surfactants onto cellulose nanofibrils did not affect its hydrolytic conversion. By taking advantages of these findings, unbleached pulp fibers were pretreated with soy proteins and nonionic surfactant. To this end, endoglucanase activity and hydrolysis rate were measured as key enzymatic contribution in cellulose bioconversion. Overall, our results highlight the benefit of soy proteins and nonionic surfactant pretreatments to reduce nonproductive enzyme binding while maintaining the reactivity of the cellulosic substrate and increasing sugar conversion.

Mirza Halim, Carla Barbieri
Graduate Program: Parks, Recreation, and Tourism Management
Advisor: Carla Barbieri
Poster Number: 65

Ushering NC Women in Agritourism toward Success: Challenges and Opportunities

In today's challenging economic landscape, farmers are compelled to develop innovative enterprises to supplement farm income. Agritourism, defined as the offering of recreational and educational activities to increase farm revenues, is a rapidly growing farm enterprise in NC. Evidence indicates that women are the primary contributors of agritourism development, yet they are profiled as less successful than men. However, it is still unknown whether women's reduced agritourism performance is the result of myopic economic assessments that do not account for gender differences in conceptualizing "success'', and thereby limits the efficacy of outreach efforts to improve their success. Therefore we undertook a study with the following objectives in relation to women in agritourism: understand their definition of success; identify the challenges they face; and recognize opportunities for overcoming those challenges. We used a combination of qualitative research methods (focus groups, nominal group exercise, interviews) among 20 women involved in agritourism across 16 counties in NC. We analyzed transcribed discussions using a thematic coding scheme. Findings reveal that besides general indicators of entrepreneurial success (e.g., contentment, peer-recognition), participants also felt successful because agritourism provided appreciative customers and ensured the perpetuation of their farms. We found that lacking reliable staff and institutional support, managing growth, constantly facing new challenges and having multiple tasks were major challenges agritourism women face. Participants identified that peer-partnering and the growing consumers' interest in local foods/farming and in agritourism as main opportunities for overcoming their challenges.

Importantly, although some women reported to be still discovering those opportunities, others had already expanded their offerings by capitalizing on them. In conclusion, our findings support incorporating economic and non-economic indicators in the assessment of and skill-building programs for agritourism women, which is critical given the increasing economic importance of agritourism in NC and the pivotal role of women in its development.

Ben Jeuck
Graduate Program: Forest Biomaterials
Advisors: Hasan Jameel, Orlando Rojas
Poster Number: 77

Sulfite pretreatment of post-enzymatic hydrolysis softwood residue to enhance saccharification and produce lignosulfonates

Many pretreatment methods have been designed to facilitate the biochemical conversion of softwood, with none satisfying minimum economical requirements to date. Sulfite treatment has shown to be more effective than other methods, as it solubilizes both hemicellulose and lignin, produces minimal inhibitors, and creates value-added lignosulfonates (Zhu et al. 2013). Studies have also shown that addition of lignosulfonates enhances enzymatic saccharification of cellulose in softwood material (Wang et al., 2013), however, sulfite pretreatment requires large doses of costly chemicals. This research proposes a way of incorporating sulfite treatment into a multi-step process that enhances sugar yields while reducing chemical loads, making the process more economical and environmentally sound.

Additionally, it proposes that the lignosulfonates produced can be used as surfactants to enhance enzymatic hydrolysis prior to being sold. Loblolly pine (Pinus taeda) was autohydrolyzed for 1 hour at 180°C, refined to pulp and subjected to 5 FPU of cellulases for 96 hours. The material was reduced to 55% original weight and >50% sugars were recovered. Post-enzymatic residues were sulfite pretreated at 20% charge at 150°C for 2.5, 4, and 8 hour retention times and subsequently subjected to a second enzymatic hydrolysis. Maximum sugar recovery peaked at ~68%, while lignosulfonate production maximized at 26%, based on raw material composition. Combined sugar and lignosulfonate yields require further economic analyses but may have industrial potential. Lignosulfonates hold a $300M worldwide market share (United Nations, 2012) that continues to grow with diversifying applications.

Gareth Jones
Graduate Program: Parks, Recreation, and Tourism Management
Advisor: Michael B. Edwards
Poster Number: 37

Collaborative advantages: The role of inter-organizational partnerships in enhancing the organizational capacity of youth sport nonprofit organizations

Due to the continued privatization of youth sports over the last thirty years, nonprofit organizations have become a key component of grassroots sport participation. Community sport clubs represent one of the largest sectors of nonprofit organizations in many Western countries, and are ideally positioned to enhance the mental, social, and physical health of youth and communities. However, many struggle to build and maintain organizational capacities amid increased competition and declining resources, which limits their effectiveness. Inter- organizational partnerships have been utilized by nonprofits in a variety of industries to increase organizational capacity, yet remain drastically underutilized by youth sport nonprofits. While previous research has focused on features of dyadic relations that influence partnerships, there has been less attention to broader networks. Thus, this study examined structural properties of a youth sport network to understand how inter-organizational partnerships were utilized to build organizational capacity. Interviews with key personnel were used to collect network data from each organization within a specified network, and secondary sources were utilized to collect attribute data related to organizational capacity. Whole network analysis was used to study partnerships between youth sport nonprofits, and ego-network analysis was used to examine cross-sector partnerships with other organizations. Results indicated that youth sport nonprofit organizations were characterized by a low level of cohesiveness, indicating a competitive rather than collaborative landscape. This fragmentation between youth sport nonprofits also created structural power imbalances that favored external organizations and resource providers.

Partnerships with external organizations were characterized by limited engagement and interaction, and consisted primarily of philanthropic financial ties. Given the limited capacity of most youth sport nonprofits, the addition of an independent third-party 'broker' could improve the efficiency of inter-organizational partnerships between youth sport nonprofit organizations. This collaborative structure would increase organizational capacities and allow youth sport nonprofits to maximize their position within communities.

Priscilla Morris
Graduate Program: Forest Biomaterials
Advisor: Sudipta Dasmohapatra
Poster Number: 110

Factors contributing to Business Success of Forest Products Industry in Coastal Communities Affected by Climate Change

Coastal businesses and industries in North Carolina are affected by gradual as well as extreme weather conditions due to climate change now more than they have ever been. This poster includes results from a case study on a small sample of business owners located in a highly vulnerable coastal region of North Carolina. Results from the case study includes business owner perceptions of the risks associated with climate change, economic viability of the region and the future viability of businesses in the region. After analyzing the responses of business owners in the community it was apparent that there is a gap in involvement of the forest industry in the community. This gap could potentially be closed through the utilization of ecosystem markets. The bridging of this this gap can be done by fostering better business relationships between the community and the forest industry. This can be done through providing the means to create and manage ecosystem service based businesses that can economically benefit the industry, community and potentially the entire region. Ecotourism based businesses provides local communities with motivation to maintain and protect forests and wildlife as well as return approximately 95% of total earnings into the local economy compared to the 20% the more traditional forms of tourism businesses return to the economy. In utilizing ecosystem markets, the industry and the community is provided an economically sustainable alternative market that potentially has the ability to thrive in the face of climate change impacts.

Robert H Narron, Qiang Han
Graduate Program: Forest Biomaterials
Advisors: Hasan Jameel, Sunkyu Park, Hou-min Chang
Poster Number: 115

Sustainable Lignocellulosic Biorefinery Process for Generating Valuable Products from Woody and Nonwoody Biomass

In order to sustain the demands of our growing population on a resource-limited planet, it is imperative to establish sustainability in how we generate the products we utilize and consume. Presently the majority of produced fuels, materials, and chemicals are derived from crude petroleum oil. Despite historic lows in the prices of oil, the intrinsic unsustainability of society's dependence upon it harkens for a change to a sustainable and carbon-neutral feedstock for supplying products that markets demand. The lignocellulosic biorefinery, which utilizes woody and nonwoody biomass for producing fuels, materials, and chemicals, is the logical evolution from the petroleum standard. Its proposal has created a significant paradigm shift in scientific research and spawned effort toward realizing this process at an industrial level. We present a low-cost and environmentally-friendly process for generating two useful and valuable streams from raw biomass: 1) low-cost fermentable carbohydrates, and 2) partially hydrolyzed lignins. First, raw incoming biomass is subject to hot deionized water pretreatment and high-intensity mechanical refining to enhance the upcoming enzymatic conversion of solid biomass. Finally, natural cellulolytic enzyme systems are applied to the pretreated solids to obtain a carbohydrate-rich aqueous hydrolysate. The sugars could then be fermented through a variety of pathways to high-value end products, such as lactic acid or succinic acid- precursors for bioplastic manufacturing. The residual solids after enzymatic hydrolysis are enriched with lignin due to high carbohydrate conversion. The partially-hydrolyzed and semi-pure lignin has vast potential for upgrading its value. Sophisticated characterization of several hardwood and nonwoody biorefinery lignins is presented with the purpose of aiding in the development of valorization processes for lignin that are robust to the protolignin of incoming biomass. The lignin valorization highlighted is substitution of petro-phenol with our biorefinery lignin as a reagent for plywood adhesive manufacturing.

Courtney Schultz[1], Sonja Wilhelm Stanis[2], Stephen Sayers[3], Ian Thomas[4]
Graduate Programs: Parks, Recreation, and Tourism Management, North Carolina State University[1]; Parks, Recreation and Tourism, University of Missouri[2]; Physical Therapy, University of Missouri[3]; PedNet Coalition[4]
Advisors: Jason Bocarro, Myron Floyd
Poster Number: 147

A Longitudinal Examination of Improved Pedestrian Access on Active Living Behaviors in an African American Neighborhood Park

Sedentary behavior and obesity are highest among underserved communities with predominantly low-income and minority populations (Day, 2006). Access to parks and safe active transportation routes promote physical activity, yet few studies have evaluated the influence of pedestrian infrastructure changes on park use and pedestrian behavior. In 2012- 2014, the installation of a signalized crosswalk and landscaped median linking low-income housing with a public park provided a natural experiment to examine the effect of environmental changes upon active living behaviors. This study aimed to evaluate how the installation of a signalized pedestrian crosswalk impacted park use, pedestrian behaviors and vehicular traffic within a low-income and predominantly African American community by gender and age. Data collection ran for a total of 21 observation shifts over the same two-week period in June 2012 (pre-crosswalk installation), June 2013 (post-crosswalk installation) and June 2014 (follow up). Park use behaviors were collected using a modified System for Observing Play and Recreation in Communities (SOPARC; McKenzie et al., 2006). Street crossing behaviors were collected using direct observation. Magnetic traffic detectors were also embedded in the streets during the data collection to capture traffic volume and speed. Across the three years, there were significant changes in both park use ($p=0.001$) and energy expenditure ($p<0.001$). In addition, both total traffic volume and instances of speeding significantly decreased. This study suggests that street crossing infrastructure improvements can help support lasting changes in active living behaviors. By demonstrating increased pedestrian safety and traffic calming longitudinally, this study adds support to the feasibility of advocacy efforts to promote transportation practices that favor safe pedestrian accessibility over vehicular traffic. Additionally, this study shows that increased safe access can positively impact park use.

College of Sciences

Zubair Azad
Graduate Program: Physics
Advisor: Robert Riehn
Poster Number: 9

Dynamics of Large DNA Loops

Long range interactions between genetically distant regions of DNA (>10 kbp) are not governed by the elastic energies of bending and twisting of DNA, but rather by entropic forces. Furthermore, such large scale interactions are mediated strongly by the excluded volume interactions of DNA and proteins of the cellular environment. It is not clear how these interactions locally couple to variables such as temperature, salt strength, pH, etc. in nanoconfined volumes where the monomer density of DNA is comparable to that in the cell nucleus. Using a nanofluidic device, we manipulate fluid flow to drive DNA into large loops, on the order of kilobasepairs, in a range of buffer concentrations and protein backgrounds. By analyzing the dynamics of the loop formation, steady state fluctuations, and deformation, we quantify an energy landscape. We can use this energy landscape to characterize activation barriers for proteins to form DNA loops. Once these activation barriers are overcome, we can test for enhancements in the loop elongation rate due to proteins. In addition, we can test for arrested states caused by proteins binding to specific sequences.

J. Lisa Babuin[1], David P. Genereux[1], Detlef R.U. Knappe[2]
Graduate Programs: Marine, Earth, and Atmospheric Sciences[1]; Civil, Construction, and Environmental Engineering[2]
Advisor: David P. Genereux
Poster Number: 10

Coupled groundwater and volatile organic compound fluxes through a coastal plain streambed, North Carolina

Volatile organic compound (VOC) flux from a contaminated aquifer to an adjacent stream is an understudied factor in the transport and fate of groundwater contaminants. VOCs are commonly found in US aquifers and many VOCs are potent carcinogens. This study aims to investigate the magnitude, and spatial and temporal variability, of VOC flux into Hominy Swamp Creek in Wilson, NC using numerous point measurements at the groundwater-stream interface, the streambed. The piezomanometer (a pushable piezometer coupled with an oil-water manometer) was used to measure the streambed vertical hydraulic head gradient (J) and sample groundwater in June 2015 and January 2016. Falling head tests with field permeameters measured the streambed vertical hydraulic conductivity (K) at the same places/times.

Groundwater flux was calculated as v = KJ and VOC flux as FVOC = v[VOC], where [VOC] is groundwater VOC concentration.

VOCs detected were, from highest FVOC to lowest: benzene, cis-1,2-dichloroethene, vinyl chloride, trichloroethene, 1,2-dichloroethane, dichloromethane, trans-1,2-dichloroethene, 1,2- dichloropropane, 1,1-dichloroethane, 1,3-butadiene, 1,1,2,2-tetrachloroethane, 1,1- dichloroethene, 1,2,3-trichloropropane, and tetrachloroethene. Interpolated, contoured maps of FVOC show that most VOC discharge occurred in discrete zones rather than broadly over the full streambed. The west side of the stream channel had a plume discharging primarily cis-1,2- dichloroethene while the east side had a plume primarily discharging benzene. The center of the west plume shifted roughly 24 m south (downstream) from June 2015 to January 2016, but the east plume did not shift. The average annual mass loss from aquifer to stream for benzene, cis- 1,2-dichloroethene, and vinyl chloride were about 2.5, 0.9, and 0.5 kg yr-1, respectively. Mass losses were higher in January 2016 than in June 2015, in part due to higher groundwater discharge in January. Understanding variation of VOC fluxes gives quantitative insight into the impact of multiple plumes discharging to a single urban stream over time.

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Graduate Program and Collaborators: Marine, Earth, and Atmospheric Sciences, North Carolina State University;[1] National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory[2]
Advisor: Viney P. Aneja
Poster Number: 13

Evaluating ammonia (NH3) predictions in the NOAA National Air Quality Forecast Capability (NAQFC) using ground-based and satellite-based measurements

Ammonia (NH3) gas in the atmosphere contributes to the formation of airborne fine particulate matter (PM2.5), which is linked to adverse health effects. Atmospheric NH3 also deposits into terrestrial and aquatic ecosystems, potentially contributing to eutrophication and impacts on species diversity. The National Oceanic and Atmospheric Administration (NOAA) is responsible for forecasting elevated levels of PM2.5 under the of National Air Quality Forecast System (NAQFS), and these forecasts require reliable estimates of precursor NH3 concentrations. The Community Multiscale Air Quality (CMAQ) model is used to simulate atmospheric emissions and transport and conversion of NH3 to PM2.5; however, emissions and transport processes for NH3 are subject to considerable uncertainty. The objective of the current research is to design a framework for using satellite-based measurements to improve CMAQ predictions of NH3.

Measurements of NH3 by the Tropospheric Emission Spectrometer (TES) on the Aura satellite were compiled for the continental U.S. over the entire operational period of the instrument (2004 through the present). These were compared with available ground-based measurements from the Ammonia Monitoring Network (AMoN) and other sources. Both of these data sets were used to evaluate CMAQ NH3 predictions for a one-month case study period – July 2011. For the TES comparisons, model predictions were compared with satellite retrievals of ground level concentrations, total column concentrations, and concentrations at the altitude of maximum satellite sensitivity. Model biases were computed, and regional patterns in bias were evaluated using cluster analysis.

Correlation between NH3 model predictions and measurements is poor, indicating that there is a need to improve CMAQ predictions. Model biases are subject to considerable spatial variation, with notable under-prediction in parts of the West and Midwest and over-prediction in the Southeast. Additional longer-term analysis is needed to determine if these patterns of bias are persistent, and to develop more accurate NH3 predictions.

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Poster Number: 97

Activity-based protein profiling of ammonia monooxygenase in Nitrosomonas europaea

The nitrifying bacterium Nitrosomonas europaea oxidizes ammonia (NH3) to nitrite (NO2) through the sequential activities of ammonia monooxygenase (AMO) and hydroxylamine oxidoreductase (HAO). 1,7-octadiyne (17OD) was evaluated as a mechanism-based inactivator of AMO and used as an activity-based protein profiling probe for AMO. Inactivation of NH4 -dependent O2 uptake by N. europaea was time and concentration dependent in the presence of 17OD, and there was no effect of 17OD on HAO activity. The effects of 17OD were irreversible, and de novo protein synthesis was required for the recovery of ammonia-oxidizing activity following exposure to 17OD. Cells exposed to 17OD were reacted with Alexafluor 647-azide using a copper-catalyzed azide- alkyne cycloaddition reaction and analyzed by SDS-PAGE and IR scanning. A fluorescent 28 kDa polypeptide consistent with the mass of AmoA was observed in cells exposed to 17OD, but not in cells that were pre-treated with either allylthiourea or acetylene before 17OD. The 28 kDa polypeptide was membrane-associated and aggregated when SDS-solubilized samples were heated in the presence of β-mercaptoethanol. The same fluorescent polypeptide was also observed in cells pre-treated with several other diynes, but not in cells that were pre-treated with the structural homologs of these diynes, which contained only a single ethynyl functional group. Proteomic analyses including in gel digestion and MALDI-TOF/TOF analysis of the fluorescent polypeptide and on-bead digestion of biotin/streptavidin purified proteins from 17OD-treated cells confirmed the target of 17OD was AmoA, the active-site-containing polypeptide of AMO.

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Advisor: Viney Aneja
Poster Number: 21

Evaluation of the impact of increased wildfires in California on ammonia concentrations using satellite and ground based measurements

This study will utilize satellite observations of ammonia and wildfires as well as ground level observations of ammonia and ammonium across much of the Continental United States (CONUS) over a five year period (2010-2014). Ground based ammonia concentrations will be obtained from the Ammonia Monitoring Network (AMoN), NASA's Fire Information for Resource Management System (FIRMS) will be utilized to obtain archived fire locations obtained from the Moderate Resolution Imaging Spectroradiometer (MODIS) sensor on NASA's Earth Observing System satellites (Terra and Aqua) and Tropospheric ammonia concentrations will be measured using the Tropospheric Emission Spectrometer (TES) on NASA's Aqua satellite. Both satellite and ground based measurements of ammonia will be analyzed over the period to determine trends in the concentrations both over each season and over the past 5 years. In addition to this, this data will also be compared with observed wildfires in order to speculate as to the impact that the wildfires had on ammonia concentrations. With the increase in wildfires plaguing the western US over the past decade, it is expected that ammonia concentrations will have increased over the past five years due to the additional emissions into the atmosphere.

Tyler Bridges
Graduate Program: Zoology
Advisor: Mary Schweitzer
Poster Number: 22

Actualistic Experimental Model for the Preservation of Skin in Extinct Archosaurs

Dinosaur skin in the fossil record has been known for over a hundred years but little work has been done in understanding how it fossilized. We propose a model for dinosaur skin preservation, based upon a series of actualistic experiments with varying skin types in different environments. Archosaur skin consists of both alpha-keratin and beta-keratin; the latter is more resistant to degradation. Mammal skin has only alpha-keratin. We predict, therefore, that archosaurian skin will persist longer than mammal skin. We designed actualistic experiments to test three hypotheses: First, that archosaur skin is more resistant to degradation than skin comprised only of alpha, represented by mammals. Second, that epidermal appendages (hair, feathers, and osteoderms) would affect preservation. Third, that environmental factors influence preservation by comparing samples in lake water to those in sterile water. In all cases, microbial growth was more rapid in lacustrine conditions. Within lacustrine conditions, microbial growth was slowest on alligator samples, and fastest on mammalian skin. Microbial type also differed, with mammalian skin showing confluent fungal growth, while in both archosaur samples, biofilm predominated. We show that after biofilm forms, archosaur skin shows epidermal separation from underlying dermis. Presence of osteoderms did not affect preservation over the course of this experiment. Avian feathered skin and non-feathered skin were altered. In all cases, skin in model lacustrine environments degraded more rapidly than in sterile water. We propose that these experimental data may elucidate patterns of degradation in archosaurian skin preserved in the Cretaceous rock record. The rapid dermal degradation contrasts with the relatively intact, keratin containing epidermis. This may result in the separation of the epidermis from skeletal elements in the fossil record. Our data suggests that feathers (beta keratin only) persist longer than skin, consistent with the observation that skin is rarely observed in dinosaurs with feathers.

Brice E. Coffer
Graduate Program: Marine, Earth, and Atmospheric Sciences
Advisor: Matthew D. Parker
Poster Number: 39

Observations and simulations of nontornadic and tornadic storms

Severe storms and tornadoes cause millions of dollars in damage each year across the United States. In the last two decades, considerable progress has been made regarding our understanding and forecasting of severe storms. However, the average lead time for tornadoes has plateaued at 15 minutes, and perhaps more concerning, three out of every four warnings are false alarms. Further progress will most likely require a more complete understanding of the tornadogenesis process, including how differences in the environment affect the in-storm processes that lead to tornadogenesis.

To address this gap in the knowledge base, numerous near-storm observations were collected in order to further understand the relationship between the environments and tornadoes. To identify reoccurring differences between nontornadic and tornadic storm environments, composite environments from 134 weather balloon launches were generated. The most interesting differences between nontornadic and tornadic storms were in the wind profile within the lowest few hundred meters of the atmosphere.

From these composite environments, we have simulated high-resolution non-tornadic and tornadic storms. The simulated storm in the tornadic environment produces an intense, long- lived tornado within the simulated storm; the non-tornadic environment does not. This is due to a much stronger low-level updraft in the tornadic storm, which leads to more stretching at the surface. The stronger updraft in the tornadic storm is directly attributable to the more favorable low-level winds.

Since these low-level winds seem to be really important to the tornado genesis process, it is interesting to ask whether our best-available observational dataset can reproduce the subtle differences between the environments of nontornadic and tornadic storms. In general, the winds near the surface were misrepresented in the normal observational network. This suggests that more regularly obtained observations could be beneficial to forecasters in order to lower the tornado warning false alarm rate and increase lead time.

Jennifer Greenstein
Graduate Program: Microbiology
Advisor: Paul Hamilton
Poster Number: 63

Cell-Surface Immobilized Enzyme for Biodiesel Production

Lipase is a type of biological enzyme catalyst that processes triglycerides, fats, and oils. Lipases derived from microorganisms have demonstrated that they can convert Free Fatty Acids and methanol to biodiesel and glycerol, without washing steps and waste. To make enzymes more efficient in catalyzing reactions, they are commonly immobilized onto microparticles. A novel immobilization system is investigated to increase enzymatic activity, bypass several steps of typical enzyme production, and allow the enzyme to be easily recaptured and reused for sequential batches of biodiesel production. This research characterizes Geobacillus lipases and develops a novel cell-surface display expression system. First, the lipase from thermophilic bacteria Geobacillus kaustophilus HTA426 was cloned and expressed in E. coli. The lipase activity was assessed to provide a baseline for comparison to the enzyme anchored on the cell surface. The lipase genetic sequence was amplified from the Geobacillus DNA and inserted into cloning and expression vectors. The lipase was expressed in Arctic Express E. coli from vector pET-28b, and the enzyme was characterized for feedstock range, methanol tolerance, and activity across pH 4-10 and temperature 35-95°C. To investigate the cell-surface expression system using two different protein models, first a PBD-GFP fusion was constructed in an E. coli- Geobacillus shuttle vector, and GFP was visualized in E. coli. Geobacillus thermoglucosidasius was transformed with this construct to achieve immobilized protein. Next, lipase is incorporated in the construct fused to PBD and expressed on Geobacillus. When expressed from E. coli, the lipase revealed broad substrate specificity of C4-C15 fatty acids and tolerance of up to 10% methanol. The lipase optimal conditions are temperature of 75°C and pH 7, but the lipase maintains activity from 35-75°C and pH 5-9. GFP was expressed from the shuttle vector, and the resulting transformants glowed under UV light.

Zhen Han, Alyson Wilson
Graduate Program: Statistics
Advisor: Alyson Wilson
Poster Number: 66

Dynamic Stacked Generalization for Node Classification on Networks

We propose a novel stacked generalization (stacking) method as a dynamic ensemble technique using a pool of heterogeneous classifiers for node label classification on networks. The proposed method assigns component models a set of functional coefficients, which can vary smoothly with certain topological features of a node. Compared to the traditional stacking model, the proposed method can dynamically adjust the weights of individual models as we move across the graph and provide a more versatile and significantly more accurate stacking model for label prediction on a network. We demonstrate the benefits of the proposed model using both a simulation study and real data analysis.

Joey Hart
Graduate Program: Applied Mathematics
Advisor: Pierre Gremaud
Poster Number: 69

Computing Sobol' indices for stochastic processes

One aim of sensitivity analysis is to infer the sensitivity of a model to uncertainty in its parameters. This problem has been studied extensively for deterministic models. However, stochastic models are replacing deterministic models in many applications; biological systems and chemical reaction networks are two examples. Generalizing the existing methods of sensitivity analysis to stochastic models creates numerous challenges both theoretically and computationally. In this work, we provide a mathematical framework to address the theoretical challenges as well as analyze the computational challenges and give an efficient method for performing sensitivity analysis on stochastic models.

To define the sensitivity of a stochastic model to uncertainty in its parameters, the intrinsic randomness and parameter uncertainty must be decomposed appropriately. We do so by considering the sensitivity of the parameters as random variables. The dependence of the parameter sensitivity upon the intrinsic randomness is easily identified. The distributions of these sensitivity indices provide valuable information needed for sensitivity analysis.

There are various ways to define a sensitivity index for a deterministic model.

One common way is the Sobol' indices. Unfortunately, the additional complexity of intrinsic randomness makes the direct computation of Sobol' indices infeasible in most applications. To combat this, we propose the use of surrogate models. Numerical results indicate that computing Sobol' indices from surrogate models can be done efficiently.

Numerical results are reported confirming the efficiency of the proposed method on a synthetic test problem. Further, we consider an application of our method to the Genetic Oscillator, a chemical reaction network. We report results for the sensitivity of this system to its uncertain reaction rates.

In conclusion, this work provides both theoretical and computational answers to difficult questions about stochastic models. We provide a first step toward a general framework that allows efficient and effective sensitivity analysis for stochastic models.

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Graduate Programs: Chemistry, North Carolina State University[1]; Statistics, North Carolina State University[2]; Gynecologic Surgery, Mayo Clinic[3]
Advisor: David C. Muddiman
Poster Number: 71

From Humans to Hens, Quantifying the Potential of *N*-Linked Glycans as Ovarian Cancer Biomarkers

Discovery of a predictive and diagnostic biomarker is the key to treating ovarian cancer, where~85% of cases are caught in the late stage and carry approximately a 10% 5-year survival rate. In the following studies, we focused on developing high resolving power mass spectrometry technologies for the analysis of N-linked glycans, a co- and post-translational modification of proteins that is critical to cellular functions. In the first biological application of the Individuality Normalization when Labeling with Glycan Hydrazide Tags (INLIGHT) strategy, higher order modeling was used to detect plasma glycans significantly regulated by ovarian cancer tumors in a matched human case-control study. Eleven N-glycans were determined to be statistically significant, of which four compositions demonstrated novel associations with cancer. The sensitivity afforded by the INLIGHT strategy, detecting changes in the relative glycan cancer burden as low as 17%, revealed that glycans were regulated in an alternating fashion. As cancer stage progressed, the magnitude and vector of the abundances of the significant glycans were sequentially reversed, suggesting changes in the body's biochemical response to the cancer antagonist. Further investigation into the significance and predictive ability of N-glycans was carried out in the spontaneous avian model of ovarian cancer. Animal models are particularly advantageous because they can be carried out at the large-scale, adding power to the study, and they control for variables such as environmental effects and genetics, reducing heterogeneity. To make the study feasible, the methodology for INLIGHT was evolved and validated for high- throughput applications, from a solid phase extraction to a filter platform. In the first stage of the cross-panel ovarian cancer study, a subset of control hens were selected to better characterize the hen model. Within these baseline birds, measurements were taken to calculate the INLIGHT analytical variability, the longitudinal intra-variability, and the across-hen inter-variability.

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Graduate Program: Toxicology
Advisor: Gerald A. LeBlanc
Poster Number: 73

Transactivation of the PPAR Gamma Signaling Pathway by Insect Growth Regulating Insecticides with Commensurate Increases in Adipocyte Differentiation

Metabolic syndrome (i.e., obesity, diabetes, etc.) is endemic in some human populations. The involvement of environmental chemicals in this condition remains speculative. Insect growth regulating insecticides (IGRs) are used in a variety of indoor and outdoor applications including pest control on household pets. These compounds are considered to be relatively non-toxic to mammals; however, the potential for prolonged exposure to pets and their owners is significant. We evaluated the ability of the IGRs, pyriproxyfen and fenoxycarb, to interact with the peroxisome proliferator-activated receptor (PPAR) signaling network which contributes to the regulation of lipid and glucose metabolism and whose perturbation could contribute to the etiology of metabolic syndrome. Luciferase-based reporter assays were used to evaluate the ability of these IGRs to activate the human PPARα:RXRα and the PPARγ:RXRα receptor complexes. Pyriproxyfen and fenoxycarb had no activity towards the PPARα:RXR α receptor complex, but activated the PPARγ:RXRα receptor complex. Analyses of the individual receptor subunits revealed that pyriproxyfen activated only the PPARγ subunit, therefore activation of the PPARγ:RXRα receptor complex was solely due to interaction with PPARγ. Fenoxycarb activated both the PPARγ and the RXRα receptor subunits. Assays using fenoxycarb along with the RXRα:RXRα inhibitor, LG100754, confirmed that fenoxycarb activated PPARγ:RXRα heterodimers in our gal4 reporter systems over the RXRα:RXRα homodimer activation.

PPARγ:RXRα activation typically results in differentiation of pre-adipocytes into adipocytes and lipid accumulation within the differentiated adipocytes. Therefore, the ability of the IGRs to stimulate differentiation and lipid accumulation in mouse 3T3-L1 pre-adipocytes was evaluated. Pyriproxyfen and fenoxycarb stimulated differentiation and significantly elevated lipid accumulation within these cells. In conclusion, pyriproxyfen and fenoxycarb selectively activated the PPARγ signaling pathway. These IGRs increase lipid accumulation in vitro and such effects warrant evaluation of these compounds for obesogenicity in vivo at relevant exposure concentrations.

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Advisor: Harald Ade
Poster Number: 78

High FF ternary blend solar cells achieved by manipulating sensitizer domains with less recombination

Organic solar cells (OPV) based on bulk heterojunction (BHJ) configuration recently receive extensive attention due to the rapid improvement of power convention efficiency (PCE).

However, the intrinsically narrow absorption range of donor and acceptor materials renders full coverage of sunlight spectrum a challenge, which limits the maximum PCE. Ternary blends provide a promising strategy, in which a third component is incorporated into the host blends as a sensitizer with complementary absorption range. In our study, by incorporating Si-PCPDTBT as the sensitizer into the host blend PTB7:PCBM71, the PCE of resultant ternary blend displays a 15% improvement, mainly due to the enhanced FF (FF=77%, highest FF in ternary system). The origin of this enhancement was systematically investigated from morphology and photophysics by changing the incorporation amount of Si-PCPDTBT. The enhancement brought by the incorporation of Si-PCPDTBT is attributed to two aspects: firstly, the incorporation of Si- PCPDTBT in the optimum ternary blend does not disturb the originally optimized morphology of host blend. Secondly, the Si-PCPDTBT forms relatively high purity domains, which induces lesser recombination for hole transport. Conventionally, sensitizer was considered to transfer holes to donor material and electrons to acceptor material by forming an energy cascade landscape with the host donor and acceptor materials. Here, Si-PCPDTBT does not form energy cascade with PTB7 and PCBM71. Instead, Si-PCPDTBT withdraws holes from PTB7 and assists transporting holes to electrode. This is consistent with higher hole mobility at the corresponding ternary blend. The “highway” domain formed by the sensitizer for hole transport is counter-intuitive to the conventional understanding of the design principle of ternary blends and can provide guidelines for further ternary blend development.

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Advisor: Gavin J. Williams
Poster Number: 83

Engineering Polyketide Biosynthesis Using Genetically-Encoded Biosensors and Bioreactor-Scale Production Design

Erythromycin A and its derivatives are among the most important antibiotics of the last fifty years. Effective semi-synthetic analoging of erythromycin A has led to improvements of the original polyketide scaffold including increased potency, reduced side effects, and extended half-life. Despite these outstanding successes, derivatization of erythromycin by organic synthesis has been limited to a few reactive portions. Engineering the enzymatic biosynthesis of erythromycin A to generate analogs is an attractive route to diversify the polyketide core and associated post- polyketide synthase modifications. Yet, high-throughput detection of erythromycin analogs remains a challenge and this limits the number of pathway or enzyme variants that can be screened for improvements. A major focus of this work is to develop a genetically-encoded repressor protein biosensor platform capable of screening millions of cells a day for the production of potentially valuable erythromycin analogs. Flow cytometry combined with microtiter-based screening using a fluorescent protein reporter has been used to overcome key challenges in the development of optimized biosensors. We have used directed evolution to engineer the properties of a repressor protein for increased sensitivity, discrimination between semi-synthetic analogs, and specificity for various erythromycin biosynthetic intermediates. Another focus of our work is to transition culturing from shake-flask to bioreactor scale production of the erythromycin intermediate, 6-deoxyerythronolide B (6dEB). 6dEB is an attractive molecule for the biosynthetic or chemical diversification of a polyketide natural product. Tailored biosensors for specific macrolide antibiotics and optimized bioreactor production will facilitate metabolic engineering and synthetic biology approaches for the optimized biosynthesis of erythromycin A and designed analogs of this important pharmaceutical compound.

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Advisors: Wenbin Lu, Jung-Ying Tzeng
Poster Number: 100

Rare Variant Prioritization Using Structure-Supervised Kernel Association Tests

Rare variants are of increasing interest in genetic association studies, largely due to their part in explaining common complex diseases. However, rare variants are difficult to detect individually since they are uncommon and often have weak effects. Traditional aggregation analyses improve signal compared to single variant tests but suffer from loss of power from incorporating noise variants and are not able to pinpoint causal variants within a variant set. One way to overcome these issues is to incorporate additional information, e.g. on structure or predicted function. We propose a rare variant association test which utilizes protein tertiary structure to increase signal and identify likely causal variants. Following the biological hypothesis that important variants are likely to cluster together in 3D protein space, we perform structure-guided collapsing, leading to variant-level tests which borrow information from neighboring variants on a protein. We use a kernel machine framework along with resampling to obtain variant-level significance, and show that our method performs at least as well as single variant level tests in the absence of clustered causal variants.

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Poster Number: 103

Behavior Matters: A Bio-Physical Model for the Dispersal of Deep-Sea Methane Seep Larvae

Improved larval dispersal transport modeling techniques can enhance the accuracy of population connectivity of invertebrates among deep-sea methane seep sites. Ocean circulation dynamics and population connectivity of invertebrates in the deep sea are active areas of research; however, they are often limited by a dearth of observations and empirical data on larval distributions in the water column, larval behavior, and locations of spawning. Our objectives are (1) to determine the biological and physical drivers of larval particle dispersal potential, and to (2) assess the effect of behavior and pelagic larval duration (PLD) on dispersal potential. Here, we present the results of a coupled bio-physical model used to assess dispersal potential of the mussel, “Bathymodiolus” childressi, the tubeworm, Lamellibrachia luymesi, the snail, Bathynerita naticoidea, and the shrimp, Alvinocaris muricola among five methane seep sites throughout the Gulf of Mexico and Atlantic Ocean. Larval particles were programmed with species-specific PLDs and behaviors that best matched empirical data. Particles were then released into the flow field provided by the model domain that accurately characterizes climatological conditions at ~7-kilometer horizontal resolution. Larval particles with behavior were then compared to particles advected only by the ambient currents to evaluate the influence of larval behavior on overall dispersal patterns. Results show that larval behavior has a significant impact on larval dispersal potential and potential connectivity among sites of varying depths and locations. This integrative approach of hydrodynamic modeling and simulated behavior advances our understanding of the factors regulating dispersal throughout the ocean, and the combined effects of oceanographic conditions and larval behavior on potential connectivity of four methane seep species in the Gulf of Mexico and Atlantic Ocean.

Samantha Meiser
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Advisor: Gavin J. Williams
Poster Number: 104

Harnessing promiscuous enzymes for polyketide diversification

Polyketides are a class of diverse natural products that have significant and potent biological activity, including antibiotic, antitumor, and immunosuppressant properties. These complex natural products are biosynthesized by the condensation of small molecule building blocks, catalyzed by giant mega-enzyme assembly lines called polyketide synthases (PKSs). The enzyme activities of PKSs are often organized into modules, whereby each module is responsible for the selection and installation of each building block into the growing polyketide chain. This modular architecture makes PKSs intriguing engineering candidates for the biosynthesis of “non-natural” natural products. One strategy for polyketide diversification involves using trans-acting acyltransferases (trans-ATs) to select and introduce non- natural building blocks without disrupting the overall PKS architecture. However, application of this technique is limited due to the narrow substrate specificity of trans-ATs. We describe the previously unknown substrate promiscuity of a trans-AT and discuss strategies that leverage such promiscuity for the production of polyketide analogues.

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Advisor: Robert C Smart
Poster Number: 105

Deletion of C/EBPβ in Oncogenic Ras Tumors Results in Tumor Regression

Ras is a small membrane bound GTPase which acts as a molecular switch and mediates extracellular signal transduction. Ras is mutated in 30% of all human cancer where it is permanently “switched on”. Our lab was the first to show that the bZIP transcription factor CCAAT/enhancer-binding protein beta (C/EBPβ) can be activated downstream of oncogenic Ras as well as C/EBPβ being required for oncogenic Ras-mediated skin tumor development. To determine if C/EBPβ is required for oncogenic Ras driven tumor survival we generated mice in which C/EBPβ could be deleted in preexisting skin tumors. Deletion of C/EBPβ in Ras driven skin tumors resulted in rapid tumor regression. Tumor volume was reduced by 95% and tumor multiplicity was reduced by 80%, 8 weeks after C/EBPβ deletion. Regressing tumors displayed elevated levels of apoptosis and increased p53 staining in the epithelial compartment where C/EBPβ had been deleted. The transcription factor p53 is a potent tumor suppressor which can be activated downstream of both oncogenic signaling and DNA damage. p53 is a master regulator of cell cycle arrest, senescence and apoptosis. To determine if p53 is required for tumor regression following deletion of C/EBPβ we generated mice in which both C/EBPβ and p53 could be simultaneously deleted in skin tumors. Deletion of p53 in addition to C/EBPβ prevented the tumor regression demonstrating that p53 is required for the observed regression. Our findings demonstrate that C/EBPβ can repress the levels and activity of p53 in oncogenic Ras driven skin tumors and that deletion of C/EBPβ stimulates the anti-tumor activity of p53 resulting in apoptosis and rapid tumor regression. These results suggest C/EBPβ could be a molecular target for cancer therapy involving oncogenic Ras.

Yasamin Moazami
Graduate Program: Chemistry
Advisor: Joshua G. Pierce
Poster Number: 107

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

For many years the diverse molecular architectures of natural products have been a major source of inspiration for both novel reaction development and therapeutic lead molecules. The marine environment has become one of the most prolific sources of chemical and biological diversity. One such example is the recently isolated apoptosis- inducing pentacyclic guanidinium alkaloid, monanchocidin A, isolated from a Far Eastern marine sponge. The intricacy and novelty observed in the structure of the pentacyclic guanidinium alkaloids, coupled with the wide range of biological activities exhibited by these molecules, have attracted significant attention from the scientific community.

We are developing an approach to the pentacyclic guanidinium core of the monanchocidins that relies on the utilization of a disubstituted trans β-lactam building block in order to overcome the stereochemical challenges associated with the previous syntheses of this class of natural products. Our synthetic approach combines asymmetric synthesis with biomimetic cascades to provide greatly increased efficiency and selectivity. Furthermore, our approach should allow for pinpoint modification of the molecules’ complex functionality to further optimize its potent biological activity, uncover its mechanism of action and potentially develop simplified lead molecules for chemical probe development. To date, we have successfully prepared the desired β-lactam scaffold and efforts are underway to explore the reminder of the synthetic sequence to the core. Additionally, we are working towards the synthesis of simplified analogues and other less complex pentacyclic guanidine scaffolds in this class of natural products to begin addressing long-standing questions regarding their mechanism of biological activity.

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Advisor: Trudy Mackay
Poster Number: 109

Effect of Sample Size and Genetic Architecture on the Accuracy of Genomic Prediction of Complex Traits in Drosophila melanogaster

Understanding the genetic architecture of complex traits is a fundamental aim of many branches of genetics. To date, genome wide association studies (GWAS) have been successful at identifying some loci affecting complex traits. However, those loci account for just a very small proportion of the total genetic variation, a phenomenon called “missing heritability”. This is mainly due to small sample size of most studies, which allows only large effect variants to be detected. In addition, the multiple testing correction needed when performing many statistical tests is huge in the case of GWAS and the threshold to declare significance is very low. It has been shown that methods that regress phenotypes on hundreds of thousands of markers concurrently may be able to capture a consistent amount of the genetic variation of quantitative traits and increase the predictive ability. However, most of those methods assume strict additivity and traits shown to be dominated by non-additive (epistatic) interactions have not shown any gain in predictive ability. Here, we investigate the effect of sample size and genetic architecture on the accuracy of genomic prediction of complex traits. In order to do that, we made use of state-of-the-art statistical methods and the unique resource of the Drosophila Genetic Reference Panel (DGRP), a collection of 205 fully sequenced inbred lines, as well as simulated data. The results show that the accuracy of prediction increases as the sample size increases, provided that the genetic architecture of traits is taken into account in the statistical model used.

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Advisor: Subhashis Ghoshal
Poster Number: 120

Bayesian method for causal inference in high dimensional time series with applications to sales data

We propose a novel Bayesian method for detecting causal impact in high-dimensional time- series. A Bayesian structural time-series model with spatially correlated variables are considered. A variable selection mechanism is considered within the proposed method to introduce sparsity in the model and G-Wishart prior is used on the precision matrix to give a graphical structure in the model. We adopt the stochastic search variable selection method for posterior computation and measure the causal effect by comparing the posterior distribution of the trend given the entire data and that given a part of data without observations possible affected by the causal impact. The method is shown to give useful results in simulation studies. Further the method is applied on a data set on sales to determine the effect of an advertising campaign.

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Advisor: Paul Huffman
Poster Number: 137

Generalized Bistability in Origami Cylinders

Origami folded cylinders (origami bellows) have found increasingly sophisticated applications in space flight, medicine, and even experimental nuclear physics. In spite of this interest, a general understanding of the dynamics of an origami folded cylinder has been elusive. By solving the fully constrained behavior of a periodic fundamental origami cell defined by unit vectors, we have found an analytic solution for all possible rigid-face states accessible from a cylindrical Miura-ori pattern. Although an idealized bellows has two rigid-face configurations over a well-defined region, a physical device, limited by nonzero material thickness and forced to balance hinge with plate-bending energy, often cannot stably maintain a stowed configuration. We have identified and measured the parameters that control this emergent bistability, and have demonstrated the ability to fabricate bellows with tunable deployability.

Dan Scofield
Graduate Program: Mathematics
Advisor: Radmila Sazdanovic
Poster Number: 149

Computing torsion in Khovanov link homology from graphs

Knot theory is a growing field of mathematics with applications in quantum physics, DNA replication, and fluid dynamics. A multitude of mathematical tools, known as knot invariants, have been developed in the attempt to distinguish knots and links. These include recently-discovered invariants such as Khovanov homology (2000), which upgrades the Jones polynomial (1984). Some important aspects of Khovanov homology, including the occurrence of torsion, are not fully understood. We present work in progress on computing torsion of Khovanov homology via a related homology theory for graphs.

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Advisor: C. Fröhlich
Poster Number: 144

Nucleosynthesis in CoreCollapse Supernovae

The aim of nuclear astrophysics is to understand the origin of the elements. Contemporary nucleosynthesis theory associates the production of certain elements with specific astrophysical sites, the most significant of which are stars and supernovae. Massive stars can end their lives in energetic explosions called corecollapse supernovae. They play a vital role in the synthesis and dissemination of many heavy elements in the universe. However, despite many decades of theoretical and numerical modeling, the detailed explosion mechanism of corecollapse supernovae is not yet fully understood. In the past, corecollapse supernova nucleosynthesis calculations have relied on artificial explosion methods that do not adequately capture the physics of the innermost layers of the star. Here, we use the PUSH method, calibrated against SN1987A, to trigger parametrized explosions. This method utilizes the energy of heavyflavor neutrinos emitted by the protoneutron star (PNS). As a result, we can follow the consistent evolution of the PNS and ensure a more accurate treatment of the electron fraction of the ejecta, both of which are critical for nucleosynthesis calculations. Being robust and computationally affordable, this method is an ideal tool for performing extended progenitor studies. Here, nucleosynthesis results for corecollapse supernovae, exploded with PUSH, will be presented for a wide range of progenitor masses. Multiple interesting trends of ejected alpha elements with respect to progenitor compactness, explosion energies and neutronstar remnant masses are found. Comparisons of the calculated yields to observational metalpoor star data will also be presented. These complete nucleosynthesis yield predictions will be immensely useful as an input to galactic chemical evolution models.

Andrea Vogel, Lisa McGraw
Graduate Program: Genetics, Biological Sciences; W.M. Keck Center for Behavioral Biology
Advisor: Lisa McGraw
Poster Number: 172

Behavior and Heritability Correlates in Prairie Voles (Microtus ochrogaster)

Prairie voles (Microtus ochrogaster) are among the rare mammal species that have monogamous relationships. In natural environments, however, not all male prairie voles will form pair bonds. Approximately 33% of males will become “wanderers”, who do not have territories and do not have a pair-bonded mate. Pair-bonding is hypothesized to create behavioral changes in the animals, making some behaviors more or less prevalent after pair-bonding occurs. The behaviors of interest are anxiety, alloparental care, and aggression against same-sex intruders. Combining the ideas of behavioral changes due to pair-bonding and that not all males will pair-bond, I examine these three behaviors hypothesized to change after pair-bonding occurs, using a large sample size that captures the full range of pair-bonding interactions. Additionally, to determine the degree of heritability of these behaviors, I use pedigree data of each experimental animal, going back to the founding members of the colony, to estimate heritability.

AtLee T. D. Watson
Graduate Program: Toxicology
Advisor: Seth W. Kullman
Poster Number: 176

TCDD Dysregulates Osteoblast Differentiation in Human Bone-Derived Mesenchymal Cells, And In Japanese Medaka In Vivo

Bone and cartilage development have been identified as potentially sensitive targets for TCDD and other aryl hydrocarbon receptor ligands. In this study, we assess how TCDD impacts osteogenesis in the teleost fish Japanese medaka (Oryzias latipes) and in a multipotent progenitor human bone-derived mesenchymal stem cell (hBMSC) in vitro model. Following embryonic exposure to TCDD, confocal imaging of transgenic medaka larvae (twist1:EGFP, osx:mCherry, col10a1:nlGFP) reveals a significant attenuation of mineralization within vertebral structures, as well as alterations in number and localization of transgene-labeled osteoblast and osteoblast progenitor cells. At the transcriptional level, expression of the osteogenic regulators, osx and runx2, and terminal markers of osteoblast differentiation, opn and bglap, were significantly diminished suggesting that TCDD impacts bone formation in vivo through inhibition of key regulators governing osteoblast differentiation. To assess concordance between teleosts and human cells in vitro, hBMSCs were dosed with TCDD for 14 days to determine whether TCDD dysregulates early differentiation of hBMSCs into osteoblasts. At early-intermediate stages of hMBSC differentiation, treatment with 10 nM TCDD resulted in a significant reduction in osx and spp1 expression. This effect was maintained throughout the experiment with diminished expression of osx and spp1 during the apical matrix mineralization stage. The preliminary results presented herein indicates that TCDD additionally dysregulate commitment of mesenchymal cells to an osteogenic lineage. Current work is underway to dissect the precise mechanisms whereby TCDD impacts transcriptional regulation of bone formation. These findings demonstrate that TCDD and other AhR ligands present in the environment may significantly impact human bone development, and further emphasize the use of small fish as translational models to investigate xenobiotic-induced alterations in skeletogenesis.

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Graduate Programs: Chemistry[1]; Biology[2]
Advisor: Leslie A. Sombers
Poster Number: 181

Real-Time Striatal Measurements of Oxidative Stress and Dopamine in the Dyskinetic Rat During Chronic L-DOPA Treatment for Parkinson's Disease

Parkinson's disease (PD) is a chronic neurodegenerative disorder characterized by the preferential loss of dopaminergic neurons stemming from the substantia nigra pars compacta and innervating the dorsal striatum. The substantial decreases in striatal dopamine (DA) result in devastating hypokinetic movements and motor disturbances. Increased generation of reactive oxygen species, such as hydrogen peroxide (H2O2), is also thought to contribute to Parkinsonian symptoms. However, the precise role of H2O2 in the initiation, progression, and maintenance of the disease remains unclear, as reactive oxygen species are difficult to monitor in brain tissue. Further, several lines of evidence suggest that the standard treatment strategy of dopaminergic replacement therapy via administration of Levodopa (L-DOPA; L-3,4 dihydroxyphenylalanine) may serve to increase oxidative stress and potentiate cell death. We aim to investigate how striatal H2O2 and DA dynamics underlie behavioral changes that result from chronic L-DOPA administration in a rodent model of PD (unilateral 6-OHDA lesion) using fast-scan cyclic voltammetry, an electrochemical technique that affords precise spatial and temporal resolution, as well as selective detection of these neurochemicals. Specifically, carbon- fiber microelectrodes are used to simultaneously quantify rapid H2O2 and DA fluctuations at single recording sites in the dorsal striatum over several weeks of L-DOPA administration. The chemical fluctuations are correlated with behavioral abnormalities that develop over the course of treatment. These studies will aid in our understanding of how oxidative stress modulates nigrostriatal DA signaling, and will demonstrate how these signals correspond with the development of dyskinetic movements in the treatment of PD.

Yan Zhang
Graduate Program: Statistics
Advisor: Howard D. Bondell, Brian J. Reich
Poster Number: 153

High Dimensional Linear Regression via the R2-D2 Shrinkage Prior

We propose a new class of R-square induced Dirichlet Decomposition prior that we term the "R2-D2" prior in this paper. The prior is induced by a Beta prior on the coefficient of determination, and then the total prior variance of the regression coefficients is decomposed through a Dirichlet prior. We demonstrate both theoreti- cally and empirically the advantages of the R2-D2 prior, over a number of common shrinkage priors, including the Horseshoe, Horseshoe+, and Dirichlet-Laplace priors. The R2-D2 prior possesses the fastest concentration rate around zero and heaviest tails among the common shrinkage priors, which is established based on its marginal density, a class of Meijer G-function. We demonstrate that the proposed R2-D2 es- timator guarantees the Bayes estimator converge to the truth at a Kullback-Leibler super-efficiency rate, attaining a sharper information theoretic bound than existing common shrinkage priors. The R2-D2 prior enjoys computational tractability with straightforward Gibbs samplers. Posterior consistency of the R2-D2 prior is also given. The proposed prior is further investigated in a gene expression application.

College of Textiles

Ruth D. Adikorley
Graduate Program: Textile Technology Management
Advisors: Kristin Thoney-Barletta, Jeff Joines, Lori Rothenberg
Poster Number: 2

Sub-Saharan Africa's Competitiveness in the U.S. Apparel Market

Apparel production (i.e., cut and sew) is a labor-intensive process with relatively low startup costs. Therefore, apparel production is often outsourced to developing countries due to relatively low wages and an ample labor force. The U.S sources a majority of its apparel from regions like Asia, Latin America, and the Caribbean. However, one developing region from which the U.S currently imports little apparel is Sub-Saharan Africa (SSA). This study explores the competitiveness of apparel production in SSA countries and examines the potential rewards and perceived risks of apparel sourcing in SSA. A mixed methods approach was used to answer the research questions. The cost of manufacturing apparel in selected SSA countries was calculated and compared to countries in other regions from which the U.S. imports most of its apparel. The textile and apparel manufacturing supply chain was analyzed using factors such as labor wages, energy, water, transportation costs, and import duty charges. From the calculated landed cost, SSA countries were found to be cost competitive as compared to the traditional sourcing regions. Six of the seven SSA countries analyzed were in the top ten least expensive countries for apparel production. Factors that contribute to their competitiveness are labor wages and the benefits derived the African Growth and Opportunity Act (AGOA) trade agreement. However, transportation cost does impact the competitiveness of some SSA countries. Further analysis through interviews with apparel brand and retail executives involved in apparel sourcing will be conducted to examine the rewards and perceived challenges faced in sourcing from SSA.

Allison Bowles
Graduate Program: Textiles
Advisor: Katherine Annett-Hitchcock
Poster Number: 20

Size Grading of Zero Waste Garments

Existing studies focus on the zerowaste design process and role of the designer in this process, but few look at how a zero-waste garment may be graded into different sizes. This study tested two methods for grading zerowaste garments: (1) traditional grading and (2) varying fabric width for each size. The fabric utilization, fit, and design integrity was evaluated for each grading method in order to compare how each might meet industry expectations for garment grading. The "jigsaw" zerowaste design method was used to redesign a nonzero waste garment so that the pattern pieces interlock and use 100% of the fabric in the marker. Grade rules were assigned to cardinal points on the "jigsaw" pattern pieces, and then the pieces were graded to a size four and size twelve. The second grading method was performed by reducing the width of the fabric to 36" for the size four garment and increasing the width of the fabric to 44" for the size twelve garment. The "jigsaw" marker was scaled up and down proportionally in order to fit the new fabric widths. Quantitative data related to fabric utilization in the markers for each garment was was gathered and compared. Qualitative data was gathered from three individuals with fitting experience by rating each garment on specific fit and design elements using a likert scale. The results of the study found that the highest evaluated garment was the size four garment scaled to 36" wide fabric and the lowest evaluated garment was the size twelve garment scaled to 44" wide fabric. The study concludes that scaling a garment to different widths of fabric may be an acceptable grading method for zerowaste garments; however, the success of the fit and design integrity is dependent on the amount of increase in the fabric width.

Forrest Cannon
Graduate Program: Textile Engineering
Advisor: Emiel Den Hartog
Poster Number: 30

A Comparison of Mattresses Using a Thermal Manikin

Mattresses may cause different degrees of thermal comfort to users. However, there is no current standardized test method for assessing the thermal comfort of mattresses. To create such a test method, we used a segmented thermal manikin heated to 35C that was placed on three different mattresses at 20C ambient temperature. Three mattresses were tested: innerspring, polyurethane (PU) foam, and PU foam with phase change materials (PCMs). By analyzing surface temperatures and heat fluxes of the manikin, significant differences between the mattresses were found within the first 30 minutes. Heat flux generated by the manikin, thermal resistance, and time to reach steady state were also analyzed, but did not provide sufficient discrimination between the mattresses and the variability was fairly large.

Yavuz Caydamli
Graduate Program: Fiber and Polymer Science
Advisors: Alan E. Tonelli, Richard J. Spontak
Poster Number: 32

Comparison of the behavior of PEG-POSS stars with unlinked POSS in PEO films

Polyhedral Oligomeric Silsesquioxanes (POSS) are hybrid molecules, with inorganic cores and organic groups on their corners, which can be changed to produce many different types of POSS structures. Besides their unique structure, POSSes have a wide range of application areas, such as electronics, energy, battery, space, and biomedical. They can be used with polymers and might increase mechanical properties, dyeing efficiency, and thermal stability. However POSSes, with inorganic core cage structures, have phase separation and agglomeration problems when added to a polymer matrix beyond a certain wt% limit. This causes a loss in the desired properties of polymer/POSS composite materials that we obtain when processing POSSes into polymer melts or solutions. As POSSes have a wide variety of functional organic groups covalently linked on their Si corners, they affect the nucleation ability of POSS particles, and the crystallization, crystal size, phase separation behavior and overall performance of the polymer matrix. In this study, we systematically investigate how POSS mixes in a polymer matrices when the same type of short chain polymers are linked on its 8 corners and compare this with the addition of a non-functionalized POSS. For this purpose PEG functionalized star-shaped POSS is used to investigate its effect on high molecular weight PEO. We compare the behavior of PEG-POSS with POSSes functionalized with methyl, isobutyl, or isooctyl groups and mixed with free PEG molecules which have almost same molecular weight as the PEG chains on the PEG- POSS. Thus, all films have almost the same amount of silica cage and PEG molecules, but with different molecular structures, and their mechanical and thermal properties were tested. With the help of polarized light and confocal microscopes, the crystal structures, crystal sizes, and surface topographies of these POSS/PEO films were visualized.

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Advisor: Martin W. King
Poster Number: 19

A Biodegradable Knitted Cardiac Patch For Myocardium Regeneration Using Cardiosphere-derived Cells (CDCs)

The damaged myocardium of patients who survive a heart attack or myocardial infarction (MI) can be regenerated by delivering stem cells to the injured cardiac muscle. Cardiosphere-derived stem cells (CDC's) are known to significantly improve the healing and function of the left ventricles of rats following an experimentally induced infarction. It is therefore proposed to deliver the CDC's to the injured myocardium by means of a cardiac patch, which can also promote cell proliferation and provide mechanical support to the ventricular wall while it undergoes remodeling. The objective of this study was to design and fabricate weft knitted fabrics that mimic the non-linear biaxial mechanical properties of myocardium. Initially a series of various textile structures was weft knitted from polyethylene terephthalate (PET) yarns so as to determine the optimal structure for knitting cardiac patch prototypes from resorbable polylactic acid (PLA) yarns. Their uniaxial and biaxial mechanical properties as well as the total porosity were determine for each weft knitted PLA structure. CDC's were seeded and cultured on the PLA samples for seven days and evaluated for proliferation by SEM observations and an MTT assay. In the mechanical tests, the tuck and rib stitch designs gave non-linear stress-strain curves and Young's moduli which mimicked human and rat myocardium. The use of in vitro cell culture tests, SEM observations and an MTT assay confirmed the attachment and proliferation of the CDC's on the surface of the PLA yarns. The rib stitch generated a significantly higher yield of cells than either the jersey or tuck stitch structures. So in conclusion, the rib stitch was found to be the most promising candidate for the design of a PLA knitted cardiac patch.

Ashish Kapoor[1], Kony Chatterjee[2], Michael McKnight[3]
Graduate Programs: Fiber and Polymer Science[1]; Textile Engineering[2]; Electrical Engineering[3]
Advisors: Tushar K. Ghosh, Alper Bozkurt
Poster Number: 33

Fiber based Active Sensory Textiles

The prime objective of this work is to provide sensing capability to electronic textiles. In this work, co-extruded multi component fibers produced by melt extrusion will be woven to develop fiber based active sensory textiles which will be capable of monitoring and measuring biopotentials, tactile forces, and moisture. The uniqueness of this approach is the introduction of electrical characteristics at the fiber level by using conducting and insulating materials in fiber cross section. A thermoplastic polymer is used as the base polymer acting as the insulating part and carbonaceous particles are incorporated to get the desired conductivity. In this fabric, the fibers are the sensory elements. This wearable biomedical sensor can be used as an electrode to measure biopotentials, as capacitive sensor to detect tactile forces and as an impedance sensor to sense wetness or moisture. Possible applications include chest bands for detection of projectile impact, fabric based electrodes for electrocardiography and armbands for electromyography and electroencephalography. The microfluidic approach has been used for producing the desired fiber cross-section due to its versatility and flexibility for fiber production.

Jennifer D. Leary
Graduate Program: Fiber and Polymer Science; Textile Technology Management
Advisors: Behnam Pourdeyhimi, Benoît Mazé
Poster Number: 88

Carbon-Treated Fibers for High Surface Area Supercapacitor Electrodes: A Comprehensive Study of Processing Parameters

From wastewater conversion to energy storage devices, reaction efficiency is partly dependent on the surface area presented by electrodes. Three-dimensional electrodes based on structures such as sponges and textiles can lead to increased device performance. First, the NC State University Nonwovens Institute produced a range of substrates with different densities, polymers, fiber diameters and fiber shapes to be studied as scaffold materials. Next, electrical conductivity was imparted by two different approaches: (1) carbon coating or (2) conversion to carbon fiber. After being made conductive, the fabrics were either electrodeposited with polyaniline (PANI) or activated through CO2 treatment. Our aim was to identify which factors most strongly impact supercapacitor electrode performance, and why. For carbon coatings, UV-vis and dynamic light scattering (DLS) shed light on the dispersion properties associated with three dispersant types (carbon nanotubes, graphene oxide, and exfoliated graphite flake). The role of fabric properties in coating formation was analyzed by imaging techniques, while through-plane resistance and electrochemical impedance spectroscopy (EIS) measurements described the electrical properties of coated fabrics. For carbon fibers, X-ray photoemission spectroscopy (XPS) and X-ray diffraction (XRD) were used to track the development of chemical and microstructural changes. After carbon fiber activation, nitrogen adsorption studies were used to link microporous surface characteristics with carbonization variables. Key findings include: carbon coating morphology is greatly dependent on fabric density, with high-density structures causing agglomeration of the coating materials; graphite flake dispersion concentration can be increased by optimizing processing parameters and its robust electrical and electrochemical performance reveals it to be a practical low-cost alternative to nanotubes; polyacrylonitrile (PAN) fiber results in high specific surface area (SSA) materials only when carbon microstructure is poorly developed via low treatment temperatures; and aniline concentration is the most influential PANI processing variable, leading to high performance (> 300 F g-1) textile-based supercapacitor electrodes.

Meredith McQuerry
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Poster Number: 184

Ventilation of Structural Firefighter Turnout Suits: Reducing Heat Strain and Improving Physiological Comfort

The field of firefighting is one of the most dangerous occupations in the world. Firefighting results in an average of 80,000 occupational injuries per year, over half of which are due to heat stress and cardiovascular strain. Protection requirements often contradict the need for heat dissipation, leading to excessive clothing insulation which creates a negative impact on wearer comfort between 80-90% of a firefighter's working time. The purpose of this research was to investigate clothing ventilation designs for their ability to reduce heat stress incurred during firefighting activities. Ventilation openings were fabricated in structural firefighter turnout suits, including both passive and active systems, to determine the potential for increased heat loss. A total of five different designs were evaluated on the garment level using a sweating thermal manikin to gather insulation and evaporative resistance measurements in four test conditions (standing with still air, walking with still air, standing with wind, and walking with wind). A predicted manikin total heat loss (THL) was calculated for each vented turnout suit design and compared back to a standard control turnout with no vent openings. Virtual human modeling was conducted to predict the wearer's physiological responses (core temperature, skin temperature, and sweat rate) in a specified protocol indicative of a realistic vehicle extrication scenario. A significant increase in THL was measured, along with meaningful predicted improvements in wearer comfort, especially for the passive open vent and active vent designs. Data from this research was used to inform the product development process of revolutionary modern turnout suits with improved comfort performance properties. Future research includes full systems level human wear trial testing of structural firefighter turnout prototypes with novel ventilation designs.

Yusuke Mukai
Graduate Program: Textiles
Advisor: Minyoung Suh
Poster Number: 112

Inkjet-Printed Wearable Antenna for Hyperthermia Therapy: Comparison between Simulation and Measurement

Hyperthermia therapy is a cancer treatment, where body tissue is exposed to heat to shrink cancer tumors. From cytological studies, it has been known that cancer cells are deactivated and killed at 40 ~ 42 ˚C [1], while normal cells can tolerate at up to 45 ˚C [2]. Heat produced during hyperthermia therapy can be also beneficial to promote the effects of traditional cancer treatments such as radiotherapy and chemotherapy. The current challenges of hyperthermia therapy include adequate heating technique with reasonable heat management and longer treatment duration.

Objective of this research is to present an inkjet-printed wearable antenna for a patient-friendly hyperthermia device. A 2.45 GHz rectangular microstrip patch antenna was designed based on

the transmission-line model, followed by 3D full-wave electromagnetic simulation with CST STUDIO SUITE®. Then, a prototype antenna was fabricated by printing silver ink on a polyethylene terephthalate substrate for measurements of the antenna properties.

The simulation gave return loss of -9.8 dB at 2.43 GHz, and the measurement gave return loss of -4.8 dB at 2.49 GHz. Factors attribute to the higher return loss compared to the simulation are dielectric properties of the substrate, limited thickness of printing, and high resistivity of the silver conductive epoxy. The potential use of the microstrip patch antenna for wearable hyperthermia therapy will be discussed for further investigation.

[1] C. W. Song et al., “Implication of Blood Flow in Hyperthermic Treatment of Tumors”, IEEE Trans. Biomed. Eng., vol. 31(1), 1984, pp. 9-16.

[2] G. Ma and G. Jiang, “Review of Tumor Hyperthermia Technique in Biomedical Engineering Frontier”, in 3rd Int. Conf. on Biomed. Eng. and Informat., Yantai, China, 2010.

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Poster Number: 189

Advanced Layering System and Design for the Increased Thermal Protection of Wildland Fire Shelters

The last line of defense for wildland firefighters is their emergency fire shelter. These shelters consist of a multilayer outer dome composed of an aluminum foil laminated to a woven silica fabric and an aluminum foil laminated to a woven fiberglass fabric. Wildland fires are extremely variable and can change direction and intensity at any point. If a wildland firefighter gets caught in an entrapment scenario they are trained to deploy their shelter, get inside, lay on the ground, and allow the fire to burn over them. Research being performed at Textile Protection and Comfort Center (TPACC) aims to create lightweight shelter materials and layering structures that better protect wildland firefighters in these conditions. This project aims to improve the thermal protective performance of the shelter materials through the incorporation of convective heat blockers and insulative battings. Various metals foils, including aluminum and copper, were used as the convective blockers and ceramic nonwoven fabrics were used as insulative batting. Layering concepts have been tested using a single Meker burner apparatus to expose the samples to combined radiant and convective heat. The results from the bench level testing identified materials that offer the most protection per weight. Layering designs that incorporated convective blockers and inorganic nonwovens outperformed the control due to the additional layers of thermal protection and the added air layers. The most promising designs will be made into prototype shelters and will undergo full scale testing in both the PyroMan™ fire test chamber and in live fire field scenarios.

Yingjie Ou
Graduate Program: Textile Technology Management
Advisors: William Oxenham, Kristin Thoney-Barletta
Poster Number: 124

Evolution of Emerging Technologies for Producing Fabrics for Air Filtration

Nonwovens is a fast growing industry filled with technological innovations and development, and one of the major application areas for nonwovens is for air filtration. Existing research on nonwovens technologies is mainly focused on the science and technology areas. However, very little published research has concentrated on technology management issues within the nonwovens industry, particularly using Tech Mining (text analyses based on science and technology information) to investigate these issues. The purpose of the study is to quantify the developments in nonwovens technologies to create novel fabrics for use in the subsequent manufacture of filters via Tech Mining, and to forecast the future of these technologies and filter markets.

As valuable knowledge sources, both patents and scientific publications play a vital role in identifying the development trends and opportunities, especially for emerging technologies. In order to measure the R&D activities and evaluate the state-of-the-art developments in nonwovens technologies and filtration manufacturing, extensive use has been made of sources such as journal publications and patent literature, and a systematic search strategy has been employed to collect relevant publications in our study. The results from the analyses using text mining and visualization tools reveal the technological pathways and potential growth within the nonwovens air filtration industry. This study fills a research gap by providing fresh insights into the development in the nonwovens technologies and their application area - air filtration - from a technology management perspective. It contributes to the overall understanding of nonwovens filtration medium manufacturing and innovations. Ultimately, this study should have implications for researchers and manufacturers looking to target emerging technologies, such as nanofibers, for making nonwovens filtration products.

Rachel Relyea
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Co-Advisors: Katherine Annett-Hitchcock, Marguerite Moore
Poster Number: 139

Identifying Best Practices and Determinants for Success in U.S. Fashion Incubators

Business incubation is growing rapidly throughout the country and the world. Business incubators have evolved and developed to aid nascent businesses in becoming successful and self-sustaining. In today's market environment, fashion designers and new product developers face the difficult task of making their business a reality.

Incubators can provide a space for the fashion industry to grow in a way that lowers risk to participating companies, and connect them with the resources necessary to become successful. Companies that eventually become self-sufficient enhance job growth, and stimulate the domestic and global economy. Fashion incubation, in particular, has its own unique challenges, but has great potential in the U.S. Market. The purpose of this research was to determine best practices and determinants of success for fashion incubators in the United States in hopes to aid in the development of more fashion incubators and help guide those in existence. Due to lack of substantial research on fashion incubators in the U.S., this study was exploratory. A qualitative research design was used to conduct analysis of three existing fashion incubators in the eastern U.S. from multiple constituent perspectives. Data was collected using an interview process in which the researcher interviewed both directors and clients in the fashion incubators; each key informant was asked 15 questions aimed at identifying attributes of fashion incubators that play important roles in the success of both the incubator and its clients. Interviews revealed rich depth of information, and further research could provide breadth by increasing the number of incubators analyzed. Results suggest several common key determinants for success across different fashion incubators. Themes that emerged included physical space, mentorship, networking, resource connections, and community.

Farzad Rezaei
Graduate Program: Fiber and Polymer Science
Advisors: Peter Hauser, Michael Dickey
Poster Number: 140

Polymeric Encapsulation via Plasma Surface Polymerization

Plasma gases are fascinating factories of reactive chemicals such as free radicals. Because these reactive species are in a gaseous phase, they only interact with the very top atomic layer of a condensed phase (liquid or solid) as a target substrate. This localized reaction offers exceptional applications, particularly in the field of surface modification. The present study benefits from this characteristic to offer a facile encapsulation method via an atmospheric pressure plasma (APP) system. In this design the APP polymerizes the outermost layer of a polymerizable liquid (such as multifunctional acrylate) forming a thin polymeric skin on the surface of the liquid. Formation of the skin passivates the underlying unstable liquid from any further reactions with plasma free radicals. Primary measurements revealed that the skin is approximately 50 nm thick for a di-acrylate based resin. Next, we used this technique to encapsulate droplets of different resins on glass slide carriers and employed it to create reactive adhesive capsules. The reactive adhesive has two main components: reactive species and a catalyst. The two components were separated by incorporating them into two sets of capsulated droplets. Physical contact of two carriers having each of the main components on board - or contact between one carrier that has both components with an arbitrary substrate - breaks the capsules. Subsequently, the liquid resin and the catalyst only come in touch with each other while performing the curing reaction between the two substrates. After few minutes, the liquid resin forms an adhesive polymer between the two contacted substrates. Confocal laser microscpy showed the morphology of the capsules and a tensile testing apparatus measured the adhesion strength via lap shear test.

Jialong Shen
Graduate Program: Fiber and Polymer Science
Advisor: Alan E. Tonelli
Poster Number: 155

The Structural Bases for Polymer Glass Transition Temperatures

The nature of the glass transition is widely accepted as one of the most complex and interesting unsolved problems in condensed matter physics and has broad implications in diverse fields of studies, ranging from the physics of liquids to that of colloids, and even to the dynamics of biological systems. In polymer science and engineering, the glass transition temperature (Tg) is essentially the temperature where the chains in a bulk amorphous polymer solid begin to change conformations and move irreversibly, resulting in dramatic alterations in their macroscopic behaviors. Therefore, Tg is one of the most important parameters determining the formation and use mechanical properties of polymer materials. However, the molecular structural bases for the wide range of glass transition temperatures observed for chemically distinct polymers are unclear due to the fact that structural distinctions usually contribute to multiple factors of varying relative importance affecting Tgs. In this study, linear aliphatic polyamides and polyesters with the same functional group (amide or ester bonds) to methylene ratio were chosen to compare and evaluate the relative importance of these various intermolecular interactions, i.e., for example, hydrogen bonding vs van der Waals forces, while keeping other factors fixed. Wholly amorphous random copolymers with relatively high molecular weights were synthesized to eliminate the effects of crystallinity and chain length and their Tgs measured. The measured Tgs of analogous polyamides and polyesters increase linearly with the ratios of functional groups per methylene group. Measured polyamide Tgs are over 100K higher than that of the analogous polyesters, but manifest a smaller slope when plotted against the functional group to methylene group ratio. Possible explanations will be discussed in terms of the differences in the nature and properties of two intermolecular interactions; i.e., hydrogen bondings that are saturatable and directional and van der Waal forces that are additive.

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Poster Number: 163

Uniaxial and Biaxial Mechanical Performance of 3D Knitted Muscle Tendon Junction Scaffolds

Injuries that occur at a muscle-tendon junction (MTJ) are the most difficult to repair surgically. This is because this tissue junction contains two distinctive regions with different characteristics. The muscle region is responsible for initiating the displacement and providing stretch, while the tendon acts as a channel for transmitting the force [1]. Thus, it is necessary for a muscle-tendon tissue-engineered scaffold to satisfy the functional requirements and mechanical properties of both tissues in these separate zones. A series of 3D spacer fabrics was knitted from resorbable poly(lactic acid) (PLA) and PET yarns in the College of Textiles. By changing the knitted stitches, adding extra feed yarns and varying the fabric take-up speed in different parts of the same knitted fabric, it was possible to create separate tendon and muscle regions in the same spacer fabric scaffold, each with its own structure, mechanical properties and porosity to mimic the muscle and tendon [2, 3]. The objective of the study was to demonstrate that the mechanical properties of the muscle zones and the tendon zones were different from each other when exposed to 10% strain and that their initial dynamic mechanical response mimicked that of native muscle and tendon tissues. This was confirmed experimentally by performing cyclic uniaxial and biaxial tests on the separate zones of the MTJ samples. Because the biaxial specimens were restrained in the crosswise direction while under test, the force required to reach 10% strain was found to be significantly greater than the force measured by the uniaxial test method. The conclusion of the study includes recommendations about which 3D knitted spacer scaffold structure most closely mimics the mechanical performance of the native muscle-tendon junction.

Reference:

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Poster Number: 186

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.

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Poster Number: 42

A Superior Carbon-Coated Separator for Achieving Exceptional High Performance Lithium-Sulfur Batteries

Lithium-sulfur batteries have received intense attention because of their high theoretical capacity, low cost and environmental friendliness. However, low active material utilization and poor cycle lie limit their practical applications. Here, we report a strategy to obtain high capacity with long cycle life and rapid charge rate by introducing a carbon coating on the separator. Excellent cycling performance with a high capacity 956 mAh g-1 after 200 cycles and outstanding high-rate response up to 4C are achieved, which are among the best reports so far. High electrochemical performance can be obtained even at a high sulfur loading of 3.37 mg cm-2. Such improved results could be ascribed to the conductive carbon coating, which not only reduces the cell resistance but also blocks the diffusion of soluble polysulfides avoiding shuttle effect during cycling. This study demonstrates a feasible, low cost and scalable approach to address the long- term cycling challenge for lithium-sulfur batteries.

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Poster Number: 41

The Anti-Rheumatic Drug, Leflunomide, Implicates the Aryl Hydrocarbon Receptor in Altered Dopaminergic Biology

Leflunomide is a drug commonly used to treat rheumatoid arthritis. Its therapeutic effects are attributed to its metabolite, teriflunomide, which inhibits an enzyme important in de novo pyrimidine biosynthesis and T cell function. Previous studies also showed that leflunomide interferes with neural crest cell function leading to the loss of melanin production. Melanin and the neurotransmitter, dopamine, are derived from tyrosine and because of this connection, it was hypothesized that leflunomide might also have neurological effects. Our studies utilized zebrafish, a resourceful model for studying the effects of environmental exposures on neurodevelopment, to show that tyrosine hydroxylase, an enzyme used in the conversion of tyrosine to dopamine, is downregulated and aberrantly expressed in response to leflunomide exposure. Behavioral studies indicated that zebrafish exposed developmentally to leflunomide have dampened responses to cycles of light and dark stimuli compared to unexposed controls. This effect was abrogated by the inactivation of the gene encoding the aryl hydrocarbon receptor 2 (AhR2). Furthermore, adult zebrafish exposed to low levels of leflunomide (500nM), exhibited anxiety, as measured in a novel tank assay, when compared to unexposed controls. These findings suggest that leflunomide may affect neurological development via the AhR signaling pathway.

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Poster Number: 53

Evaluation of a DLA-79 allele associated with multiple immune-mediated diseases in dogs

Immune-mediated diseases are common and life-threatening disorders in dogs. Many canine immune-mediated diseases have strong breed predispositions and are believed to be inherited. However, the genetic mutations that cause these diseases are mostly unknown. As many immune-mediated diseases in humans share polymorphisms among a common set of genes, we conducted a candidate gene study of 15 of these genes across four immune-mediated diseases (immune-mediated hemolytic anemia, immune-mediated thrombocytopenia, immune- mediated polyarthritis (IMPA), and atopic dermatitis) in 195 affected and 206 unaffected dogs to assess whether causative or predictive polymorphisms might exist in similar genes in dogs.

We demonstrate a strong association (Fisher's exact p = 0.0004 for allelic association, p = 0.0035 for genotypic association) between two polymorphic positions (10 bp apart) in exon 2 of one allele in DLA-79, DLA-79*001:02, and multiple immune-mediated diseases. The frequency of this allele was significantly higher in dogs with immune-mediated disease than in control dogs (0.21 vs. 0.12), and ranged from 0.28 in dogs with IMPA to 0.15 in dogs with atopic dermatitis. This allele has two non-synonymous substitutions (compared to the reference allele, DLA- 79*001:01) resulting in F33L and N37D amino acid changes. These mutations occur in the peptide binding pocket of the protein, and based upon our computational modeling studies are likely to affect critical interactions with the peptide N-terminus. Further studies are warranted to confirm these findings more broadly, and to determine the specific mechanism by which the identified variants alter canine immune system function.

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Poster Number: 99

Validation of High-Throughput screening data and novel mechanistic insights into VDR-xenobiotic interactions by orthogonal assays

Exposure to environmental neurotoxicants can lead to adult neurobehavioral disorders in humans. Vitamin D in recent years has emerged as crucial player driving embryonic neurodevelopment, neuroprotection from xenobiotics and its deficiency has been implicated as a risk factor for development of neurodegenerative diseases such as Parkinson's disease, Schizophrenia, and Multiple sclerosis. A quantitative high- throughput (qHTS) screen using the U.S. EPA ToxCast Data Analysis Pipeline generated ~90 potential VDR agonists and ~380 potential VDR antagonists. We identified 26 agonists and 24 antagonists based on potency, efficacy, and vdr selectivity and validated them using our in-house luciferase reporter gene assays. Transient transactivation assay (TT) using a human VDR plasmid and Cyp241A1 luciferase reporter construct in Hek 293T cells revealed 22/26 active VDR agonists and 23 active VDR antagonists. Data was consistent when a Zebrafish VDR alpha construct was used instead. Compounds were then tested using mammalian-2-hybrid assay (M2H) to evaluate VDR interactions with co-activators and co-regulators. With the exception of a few compounds, agonists showed moderate recruitment of co-regulators and co- activators whereas antagonists showed moderate to marked attenuation of co-activator recruitment by vdr both in the presence and absence of co-regulators. Overall, the data emphasizes the molecular complexity of VDR transcription machinery in terms of differential and preferential affinities of compounds for co-regulators/co-activators and respective sites of action. Further research will help decipher pathways that these chemicals follow to attain functional outcomes.

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Poster Number: 113

Pharmacokinetics and distribution in interstitial and pulmonary epithelial lining fluid of danofloxacin in ruminant and preruminant calves

Danofloxacin is a synthetic fluoroquinolone antibiotic licensed for use in cattle in the United States for the treatment of bovine respiratory disease (BRD) associated with Mannheimia haemolytica and Pasteurella multocida. Although respiratory disease is one of the leading causes of calf mortality in preruminant calves, there are very limited number of drugs approved for this class of cattle. The objective of this study was to compare active drug concentrations in the plasma versus different effector compartments including interstitial fluid (ISF) and pulmonary epithelial lining fluid (PELF) of healthy pre-ruminating (3-week old) and ruminating (6-month old) calves. Eight calves in each age group were given a single subcutaneous (s.c.) dose (8 mg/kg) of danofloxacin. Plasma, ISF and bronchoalveolar lavage (BAL) fluid were collected over 96 h and analyzed by high pressure liquid chromatography. PELF concentrations were calculated by a urea dilution assay of the BAL fluids. Plasma protein binding was measured using a microcentrifugation system. For most preruminant and ruminant calves, the concentration-time profile of the central compartment was best described by a 2 -compartment open body model.

For some calves, a third compartment, which was not reported in previous studies, was also observed. The time to maximum concentration in the plasma was longer in preruminating calves (3.1 h) versus ruminating calves (1.4 h). Clearance (CL/F) was 385.15 and 535.11 mL/h/kg in preruminant and ruminant calves respectively. Ruminant calves maintain higher ISF/plasma concentration ratios throughout study period as compared to that observed in preruminant calves. Potential reasons for age-related differences in plasma concentration-time profiles and partitioning of the drug to lungs and ISF as a function of age are explored.

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Poster Number: 160

Generation of A Stable Transgenic Swine Model for Cell Tracking and Chromosome Dynamic Studies

Transgenic pigs are an attractive research model in the field of translational research, regenerative medicine, and stem cell therapy due to their anatomic, genetic and physiological similarities with humans. The development of a transgenic murine model with a fusion of GFP to Histone 2B protein (H2B, protein of nucleosome core) resulted in an easier and more convenient method for tracking cell migration and engraftment levels after transplantation as well as a way to better understand the complexity of molecular regulation within cell cycle/division, cancer biology, and chromosome dynamics. Here we describe the first viable transgenic H2B- GFP swine model, and demonstrated that H2B-GFP fetal liver hematopoietic stem cells are capable of engrafting severe combined immunodeficient (SCID) transgenic piglets. Transplanted cells were easily traceable due to GFP expression.

Objectives: 1) Develop the first transgenic porcine H2B-GFP model via CRISPR-CAS9 mediated recombination and somatic cell nuclear transfer (SCNT). 2) Demonstrate H2B-GFP fetal liver hematopoietic stem cells engraftment into SCID pig fetuses via In Utero Hematopoietic Stem Cell Transplantation (IUHCT).

Experimental methods: Porcine fetal fibroblast (PFFs) were cotransfected with custom CRISPR-CAS9 targeting the 3' UTR of ACTB locus and a targeting vector containing 1Kb homology arms to ACTB flanking an IRES-H2B-GFP transgene. Four days post-transfection GFP cells were Fluorescence Activated Cell Sorted (FACS). Single cell colonies were generated and analyzed by PCR and heterozygous colonies used as donor cells for SCNT resulting in 3 piglets (P1 generation). P1 cloned boars were use to generate F1 progeny via artificial insemination. Day 42 fetal liver hematopoietic stem cells expressing H2B-GFP were transplanted via ultrasound guided IUHCT into liver of D42 SCID (IL2RG/RAG1 Null) pig fetuses. After birth, H2B-GFP lymphoid cells were identified via flow cytometry analysis of peripheral blood and fluorescence microscopy of frozen sections from lymphoid organs.

Results and discussion: The custom designed CRISPR-CAS9 knock in system demonstrated a 2.4% knockin efficiency. H2B-GFP cloned boars (P1 generation) and their offspring demonstrated ubiquitous expression of H2B-GFP. H2B-GFP transmission rate was found to be 55.8% (in concordance with Mendel's Law upon Chi Square test with $p=0.05$). Chromosome dynamics were easily visualized in a variety of primary cultured stem cells (Condrocytes, Bone Marrow derived, Umbilical Cord Derived, Adipocyte Derived and Neural Stem Cells). IUHCT of H2B-GFP fetal liver hematopoietic stem cells into D42 SCID pig fetuses resulted in reverse of immunodeficient phenotype at birth. Differentiated H2B-GFP lymphoid cells were demonstrated in peripheral blood and lymphoid organs.

Conclusion: A custom designed CRISPR-CAS 9 is able to drive homologous recombination in the ACTB locus in PFFs, allowing the generation of the first described viable H2B-GFP porcine model. Fetal liver hematopoietic stem cells were capable of engrafting SCID fetuses via IUHCT and were easy to track due to GFP expression.

The described model represents a fundamental tool in the field of stem cell therapy/regenerative medicine, translational research and chromosome dynamic studies.

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