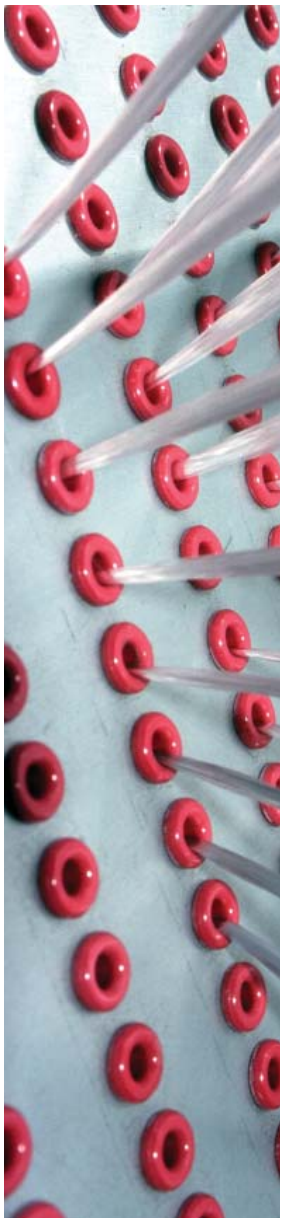
NC STATE UNIVERSITY

10th ANNUAL GRADUATE STUDENT RESEARCH SYMPOSIUM

ABSTRACTS

Wednesday, March 25, 2015
1:00 to 5:30 pm
McKimmon Center



Tenth Annual
Graduate Student Research Symposium
North Carolina State University

SYMPOSIUM ORGANIZERS

Graduate School

Dr. David Shafer - Assistant Dean
Bridget Foy - Administrative Assistant
Todd Marcks - Fellowship and Grants Administrator
Darren White – Webmaster

University Graduate Student Association (2014-15)

Milena Bobea, Materials Science and Engineering (Chair)
Christine Bradish, Horticultural Science
Gabriel Firestone, Physics
Jeremy Howard, Animal Science & Poultry Science
Qi Liu, Biomedical Engineering
Jessica Nash, Materials Science and Engineering
Lauren Pellegrino, Educational Research and Policy Analysis
Kyle Roell, Bioinformatics
Youness Alvandi Tabrizi, Mechanical Engineering
Rebecca Till, Comparative Biomedical Sciences
Eli Typhina, Communication, Rhetoric and Digital Media

AGENDA

12:00 pm – 1:00 pm	Poster Set Up	Area 1
1:15 pm – 1:30 pm	Welcoming Remarks and Symposium Overview David Fiala, UGSA President Dr. Maureen Grasso, Dean of the Graduate School Dr. David Shafer, Assistant Dean of the Graduate School	Room 6
1:30 pm – 4:00 pm	Poster Session and Competition	Area 1
4:15 pm – 5:30 pm	Announcement of Awards and Reception Milena Bobea, UGSA Vice President for Academic Affairs Dr. Maureen Grasso, Dean of the Graduate School Dr. David Shafer, Assistant Dean of the Graduate School	Rooms 2A & 2B

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ABSTRACTS

College of Agriculture and Life Sciences

Erin Almand
Graduate Program: Microbiology
Advisor: Lee-Ann Jaykus
Poster Number: 5

Human Norovirus Interactions with HBGA-positive and HBGA-negative Bacteria Isolates Cultured from Stool and Purchased from ATCC

Study of human noroviruses (HuNoVs) is hindered by the lack of a cultivable strain. Recent studies suggest *in vitro* cultivation of HuNoV might depend upon bacterial cofactor(s), although their importance remains unknown. This study characterizes the binding affinity of select bacterial isolates to representative HuNoV strains. Twenty-one bacterial isolates (5 ATCC strains; 16 fecal isolates obtained from HuNoV-positive samples plated on non-selective media) were used in this study. Isolates were grown anaerobically, exposed to HuNoV GII.4 New Orleans, GI.6, or the Tulane virus surrogate, and then pelleted. To characterize binding affinity, the pellet and supernatant were separately subjected to RNA extraction and RT-qPCR. Turnip Crinkle Virus (TCV), a plant virus with similaar size and structure to HuNoV, was used as a negative control. The three bacterial strains showing the highest binding affinity to HuNoV GII.4 were chosen for additional ELISA-based studies to determine evidence of HBGA-like molecules corresponding to ABH, Lewis A, Lewis B, Lewis Y and H type 1. When cultured in tryptic soy broth (TSB), all bacteria tested exhibited a high level of binding to GII.4 New Orleans (89.62±4.95% capture efficiency). Only bacteria incapable of growing in TSB, including *Bacteroides thetaiotaomicron* (chopped meat media), *Lactobacillus gasseri* and *L. plantarum* (MRS broth), showed a significantly lower level of binding (45.47±12.0% capture efficiency). This interaction was specific, as there were different bacterial binding patterns for both GI.6 and Tulane; no binding was observed for TCV. Only one fecal isolate showed HBGA activity, with possible Lewis A and ABH-like motifs present. This preliminary data suggests HuNoVs interact with a range of bacteria in a strain specific manner, and the ligand responsible for this interaction may not be exclusive to HBGA-like moieties. These data have relevance in efforts to cultivate HuNoV and for methods to concentrate and purify HuNoV for downstream detection.

Nicole L. Arnold[1], Shelley Feist[2], Benjamin J. Chapman[3]
Graduate Programs: Food, Bioprocessing, and Nutrition Sciences, North Carolina State University[1]; Partnership for Food Safety Education[2]; Youth, Family, and Community Sciences, North Carolina State University[3]
Advisor: Benjamin J. Chapman
Poster Number: 8

An Environmental Scan of Food Safety Educational Initiatives Targeted at Consumers in the United States

In-home food safety practices can be influenced through messages provided by food safety educators. These messages are communicated to reduce risky practices that could potentially lead to foodborne illness. This information is a necessary step to a needs assessment to better describe the current population of food safety educators, their programs, and sources of information and materials. Although many agencies, organizations, and educational outlets provide the public with food safety messages, there has not to date been a systematic collection of a landscape of whom is providing what information to what audiences. An online survey was developed with questions. The survey was distributed to the Partnership for Food Safety Education's BAC Fighter (self-subscribed health and food safety educators) and food safety educators through Internet searches expanded through a snowball participant selection process. Food safety educators from different sectors such as academia, federal government, food retail, non-profits, public health agencies, and schools (K-12) were targeted. Ninety percent (n=469) of educational programs were delivered in-person, while 36% were delivered through online sources. Almost half of food safety educators (48%, n=397) did not measure or were unaware if others measured impacts of their food safety outreach programs. When survey participants were asked whom their programming/outreach programs (n=469) were designed to reach, children, parents of children and the elderly were ranked highest, while less than 15% of these programs targeted ethnicity based populations and farmers' market vendors. Improvements can be made for educating consumers about food safety by addressing the gaps identified within the data gathered. These improvements may include greater usage of program evaluation and additional educational materials for underserved populations.

Tara Baker, MS; Kimberly Allen, Nichole Huff, Andrew Behnke,
Graduate Program: Youth, Family, and Community Sciences;
Advisor: Kimberly Allen
Poster Number: 10

Family Coaching: An Exploratory Study of Parental Perceptions

The discipline of family science is expanding to include family coaching, a concept merging family life education and coaching psychology. Family coaching is an innovative, family- centered, and strengths-based approach where family-identified goals

are met through a process-driven relationship between the family and professional coach. In an effort to grow the field of family coaching, parental opinions about family coaching and its applications were surveyed. This study begins to answer the following questions:

Are parents interested in coaching?

For which areas of family life would parents most likely seek a coaching professional?

What qualities are important to parents when searching for a family coach?

What methods would parents use to find a family coach?

What are the opinions of parents about the use of family coaching to help with family issues?

In this poster, we showcase results from a sample (N=168) of parents exploring their parental knowledge and opinions of family coaching as a method for helping families deal with family issues across the life course.

Participants completed a 35-item online questionnaire consisting of five sections: history, interest, attitudes, opinions of hiring family professionals, and demographics. A Family Coach was defined with the following statement: *Coaches help parents by partnering with and offering support to families while helping them create and reach personal goals*. Data was collected by use of a snowball sampling technique via email, word of mouth, organizational-based listserves (e.g. North Carolina Parenting Education Network), and social media platforms (i.e., Facebook & Twitter).

Findings from this study support established parental preferences of family life and parent education, furthermore suggesting that parents support the idea of hiring a family coach or parenting professional. More specifically, results from this study suggest that family coaching is applicable to areas of family practice including general parenting, and divorce.

Maria Balcazar Tellez
Graduate Program: Biological and Agricultural Engineering
Advisor: John Classen
Poster Number: 11

Added Value and Social Benefits of Anaerobic Digestion from Scraped Swine Manure

Anaerobic digestion technology, as an alternative to traditional animal waste management systems, is of increasing interest because it offers sustainable solutions to environmental issues, while producing value added products from manure. Furthermore, introducing this new technology to North Carolina swine farms may result in potential socio-economic impacts in nearby communities. Concentrated swine farming operations produce sizeable amounts of manure and are commonly treated using anaerobic lagoons that have been associated with a number of adverse environmental and health problems. Anaerobic digestion has been proven to offer solutions to the aforementioned problems including production of biogas, which offers renewable energy opportunities as collected methane, and digested effluent (digestate) which has multiple agronomic benefits for crop production. Digestate can be a valuable fertilizer because pathogens have been inactivated, odor has been reduced, and the N:P ratio has been improved relative to plant uptake needs. The recent implementation of scraper systems for swine waste removal has introduced opportunities to collect manure solids and liquids separately, providing different substrate compositions that may result in different opportunities for treatment and recovery of energy and nutrients. An interdisciplinary research effort with a focus on anaerobic digestion of scraped solids and its associated environmental, social, and economic benefits is underway. Experimentally determining the reaction rate of methane production and nutrient levels in the digestate of manure solids will help define new opportunities for this technology and will illustrate the potential of utilizing anaerobic digestion for high solids manure. Batch reactor experiments of feedstock collected with the scraper system will be conducted in order to determine the methane potential of anaerobic digestion at thermophilic temperatures (50°C-55°C), and survey data will be collected to determine community impacts. This research will provide insight into the adoption and implementation of this technology and reveal opportunities for further research.

Richard J. Bittner and Asimina L. Mila
Graduate Program: Plant Pathology
Advisor: Asimina L. Mila
Poster Number: 16

Efficacy of Oxathiapiprolin Against the Black Shank Pathogen, *Phytophthora nicotianae*

Phytophthora nicotianae van Breda de Haan (=*P. nicotianae* var. *nicotianae*), is a devastating soilborne oomycete that causes black shank disease of tobacco (*Nicotiana tabacum* L.). Annual economic losses total millions of dollars in the southeastern United States and throughout the world. Effective disease management involves an integrated approach using host resistance, cultural practices, crop rotation, and chemical control. Currently, mefenoxam is the only fungicide registered for black shank control on tobacco. However, due to the site-specificity of the mode of action (MOA) and its repeated use by growers, there is a high risk of resistance development in target pathogens. Oxathiapiprolin is a new fungicide with a novel MOA that is highly efficacious against oomycetes. The objective of our study was to determine sensitivity of a set of isolates to mefenoxam and oxathiapiprolin and the efficacy of oxathiapiprolin on multiple pathogen structures. Sixty-six *P. nicotianae* isolates collected either from tobacco or ornamental hosts were examined for sensitivity to oxathiapiprolin and mefenoxam at 1 µg a.i./ml and 100 µg a.i./ml, respectively. Mycelial growth was observed for one isolate on oxathiapiprolin treated plates. Five mefenoxam

resistant isolates were found to be sensitive to oxathiapiprolin. In vitro assays examined the efficacy of oxathiapiprolin on mycelial growth, sporangia production, zoospore motility, and zoospore germination of four race 0 and race 1 isolates collected from tobacco. These isolates were highly sensitive to low concentrations of oxathiapiprolin. EC50 values ranged from 0.0039 to 0.0049 µg a.i./ml for mycelial growth, 0.00052 to 0.00081 µg a.i./ml for sporangia production, 0.0035 to 0.0051 µg a.i./ml for encysted zoospore germination, and 0.0055 to 0.0166 µg a.i./ml for zoospore motility. Our results suggest oxathiapiprolin is a highly efficacious fungicide against *P. nicotianae*, and could be used as a chemical option for disease control.

Fabrice J. Blackson
Graduate Program: Family Life and Youth Development
Advisor: Carolyn Bird
Poster Number: 18

Cohabiting Parents' Perceptions Concerning Parental Involvement and Academic Success: A Qualitative Review

There are many different structural types of families that exist today. Divorce rates, the choice to cohabit, and changes in birthing trends, among other factors, have influenced the structural transformation of families. Nuclear families, consisting of a married heterosexual couple and their biological children, are no longer the only family structure. Trend data across multiple decades show that cohabitation, an alternative form of partnership, has increased for adults aged 19 to 44. With the increase in cohabiting couples, we can assume that there is greater social acceptability and less societal resistance of this family form. The likelihood for an unmarried, heterosexual couple to have and raise children in the same household (i.e., a cohabitative union) is greater today than ever before. Some research examining family structure finds that cohabitation has a negative effect on school-aged children and their ability to achieve academically in elementary and secondary school. However, few studies examine a child's success in relationship to parental involvement. This study seeks to explore the patterns of parental involvement in cohabiting biological-parent households and its impact on the academic achievement of school-aged children. It employs a qualitative research design. Fourteen themes emerged regarding the perceptions of parental involvement and academic success for cohabiting biological-parent families. Results found that some participants' perceptions were inconsistent with earlier findings for cohabiting families. The implications of these findings for practitioners and families are discussed. Results also highlight areas for additional research within this family type.

Amy L. Borsay
Graduate Program: Horticultural Sciences
Advisor: Anne M. Spafford
Poster Number: 20

Restorative Landscape Design for Soldiers in Transition

There is a long history of using restorative gardens in healthcare settings to provide patients a place of rest and respite and facilitate mental and emotional healing and recovery. Since the mid-2000s, the utilization of nature in the healing process for wounded veterans and active duty servicemembers has received considerable attention from medical professionals and landscape designers. The primary focus has been on servicemembers who recently served in Iraq and Afghanistan with combat-related injuries and post traumatic stress disorder. A population group often overlooked are individuals suffering from non-combat and training related injuries and disease, which occur at much greater rates than combat-related injuries, significantly impact force readiness, and have potential adverse effects on behavioral and mental health. This project therefore explores how nature in the form of a restorative garden could assist soldiers at the Warrior Transition Battalion, Fort Bragg, NC, in their recovery from primarily non-combat related musculoskeletal injuries, and help ease their transition to civilian life or return to duty. A comprehensive literature review identified general restorative landscape design recommendations, as well as recommendations specific to wounded, ill, and injured servicemembers. Data regarding veteran demographics, wartime experiences, challenges faced upon transitioning to civilian life, physical and mental injuries unique to military members, and military culture was analyzed and compared to the general design recommendations. Feedback was collected from the soldiers and other stakeholders regarding desired garden features and activities, which largely mirrored and validated current design recommendations, including plenty of shade and seating, opportunities for individual relaxation and social interaction, large diversity of plants with multi-sensory interest, and growing vegetables. A pattern analysis was performed to ensure the creation of comfortable, enjoyable, restorative outdoor spaces. Lastly, a detailed site inventory and site analysis were performed to help guide the master plan for the new Tranquility Garden design.

Amanda C. Clayton
Program: Agricultural and Resource Economics
Advisors: Melinda Morrill and Walter Thurman
Poster Number: 31

Impact of Household Dengue Incidence on Female Time Allocation

Dengue fever, though rarely fatal, represents a serious health concern for urban populations throughout the developing world. Few countries are able to effectively treat or prevent dengue and the global incidence of the disease has increased at such an alarming rate over the past fifty years that the WHO considers it to be the most important insect-borne virus in the world. Because women in many of the countries most impacted by dengue are typically responsible for domestic tasks including

caregiving activities, it follows that female residents are likely to bare a disproportionate amount of the time cost of household dengue illness. However, no studies to date look at the particular time cost of dengue illness for female household residents. The objective of this research is to assess the impact of household dengue incidence on the income generating activities of female household heads. In 2008, the introduction of a new serotype of the dengue virus caused an unseasonably large epidemic in the Amazonian city of Iquitos, Peru. I use this arguably exogenous and location-specific health shock to estimate the impact of household dengue illness on the income earning activities of female household heads by comparing the paid weekly work hours of female household heads in Iquitos to those of female household heads in Arequipa, a city in an arid region of Peru that experiences no vector-borne disease, before and after the 2008 epidemic. I rely on data collected as part of the Peruvian National Household Survey (ENAHO) carried out by the Peruvian National Institute of Information and Statistics (INEI) from 2004 to 2009. I complement the INEI data with information on yearly area-wide dengue incidence from the Peruvian Ministry of Health (MINSA). Preliminary results suggest a significant link between dengue transmission levels, household illness, and female household head paid work hours.

Shannon Creason
Graduate Program: Biological and Agricultural Engineering
Advisor: John Classen
Poster Number: 34

An Integrated Life Cycle Assessment and Economic Analysis Approach for Evaluating Manure Treatment and Nutrient Recovery Technologies

Pork is one of the largest and most important agricultural industries in North Carolina and the United States but is facing a number of challenges. One of those challenges is managing waste in an environmentally sustainable way while simultaneously trying to increase revenue for producers. Anaerobic lagoons which are commonly used for their low cost and ease of operation are also major sources of ammonia emissions and nutrient losses. Therefore, it is advisable to consider alternative technologies with the potential for improving environmental conditions and creating value added products. The implementation of scraper systems for manure removal has provided new opportunities for waste separation and substrate composition that could affect the quantity and quality of value-added products. Although the pork industry represents a huge economic sector and many producers operate on very thin margins, evaluations of alternative technologies generally focus on environmental impact and exclude some of the economic components necessary for comprehensive decision-making. Higher cost and lack of available information are prominent barriers to adoption of alternative waste treatment systems and few studies integrating both life cycle and economic assessments have been done on combined treatment and nutrient recovery systems. The objectives of this project are to 1) evaluate the economic and environmental impacts of anaerobic digestion, nutrient recovery technologies, and associated value added products; 2) use the information obtained to create an optimized total value chain for the best combination of technologies; and 3) use the value chain as a decision making tool when considering the environmental impact and economic feasibility of new technologies. Data collected from small batch reactors, gas permeable membranes, and ammonia stripping columns, as well information found in review of literature will be analyzed and used as inputs to LCC/LCA software to generate various life cycle and economic scenarios.

Katheryne Daughtry
Graduate Program: Food Science
Advisors: Rodolphe Barrangou and Suzanne Johanningsmeier
Poster Number: 36

Phenotypic and Genotypic Characterization of *Lactobacillus buchneri* Strains Isolated from Fermented Cucumber Spoilage

Lactobacillus buchneri is a gram-positive, obligate heterofermentative, facultative- anaerobe commonly affiliated with spoilage in food systems. Notably, *L. buchneri* is able to degrade lactic acid into acetic acid and 1,2-propanediol. Although beneficial to the silage industry, this metabolic capability is detrimental to preservation of cucumbers by fermentation. Lactic acid degradation in fermented cucumbers is associated with an increase in pH, providing an environment suitable for other spoilage organisms. Low- salt fermentation processes are more susceptible to spoilage; therefore, an understanding of organisms capable of lactic acid assimilation is necessary. The objective of this study was to characterize thirty-eight isolates of *L. buchneri* purified from both industrial and experimentally reproduced fermented cucumber spoilage to select strains for full genome sequencing. Genotypic and phenotypic characterization included 16S rRNA sequencing, CRISPR typing, DiversiLab® rep-PCR, colony morphology, lactic acid degradation, and API® 50 CH carbohydrate analysis. Distinct groups of isolates were consistently identified with differing colony morphologies that varied in color (translucent white to opaque yellow), diameter (1 mm – 11 mm), and shape (umbonate, flat, circular or irregular). Growth rates in MRS revealed strain differences during lag and log phases, and a wide spectrum of carbon utilization was observed. Some strains were able to ferment as many as 16 of the 49 carbon sources including lactose, mannitol, potassium ketogluconate, and xylose, while others only metabolized 9 carbohydrates as the sole source of carbon. All isolates degraded lactic acid in both fermented cucumber media and modified MRS. Isolates clustered into distinct groups based on rep-PCR fingerprints with 20 of the isolates exhibiting more than 97% similarity. Eight unique isolates were selected for full genome sequencing and annotation to elucidate the metabolic capabilities of this species that may prevent the initiation of lactic acid degradation and thus avert the onset of spoilage in a fermented cucumber matrix.

Adam Fisher, Shima Idries, Rosangela Sozzani
Graduate Program: Plant and Microbial Biology
Advisor: Rosangela Sozzani
Poster Number: 48

Determining the Molecular Mechanism Underlying Stem Cell Maintenance and Asymmetric Cell Divisions in the Cortex/Endodermis Initial Cells

Despite having evolved to multicellularity independently, both plants and animals share similarly structured stem cell niches where the stem cells have the capability to divide asymmetrically. Coordinated control of these cell divisions is required for proper tissue and organ formation. Understanding the molecular mechanism behind the maintenance and division of the cells in the stem cell niche of the Arabidopsis root can serve as a guide to understanding the behavior of stem cells in more complex organisms. Currently, the factors that maintain the distal stem cells, the columella initials, are known but the factors that maintain the proximal stem cells, which include the vascular initials, the cortex/endodermal (CEI) initials and the epidermal/lateral root cap initials, are unknown. Specifically, the CEI cells produce two cell layers with unique features and functions. The molecular mechanism involved in the two successive asymmetric cell divisions that form the two layers include SHORT-ROOT (SHR), SCARECROW (SCR), RETINOBLASTOMA-RELATED (RBR), and a D-type cyclin, CYCD6;1. Notably, CYCD6;1 is activated immediately preceding the first asymmetric cell division in the CEI and its immediate daughter cell. Thus, expression of CYCD6;1 is dependent on a stem cell specific function and can be used as a reporter to assay alternations in stem cell activity. We used CYCD6;1:GFP as a reporter in a forward genetic screen to identify possible factors involved in the maintenance of the CEI. One mutant of interest was recently isolated and showed an expanded CYCD6;1:GFP expression domain into the cortical layer, the epidermal layer, and into the vasculature. This mutant will be characterized and sequenced to determine the relevant gene that caused the observed phenotype. Future experiments will be completed to determine the role the gene plays in CEI maintenance.

Bradley J. Fritz[1], Dominic D. Reisig[1], Clyde E. Sorenson[1], Thomas E. Carter Jr.[2]
Graduate Programs: Entomology, North Carolina State University[1], USDA-ARS Soybean and Nitrogen Fixation Research[2]
Advisors: Dominic D. Reisig and Clyde E. Sorenson
Poster Number: 51

Antibiosis Resistance in Soybean Breeding Lines to the Invasive Kudzu Bug, *Megacopta cibraria* (Hemiptera:Plataspidae)

The invasive kudzu bug, *Megacopta cribraria* Fabricius, was initially discovered in Georgia in 2009, and has since spread rapidly throughout the southeastern U.S. While *M. cribraria* primarily feeds on kudzu (*Pueraria* spp.), it has also become a serious pest of soybeans, *Glycine max* Merrill, reducing yield by 19% on average. Soybean hectares infested with kudzu bug increased from 148,000 to 233,600 from 2012 to 2013, while hectares treated for kudzu bug increased 6 fold during this time. Host-plant resistance to insect attack presents an alternative to broad-spectrum insecticide use to manage this economically damaging pest. However, there are no commercially available soybean cultivars with known resistance to *M. cribraria*. Eleven soybean breeding lines with resistance to soybean aphid, *Aphis glycines* Matsumura, were evaluated for cross resistance to kudzu bug in a no-choice greenhouse assay. Of these eleven, two promising soybean plant introductions (PI's) were selected for further screening. Additionally, two soybean breeding lines (N7103 and Vance) with non-preference type resistance to kudzu bug were evaluated for possible antibiosis. Our results suggest kudzu bugs reared on aphid resistant soybean genotypes PI 567336-A and PI 567352-B suffer significantly greater mortality (70-80%) when compared to susceptible soybean genotypes (10- 20% mortality). While kudzu bugs reared on N7103 and Vance experienced similarly low mortality (10-20%), females reared on these genotypes weighed significantly less than females reared on susceptible control cultivars. Lower female weight has been linked to decreased fecundity and overwintering success in other insects, and may explain the non-preference of N7103 and Vance observed in previous field studies. Our results represent the first documented case of soybean host-plant resistance to *M. cribraria,* providing new insight for soybean breeding programs wishing to develop pest resistant cultivars.

Colin F. Funaro, Coby Schal, Edward Vargo
Graduate Program: Entomology
Advisors: Edward Vargo, Coby Schal
Poster Number: 52

Chemical Mediation of Queen and King Recognition and Other Royal Communication in Subterranean Termites (*Reticulitermes flavipes*)

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

Torey M. Gonzalez[1], Renee Strauch[2], Sirius Li[2], Eric L. Davis[1]
Graduate Programs: Plant Pathology, North Carolina State University[1], Plants for Human Health Institute, North Carolina State University at Kannapolis[2]
Advisor: Eric L. Davis
Poster Number: 65

Multiple RNAi Strategies Targeting the Secreted Chorismate Mutase Reveal its Role in Suppression of Defense Signaling in the Beet Cyst Nematode - Arabidopsis System

Plant-parasitic nematodes are microscopic round-worms living in the soil. They use a hollow stylet to inject effector proteins into living plant cells, resulting in suppression of defenses and formation of a feeding site. While most effectors act through protein-protein interactions, the secreted chorismate mutase (CM) appears to act by "metabolic manipulation". Interestingly, plant pathogens from nearly every kingdom appear to use some form of secreted CM, suggesting that different pathogens have converged upon a common point of vulnerability in plants. A better understanding of this mechanism could help produce engineered plants resistant to this effector. The established model is that CM is able to compete with the plastid for substrate, and so prevent Isochorismate Synthase1 (ICS1) from converting chorismate to salicylic acid, a major plant defense hormone. However, we explore an alternative model where metabolic changes caused by CM are translated into suppression of plant defense signaling. We used qPCR to monitor changes in expression of genes regulating SA production. This shows that the expression level of ICS1 as well the pathogenesis-related (PR) genes were suppressed during times of high CM expression and more highly expressed after 6 days post infection, when CM expression drops. Two RNAi strategies were used to target CM, using induced ingestion of siRNAs prior to infection as well as in-planta RNAi, which is ingested upon feeding in the plant root. Both strategies only produced a transient knock-down of CM1, after which the second isoform CM2 became highly expressed. RNAi showed that a temporary increase in defense markers could be produced with lower CM expression. However, defenses and ICS1 expression were again suppressed along with the compensating CM2 expression. Our data support a model in which CM suppresses defenses by using an endogenous regulatory mechanism and an unknown connection between metabolism and defense signaling.

Amanda R. Hale[1,2], Ann H. Ross[2]
Graduate Programs: Zoology[1], Sociology and Anthropology[2]
Advisors: Mary Schweitzer, Ann H. Ross
Poster Number: 68

An Innovative Analysis of Taphonomic Processes and Their Predictive Role in Juvenile Decomposition

This research will impact the scientific community by presenting a novel statistical technique that can identify key decompositional changes. Twelve *Sus scrofa* (four juvenile and eight fetal) remains were obtained fresh in the summer, fall, and winter months of 2013-14. The juvenile remains were placed on the surface. Two fetal pigs were deposited per season in a cotton blanket and in a plastic garbage bag. Decompositional observations were quantified using total body score (TBS) and fly activity. Accumulated degree days (ADD) were calculated from daily average temperatures obtained from the State Climate Office. Time series analysis was performed to account for time between observations. The surface juvenile remains showed a significant seasonal pattern in days for decomposition reaching a TBS of 26 in eight days, the fall juvenile reaching a TBS of 28 in 11 days, and the winter juvenile reaching a TBS of 27 in 79 days. There were significant associations between TBS and ADD for summer, fall, and winter (*p<0.0023, 0.0030, and 0.0022, respectively)*. Fly activity was significant for summer and fall months *(p<0.0046, 0.0345, respectively)*. The summer blanket fetals reached a TBS of 27 in seven days, in the fall they reached a TBS of 29 in 10 days, and in the winter they reached a TBS of 27 in 79 days. There were significant associations between TBS and ADD for summer, fall, and winter (*p<0.0023, 0.0300, and 0.0024, respectively)*. The summer and fall bagged fetals showed a similar decomposition pattern with the summer bagged fetals reaching a TBS of 26 in nine days, and in the fall reaching a TBS of 27 in six days. Fly activity was also significant for the fall bagged fetals. The results of this study support the importance of seasonal and burial deposition on the rate of decomposition.

Matthew D. Inman[1], David L. Jordan[1], Katie M. Jennings[2], David W. Monks[2], Alan C. York[1]
Graduate Programs: Crop Science[1]; Horticulture[2]
Advisors: David L. Jordan and Katie M. Jennings
Poster Number: 76

Long-term Management of Palmer Amaranth In Cotton With Herbicides and Cultural Practices

Herbicide resistance has caused growers to modify weed management programs in cotton (Gossypium hirsutum L.) over the past decade. Glyphosate-resistant (GR) Palmer amaranth (Amaranthus palmeri S. Wats) has become one of the most troublesome and economically important weed species to manage most cropping systems in southeastern United States. Adoptions of new strategies are integrated with existing methods to control this weed. Because of the ability of this weed species to colonize fields quickly, long-term management strategies must be implemented. Research was conducted to compare multiple strategies including herbicides, deep tillage, and prevention of seed production to manage Palmer amaranth in cotton.

In one experiment, research was conducted from 2011-2014 to determine weed population dynamics and frequency of resistance of GR Palmer amaranth with herbicide combinations consisting of glyphosate, dicamba, and residual herbicides in

dicamba-tolerant cotton. Treatments with glyphosate only had the highest population of Palmer amaranth. In contrast, the lowest populations were observed in treatments including dicamba. Frequency of GR was lower in dicamba-treated cotton although by the end of the experiment GR was prevalent regardless of herbicide program.

In a second experiment, research was conducted from 2012-2014 to determine the influence of a single deep tillage operation and prevention of weed seed production on Palmer amaranth populations in cotton. In this experiment the economic value of a single deep tillage operation was compared with a zero tolerance seed production strategy over 3 years on Palmer amaranth populations. Moldboard plowing and hand removal of weeds reduced the Palmer amaranth population in subsequent years. However, differences in weed populations did not always translate into differences in yield and economic returns. When herbicides are used that control GR Palmer amaranth, the benefits of a single deep tillage operation and hand-removal of weeds were minor.

Tomas J. Ivasauskas and Thomas J. Kwak
Graduate Program: Fisheries, Wildlife, and Conservation Biology
Advisor: Thomas J. Kwak
Poster Number: 77

Techniques for Sampling Larval and Juvenile Fishes in Appalachian Mountain Rivers

Little effort has been directed toward sampling larval and juvenile fishes in Appalachian Mountain rivers, despite the relevance to fish population and assemblage dynamics. We compared the efficiency of four techniques for sampling larval and juvenile fishes from sites located along the Valley River, a major tributary to the Hiwassee River in Western North Carolina. A diverse fish assemblage composed of 51 species representing 10 families, including six species of redhorse (genus *Moxostoma*), inhabit the Valley River and occupy it for spawning. Light trapping and drift netting were most effective for sampling larvae 5 – 20 mm total length (TL), and highest catch rates (of all species) occurred in early- to mid-June. Visual dip netting was most effective for larvae 10 – 25 mm TL with highest efficiency in early-June. Backpack electrofishing was most effective for sampling juvenile fish that were not vulnerable to drift nets or light traps and had achieved swimming ability to evade capture with a dip net. These findings may guide fisheries scientists in planning seasonal sampling to most effectively characterize the early life stages of fishes in freshwater mountain rivers.

Brant R. Johnson[1, 2], Rodolphe Barrangou[2], and Todd R. Klaenhammer[1, 2]
Graduate Programs:[1] Microbiology[2], Food, Bioprocessing, and Nutrition Science
Advisor: Todd R. Klaenhammer
Poster Number: 80

Exoproteome Analysis of Cell Surface Proteins in S-layer and Non-S-layer Forming Species of *Lactobacillus* Reveal Conserved Proteins Putatively Involved in Probiotic-host Interactions

The *Lactobacillus acidophilus* complex is a clade of homologous Gram-positive, lactic acid bacteria including *L. acidophilus*, *L. helveticus*, *L. crispatus*, *L. amylovorus*, *L. gallinarum*, *L. delbrueckii* subsp. *bulgaricus*, *L. gasseri*, and *L. johnsonii*. Although these bacteria are closely related, they have varied ecological lifestyles ranging from dairy and food fermentations, to allochthonous probiotics, and autochthonous commensals of the host gastrointestinal tract. Bacterial cell surface components play a critical role in the molecular dialogue between bacteria, and their interaction with the intestinal mucosa. Notably, the *L. acidophilus* complex bacteria can be split based on their ability to produce S-layers, which are semi-porous, crystalline arrays of self-assembling, proteinaceous subunits found as the outermost layer of the bacterial cell wall. Based on previous data regarding the identification of S-layer associated proteins (SLAPs) in *L. acidophilus*, we employed a proteomic analysis of secreted surface proteins of the S-layer forming and non-S-layer forming bacteria of the *L. acidophilus* complex. Using a modified LiCl extraction protocol coupled with LC-MS/MS, we have proteomically identified the various extracellular proteins and SLAPs of the *L. acidophilus* complex, including anticipated annotated cell surface proteins, as well as conserved hypothetical proteins of unknown function. Analyses of these data highlight the proteomic complexity and differences of the cell surface of probiotic lactobacilli and reveal the potential for SLAPs to mediate intimate interactions with the intestinal mucosa. This opens new avenues for the selection of effective probiotics, and the engineering of immunomodulatory bacteria.

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Graduate Programs: [1]Dept. of Horticultural Science, [2]Dept. of Plant Pathology; North Carolina State University
Advisors: Dilip R. Panthee; Frank J. Louws
Poster Number: 92

Tomato Rootstock Resistance to Bacterial Wilt as Modulated by Grafting and NC Regional Isolates

Tomato (*Solanum lycopersicum* L.) is afflicted by the soil-borne bacterial pathogen *Ralstonia solanacearum* Smith (Rs), which causes bacterial wilt (BW) in many growing regions around the world, including the Southeastern USA, where it jeopardizes tomato production efficacy. There is no effective chemical or cultural control practice that can manage BW in colonized fields. Use of host resistance is an effective management strategy, but must be mobilized in the context of a grafted vegetable production system due to tight genetic associations between BW resistance and small fruit size. Because BW resistance is heavily influenced by localized strains of Rs and environmental factors, we set out to determine what resistant rootstock genotypes would provide the best BW control in North Carolina tomato growing regions. We assessed 11 tomato genotypes for resistance

to BW in field and greenhouse conditions, and for their yields when used as a rootstock for the popular, large-fruited commercial scion 'Florida 47'. The greenhouse study compared resistance levels against two Rs isolates from the Coastal Plains and the Mountain growing regions, while the field study relied upon natural inoculum pressure in the Mountains. We observed that the use of a fine overhead mist under dense shade cloth was an effective environment for healing the grafted plants. Grafting a BW susceptible cultivar onto resistant rootstocks was an effective BW management strategy. No significant differential resistance responses by Rs strain were observed in any of the tomato genotypes, suggesting that a rootstock resistance response would be comparable across NC. Rootstock genotypes 'Hawaii 7997', 'Hawaii 7998', 'RST-04-106-T', and 'Cheong Gang' exhibited a comparably high level of BW resistance, yet the 'Florida 47' scion yielded about twice as much tomato fresh weight when grafted onto the latter two compared to the former two. All four rootstocks are recommended for BW management in NC.

Hope Lima[1], Sheila Jacobi[1], Chaolai Man[1], Kaitlyn Walker[1], Jeffrey Sommer[1], William Flowers[1], Anthony Blikslager[2], Lin Xi[1], Jack Odle[1]
Graduate Programs: Animal Science[1], Clinical Sciences[2],
Advisors: Lin Xi and Jack Odle
Poster Number: 103

Effects of Methylating Vitamins and Docosahexaenoic Acid (DHA) Supplementation on Intra-uterine Growth Retardation (IUGR) in a Feed-restricted Swine Model

IUGR can result from malnourishment during pregnancy and negatively influences the long-term health of offspring; being litter bearing, swine have an increased incidence for IUGR. Our study exploited this to examine nutritional influences on fetal development in malnourished dams. Control gilts (n=5) received 2.0 kg/d of a corn-isolated soy-protein diet supplemented with a mixture of vitamins (mg/kg feed) containing folic acid (1.3), pyridoxine (1.0), B12 (0.015), riboflavin (3.75), choline (1250) and DHA (2420). Basal diet allotment to restricted sows was reduced progressively from 1.0 to 0.6 kg/d and was supplemented according to a 2 (± vitamins) x 2 (± DHA) factorial design (n = 4-6; vitamin amounts described above). Control dams gained more weight (49.31 ± 6.19 kg) than restricted dams (3.01 ± 3.34; $p < 0.0001$). However, average term piglet weight (1.13 ± 0.016 kg; $p = 0.5094$) and percent of IUGR piglets (< 900 g; 17.9 ± 3.76%; $p = 0.6223$) were unaffected. Dams supplemented with DHA gave birth to offspring with significantly higher omega-3 levels in brain and liver tissues than piglets born to non-supplemented dams ($p < 0.05$). Global DNA methylation status of piglets born to restricted dams was significantly higher in brain, liver, heart, muscle and placental tissues ($p < 0.05$) than control piglets. Addition of DHA in the absence of methylating vitamins altered brain DNA methylation patterns, with significantly increased methylation in low birth weight (LBW) piglets compared to normal birth weight piglets ($p < 0.05$). These results illustrate the preferential partitioning of maternal resources to developing fetuses during nutrient depravation. Preferential incorporation of DHA into brain and liver tissue indicate a role for DHA in healthy organ development. Changes in global DNA methylation status are indicative of metabolic differences between IUGR and normal birth weight piglets.

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Graduate Programs: Horticultural Science, North Carolina State University[1]; Plants for Human Health Institute, North Carolina State University, Kannapolis, NC[2]; Biotechnology, Rowan-Cabarrus Community College[3]; USDA-ARS, Genetic Improvement of Fruits and Vegetables Laboratory[4]; Bioinformatics, UNC-Charlotte[5]
Advisor: Allan Brown
Poster Number: 106

A Functional, Consensus Linkage Map of Blueberry and Cranberry

Blueberry (*Vaccinium* spp.) is one of the most economically important small fruits that native to North America, and the United States is the world largest producer with 564.4 million pounds of blueberries harvested, totaled up with the value of nearly $850.9 million in 2012. North Carolina has always been one of the top five blueberry producing states in Untied States.

Though blueberry has been a part of our diet for thousands of years, people know little about genome of blueberry. Traditional blueberry breeding programs have been limited due to the complicated nature of the polyploidy genome, the long generation period, and inbreeding depression. With the advent of next-generation sequencing and bioinformatic tools in the last decade, better understanding of the blueberry genome and molecular- assisted selection is likely to aid in blueberry breeding.

Multiple genetic linkage maps of blueberry and cranberry (a close relative) have been created for purposes such as understanding cold hardiness and climatic adaptability. The goal of this research is to create a blueberry consensus map of these populations that also integrates whole-genome sequencing data. Blast searches were conducted using existing SSR marker primers to identify genomic scaffolds that contained markers from existing maps. And new Simple sequence repeats (SSRs) markers were designed for larger scaffolds and for targeting genes in anthocyanin biosynthesis pathway.

Markers that showed polymorphism were then added to an existing linkage map. With this information, we are able to create a functional, consensus map. Completion of this map is expected by mid-year 2015 and should provide an important resource to blueberry and cranberry researchers as well as providing the genomic framework for the completion of the blueberry genomic sequence.

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Graduate Programs: Microbiology[1] and Forest Biomaterials[2]
Advisors: Amy M. Grunden, Joel Pawlak
Poster Number: 111

Biodegradation and Bioconversion of Pulping Waste by *Paenibacillus glucanolyticus*

The pulping material black liquor is generated by the kraft process, and this underutilized waste stream has potential for downstream bioconversion. A microorganism was isolated from a black liquor sample collected from the Department of Forest Biomaterials at North Carolina State University. The organism was identified as *Paenibacillus glucanolyticus* using 16S rDNA sequence analysis and was shown to be capable of growth on black liquor as the sole carbon source based on minimal media growth studies. Minimal media growth curves demonstrated that this facultative anaerobic microorganism can degrade black liquor as well as cellulose, hemicellulose, and lignin. High performance liquid chromatography (HPLC) and gas chromatography-mass spectrometry (GC-MS) were used to identify the products generated by *P. glucanolyticus* when grown anaerobically on black liquor. Fermentation products which could be converted into high-value chemicals such as succinic, propanoic, lactic, and malonic acids were detected. Vanillic and gallic acids were also produced which suggest that *P. glucanolyticus* can degrade lignin. GC-MS analysis of *P. glucanolyticus* culture supernatant when grown on cellulose, hemicellulose, and lignin as the sole carbon source correlated the production of fermentation products with the components of black liquor. Lignin degradation was also confirmed by comparing lignin weight and molecular weight distribution before and after bacterial growth on lignin as the sole carbon source. These results indicate that *P. glucanolyticus* can grow on black liquor by degrading the carbon sources that make up this pulping byproduct and in the process produce high-value chemicals. *P. glucanolyticus*, like many soil bacteria, can degrade the sugars present in black liquor. However, the ability of *P. glucanolyticus* to degrade lignin and produce valuable organic acids is unique. Further experiments aim to identify the enzymes produced by *P. glucanolyticus* that are responsible for degrading cellulose, hemicellulose, and lignin.

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Graduate Programs: Plant Pathology[1] and Crop Science[2]
Advisor: H. David Shew
Poster Number: 114

Adaptation to Host Resistance Genes by *Phytophthora nicotianae*

Black shank, caused by the oomycete *Phytophthora nicotianae,* is an important disease of tobacco. Host resistance is the easiest and most cost effective tool for disease control; however, the widespread deployment of complete host resistance controlled by the *Php* gene, resulted in a rapid race shift from the wild type race 0 to race 1. Race 1 overcomes the *Php* gene. Partial resistance is available and offers some protection from both races, but severe losses may still occur. All partial resistance in commercial varieties comes from variety Florida 301. To increase the level of partial resistance, a new source of partial resistance from variety Beinhart 1000 was investigated. All resistance genes place selection pressure on the pathogen to adapt. The objectives of our study were to determine how race 0 and race 1 isolates adapt to varying sources and levels of partial resistance, if adaptations are specific to source of resistance, and what genetic changes occur over time. Ten tobacco lines with resistance derived from Florida 301, Beinhart 1000, and single genes *Wz* and *Php* were grown in the greenhouse. All lines were inoculated with a race 0 and race 1 isolate and rated for incubation period and percent root rot over six generations. One isolate per variety and race was collected from the plant with the shortest incubation period and used to inoculate the next generation of the same variety. Adapted isolates were compared across generations for each variety and pathogen race combination. An increase in pathogen aggressiveness was observed over generations for both races on multiple varieties and resistance sources. More aggressive isolates had a decrease in incubation period and an increase in percent root rot. Understanding how *P. nicotianae* adapts to resistance will assist with making recommendations for variety rotation to manage the pathogen and disease.

Amanda L. McWhirt[1], Michelle Schroeder-Moreno[1], Gina Fernandez[2]
Graduate Programs: Crop Science; Horticultural Sciences[2]
Advisor: Michelle Schroeder-Moreno
Poster Number: 116

Impacts on Soil Health: Evaluation of Individual and Combined Sustainable Soil Management Practices in Fumigated and Non-fumigated Plasticulture Strawberry Systems in the SE.

Southeastern (SE) strawberry production generally relies on annual fumigation to combat intense disease pressure present in the region and a lack of crop rotation. This combination of management practices overtime directly contributes to losses in soil health. Previous work has established the value of incorporating sustainable soil management practices like compost, cover crops and beneficial soil inoculants to maintaining long-term soil health. However, this work has generally been limited to organic systems and the use and applicability of sustainable soil management practices in conjunction with fumigation has not been actively studied for the specific plasticulture strawberry systems present in the SE. As such our study investigates the use of compost, a summer cover crop mix (Cowpea var. 'Iron Clay'(*Vigna unguiculata*) and Pearl Millet (*Pennisetum glaucum*-genus)), and the beneficial soil inoculants of vermicompost and arbuscular mycorrhizal fungi (AMF) as applied individually and in various combinations to both conventionally fumigated and non-fumigated plasticulture strawberry production. Measured indicators of soil health include presence and abundance of AMF, total soil organic matter, soil aggregation, soil nutrients and nematode populations. These indicators were measured prior to the start of our study and following the first field season. Initial

results from our on-going field study for these indicators under both fumigation strategies will be presented. Final results from this study will determine what practices contribute the most to these indicators of soil health while maintaining yields in both conventionally managed and organic strawberry production systems in the SE.

Lucky K. Mehra, Christina Cowger and Peter S. Ojiambo
Graduate Program: Plant Pathology
Advisors: Peter S. Ojiambo and Christina Cowger
Poster Number: 119

A Pre-planting Risk Assessment Model to Predict Stagonospora Nodorum Blotch in Winter Wheat

Stagonospora nodorum blotch (SNB) caused by *Parastagonospora nodorum*, is a major disease of wheat and can lead to reduction in both quantity and quality of yield. Pre-planting cultural factors such as tillage, host genotype, disease history and location of a field have been suggested to affect disease intensity in the season. However, there is no quantitative information on risk of the SNB due to these pre-planting factors. Experiments were conducted at several locations in North Carolina in 2012, 2013, and 2014. Area under the disease progress curve (AUDPC) was calculated from disease severity assessments and used as a response variable. At each location, longitude, latitude, tillage type, previous crop, disease history, wheat residue coverage on the ground, cultivar resistance, fungicide seed treatment, and seeding rate were recorded and considered as predictor variables. Multiple regression and classification and regression tree (CART) approaches were used to develop a pre-planting risk assessment model to predict SNB in wheat. Data composed of 339 unique cases that were randomly divided into training, validation, and test dataset (70, 20, and 10% cases, respectively), and this process was repeated 15 times. Models were developed using training dataset, optimized using validation dataset, and their prediction accuracy was tested on the test data by regressing observed AUDPC against predicted AUDPC. For the test data, the multiple regression model explained 73% of the variation in the disease data, while CART model explained 68% of the variation in the data. Previous crop, tillage type, longitude, latitude, and cultivar resistance were identified as significant predictors of SNB. Given that the SNB development is dependent on in- season weather, pre-planting variables showed a strong relationship with AUDPC and were good predictors of disease intensity. Once optimized, these models can provide important information on the likelihood of disease and guide pre-planting management decisions for SNB.

Emily K. Meineke[1], Elsa K. Youngsteadt[1], Robert R. Dunn[2], and Steven D. Frank[1]
Graduate Programs: [1]Entomology, [2] Biological Sciences
Advisor: Steven D. Frank
Poster Number: 120

Hot in the City: Insect Herbivores and the Future of Warmer Urban Forests

Urbanization and global warming are important forces of ecological change. Herbivory by arthropods increases during warmer periods in the fossil record and with latitude, which suggests that present day warming may also lead to more herbivory. We hypothesized that unexplained herbivore outbreaks in cities are a result of local warming known as the urban heat island effect. Our study shows that insect communities on urban trees change as thermal minima increase, such that warmer trees have more arthropod herbivores. Changes in community composition were driven by higher abundance of scale insects and mites, two of the common and destructive urban plant pests. Pest insects had a delayed, negative effect on tree growth, while warming enhanced growth. Our findings indicate warming threatens urban forests in some ways but can enhance certain services provided by trees. Our results also suggest that global warming over the next century will increase herbivore abundance and change the extent of forest ecosystem services.

Colin Murphree
Graduate Program: Plant and Microbial Biology
Advisor: Heike Sederoff
Poster Number: 128

Molecular Characterization of Amino Acid Metabolism in *Dunaliella spp.*

Photoautotroph algae grow quickly and can produce large amounts of oil. *Dunaliella spp*. are marine microalgae that grow best in a saline environments, and therefore do not compete with agricultural land or freshwater for food and feed production. However, growing these organisms requires a source of nitrogen fertilizer. Fertilizer is made via the Haber-Bosch process, which itself requires energy from burning fossil fuels. A more sustainable algal growth system would instead use amino acids derived from the non-oil algal biomass, effectively recycling the fertilizer.

We seek to show that amino acids can be used as a nitrogen source in *Dunaliella spp.* by establishing their effects on growth and physiology. Two species of *Dunaliella* were grown in batch culture with amino acids and harvested for metabolite analysis. We determined that of the 20 proteinogenic amino acids, only four support growth in these species. Additionally, these amino acids perturb carbon and nitrogen assimilation.

Changes in carbon and nitrogen assimilation will be investigated at the levels of transcriptional regulation and metabolite flux. *Dunaliella viridis* was fed glutamine, and a resulting transcriptional profile was generated RNA-Seq. The mechanism by which these organisms are able to incorporate amino acids into algal biomass will be assessed using isotope labeled glutamine and analysis by NMR.

The information gained by this project will be leveraged with an established transformation method to generate *Dunaliella spp.* with the ability to use all 20 amino acids as a nitrogen source.

Allison Nolker
Graduate Program: Applied Ecology
Advisor: Theodore Simons
Poster Number: 133

Changes in Northern Mockingbird *Mimus polyglottos* Vocalizations in Central North Carolina Between 1981 and 2013.

Increased urbanization and anthropogenic disturbance present new challenges to which some species cannot adapt. Others adapt to urban environments in a way which allows them to persist in acoustically variable environments. Adjustment of song frequency is one adaptation that enables some songbird species to prosper despite increased noise. Northern Mockingbirds (*Mimus polyglottos*) have the capacity for behavioral plasticity that allows them to navigate variable urban soundscapes. Using historical urban song recordings from 1981 and 1982 and contemporary recordings from urban and rural sites in 2013, we show that mockingbirds have modulated their song frequencies to higher pitches in response to low-frequency noise in urban habitats over time. Contrary to similar studies of other songbird species, we did not detect site-level frequency differences among contemporary rural and urban mockingbirds. This lack of site-dependent difference could be due to the synurbic nature of mockingbirds. Our data suggest a slight adjustment in the seasonal timing of singing between contemporary populations. In order to fully understand the underlying mechanisms which allow mockingbirds to flourish in variable acoustic environments, additional analyses with captive breeding, reciprocal transplants and genetic components must be conducted.

Katie Overbey
Graduate Program: Food Science
Advisors: Benjamin Chapman and LeeAnn Jaykus
Poster Number: 136

Working Knowledge and Communication Practices of Public Health Officials in Response to Norovirus Outbreaks in Schools

Norovirus is the leading cause of viral gastroenteritis in schools. School administrators often turn to public health departments for their expertise during gastroenteritis outbreaks, making public health officials and school administrators important players in managing outbreaks. The objective of this study was to investigate communication messages and methods of local health officials to school risk managers (principals, janitorial staff, nurses) about prevention and infection management of norovirus. Norovirus-related communications by local public health officials (n = 127) and their level of engagement with schools were evaluated using a 26-question online survey. Participants were selected via a convenience sample of North Carolina health departments and asked a combination of open-ended, Likert scale, and importance-ranking tasks. Questions focused on interactions with schools, knowledge of norovirus prevention, recommended norovirus control measures, education methods currently used in schools, and preferences for new education programs. When asked about norovirus control measures, many participants said they would recommend cleaning with bleach (93%) and excluding sick food handlers (97%, n = 102), but 22% (n = 102) would also recommend quaternary ammonium compounds for sanitizing, which are not effective against noroviruses. Nearly a quarter (23%, n = 102) reported recommending commercially available alcohol-based hand sanitizers to schools as an effective control measure. Only 31% of participants (n = 127) had been contacted by a school about norovirus, and few participants (15%, n = 118) said they have provided training to school staff about norovirus. This study suggests that many public health officials provide correct information that aids in the control of norovirus outbreaks in schools; some, however, provide information that is not evidence-based. In practice, these inaccuracies may lead to prolonged norovirus outbreaks in schools, but they also highlight areas where better knowledge transfer to the public health community is needed.

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Graduate Programs: Plant and Microbial Biology[1]; Forestry and Environmental Resources[2]
Advisor: Qiuyun (Jenny) Xiang
Poster Number: 137

Ecological Genomics of *Cornus florida* L. by Genotyping by Sequencing

Discovering the genetic underpinnings of local adaptation in natural populations is a critically important goal in Evolutionary Ecology. Flowering dogwoods (*Cornus florida* L.) are ecologically important understory trees threatened in the eastern US. Given limited knowledge of their natural genetic predisposition to adapt to ecological disturbances and emergent diseases, we employed the genotyping by sequencing (GBS) method to genotype loci under selection. To test for and minimize biases of GBS, we genotyped from two similarly sampled datasets (96 and 85 individuals) of six subpopulations from three distinct ecological habitats (mountain, piedmont, and coast). We measured environmental variables and functional traits from each subpopulation using soil cores, visual estimates of canopy health, leaf osmotic potential readings, and interpolated climate data to identify genotypes associated with environment via latent factor mixed models (LFMM). To test if heterogeneity of

abiotic pressures resulted in genetic differentiation indicative of local adaptation, we estimated Fst per locus using Arlequin's hierarchical approach. We found 153 and 221 potential outlier loci with high Fst values in first and second Illumina library results respectively. LFMM revealed 92 and 123 genotypes in library one and two respectively passing Bonferroni corrections for association with at least one environmental variable (elevation, proximity to water, canopy cover, soil nutrients and cations, frost-free period, mean monthly rainfall, mean annual temperature, and length of growing period). A set of genotypes were correlated with plant health, and a smaller set were correlated to leaf osmotic potential. Half correlated genotypes from LFMM results were also Arlequin outliers. Approximately a quarter of results from LFMM and Arlequin analyses were called in both datasets. These results suggest environment driven selection has resulted in local adaptation in response to disease and other abiotic factors—shaping genotypic differences among mountain, piedmont, and coastal populations sampled across North Carolina.

Shelby Rajkovich[1], Deanna Osmond[1], Randy Weisz[2], Carl Crozier[1], and Wes Childres[1]
Graduate Programs: Soil Science[1], Crop Science[2]
Advisor: Deanna Osmond
Poster Number: 147

Evaluating N-Loss Prevention Products in North Carolina: Preliminary Results on Corn and Wheat

Determining optimum nitrogen (N) fertilization rates is critical to preventing over-application and environmental losses of N to air and water, and as such, we designed field trials to: 1) determine optimum N rates for corn and wheat in three different regions of North Carolina (Coastal Plain, Piedmont, and Mountains), and 2) determine the value of alternative fertilizer additives in reducing N losses. The standard fertilizer treatment of urea ammonium nitrate (UAN) was compared with UAN with AgrotainPlus®, UAN with Instinct®, and UAN with NZone® at six different nitrogen rates in corn and five different nitrogen rates in wheat. A linear-plateau statistical model determined the optimum N rates as 134, 104, and 59 lb ac^{-1} for corn in the Coastal Plain, Piedmont, and the Mountains, respectively. Spring N applications to wheat were optimum at 111 lb ac^{-1} in the Coastal Plain and 100 lb ac^{-1} at the Piedmont location. Apparent nutrient use efficiency (NUE) data indicated that both the Coastal Plain and Piedmont wheat NUE peaked at the spring N rate of 80 lb ac^{-1}, though the Piedmont wheat NUE declined at higher application rates. Corn NUE data is forthcoming. The fertilizer additives did not appear to lend an advantage to yield in either crop. Preliminary results indicate that these products may not significantly prevent N loss compared to UAN alone, indicating that proper N application rates may be a more efficient nutrient management strategy. A separate experiment compared six differently timed applications of Environmentally Smart Nitrogen (ESN), with and without ammonium sulfate to UAN on wheat in the Coastal Plain and Piedmont. In the Coastal Plain, the recommended split N application of ammonium sulfate and UAN showed yields significantly higher than various application rates of ESN. In the Piedmont, results were not significant by fertilizer source or timing for either grain or stover.

Wayne R. Roper[1], Julie M. Grossman[2], Owen W. Duckworth[1], Daniel W. Israel[1]
Graduate Programs: Soil Science, North Carolina State University[1]; Horticulture, University of Minnesota-Twin Cities[2]
Advisor: Owen W. Duckworth
Poster Number: 154

***Rhizobium leguminosarum* Strain Combination Effects on Nodulation and Biological Nitrogen Fixation in Cover Crop *Vicia villosa*.**

Hairy vetch (*Vicia villosa*) is an important leguminous cover crop used to improve soil fertility in cropping systems. The soil bacterium *Rhizobium leguminosarum* specifically nodulates roots of *V. villosa* and fixes atmospheric nitrogen [N] gas into ammonia that is assimilated into plant tissue. Many producers inoculate seeds with rhizobia to enhance biological N fixation [BNF], but utilization of more effective inoculant strains is limited by perceived competition from native rhizobia. Improved BNF in cover crop legumes resulting from inoculation could enhance N fertility and reduce fertilizer requirements in organic systems. We evaluated the ability of four rhizobia strains to nodulate and improve *V. villosa* growth as individual and combined inoculants compared to controls with no rhizobia added. Plants were inoculated with equal ratios of one to four strains and grown under controlled conditions for 46 days. After harvest, biomass, nodule number, nodule mass, and N content were measured. Rep-PCR generated DNA fingerprints of rhizobia strains found in nodules were used to assess nodule occupancy of each strain. Nodulation was variable across all treatments, with root nodule count ranging from 21 to 197. Mean plant shoot N from BNF of inoculant strains C10 and NCSU478 was 43.4 and 44.2 mg, respectively, and greater than strain NCSU435 which yielded 23.4 mg ($p<0.05$). Uninoculated controls without N fertilization averaged less plant biomass N than other treatments at 6.3 mg ($p<0.001$). Results indicate that individual rhizobia strains differ in their ability to improve plant growth but treatments containing multiple inoculant strains were not different in nodulation or relative plant biomass N. Furthermore, nodule occupancy determined by rep-PCR was variable with no consistently between the dominant strain and BNF. Overall, inoculation with multiple strains improved plant growth but BNF was not closely linked to competitiveness.

Anthea Cristina Saez
Graduate Program: Crop Science
Advisor: Lori Unruh-Snyder
Poster Number: 158

Long-term Effects of Burning vs. Mowing Management Treatments on Yield Potential and Carbon Sequestration of Switchgrass for Biofuel Systems

Bio-energy Feedstock Development Program and U.S. Department of Energy has recommended Switchgrass (*Panicum virgatum*), as a promising feedstock for conversion to biofuels due to the capacity to produce high yields (14.5 Mg ha-1 vs. 5.7 Mg ha-1 of Maize, Raleigh NC). The potential long-term storage of soil organic carbon in bioenergy agro-systems depends on the management techniques and effects on the soil by switchgrass. Long-term effects of cultivating switchgrass to the soil and biomass yields under mowing/burning management have yet to be researched. Long-term (20-years) effects of mowing/burning management practices on above/below ground biomass of Switchgrass along with the potential to establish soil-carbon partitioning/sequestration and calculating C/N balances will be researched. Switchgrass plots (8) were established (1992) with upland/lowland varieties at NCSU Lake Wheeler Plant Science Facility in Raleigh, NC and have been maintained since 2003 under two different management treatments once a year: mowed to ~4 to 6 inches or burned. Since 2005, no soil or crop analysis has occurred. In the spring and fall of 2014 subsamples of harvested biomass were collected from each plot for dry matter determination and forage nutrient analysis including use of near infrared spectroscopy (NIRS) analysis in order to determine N, P, K, NDF, ADF, and in vitro dry matter digestibility. Soil core samples from each plot were collected from 0-5-cm, 5-15-cm, 15-30-cm, 30-60-cm, 60-90-cm and 90-120-cm for to soil quality analysis (soil microbial biomass, combined particle organic matter/clay content and extraction of inorganic Nitrogen) with a Leco-TruSpec for CN/POM and an auto-analyzer for NO3/NH4 in order to determine total/particulate organic C/N, soil microbial biomass C and flush of CO2. A conclusion to date show that 8.25% more yield was found within the burning vs mowing management treatments; it's expected that the mowing treatments will have more soil-carbon partitioning/sequestration and N recycling.

Ana Sevarolli Loftus, Inkyung Park, Fabricio R. Castelini, Jeffrey A. Hansen, and Sung Woo Kim
Graduate Program: Animal Science
Advisor: Sung Woo Kim
Poster Number: 161

Pigs Like Yogurt!: Impacts of Direct-fed Microorganisms on Growth, Health and Meat Characteristics of Growing-finishing Pigs

Pork is the most widely eaten meat representing 37% of human meat intake. Pork production has been highly efficient with the use of growth promoting additives. However, the new antimicrobial and growth-promoting regulation are stimulating producers to find alternatives to maintain high productivity and meat quality. Direct-fed microorganisms (DFM) are one of successful alternatives. This study investigated the supplemental effects of DFM on the growth performance, health and carcass traits of growing-finishing pigs. DFM used includes *Lactobacillus acidophilus*, *Lactobacillus casei*, *Bifidobacterium thermophilum* and *Enterococcus faecium* (2.5 x10^7 cfu/g each). Sixty pigs at 88.5 ± 0.6 kg BW were housed in pens (3 pigs/pen) and allotted to 2 dietary treatments (0 or 0.05% DFM) in a randomized complete block design. Pig diets mainly included corn, soybean meal, and DDGS. BW and feed intake were measured weekly. After 4 weeks, pigs were harvested at a local abattoir. Hot and chilled carcass weights were obtained to measure carcass yield (%). Backfat thickness (mm) was measured to estimate lean carcass content. Loin was weighed and used to determine loin color, marbling score, drip loss, and chemical composition. Data were analyzed using Proc Mixed of SAS with treatment and sex as fixed effects and initial body weight blocks as a random effect. Pigs fed DFM had greater ($P < 0.05$) ADFI (2.79 and 2.56 kg/d) and ADG (0.89 and 0.79 kg/d). Loin tended to be heavier ($P = 0.099$) for pigs fed DFM (7.55 kg/side) than pigs without DFM (6.64 kg/side). There was no difference in backfat thickness between treatments. Chemical meat composition and drip loss did not differ between treatments. Loin samples from DFM treatment tended to be lighter ($P = 0.054$, 53.9 vs. 51.9 L* value). Collectively, pigs' growth performance was enhanced without altering loin quality indicating that DFM could benefit pork producers.

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Graduate Program: Food, Bioprocessing and Nutrition Science[1]; Youth, Family and Community Sciences[2]
Advisor: Benjamin Chapman
Poster Number: 162

Evaluating the Evidence-base of Outbreak Management and Clean-up Guidelines Available to Schools Experiencing Norovirus Outbreaks

An estimated 75% of absenteeism in schools is due to illness or injury, posing an educational impact on students and economic impact on families, and schools. It is estimated that norovirus causes nearly a quarter of school gastrointestinal outbreaks. Current materials provided to schools may not be effectively relaying accurate information. Public health officials and outbreak reports suggest that while evidence- based norovirus infection control guidelines specific to schools exist, the best management practices are not always used. The project aim was to evaluate currently available norovirus management literature directed at schools for technical content and evaluate accuracy of the information. The project was carried out to provide insight into gaps in communication and evaluate the need for future development of materials based on the best available science. Artifacts, defined as publicly accessible online guidelines and instruction documents (n=63), were found using online searches such as 'school norovirus guidelines,' and 'school norovirus prevention and control.' Content analysis was employed to evaluate document source and themes. Coders identified agreement with U.S. Centers for Disease Control and Prevention evidence-based

best practices and captured erroneous recommendations (omission and commission). There were inconsistencies and inaccuracies in the material and instructions provided to schools. Of the analyzed documents, 24% gave vague instructions void of specific compounds, PPE use or distance around a vomit event. Preventative cleaning was mentioned in 60% of documents; only 14% mentioned that commercially available, alcohol-based hand sanitizers are not effective. Twenty-four percent of documents said individuals could return after symptoms cleared; 30% did not mention absenteeism. The results suggest a need for more evidence-based and more detailed materials targeted towards schools control and prevention methods. Targeted, clear instructions with varying formats may increase compliance and decrease the frequency and/or severity of norovirus outbreaks.

R.A. Stern[1], C.M. Ashwell[1], S. Dasarathy[2] and P.E. Mozdziak[1]
Graduate Programs/Institutions: Physiology[1]; Pathobiology, Lerner Research Institute, and Department of Gastroenterology, Digestive Disease Institute, Cleveland Clinic[2]
Advisor: Paul E. Mozdziak
Poster Number: 171

Avian Embryos Reveal a Novel Outcome of Hyperammonemia on Muscle Development

Understanding mechanisms of muscle growth and muscle wasting is important for the advancement of both agricultural production, as well as human medicine. Hyperammonemia, or excess ammonia in the blood, is a product of metabolic disregulation and is associated with a number of human diseases, and notably liver failure. In hyperammonemic patients, and animal models of this condition, severe muscle wasting is a secondary, but serious, effect of this disorder that is poorly understood. Myogenesis is facilitated by myogenic regulatory factors and is significantly inhibited by myostatin. The objective of the current study was to examine embryonic gene regulation of myostatin/myogenic regulatory factors, and subsequent manipulations of protein synthesis, in broiler embryos under induced hyperammonemia. Quantitative real-time PCR, Western blotting, and amino acid assay techniques were used to analyze the effects of hyperammonemia on the developing muscle in late stage broiler embryos. Unlike other animal models of hyperammonemia, the current results suggest induced hyperammonemia has the potential to positively impact muscle growth in avian embryos. Notably, there was a significant downregulation of myostatin ($P<0.01$) following induced hyperammonemia, which is a unique finding in the avian model. Western blot analysis of myostatin protein levels confirmed lower myostatin expression ($P<0.05$) corresponding with increased glutamine concentrations in the muscle of ammonium acetate treated embryos ($P<0.01$). Glutamine is known to directly downregulate myostatin expression, and is produced as a primary method of skeletal muscle ammonia detoxification in avian species. Overall, the data suggest that following induced hyperammonemia in avian embryos, skeletal muscle glutamine production was increased, as a method of ammonia utilization, resulting in a downregulation of myostatin, which is expected to have a positive impact on embryonic myogenesis and postnatal muscle growth.

Sally V. Taylor and Clyde E. Sorenson
Graduate Program: Entomology
Advisor: Clyde E. Sorenson
Poster Number: 176

The Use of Systemic Imidacloprid Affects Parasitoids Differently Within the Same Feeding Guild

Toxoneuron nigriceps and Campoletis sonorensis are solitary endoparasitoids of the tobacco budworm Heliothis virescens. They are valuable biological tools in controlling H. virescens populations in Southeastern US agricultural production systems. Field and greenhouse trials conducted from 2011-2014 compared parasitism rates and parasitoid life span of these parasitoids that developed inside H. virescens larvae fed tobacco plant tissue treated with imidacloprid and without. Residues of imidacloprid and its metabolites were detectable in the bodies of H. virescens larvae that fed on treated plants. The two parasitoids in our study did not have similar responses to larvae fed with this insecticide. T. nigriceps had reduced successful parasitism and reduced adult lifespan. Residues of this chemical were detectable in the bodies of T. nigriceps larvae and adults from H. virescens larvae fed on treated plants. However, C. sonorensis did not have reduced parasitism rate or effects on life span. These findings suggest that there are ecological effects of imidacloprid use on a tritrophic level, and that insecticide use may selectively affect natural enemies with similar feeding niches.

Anna Thomas, Ignazio Carbone and Peter S. Ojiambo
Graduate Program: Plant Pathology
Advisors: Peter S. Ojiambo and Ignazio Carbone
Poster Number: 177

The Resurgence of Cucurbit Downy Mildew in the United States

Cucurbit downy mildew (CDM), caused by the obligate pathogen *Pseudoperonospora cubensis*, is considered the most destructive disease of cucurbits (cucumber, cantaloupe, squash, pumpkin and watermelon) worldwide. While downy mildew has been a major problem in other parts of the world, availability of effective host resistance in cucumber is predicted to have reduced the severity of CDM in the US. However, in 2004, this scenario changed with the emergence of a new variant of the pathogen capable of overcoming host resistance. The introduction of a new pathotype or genetic recombinant or a new lineage of the pathogen has been suggested as a potential reason for the disease resurgence. A study conducted using a set of 16 host differentials has revealed the presence of pathotypes III and VI in the US, that were previously known to exist only in Asia.

Mating types of 39 isolates collected after 2004 from different parts of the country were tested using a pairing experiment with known tester isolates. Test results showed the presence of the A1 and A2 mating types, and for the first time, documented the formation of viable sexual propagules (oospores) in the US. A1 mating type isolates were found to be associated with cucumber and pumpkin, whereas the A2 mating type isolates were associated with squash and watermelons. Comparative genomic analysis of nine *P. cubensis* isolates collected from all the economically important cucurbits revealed the presence of two distinct host-specific evolutionary lineages. Lineage I was found to be associated with cucumber, cantaloupe and pumpkin, while lineage II isolates were associated with squash and watermelons. These results indicate that lineage I comprising A1 mating types from pathotype III, may be responsible for the resurgence of CDM in the US.

Leah E. Vang, Eric L. Davis, Charles H. Opperman, Michael R. Schwarz
Graduate Program: Plant Pathology
Advisor: Eric L. Davis
Poster Number: 184

The Effects of Spirotetramat on Nematodes

Thousands of nematode species are known to parasitize plants worldwide, causing a variety of plant diseases, and resulting in devastating crop losses annually. Many traditionally used nematicides have been banned or restricted in recent years due to their inherent toxicity and environmental hazards. There is a strong need for registration of safe, effective nematicides. A promising candidate is spirotetramat (Movento™), an effective insecticide manufactured by Bayer CropScience that has also been shown to suppress nematode populations. Spirotetramat functions as a lipid biosynthesis inhibitor with no known acute toxicity and also shows unique acropetal and basipetal systemic movement in plants. Little is actually known about how spirotetramat suppresses nematode populations; therefore, the first research objective was to determine what stages of the nematode life cycle are most affected by spirotetramat. Hatching tests were conducted with the model nematode *Caenorhabditis elegans*, with no significant ($p>0.05$) effects on hatching rates observed at a maximum spirotetramat-enol concentration of 105ppm. Spirotetramat-enol also did not effect hatching of phytoparasitic *Meloidogyne incognita* (southern root-knot nematode) and *Heterodera glycines* (soybean cyst nematode). Life-stage assays conducted with *C. elegans* indicated an arrest of juvenile development before reaching adulthood at spirotetramat-enol concentrations as low as 30ppm. Objective 2 evaluated the optimal time to spray spirotetramat on plant foliage for systemic effects on nematodes infecting the plant's roots. Formulated spirotetramat (Movento™) was applied to plant foliage at the labeled insecticidal rate (5 fl oz/acre) in the greenhouse at 1-week intervals starting at 1 week prior to inoculation with *H. glycines* (soybean plants) or *M. incognita* (tomato plants) and ending applications at 3 weeks after inoculation. Overall, results indicated that spirotetramat inhibits nematode reproduction best when applied 1-2 weeks after inoculation. Optimal spirotetramat application timings coincide with the early stages of root infection, when nematodes are in the vulnerable juvenile stage.

Ty Wagoner[1], Loren Ward[2], Chris Pernell[1], E. Allen Foegeding[1]
Graduate Program and Affiliations: Food Science, North Carolina State University[1], Glanbia Nutritionals[2]
Advisor: E. Allen Foegeding
Poster Number: 188

Development and Characterization of Whey Protein Nanoparticles for Beverage Applications

Whey protein consumption has been linked to a number of health benefits including increased satiety and metabolic regulation; therefore, there is interest in increased consumption of foods rich in whey proteins. Meal replacement beverages and sports drinks are foods that contain whey proteins, but low thermal stability – especially near the protein isoelectric point (pI) – limits the pH range at which beverages can be formulated. Studies have shown that at a narrow pH range close to the pI, whey proteins and pectin self assemble into soluble complexes (SCs) that could be designed for colloidal stability. Our objectives were to 1) determine the conditions required to form stable whey protein-pectin SCs, 2) characterize physical properties of the SCs, and 3) evaluate the effect of particles on bulk rheological properties. The effects of protein concentration (1, 4, 5 and 6% wt/wt) and heat treatment (85˚C for 25 min) were evaluated. The properties of the SCs were characterized via intrinsic viscosity and particle size distribution, and bulk flow rheology was evaluated using shear rate sweeps over a dynamic range. Laser diffraction particle size analysis revealed that heating shifted particle size towards a monomodal distribution with mean diameter of ~100 nm for all protein concentrations. Heated SCs also had a significantly ($p < 0.05$) lower intrinsic viscosity after heating, suggesting conformational changes that favor a smaller hydrodynamic size. Increasing protein concentration had no significant impact on size of heated SCs. Per Stoke's Law, the colloidal stability of SCs is primarily driven by small size and a density similar to that of the bulk solvent. These results indicate that whey protein-pectin SCs can be stabilized by heat treatment to form particles with enhanced colloidal stability, with no negative impact on rheological properties.

Jason M. Whitham[1,4], Oscar Tirado-Acevedo[1], Ben G. Bobay[2], Mari S. Chinn[3], Joel J. Pawlak[4] and Amy M. Grunden[1]
Graduate Programs: Plant and Microbial Biology[1]; Molecular and Structural Biochemistry[2]; Biological and Agricultural Engineering [3]; Forest Biomaterials[4];
Advisors: Amy M. Grunden and Joel J. Pawlak
Poster Number: 195

Identification of Four Single Nucleotide Polymorphisms Potentially Responsible for the Higher Ethanol Production Phenotype of *Clostridium ljungdahlii* Strain OTA1

The Renewable Fuel Standard Consumption Mandate (RFS2) created under the Energy Policy Act of 2005 requires that U.S. industry must produce 16 billion gallons of cellulosic ethanol and another 4 billion gallons of non-grain biofuels by 2022. A potential technology that may enable industry to meet these requirements involves gasification of biomass into syngas (mixture of carbon monoxide, carbon dioxide, hydrogen, nitrogen, other less abundant gases, chars and tars) followed by fermentation of the syngas to biofuels. One of the major issues of this technology is low liquid fuels product yield. *Clostridium ljungdahlii* is one of the more promising syngas- fermenting ethanol-producing microbes; however, new strains that produce higher concentrations of ethanol must be generated for gasification fermentation to be a cost-effective solution. Here we identified four potential single nucleotide polymorphisms (SNPs) in a mutant strain of *C. ljungdahlii* designated strain OTA1, which produces twice as much ethanol as the wild type strain when cultured in mixotrophic conditions. RNAseq differential expression analysis showed that genes in proximity to two mutated transcriptional regulators are among the most differentially expressed genes between wild type and OTA1. Furthermore, a SNP in one of the carbon monoxide dehydrogenase genes seems to be responsible for faster consumption of carbon monoxide, which may be explained by hyperactivity as supported by structural modeling and cofactor docking simulations. The fourth SNP is found in a gene annotated for porphyrin (metal-binding cofactor) biosynthesis, which may be important for *C. ljungdahlii*'s branched TCA cycle-like metabolism. These SNPs are therefore potentially important targets for enhancing biofuels production by *C. ljungdahlii*.

Jaime A. Willett[1,2,3], Jinyan Cao[1,2], David M. Dorris[1], and John Meitzen[1,2]
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Advisor: John Meitzen
Poster Number: 198

Exploring Sex Differences in the Nucleus Accumbens Shell, a Critical Brain Region for Motivated Behavior and Reward

Sex differences exist in how the brain mediates motivated behavior and reward, both in normal and pathological contexts. For example, women are more susceptible to addiction and advance more rapidly through the stages relative to men. Investigations into the underlying neural mecha- nisms yield accumulating evidence of sexually different cellular morphology and neuromodula-tor/hormone action in the striatal brain regions, including the nucleus accumbens shell. It is un- known whether these sex differences influence the electrical properties of neurons in this brain region. This is a critical unaddressed question because the electrical activity of neurons directly underlies behavior, including motivation and reward. Thus, I hypothesize that the electrophysio- logical properties of medium spiny neurons (MSNs), the output neurons of this brain region, differ by sex. To test this hypothesis, I performed whole-cell patch clamp recordings on 32 female MSNs and 28 male MSNs in acute living brain slices of rat nucleus accumbens shell. Blind analysis of the electrophysiological properties is ongoing, with a particular emphasis on excitato- ry synaptic properties and intrinsic excitability, which have been found to differ by sex in other striatal regions. Depending on the results of the analysis, a number of future research directions could be pursued, including further elucidation of the synaptic input, subtypes of MSNs, and modulation by local interneurons. Overall, given the significant sex differences in addiction and the normal behavioral output of these circuits, understanding the nature of sex differences in the nucleus accumbens shell is an important research goal.

Jiameng Zheng
Graduate Program: Plant Biology
Advisor: Marcela Rojas-Pierce
Poster Number: 206

The HOPS Subunit AtVPS41 is Involved in Homotypic Vacuole Fusion

Vacuoles perform many crucial functions in plant cells and are essential organelles. Plant vacuole biogenesis requires homotypic fusion of vacuolar membranes but this process is not well understood. Our previous published work indicated that a SNARE protein, VTI11 is required for homotypic vacuole fusion and that a phosphoinositide, PtdIns(3)P negatively regulate vacuole fusion. We postulate that PtdIns(3)P may act as a signaling molecule to regulate vacuolar SNARE function and homotypic membrane fusion via other effector proteins. The HOPS complex (homotypic fusion and vacuolar protein sorting) is a tethering factor that was shown to localize to the vacuole, bind to PtdIns(3)P and interact with the vacuolar SNARE proteins in *Saccharomyces*. However, very little is known about HOPS in plants. Studies from our lab shows that loss of function mutant of a HOPS subunit, *vps41-1* has defective male but not female gametophyte. Expression of flourescent GFP fusion with the AtVPS41 protein shows its localization to the vacuole, supporting its role in regulation of vacuole fusion. In addition, biomolecular flouresent complimentation (BiFC) experiment in protoplast revealed that AtVPS41 interacts with the vacuolar SNARE SYP22. Together, our data suggests that AtVPS41 is required for male gametophyte development and regulates the vacuolar SNARE function and vacuole fusion. Our future work will focus on the regulation of PtdIns(3)P on VPS41 localizations.

College of Design

Ece Altinbasak
Graduate Program: Design
Advisor: Dr. Celen Pasalar
Poster Number: 7

Comparison of Teacher Attitudes and Preferences Toward Classroom Design

A review of the research studies has indicated that the physical arrangement of classrooms is an important setting for learning. Classrooms can provide students effective instruction and facilitate positive learning interactions. The literature also indicates that classroom design can influence teachers and learning opportunities differently in variety of classroom shapes. However, classrooms are both physical and organizational units where there is a complex relationship between the built structure and arrangement, teachers, students, and the distribution of the space. One of the difficulties of identifying conclusive research findings about the environmental factors that would promote learning is the diversity in teachers, which creates a gap in physical environment - human behavior studies in classroom literature. Therefore, the purpose of the study was to expand the understanding of how classroom arrangements and shapes are associated with teacher attitudes such as preferences on classroom design, teaching methods, motivational strategies, and level of environmental awareness (being aware of the influences on physical settings on behaviors). One of the most unique assumptions of this study is measuring teachers' environmental awareness. The Environmental Response Inventory (ERI) assessment instrument was used to help define and measure differences in the way teachers interact with the environment Thus, a correlational research method (survey data) is employed to understand whether the variables of the study distinguish teacher differences. In order to address the extents to which two or more variables co-vary, multiple variable analyses method is used through multivariate multiple regression technique. Comparisons between teacher responses will reveal evidence-based results and suggestions for the design and improvement of middle schools based on behavioral research outcomes. Analysis of this study can inform school design principles and provide impetus to further research studies for classrooms and design innovative learning environments.

Alyssa Barrett
Graduate Program: Art + Design
Advisor: Marc Russo
Poster Number: 12

The Power of Play: Disseminating Narrative as Branded Entertainment Utilizing 3D Animation

This thesis documents and supports the created of a 3D animated short created for Marbles Kid's Museum as part of a content marketing strategy and campaign. The growth of digital media has increased the dissemination of quality stories and the ability to tell the story of a brand in an entertaining way has become invaluable. Not only do consumers want to see what companies are selling or providing; they want to be entertained. This research focuses on Marbles Kid's Museum's K-5 audience as the client for the project as well as the main driver of narrative. The importance of content marketing is illustrated as well as the current and anticipated increased use of 3D animation as a tool for implementing branded entertainment.

Mackenzie J. Bullard
Graduate Program: Art + Design
Advisor: Cecilia Mouat
Poster Number: 23

Nature's Memory: A Studio Manual for Dyeing and Designing with Natural Dyes

Natural Dyes will save the world. Such a statement is both bold and foolhardy juxtaposed with the world's problems. But clearly, the sustainable practice of harvesting flora, fauna, and minerals is socially, environmentally, and ecologically responsible. A better understanding of renewable dye resources will be widely recognized as a means of imparting color onto cloth; harvesting and processing natural dyestuffs, combined with ancient and contemporary surface design practices, will result in alternative choices for the consumer market.

As designing requires material, function and product choice, the knowledge of an object's life has bearing educationally, as well as practically, in clothing the world's populace. Natural dye processes, materials, tools, and techniques require forward planning, multiple steps of operation, and exactness in measurements, temperatures and times. The creation of a studio manual requires specific methodologies for process, recipes, and developing language that is easy to follow and reproduce.

Specificity in material types, tools, and application methods for each step must be approachable, clear and concise. Thus the contribution of a concise studio manual for the natural dye market will allow craftspeople to explore an alternate means of naturally beautifying, coloring, and designing fiber surfaces, building a body of knowledge that addresses the potential of materials and the effective application of color onto cloth.

Kevin Diamond[1] and Daniel Goldstein[3]
Graduate Programs: Architecture
Advisor: Kristen Schaffer
Poster Number: 40

Communal Identity Through Sustainable Urban Densification

Located along the San Francisco Bay, the initial inspiration for the Embarcadero House came out of a curiosity for the Bay Area's sail-boat culture. The inherent aspect of sails mediating wind inspired the idea for a 500' tall structure free of mechanical systems. In a world where working towards a lower carbon footprint is no longer an option, the mission was to explore sustainable urban densification while attempting to create a communal identity for urban dwellers. Responding to the saw-tooth plan formation of the city as it met the waterfront, the concept was to create a pair of offset towers which behaved as one structural system. Laying out the residential units to share massive dividing walls, which housed plumbing and storage, left the spaces open for ventilation and day-lighting. A geometric system of concentric squares became the strategy for setting up structure, but equally important, relating the human being to the scale of the city.

David Eidson
Graduate Program: Industrial Design
Advisor: Sharon Joines
Poster Number: 44

Designing the Interior Environment for Long Haul Trucks: An Investigation into the Lifestyle Needs of Over the Road Truck Drivers.

Current research has shown there has been a shortage of truck drivers in America for the last 10 years and is projected to continue through 2025. One of the primary reasons for this shortage is the difficult and demanding lifestyle that comes with this occupation. Drivers can spend up to 20 hours a day in the cabin of their truck where they operate the vehicle and live. A plethora of research has been done examining the health effects of this sedentary lifestyle; however, there is very limited literature discussing the design of these environments.

The purpose of this research is to examine how drivers interact with the truck cab and living environment and to identify which of their needs are not being met with current cab designs. Ethnographic research in the form of interviews and job/lifestyle shadowing are the primary source of data collection. To understand these challenges I recruited 20 drivers, 10 fleet, 5 Owner/Operator, and 5 Team Drivers who will be interviewed. Three ride-along trips will be conducted where observation and video recording will capture the interactions between the driver, cockpit, and cabin. Drivers will be encouraged to use the talk aloud method to describe their activities, challenges, and concerns. Additionally, I will be spending the night in a cab sleeper to gain further insight into the lifestyle. The results from this research will provide insight into the challenges that drivers face and will be helpful in developing design criteria and inspiration for prototyping better cabs and interior components, in an effort to enhance the lifestyle for drivers in this industry.

Haidy El-Borombaly
Graduate Program: Industrial Design
Advisor: Sharon Joines
Poster Number: 45

Toddlers' and Parents' Experience with High Chairs

My project is about toddler's experience while eating in public restaurants and how products such as high chairs can affect their behavior. These behaviors in extreme cases result in substantial injuries to the toddlers while using the product (high chair). Using observations of public behaviors of toddlers and mothers in a variety of restaurants, I have observed toddler's actions, parent's reactions and the interaction between both with the high chair. While children in specific age group require the assistance of the parent to appropriately and safely get in and out of the high chair, this case study has included both the parents' and toddlers' needs in the product and experience assessment. Several studies have shown that mothers are not aware of the serious problems that can result from poor biomechanics (while lifting the toddler) associated with use of high chair. The awkward lifting is a result of high chairs designed for function while ignoring the needs of children and resulting ergonomics for the parent or caregiver. More specifically the high chair requires an interaction between 2 users; mother and child, with the same product; but the needs of the users are divergent resulting in a design for which the needs of neither user are fully addressed. Due to large anthropometric variability of children within even a narrow age range, one size fits all design results in poor product performance, which is associated with a high rate of accidents and injuries. This investigation is focused on designing a high chair focusing on the needs of both the caregiver and child while being informed by the needs of other stakeholders such as the restaurant owners and wait staff. The designs will be evaluated in full scale by parents and children using objective and subjective postural and preference assessments.

Jedidiah Gant
Graduate Program: Art + Design
Advisor: Marc Russo
Poster Number: 57

Citizen Informed: Urban Engagement Through Technology

For several decades, the importance and approach of civic engagement have both been debated. How to get citizens more involved in urban life has been a mystery to some but a simple equation to others. Many strategies have work and just as many have faltered. Therefore, what if we think beyond the traditional definitions of civic engagement and integrate technology in cities in a way that makes being engaged in our urban surroundings simple, enticing, and integral to the current infrastructure. *Citizen Informed* develops a system for Raleigh to better inform citizens and enhance engagement through technology within the urban landscape. The key components of the project are the city, its citizens, and the information shared through technology.

Through the mapping of digital demographics and technological motivations, locations throughout Raleigh have been identified and a system created to connect specific parts of the city through physical and technological interventions. The interventions range from single spots spread out across the city, to corridor networks, zone overlays in large areas, and direct connections between distant locations. Each of these intervention types create new ways to connect citizens through technology. The intervention is specific to its location and provides a distinct type of interaction and information content. The potential of this system increases as these interventions overlap throughout the city, creating new forms of technological urban engagement. With the implementation of this type of technological system, citizens would be able to experience a new strategy of 21st century urban life. Through the overlap of technology in cities, information can be shared in more efficient and interactive ways.

Jeri-lynn Gehr
Graduate Program: Graphic Design
Advisor: Denise Gonzales Crisp
Poster Number: 61

Using Design to Facilitate Storytelling and Encourage College Survivors of Date Rape to Share their Experiences

People have long since used storytelling or narratives as a means of learning and exercising agency, shaping identity, and motivating action. The telling of a traumatic experience can not only help a survivor make sense of that experience, but it can engage others to share their own stories. Date rape is one of the most underreported types of sexual assault afflicting college campuses across the United States. Among the most common reasons for not reporting date rape include shame, guilt, and fear of being doubted or blamed. A common misconception or myth is that rape is a violent crime committed by a stranger usually yielding a weapon. Because date rape occurs between two acquaintances, survivors often perceive the incident as "normal" or not severe enough to report to the police or university, thus creating an endless cycle of low reporting rates and perpetuated myths. The purpose of this investigation is to explore the potential for design intervention of interactions that facilitate storytelling as a means of engaging and encouraging college date rape survivors to share their experiences. The interactions give survivors the opportunity to share their experiences in different phases or stages: privately, to other survivors, and publicly as a means of engaging those who are not ready to share.

To gain insight on the current structures, behaviors, and practices of the current support and reporting services available to survivors on campus, interviews were conducted with various leaders of the Women's Center, NCSU Police, and the Counseling Center. This research, among an extensive literature review and several cases studies of precedents in design, informed my interventions. The small design studies I completed in this investigation inform the "look and feel" of these interactions that convey sensitivity to the survivor and her needs. In these studies, I examined the importance of survivor control and anonymity, as well as the visualization of private versus public sharing.

Michael Goralnik
Graduate Program: Landscape Architecture
Advisor: Kofi Boone
Poster Number: 66

Natural Capital: Blending Ecosystem Services and Community Design Approaches to Floodplain Design

While recent initiatives like the 100 Resilient Cities Challenge and Rebuild By Design competition have stimulated considerable conversation related to resiliency in urban contexts, there has been comparatively little discussion in planning and design circles on achieving resiliency outside of the city. For many small communities, this lack of attention, coupled with the limitations in capacity (including staff, funding, and other resources) that often plague rural municipalities, constitute significant roadblocks on the path to resiliency for millions of Americans.

"Natural Capital: Blending Ecosystem Services and Community Design Approaches to Floodplain Design" explores potential roles for ecosystem service assessments in rural resiliency planning and design. Using the ITree ecosystem service analysis tool, I gauge the economic value of two discrete ecosystem services (nutrient retention and carbon sequestration/storage) that operate within the 750 acres of Kinston, NC's FEMA buyout zone. I then explore, compare, and evaluate design scenarios that

both optimize each of these ecosystem services, and incorporate critical community programming such as recreation, food security, and interactive placemaking on the site. Finally, I speculate on how this ecosystem service-based strategy can be applied in other rural communities in eastern North Carolina and elsewhere.

Engin Kapkin
Graduate Program: Industrial Design
Advisor: Sharon Joines
Poster Number: 85

Meaning Attribution Process of Product Forms: A Mixed Method Approach

Each year, companies release new product lines showcasing their advancements in technology and craft through a new form factor. Thus, product forms signify more than an enclosure of the customer's devices. Product form, whether it is a physical quality (bottom-up approach) or a mental construct (top-down approach), has been debated in theoretical discussion of both aesthetics and perception. Some studies suggest product form, as a physical quality, informs meanings of functionality and utilitarian features; however, some suggest product form is a communication medium dependent upon the context. Others suggest form is a construct creating meanings by evoking emotion and pleasure. There are limited studies providing a holistic view to these approaches to understand the meaning attribution process of product forms. Extending the aforementioned concept, the current study explores the relationship between how people understand the meaning of an object (e.g., safe, elegant, high-tech look) based on its physical features (roundness in multiple dimensions). A mixed method approach to understanding the meaning attribution process for product form is investigated in a set of experiments. Participants in experiment one interacted with nine basic geometric objects while participants in experiment two experienced nine hard-disk drive and nine soup dispenser forms. The roundness of object corners were altered from crisp 90 degree edges to blunt round edges along 2- and 3-dimensions. A survey captured rankings of meanings for each object, and interviews explored meaning attribution strategies of the participants. Results suggest the involvement of both bottom-up and top-down approaches in participants' meaning attribution process depending on the meaning of interest. Moreover, the data suggests that a very small change in roundness of the form lead to large impacts on meaning (suggesting a quadratic relationship). Finally, results indicate a connection between central and complicated meanings.

Leye Lin
Graduate Program: Graphic Design
Advisor: Meredith Davis
Poster Number: 104

Designing Instant Data Visualization of Biofeedback Interactions to Inform Patient/User Behavior in Executing a Self-oriented Recovery Process

The complexity of biofeedback information that tracked from patients makes it hard to understand correctly without the explanation from a doctor. Numbers and charts of existing data visualization strategies that shows patients' health status and conditions now are mainly focused on short term and single type of health data. The lacking of comprehensive display of multi-types of health data at the same time will limit the understanding of the causes of health status. However, potential problems of current data visualization is they can only be viewed as a short-term result, which means it is hard to use them to help patients better understanding what are those health data really mean to their health, neither reflecting on their previous activities. Reflection on previous behavior correctly, and how different activities influence each other that matters patients' health will definitely help them to behave in a better way in the future. Situations of the patients who are executing their recoveries need a more effective and helpful guiding and reminding combined recovery experience. This study investigates how instant and long-term data visualization of biofeedback interaction work together can help patients to execute self-oriented recovery according to the assistance from available personal technology. The solution will address how sensors, wearable devices, and smartphone work together to cater the needs of body parts physical injury recovery process. It contains three main parts, which are instant biofeedback notification system for daily activity tracking, physical exercises guidance and data collecting, and comprehensive health data visualization interaction. Hence, a well-concerned instant and long-term biofeedback notification system as well as visualization strategy have great potential to help the patients to understand what is happening to them and how they should behave in real time in order to improve their whole self-oriented recovery experience.

Ahoo Malekafzali
Graduate Program: Design
Advisor: Jianxin Hu
Poster Number: 108

Daylighting Assessment and Optimization of Multi-zone Electrochromic Glass Window Integrated with Light Shelf System

Electrochromic (EC) glazing, which varies it's visual and thermal properties by electric field, has the potential to be the next major advance in energy-efficient window technology, helping to transform windows from an energy liability to an energy source for the building sector. Although EC windows can provide considerable energy saving and relatively stable light levels, they cannot effectively block direct sunlight and tend to have unbalanced light distribution. This research focuses on the optimization of EC glass application in buildings to improve its qualitative and quantitative performances.

Specifically, EC glazing is integrated with light shelf, an interior horizontal light reflecting device installed approximately 8 feet above the floor adjacent to glazing. The light shelf divides the glazing into two zones, daylight glazing (the zone about the light shelf) and view glazing (the zone below). The light shelf potentially provides protection from direct sunlight and projects daylight into deeper areas of the space. EC glass with different tinting control algorithms based on interior light sensor is installed in the daylight and view glazing areas to dynamically control the visible light transmittance of both zones according to the exterior light intensity and solar angle incident on the window.

Physical experiment is adopted as the primary method for assessing daylighting performance. Two pieces of SAGE Electrochromic glass are installed in a full-scale rotatable test-cell at NCSU daylighting lab equipped with16 photometer sensors for daylight level measurement. The first phase assessment focuses on the initial testing on the Electrochromic window configurations and other systems outlined above. The configurations and algorithms will be evaluated and optimized based on this preliminary assessment. The second phase assessment focuses on climate-based daylight modeling, which is to monitor the daylighting systems on a long-term basis. The experimental test and computer simulation results show that the proposed multiple-zone Electrochromic window system that is integrated with light-shelf system can significantly improve the daylighting performance and visual comfort of the daylit space.

Sedighehsadat Mirianhosseinabadi
Graduate Program: Design
Advisor: Soolyeon Cho
Poster Number: 123

Development of Technologies for "Real-time Performance Measurement & Verification and Commissioning" Using Building Automation Systems in Existing Buildings

People are very much interested in High Performance Buildings (HPBs) as they are meant to be energy-efficient, economic, and environmentally friendly. Among the new technologies for the development of high performance buildings, Building Automation Systems (BAS) and Building Energy Management Systems (BEMS) are frequently used by building owners and/or energy managers to achieve the sustainability goals. This is mostly because BAS, BEMS, and Energy Management and Control Systems (EMCS) are main information sources for building commissioning (Cx) and Performance Measurement and Verification (PM&V) process in achieving energy savings and energy efficiency goals. Existing BAS/BEMS and EMCSs are able to acquire, store, and trend data collected from building systems. Using these features, a building manager can detect any system degradation over the long term and also identify situations under which systems are operating in an unintended mode. However, these systems do not have the capability of estimating the performance degradation relative to the design intent. Moreover, the BAS is not able to inform the building manager on how much energy has been saved by implementing the Energy Efficiency Measures (EEMs) in the building after the Cx process.

This research aims to develop a new framework to expedite the Cx and PM&V processes, which can maintain and/or improve the energy performance level of buildings in real-time basis. This advanced tool will consist of key parameters and key data points from BAS/BEMS and EMCS that mainly affect the building energy performance and focus on energy related issues for maximum energy savings in buildings.

The new framework (or tool) integrates the Cx process and IPMVP Option-D. It uses a calibrated building model simulation to calculate and predict the building energy consumption and savings before and after implementing EEMs. The calibrated EnergyPlus reference model and measured quantities from real building are compared together through statistical process control using MATLAB to detect anomalies and faults in buildings. Several EEMs will be developed using the tool and added to the calibrated building model to calculate the ultimate energy savings.

The methodology will be tested in an office building in centennial campus to demonstrate the potential building performance improvements, ideally to its design intent, by implementing corrective actions and adding the EEMs to the building.

Seyed Danial Moeinzadeh, Kimberly Johnson
Graduate Program: Architecture
Advisor: Wayne Place
Poster Number: 125

Skyscraper Design in San Francisco

Developing more dense urban habitats is a promising approach to reducing energy expenditures and carbon emissions, by limiting transportation and sharing energy resources associated with shared housing. This project explores ways of enhancing the life-quality for the occupants of a tall building. It also addresses various measures to make the building more energy and material efficient through the use of solar shading, ventilative cooling, passive solar heating, water recycling, and innovative structural systems to reduce material expenditure. There is also a substantial component devoted to the local growing of fruits and vegetables, assuring freshness of the food and reducing transportation costs and energy waste. The urban site chosen for this design study is in San Francisco. This work was done as part of an architecture studio in the College of Design, taught in conjunction with personnel from the San Francisco office of Skidmore Owings and Merrill.

Rebecca E. Ryan[1] and Beth A. Faragan[2]
Graduate Programs: Architecture[1], Landscape Architecture[2]
Advisors: David B. Hill, Andrew A. Fox
Poster Number: 157

Brownfield Redevelopment

A chain of thin barrier islands that are migratory, flat, and storm-prone form the Outer Banks of North Carolina. Despite the difficult and potentially dangerous implications of human settlement in such a dynamic environment, the number of seasonal and permanent residences continues to increase, and commercial development follows its lead. There are fewer than 400 square miles of land in Dare County, the majority under the 100year floodplain. Because of this, all vacant or underutilized sites on the islands have great potential. Brownfields are a tricky subset of these available sites because some amount of contamination has affected their value and ability to be reused. The EPA defines a brownfield site as "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant." The objectives of this research were to (1) identify contaminated sites, existing brownfields, and hazardous waste handlers within Dare County via EPA Enforcement Records and the North Carolina Inactive Hazardous Sites Program, (2) interpret their vulnerability based on spatial proximity within natural systems, volume of hazardous waste generated and history of government mandated cleanup, and (3) identify the opportunities provided by existing policy by compiling current local, state, and national regulations concerning brownfields, including funding opportunities. Our study discovered a surprisingly low rate of participation in funding opportunities in coastal North Carolina. The EPA Brownfields Program and The North Carolina Brownfields Program provide grants and tax incentives to assist developers in recuperating costs associated with remediation and development of brownfields. No grants have been awarded to brownfield sites in Dare County through either federal or local programs. We identified more than a dozen hazardous sites of varying vulnerability levels, amounting to over three million dollars in possible federal brownfield remediation aid.

Laura Schoenthaler
Graduate Program: Design
Advisor: Haig Khachatoorian
Poster Number: 160

Urban Deindustrialization and the Emergence of Landscapes of Adaptation and Resiliency

Urban planning and development strategies of the second industrial revolution were designed to effectively utilize a region's natural climate, therefore, influencing the location and development of both industrial sites and transportation infrastructure throughout the core of urban centers. Decades of economic globalization, overseas outsourcing, and decentralization have forced these industrialized sites to discontinue activity, leaving behind a collection of scarred physical landscapes. The remains of these built environments are static, as the planning and development strategies relied on at their inception frequently omitted comprehensive consideration for the end of use. Marked by fragmented environments and structures along an altered topography interwoven within the urban periphery, these sites are often understood to be 'waste landscapes' in that they are characteristically understood as deteriorated and unusable. This emerging urban phenomenon spurs and altered type of decline among the cultural, social, ecological, and economic fabric of communities prone to the onset of waste landscapes.

This presentation identifies the preliminary findings within a pilot study in which select post- industrial waste landscapes in urban locations were examined. Through application of a multi- modal phenomenological and ethnographic data collection methods, a series of observations, small-scale individual surveys and document analyses provided a thematic exploration of the effect of urban deindustrialization and the emergence of landscapes of adaptation and resiliency. To understand these landscapes as adaptive and resilient in a multi-life cycle capacity, the past, current, and planned lifecycle uses are analyzed, considering the ecological, social, and environmental potential for revitalization and reprogramming of such sites.

Melissa Todd, Bridgette Cannon
Graduate Program: Architecture
Advisor: David Hill
Poster Number: 179

A History of Outer Banks Settlement and its Relationship to Trends in Infrastructure and Industry

The Outer Banks of North Carolina have attracted inhabitants since the late 1500's, beginning with the Algonquin tribes who settled along the islands' sound side. This research explores the history of settlement along the outer banks, the drivers that spurred growth, the factors that provided longevity, and the dynamism that inhabitants coexist with. The greatest change in habitation is seen in the shift from reliance on self- sufficiency and subsistence farming of permanent residences along the maritime forests of the sound side to a tourism dependent economy of seasonal residents along the ocean front side of the outer banks. Residences and businesses constructed on the ocean front side of the outer banks are faced with perpetual issues of erosion, flooding, and condemnation from both nor'easters and hurricanes. Data was gathered from census bureau records, print and internet sources, interviews with tax assessors, residents, and a local historian. The collection of research shows multiple drivers of change and evolution of habitation on the outer banks, with economic development and the increase of tourism reliant economy inherently linked with population growth and an influx of seasonal residents.

Jennifer Truman, Katherine Peeler
Graduate Program: Architecture
Advisors: Sara Queen, Burak Erdim
Poster Number: 181

Engaging City Edges: A Study in Suburban Development

All parts of the city have value. Urban design often focuses on the core, the downtown heart, of cities. Here, I examine the urban fabric that is found outside the core. Urban expansion has been studied as development of rural hinterland, suburban sprawl, exurban expanse, waste landscape and dross. Regardless of what they are called, these expansions of urban areas reflect the dependency of the core on the creation of materials, goods, food, and economy in the periphery. This periphery, this edge is not singular; there are many city edges. These edges can be formal or informal: political city limits, boundaries of old land owners or commercial developments, or cultural lines of separation. With each expansion, a new edge is formed. The rapidity of these expansions has created undervalued and under-used space in between the denser downtown areas of cities and their outlying neighbors. A brief survey of urban evolution is examined here through mapping the development of Raleigh, NC as it relates to prevalent 20th century suburban theories. Studying the shaping of urban fabric through the language of edges sheds new light on the conditions of density, movement and use that define it. The values that built this fabric become clearer and new opportunities for design are discovered. The under- used corridors of suburban dross that create and cross edges to join urban and rural fabric reveal new architectural opportunities for experimentation. Engaging city edges is meant as an exploration of the spatial value linking urban cores and expanses together, to create new design potential and suggest new sub-urban typologies.

Jimena Vergara Sanz
Graduate Program: Industrial Design
Advisor: Sharon Joines
Poster Number: 186

Universal and Inclusive Design for Leisure Activities for the Deaf and Hard of Hearing

Several studies demonstrate that social isolation and segregation are predominant characteristics in the life of people with disabilities, who represent 15% of the world and 12.1% of the North American population (U.S. Census Bureau, 2012). Available products for this population represent a small segment in the market place. This limits the innovation mainly to functional objects. Governmental regulations (ADA) address inclusive norms for organizations, working and public spaces, but still, there are several activities and places that lack inclusion. Leisure is a clear example of this lack, and at the same time is known to be an activity that supports well-being. The population with hearing impairment and deafness represents 6% of the American disabled population (U.S. Census Bureau, 2012). This project aims to support leisure through industrial design intervention, specifically for the cinema and music experience. This is a difficult challenge in itself, but the emerging wearable technology market appears to be a viable means of achieving inclusive design and reaching success in the market. Surveys and interviews with this studied population revealed an urgent need for designing inclusive objects to aid the movie-going experience. Exclusion was also detected in music-related situations. Simulation and emphatic activities revealed a need for an easier and effective system including language, delivery and adaptability issues that would improve the movie-going and music-sensing experiences. A test of inclusion viability would be that this product is universal enough to be used and valued by a larger population than the challenged one. This product will be evaluated through different prototypes and activity simulators. Persons with normal hearing, Deaf, and hearing impaired will be recruited to evaluate the design solution. This will be translated into a profitable object that minimizes exclusion and supports the stated activities.

Rachel Whitaker
Graduate Program: Industrial Design
Advisor: Haig Khachatoorian
Poster Number: 194

The Future of Furniture: A Renewed Opportunity for Domestic Furniture Design and Production

This project serves as a research investigation into the future of the domestic furniture industry. From the year 2000 to 2008 the U.S. furniture industry suffered a production capacity loss of 60%. An increase in furniture imports coupled with the offshoring of manufacturing led to this steep decline. The result was a loss of jobs, product quality, relevance to the user and reduced innovation due to the distance between design and production. This goal of this project is to explore opportunities for design and manufacturing and to outline one possible approach to regaining both dominance and relevance in the U.S. furniture industry. This will be achieved through primary and secondary research of the consumer and advanced technologies that will impact the solution. Consideration will also be given to consumer trends in lifestyle and sustainability with regards to production and use. In an effort to reverse the commodity mentality, emphasis is placed on material selection and production methods that will aid in the reestablishment of quality, value and relevance in the market.

College of Education

Amanda Hudson Allen
Graduate Program: Counselor Education
Co-Advisors: Stanley B. Baker and Adria S. Dunbar
Poster Number: 4

"I Like to MOVE IT! MOVE IT!" To Meet Student Needs: An Exploratory Study of the Use of Stationary Movement Devices (SMDs) in an Elementary School Classroom

Cognitive functioning, information retention, and student engagement are thought to improve through the incorporation of physical movement in learning environments. In contradiction, traditional classroom settings do not support the use of physical movement during lessons. Literature shows that movement can be used to teach specific concepts and can be used to reenergize students at transitional times (between two lessons). A gap in this literature exists in determining the usefulness of integrating physical movement into the learning environment in a way that allows the student to have constant voluntary access. A phenomenological qualitative study has been conducted to explore what happened when 5th grade students were allowed to use stationary movement devices (SMDs) or stationary pedals placed under student desks during their math and science class. The objectives of this study were to discover what positive and negative experiences resulted from the integration of SMDs in the learning environment. Nine students were chosen to participate in interviews based on their choice to use SMDs during class and their parent/guardian's consent to be interviewed. Interview data were analyzed and reflected upon to conduct phenomenological reduction, imaginative variation, and synthesis to best explore and isolate themes. The following four themes emerged: (a) structure: allowed for SMD use and of the classroom environment; (b) student choice: when and why students chose to use SMDs; (c) positive/desired change reported: focus, motivation, brain function, emotion regulation, performance, physical benefits and enjoyment; and (d) negative/undesired change reported: logistics of SMD use, student behaviors and distraction. For the student- participants involved in this study, positive/desired change far outweighed the negative experiences that primarily occurred because of the mechanics of the pedal model that was purchased. Unexpected findings included an increase in responsibility and ownership taken by students over their learning experience.

Hannah Carson Baggett
Graduate Program: Curriculum and Instruction
Advisors: Heather A. Davis and Jessica T. DeCuir-Gunby
Poster Number: 9

L'Égalité des Chances?: **A Critical Analysis of the Inclusion of Historically Marginalized Students in World Languages**

Students enrolled in World Languages classes often experience many positive academic and developmental outcomes. However, students' demographic backgrounds (i.e., ethnoracial, socioeconomic, disability statuses) predict access to school curricula, and teachers often hold belief orientations about diversity that may not be adaptive for meeting the needs of diverse learners. The purpose of this multi-phase, mixed methods study was to explore the extent to which World Language classes function as sites of inclusion for historically marginalized students. Three data collection and analytical techniques were employed to analyze student demographics in middle and high school World Language programs in four large, Southeastern school districts, and to explore World Language teachers' perceptions of student diversity and the students enrolled in their classes. Critical Race Theory provided the guiding framework for data collection and interpretation. Findings indicated that there were statistically significant discrepancies in equitability of enrollment in World Language courses for African American and Latino male students. Findings from two-step hierarchical clustering, MANOVAs, and interview data indicated that language teachers' orientations towards diversity varied systematically: three clusters held orientations that perpetuate status quo education for students of color and other historically marginalized student groups; one cluster held beliefs that were more inclusive, but many of the teachers in this group also struggled with specific dimensions of student diversity, such as sexual orientation and faith. Implications for policy, teacher preparation, and professional development are discussed.

Amanda Cadran
Graduate Program: Curriculum and Instruction
Advisor: Kevin Oliver
Poster Number: 25

As We Are: The Ethics of Caring in a Co-teaching Blended Model

It is widely accepted that students with severe academic challenges are more likely to struggle in school and may face challenges trying to graduate on time. While research has traditionally focused on classroom strategies, such as direct instruction, to help students learn and process information, there remains a lack of understanding regarding those teachers working with special education students. This research examines the experiences of teachers working with occupational course of study (OCS) students in a secondary blended learning setting that pairs a highly qualified exceptional children's classroom teacher with a virtual content area teacher, who work together to individualize and personalize instruction for their OCS students. This co-teaching model provides both teachers with a unique opportunity to work together without having to be in the same physical space. Using a phenomenological research design, the comments of three high school content area teachers working with exceptional classroom teachers through a state-run virtual school were analyzed for connections that can pinpoint the

essence of their shared teaching experience. Several rounds of coding pointed to shared themes that support a connection to Nel Noddings' Ethics of Care framework. While historically used to define teacher-student relationships, deep levels of analysis demonstrate that the Ethics of Caring framework applies to teacher-teacher working relationships as well, and could provide insight into what type of teaching program lends itself to a supportive environment. Findings point to flexibility, classroom/virtual teacher relationships, support structures, and the teacher's prior experience as key indicators of program success.

Elysa N. Corin[1], M. Gail Jones[1], Thomas Andre[2], Gina M. Childers[1], Vanessa Stevens[1]
Graduate Program: STEM Education, North Carolina State University[1], Iowa State University[2]
Advisor: M. Gail Jones
Poster Number: 32

Science Hobbyists as Learners and Educators: Participation in the Science Learning Ecosystem

Science hobbyists, including amateur astronomers and birders, are members of the public who engage in self-directed, free-choice science learning and many have considerable expertise in their hobby area. This study examined how adult science hobbyists use organizations in their community to support their hobby engagement. Interviews were conducted with 58 amateur astronomers and 49 birders from the midwestern and southeastern United States. A learning ecology framework of a science- learning ecosystem was used to map the community-based contexts with which the hobbyists were involved. Seven contexts were identified that support the hobbyists' involvement in their hobby over time: home, K-12 schools, universities, informal learning institutions, hobby clubs, conferences, and community organizations. Three themes emerged from the interviews and described how hobbyists interacted with organizations in their communities: 1) *Multiple Points of Entrance:* hobbyists can enter the science-learning ecosystem at any point, 2) *Organizations as Catalysts:* a hobbyist's development in their hobby advances when they participate with organizations in the science-learning ecosystem, and 3) *Beyond Consumers:* the relationship between hobbyists and the organizations they use for learning eventually becomes bidirectional. Results showed that both astronomy and birding hobbyists used community-based science-learning organizations to meet their hobby-related learning goals. Most hobbyists in the sample (90% astronomers, 78% birders) engaged in outreach and shared their hobby interest with members of their community. Patterns of interaction of the astronomy and birding hobbyists with the seven contexts (home, K-12 schools, universities, informal learning institutions, hobby clubs, conferences, and community organizations) are discussed.

Francemise Kingsberry
Graduate Program: Education Administration and Supervision Program
Advisor: Lance Fusarelli
Poster Number: 90

Protective Factors and Resiliency: A Case Study of How African American Women Overcome Barriers En Route to Superintendency

An underrepresentation of African American women in the superintendents exists in K-12 public schools as well as in the literature. Although the amount 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 negative stereotypes and limited opportunities. Further, African American women seeking the superintendency have to prove they are worthy enough to hold the position. Superintendents face numerous challenges due to the nature of the position itself, in general, without having to account for race and gender.

Research shows that African American female administrators aspiring to attain the superintendency often lack mentorship as well as a lack of awareness of how to navigate politically through the administrative structure. Another barrier is the criteria that headhunters and search consultants use to inform their superintendent searches and hiring practices. These "gatekeeping" practices are both indirect and overt biases that limit the advancement of African American women in school administration.

The purpose of this case study is 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. This work seeks to highlight their perspectives on potential barriers to becoming superintendents. By shedding light on the challenges faced by African American women superintendents and how they overcame them, Protective Factors in Resilience Theory will be used as a framework.

Tammy D. Lee
Graduate Program: Science Education
Advisor: Gail Jones
Poster Number: 97

An Exploration of Systems Thinking: Elementary In-service Teachers and Pre-service Teachers

Complex systems surround us in every aspect of our lives from the ecosystems that we inhabit and share with other living organisms to the systems that supply our water (i.e., water cycle). Developing an understanding of complex systems consists of evaluating events, entities, problems, and systems from multiple perspectives this approach is known as "systems thinking." New standard documents have made explicit the call for teaching with a "systems thinking" approach in our science classrooms. However, little is known about how elementary teachers or elementary pre-service teachers understand complex sys-

tems especially in terms of systems thinking. This mixed methods study investigated sixty-seven elementary in-service teachers and sixty-eight pre-service teachers' knowledge of a complex system (e.g., water cycle) and their knowledge of systems thinking. Quantitative and qualitative analyses of content assessment data, and questionnaires were conducted. Semi-structured interviews with a subsample were completed. Results from this study showed elementary in-service and pre-service teachers had different levels of systems thinking from novice to intermediate. Common barriers are identified with both in-service and pre-service teachers for identifying components and processes, recognizing multiple interactions and relationships between subsystems, hidden dimensions, and finally, difficulty understanding the human impact on the water cycle system.

Sonya Massengill
Graduate Program: Curriculum and Instruction
Advisor: Carl A. Young
Poster Number: 110

Exploring the Landscape of High School Writing Experiences, Writing Self-efficacy, and Composing from Multiple Sources: A Mixed Methods Study

The continued demand for remedial courses to address students' lack of preparation for college writing, as well as positive relationships between students' self-efficacy and writing achievement, are well-documented in the research literature. This mixed methods study explored the relationships between inequities in high school writing experiences, students' writing self-efficacy, and their preparation for composing from multiple sources (a skill essential to the research-based writing commonly assigned at the college level). Descriptive statistics, factor analysis, and cluster analysis were used to identify types of high school writing experiences. One-way analysis of variance (ANOVA) tests were then used to compare writing self-efficacy scores with types of high school writing experiences. The study found four different types of high school writing experiences and concluded that those differences were associated with small but significant differences in students' writing self-efficacy. Students in the Intensive Writing cluster reported the highest writing self-efficacy. Students in the Academic Writing cluster did not differ significantly in writing self-efficacy from students in the Intensive Writing cluster. Students in the Infrequent Writing cluster and the Writing to Demonstrate Knowledge cluster demonstrated the lowest writing self-efficacy. Qualitative analysis of students' essays revealed five major skills associated with students' success in composing from multiple sources: Selection, Evaluation, Organization, Connection, and Documentation. Further qualitative analysis of essays purposefully selected on the basis of students' high school writing experiences and writing self-efficacy revealed four approaches to the writing task: Out-of- Control Essays; Source-Dominated Essays; Writer-Dominated Essays; and Conversation- Dominated Essays. Students with the highest writing self-efficacy consistently wrote stronger essays than students with lower writing self-efficacy. This study provides useful information for high school and college writing instructors interested in improving teaching practices to prepare more students for the challenges of college-level writing.

Jennifer Nickell[1] and Emily Thrasher[2]
Graduate Program: Mathematics Education
Advisors: Hollylynne S. Lee[1] and Karen A. Keene[2]
Poster Number: 132

Impact of a Graduate Course on Teachers' Self-efficacy to Teach Statistics

Over the last 25 years students statistical reasoning has received considerable research and its importance in the mathematics curriculum has continued to develop (NCTM, 2000; Common Core State Standards Initiative, 2010). However, there is a lack of research on secondary teachers' statistical reasoning, knowledge, and beliefs (Batanero, Burrill, & Reading, 2011). In fact, very little is known about teachers' self-efficacy to teach statistics and professional development's impact on self-efficacy to teach statistics (Harrell-Williams, Sorto, Pierce, Lesser, & Murphy, 2013). This study explores the impact of a graduate course on teachers' self-efficacy to teach statistics. This course aimed to develop and deepen teachers' knowledge of inferential statistics through engaging in data analysis using technology. To provide data about teachers' confidence to teach statistical topics based on the Guidelines for Assessment and Instruction in Statistics Education (Franklin et al., 2007), this study uses qualitative and quantitative data from the Self-Efficacy to Teach Statistics Survey (Harrell-Williams, Sorto, Pierce, Lesser, & Murphy, 2014). The survey was given to 27 participants from two different institutions before and after the graduate course. Participants' self-efficacy to teach statistics had statistically significant increases using a Wilcoxon Signed Ranked Test ($p < 0.001$). On average participants' self-efficacy to teach statistics increased from between somewhat confident and confident to between confident and very confident. To gain a better understanding of the quantitative findings, the qualitative responses were opened coded for themes. Three themes emerged that describe what teachers draw upon to describe their self-efficacy to teach statistics: self as a learner, teaching, and student as learner.

Melissa Pendleton
Graduate Program: Curriculum & Instruction
Advisor: Angela M. Wiseman
Poster Number: 141

Text-based Discussions: Lessons Learned from One Fifth Grade Classroom

The purpose of the present study was to investigate text-based discussions in a fifth grade classroom. I purposefully selected Laura, a fifth grade teacher, because she engaged her racially diverse, lower-tracked students in discussions about texts. Laura and 11 of her students participated in this three-month study at Greenwood Elementary School, a rural, Title I school with approximately 82% of students receiving free or reduced priced lunch. Data sources were consistent with qualitative research (i.e., classroom observations with field notes, audio recordings, interviews, artifacts). Data were analyzed and collapsed into four themes using constant comparative analysis (Corbin & Strauss, 2008). The first theme focuses on how the teacher's choices influenced students' discussions. The remaining three themes explain how students co-constructed meaning, engaged in unsanctioned talk, and explored their identities related to race, gender, and socio-economic status. The findings from this study validate existing research on dialogic talk and highlight the importance of identity and classroom talk, as well as the problems of unsanctioned talk. The themes have implications for policymakers, practitioners, and future researchers.

Pamela K. Pittman
Graduate Program: Curriculum, Instruction, and Counselor Education
Advisors: Meghan Manfra and Carol Pope
Poster Number: 144

Professional Learning Communities: Developing ELA Teachers' Knowledge

Teaching is one of the few professions in which novices enter the work environment doing the same work as experts. Though the research literature supports specialized training for middle school teachers, few middle school English language arts (ELA) teachers have had formal or meaningful training in reading instruction. National and state standards now require significantly more complex thinking skills of students than ever before. Therefore, teachers need high quality professional learning opportunities to help them master the content they teach and strengthen their teaching skills.

This study examined novice ELA teachers' experiences in professional learning communities (PLCs) as a form of professional development. Additionally, this study explored the affordances and limitations of these PLCs for the development of these teachers' pedagogical- content knowledge (PCK). The middle school teachers in this study taught in a small, rural school district in southeastern North Carolina at a historically low-performing school. Using a case study method, the researcher collected data from focus group interviews, personal interviews, PLC observations, and observations in the teachers' classrooms. Shulman's (1987) concept of pedagogical-content knowledge (PCK) framed the findings of this study.

Findings indicated that these ELA teachers trained differently to participate in PLCs due to their diverse backgrounds. Further, teachers experienced two types of PLCs – a subject area PLC and a grade level PLC. However, the subject area PLC, the focus of this study, received less emphasis. Additionally, the researcher discovered a disconnect between PLC activities and the teachers' classroom practice. In spite of these obstacles, the subject area PLC offered affordances for developing teachers' PCK, namely, collaborative opportunities and a supportive environment; the sharing of knowledge, resources, and teaching strategies; and data-driven instructional opportunities. Limitations for developing teachers' PCK included time and teachers' inexperience.

Carrie Lineberry Ritter
Graduate Program: Mathematics Education
Advisor: Karen Allen Keene
Poster Number: 151

A Study of the Evolution of Pre-service Elementary Teachers' Mathematical Sophistication in a Reform-oriented Calculus Course

Research suggests that improving pre-service elementary teachers' mathematical sophistication can increase student achievement. Seaman & Szydlik (2009) call for research to describe and analyze classroom activities and experiences that increase mathematical sophistication among elementary pre-service teachers. To answer this call, the following study was designed to answer the following research question: How does pre-service elementary teachers' participation in a reform oriented calculus course effect their mathematical sophistication? The study includes nine pre-interviews, a pre-test, student work on three cognitively challenging tasks, classroom videos, a post-test, nine post-interviews and a survey on mathematical beliefs. The analysis of this study is in its preliminary stages and will continue to grow. Finding the answer to the research question will contribute to research on preparing pre-service elementary teachers possibly impacting and transforming STEM elementary education—from teacher preparation to student achievement in mathematics.

Janice Sitzes
Graduate Program: Higher Education Administration
Advisor: Duane Akroyd
Poster Number: 165

Enabling Persistence of Veteran Students at North Carolina Community Colleges through Institutional Support Programs and Policies

Over two million service men and women will be returning from the wars in Iraq and Afghanistan and will need to acquire new skills, knowledge, and credentials to facilitate their transition back to civilian life. Little research has been devoted exclusively to the persistence of veteran students, however there is increased interest in the experiences of veteran students and calls for accountability, including a 2012 Executive Order mandating that any institution that receives veteran education benefits must provide outcomes data. Combining Bean and Metzner's Model of Nontraditional Student Attrition with social support theory, this research seeks to understand the relationship between institutional support mechanisms and the persistence of veteran students in North Carolina community colleges. A letter was sent to each of the 58 North Carolina community college presidents requesting their institution's participation in the study. Administrators of consenting institutions were sent an online survey on their college's existing and planned programs and policies for veteran students. Veteran students at these same institutions were sent an online survey asking what programs and services they use and value. Initial analysis of the administrators' survey reveals that half of the responding colleges have increased their emphasis on veterans' programs and services since September 11, 2001. However, while half of the responding colleges consider veteran student retention and completion to be a priority, the number of social support services is very limited. Student data are being analyzed using logistic regression to determine the impact of academic, environmental, and institutional variables on persistence of veteran students, as measured by intent to persist. Findings will inform community colleges to help them shape institutional policy and program decision-making in order to enhance persistence and completion rates of veteran students, as well as institutional effectiveness.

Jeremy B. Tuchmayer
Graduate Program: Educational Research & Policy Analysis
Advisor: Paul D. Umbach
Poster Number: 182

The Community College Effect: A Comparison of Labor Market Outcomes of Community College Transfer and Four-year Native Graduates

Pathways to the baccalaureate degree are immense, yet understanding how the choice of postsecondary entry affects post-graduate outcomes is complex and not well understood. This study employs various propensity score matching models to explore how choice of postsecondary entry affects post-graduate wage income. This quasi-experimental study used two different matching models (i.e. matching at time of postsecondary entry and again at graduation from college) and four different treatment conditions (i.e. some community college, initial postsecondary entry at community college, earned associate's degree, and earned associate's degree for those whose postsecondary education began in community college) to explore the effect of postsecondary entry on wage income one year and four years after graduation. Utilizing the 2008/12 Baccalaureate and Beyond Longitudinal Study, this paper seeks to fill gaps in the literature on the returns to schooling by examining how post- baccalaureate wage income may differ between community college transfer and four-year native graduates. Preliminary findings suggest the results are not entirely clear. Depending on the various ways in which the comparison groups are operationalized and the choice of matching model applied, some community college transfer students report higher earnings one year after college compared to their four-year native graduate peers. However, early models indicate these wage differentials may disappear for some groups four years after graduation, while others suggest that four-year native graduates earn a wage premium four years after completion of the baccalaureate degree over those whose postsecondary education began in community college.

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Poster Number: 203

Predicting Doctoral Time-to-degree: A Three Level Model

Doctoral education is esteemed as the highest level of study. Despite its preeminent status, some facets of doctoral education need attention considering that on the whole, the median time-to-degree for all disciplines had increased from 6.3 years in 1978 to 7.7 years in 2008. The elongated time-to-degree not only has increased cost per degree for doctorate granting institutions, especially public institutions that are under severe financial constraints, but has increased opportunity costs and explicit expenses for individuals pursuing the degree. As a result, such extended time taken to earn the degree bring forth a series of questions that are still unanswered despite scholars' and researchers' previous attempts to study doctoral education. While much has been studied on doctoral student experiences, empirically, less is known about predictors affecting doctoral time-to-degree, especially on predictors affecting subpopulations of doctoral students, such as the ones of different gender or racial/ethnic backgrounds or first generation students. Drawing from Bourdieu's (1977) cultural capital theory, Beck's (1962, 1980) human capital theory, and Berger and Milem's (2000) organizational impact model, this study employed a three level hierarchical linear model to examine factors associated with doctoral time-to-degree at individual-, program-, and institutional levels. After analyzing NSF survey data with over 500,000 observations of doctoral recipients that graduated between 2002 and 2012 as well as program ranking information from the National Research Council and IPEDS data on institutional characteristics, the

study found that doctoral students with full tuition remission graduate significantly earlier than their counterparts with partial tuition remission. Moreover, doctoral time-to-degree is substantially longer for students who relied on personal savings than those who had assistantships, fellowships, and loans. This study also found that students from public institutions earned their doctorate significantly faster than their peers from private for profit institutions by more than three years.

College of Engineering

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Advisor: Emily Z. Berglund
Poster Number: 3

Evaluating Water Savings Through Conservation Policies for Basin-scale Demand Management

Growing population centers in the arid southwest increase the demand for water, which is typically met through increased groundwater withdrawals. Hydro-climatic extremes due to climate change may also increase demands and decrease the replenishment of groundwater supply. Groundwater aquifers typically cross watershed, municipal, and management boundaries, and as a result, multiple diverse agencies manage a shared resource. Municipalities and management districts define individual demand management strategies that adapt water consumption to falling groundwater levels. The interactions among governing agencies, consumers, and the environment influence the performance of local management strategies and the availability of regional groundwater resources.

This research develops an agent-based modeling (ABM) framework to analyze the dynamic interactions among changing water demands and limited groundwater resources under the stresses of population growth and climate change scenarios. Households are initialized as agents with properties and attributes to define indoor water use, outdoor water use, and water use reduction. Policy-maker agents are encoded to represent governing agencies that mandate or encourage water use restrictions. Demand management strategies are simulated as the response of a policy-maker agent to groundwater levels, safe yield, and climate variables. The framework is applied for municipalities located in the Verde River Basin, Arizona that withdraw groundwater from the Verde Formation-Basin Fill-Carbonate aquifer system. The effects of management strategies on water savings and basin-wide groundwater levels are explored, based on water use demands and reductions in different sectors of municipal water use. Insights gained through this simulation study can be used to guide groundwater policy-making under changing hydro-climatic scenarios for a long-term planning horizon.

Nouf Mousa Almousa
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Poster Number: 6

Electrothermal Capillary Plasma Source with Combustible Materials for Launch Applications

Electrothermal (ET) plasma sources are of interest for a variety of applications such as hypervelocity launch devices, fusion reactor pellet injectors, and pulse thrusters. The ET plasma can be generated in capillary sources by discharging a high current to initiate an arc. ET plasma sources that operate under ablative regime have been widely studied for fusion fueling and electric launcher applications. Various Studies were also conducted on ET sources including the electrothermal-chemical (ETC) devices in which plasma interacts with solid or liquid propellants. The ET source can also be operated under combustion regime in which the capillary is either lined or injected with energetic materials. Considerable interest has been focused on injecting energetic gaseous/liquid materials into the ET plasma source as a technique for space propulsion and hypervelocity launchers. In the present study, computational experiments have been conducted using different gaseous/liquid energetic materials with different mixing ratios to investigate the performance of the plasma jet parameters at the source exit. These parameters are the exit pressure, velocity, and heat flux as they are the important parameters for launch applications and ETC devices. Simulation results indicate that the mixing ratio of the energetic material injected into the source plays a significant role in the parameters of the generated plasma jet. The plasma kinetic temperature and the resulting heat flux are strong functions of the energetic material properties. A set of code runs have been conducted at various magnitudes of the discharge current to explore the effect on the plasma jet behavior. It has been shown that increased discharge current increases the plasma kinetic temperature and the radiant heat flux.

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Poster Number: 13

Skin Expansion for Trauma Treatment

Skin, the largest organ in the human body, is a multilayered composite material composed principally of proteins, collagen, elastic fibers, and multiple cell types including keratinocytes and fibroblasts. In regenerative medicine, significant effort has focused on a number of methods associated with procuring skin for mitigating major trauma incidents. The driving force is the significant morbidity and mortality associated with patients suffering from large area burns. The purpose of this research is to improve upon the previous proof of concept for experiments of expansion of mammalian skin in an orbicular skin expander. Epidermal tissue has been mechanically strained so that skin surface area can be increased by up to 40% of the original size within 7 days. In one experiment, mechanically expanded skin was successfully expanded and transplanted back onto the specimen for a successful wound healing. The focus is to develop operational specifics so that the greatest quantity of skin can be expanded for wound repair. To this end, a vision system to detect localized straining is being developed. This allows for light emission through the system accompanied with a camera that captures the light transmitted through the tissue to determine local thinning; effectively identifying tearing before it happens during expansion. In doing the skin expansion experiments, combined with light emission feedback, discovery of the optimal operation of an orbicular skin expander is expected.

Cameron Brown
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Poster Number: 22

Analysis of the Turbulent Energy Spectrum in Single and Two-phase Bubbly Flows in Different Geometries Based on Direct Numerical Simulation Results

Safety and operation analysis of current and future generations of nuclear reactors can benefit extensively from high fidelity predictive capabilities of multiphase flows. Computational multiphase fluid dynamics (CMFD) approach allows modeling three-dimensional distributions of gas/liquid volume fractions as well as mean velocities and turbulent parameters in various geometries. The increased capability of direct numerical simulation (DNS) tools helps us to complement the experimental data in quantifying and validating the behavior of two-phase flows.

The presented work is demonstrating how spectrally analyzing single-phase and two- phase DNS data can help improve CMFD models by providing information about the bubble interactions with the liquid turbulence. Quantifying bubble/turbulence interactions can improve advanced turbulent spectral models and turbulence closure terms. This includes investigating the turbulent spectrum in single and two-phase flows, and providing the spectral information about the bubble-induced turbulence in different flow geometries. The spectral analysis is performed by using the recorded DNS velocity fluctuations as a function of time and applying the Fast Fourier Transform (FFT). This results in an energy spectrum of the turbulence in a frequency domain.

Complexity of multiphase flow results in mixed velocity time history coming from either the liquid or gas phase. In order to quantify the effect of the liquid signal intermittency as the bubble passes through a virtual probe we also develop a modified single-phase signal to mimic the presents of bubbles. Comparisons of single-phase, modified single-phase and two-phase results will quantify the changes to the expected -5/3 slope in the energy spectrum for single- phase flows due to turbulent interactions caused by the wakes behind a bubble. DNS data greatly enhances these research capabilities since limited experimental data exists for the modification of the energy spectrum slope in two-phase flows. Current modified single-phase results are showing that energy spectrum slope modification is due entirely to the bubble- induced turbulence.

Veronica Catete
Graduate Program: Computer Science
Advisor: Tiffany Barnes
Poster Number: 29

Towards an Evaluation and Teacher Support for the Beauty and Joy of Computing

Computer Science is one of the fastest growing fields in the US with 1.2 million new job openings projected by 2020. Unfortunately Computer Science is not a popular major choice by students entering college. During the 2013 AP exam cycle, just 31,000 students took AP Computer Science, meanwhile other science and maths had 100,000 or more student participants: Calculus - 266,000, Chemistry - 132,000. Of those who do elect to take the AP CS exam, just 14% of them are females and 11% minority students; 11 entire states had no minorities take the exam. This has been a yearly trend in AP CS testing, which has caused the National Science Foundation and College Board to work together to create a new computing course that will be attractive to more students. The Computer Science Principles (CSP) course focuses on more than just coding to include both global impact of computing and computational thinking concepts like abstraction. With a new course being developed there is an initiative to get 10,000 more computing teachers in high schools by the year 2020. The majority of these teachers, however, are not computing majors, nor have they completed a certificate in computer science teaching. We are recruiting math and business teachers, who have only some experience in computing if any, and providing them with teacher professional development to prepare

to teach CSP. Through teacher training workshops, we have found that teachers are comfortable with teaching complimentary literature, and the overall picture of the course, however, they have difficulties with the programming assignments and understanding what the students should learn, and how to evaluate it. This work will help to address these issues.

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Advisor: J. C. Dietrich
Poster Number: 35

Forecast Predictions of Winds, Waves and Storm Surge During Hurricane Arthur (2014)

Hurricane Arthur (2014) uprooted trees and caused power outages and property damage in many of the coastal regions of North Carolina (NC). Its strong winds also created large offshore waves and caused flooding due to the build-up of storm surge (up to 5 feet) especially on the Outer Banks. During the storm, the ADCIRC Surge Guidance System (ASGS) provided forecast guidance for wind speeds, wave heights and periods, and storm surge via high-resolution simulations of the NC coastline, which is characterized by a unique system of estuaries, channels, sounds and barrier islands. The forecast guidance from the ASGS is used by the emergency managers in the coastal counties of NC to plan safety measures and advance the hurricane preparedness of the coastal communities. In this study, we examine the accuracy of the ASGS forecast guidance through comparisons to observations from gages operated by NOAA and the USGS. It is shown that the forecast system could represent correctly the storm surge that developed in the Pamlico Sound and caused flooding along the sound-sides of the barrier islands, but model results were affected significantly by the accuracy of the hurricane track predictions from the National Hurricane Center. Hindcast simulations show the sensitivity of ASGS results to the differences in track predictions and a new wind model formulation. All model results are visualized in ArcMap by using Kalpana, a new Python-based software that converts ADCIRC results to polygon shape files.

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Advisor: Zhen Gu
Poster Number: 39

Ultrasound-triggered Noninvasive Regulation of Blood Glucose Levels Using Microgels Integrated with Insulin Nanocapsules

An on demand, non-invasive and portable insulin delivery method that can achieve pulsatile insulin release and effective regulation of blood glucose is highly desirable for type 1 and advanced type 2 diabetes management. We report that integration of an injectable microgel integrated with insulin nanocapsules with a focused ultrasound system (FUS) can remotely regulate insulin release both *in vitro* and *in vivo*. Insulin- loaded nanocapsule was prepared by a double emulsion-based solvent evaporation method. Poly(lactic-co-glycolic acid) (PLGA) was selected as a matrix material. The microgel was acquired by electrospray chitosan microparticles encapsulated with insulin loaded PLGA nanocapsules. To demonstrate the pulsatile release profile triggered by Focused Ultrasound System (FUS), we performed multiple FUS treatment over time via optimized FUS condition. By serving as a synthetic insulin reservoir, the microgel integrated with insulin loaded PLGA nanoparticles significantly promoted insulin release upon intermittent FUS triggers. Remarkably, a maximum of 80-fold increase in the insulin release rate was observed when the microgel was exposed to the irradiation of ultrasound for 30 sec. In vivo studies validated that this method provided repeatable and spatiotemporal regulation of blood glucose levels in Type 1 diabetic mice. In conclusion, we have developed a novel means of ultrasound-triggered controlled drug delivery based on the use of an injectable microgel. It can be effectively triggered to release insulin upon FUS-mediated administration. This system provides an unprecedented useful tool for noninvasive, rapid and pulsatile regulation of BG levels for diabetes treatment. It also can be extended to deliver other drugs, therapeutic proteins, or peptides in an intermittent and spatiotemporal release fashion. Furthermore, this method can be integrated with an ultrasound imaging system for noninvasively monitoring degradation of the drug-contained formulation and facilitating the subsequent administration.

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Poster Number: 43

Galactomannans as Binding Agents for Si Anodes in Lithium-ion Batteries

Lithium-ion batteries are ubiquitous energy storage devices, yet expanding market needs require higher energy and power densities than presently available. Inexpensive materials with low-processing costs stimulate the exploration of novel battery materials. One possible method to meet charge capacity demands is through the incorporation of silicon in anode materials. However, volume expansions resulting during the lithiation of Si leads to fractured binders and electronic isolation. Binding agents are a critical component in battery behavior and may also be used to enhance electrode performance. Herein, we

report the use of galactomannans—an inexpensive, environmentally friendly, and biorenewable polymer—as a novel binder for Si electrodes. Silicon-contain electrodes with as low as 5 wt.% binder exhibit large reversible capacities with >90% charge retention after 100 cycles without use of electrolyte additives. Increased capacities allow for greater energy densities while lower binder content allows for fast Li-extraction for high-power applications. The observed performance enhancement may be attributed to many parameters; polymer-particle interactions between the hydroxyl groups of the galactomannans and native-oxide layer of Si, coupled with the inherent mechanical integrity of galactomannan thin films, allow for minimal electrode cracking and delamination upon lithiation. The undamaged electrode microstructure during large volume expansions allows for columbic efficiencies > 99% to be observed. Galactomannans also experience ample polymer swelling in common electrolyte solvents, which leads to rapid Li transport and lower resistivities than other biopolymer-bound electrodes. Galactomannan binders may provide a critical step forward in next-generation lithium-ion batteries.

Nathan Galinsky
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Poster Number: 55

Effect of Support on Metal Oxide Design for Chemical Looping Conversion of Methane

Chemical looping processes utilize lattice oxygen in oxygen carriers to convert carbonaceous fuels in a cyclic redox mode while capturing CO_2. Typical oxygen carriers are composed of a primary oxide for active lattice oxygen storage and a ceramic support for enhanced redox stability and activity. Among the various primary oxides reported to date, FeO_x represents a promising option due to its low cost and natural abundance. Mixed ionic-electronic conductor supports have shown to increase activity of iron-based materials by nearly 100 times in chemical looping schemes compared to typical inert ceramic supports. The current work investigates the effect of support on the redox performance of iron oxides as well as the underlying mechanisms. Three ceramic supports with varying physical and chemical properties, i.e. perovskite-structured $Ca_{0.8}Sr_{0.2}Ti_{0.8}Ni_{0.2}O_3$, fluorite-structured CeO_2, and spinel-structured $MgAl_2O_4$, are investigated. The results indicate the redox properties of the oxygen carrier, e.g. activity and long-term stability, are significantly affected by support and iron oxide interactions. The perovskite supported oxygen carrier exhibits high activity and stability compared to oxygen carriers with ceria support, which deactivate by as much as 75% within 10 redox cycles. High stability of perovskite supported oxygen carrier is attributable to its high mixed ionic–electronic conductivity. Deactivation of ceria supported samples results from solid-state migration of iron cations and subsequent enrichment on the oxygen carrier surface. This leads to agglomeration and lowered lattice oxygen accessibility. Activity of $MgAl_2O_4$supported oxygen carrier is found to increase during redox cycles in methane. The activity increase is a consequence of surface area increase caused by filamentous carbon formation and oxygen carrier fragmentation. While higher redox activity is desired for chemical looping processes, physical degradation of oxygen carriers can be detrimental. In summation, superior oxygen carriers can be rationally designed by using ceramic supports with excellent mixed-conductivity and support-primary oxide compatibility.

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Poster Number: 56

Network Topological Characterization

In the analysis of large, complex, social networks, it is necessary to find summaries and simplifications of the network that preserve and convey essential features. Often nodelevel statistics such as degree, clustering coefficient, or centrality measures are used, and the distribution of these features over the entire network are studied. Intermediatescale features are increasingly included in network analysis, and one such feature that has been studied extensively is the community structure of the network. A more recent intermediatescale feature is the socalled “coreperiphery decomposition” of a network, where the nodes in the core are described as being somehow important to the global structure of the network.

In this work, we present a low complexity, distributed method, based on the notion of node dominance, which yields a core-periphery decomposition of the network, as well as a systematic method for community detection. The resulting core has the additional properties of preserving shortest paths, excellent information flow, and good interconnectivity (the core is difficult to split into separate components). The periphery of the network consists of many disconnected components, and we see that these components, along with their neighbors in the core, score very well in measures attributed to social network communities.

The method is illustrated using a large coauthorship network, along with associated information about groundtruth communities. We see that the method results in a core which acts as the global scaffolding of the network, and the “candidate sets” obtained from the peripheral components contain a large majority of the ground truth communities in the network.

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Graduate Program: Electrical Engineering
Advisor: Mesut Baran
Poster Number: 75

Distributed Grid Intelligence for Monitoring and Control of Smart Power Distribution Systems

Distributed grid intelligence (DGI) is an advanced software platform for decentralized monitoring and control of smart grid. Current electric power distribution system is monitored and controlled centrally. All the information from the field devices are collected at the central control center and then control commands are sent back to the applicable devices. Centralized control center is vulnerable to single point of failure and getting overloaded by information due to fast increasing number of communication enabled field devices. Current utility industry is trying to achieve a power grid resilient to the man-made or natural disasters. Therefore a decentralized monitoring and control platform is necessary that is able to manage devices locally in an optimal manner as well as co-ordinate with the central control center during normal condition. DGI platform provides such functionalities. It runs on an industrial or embedded hardware. The platform provides communication and data management related services to the applications. Therefore, the applications can collaborate with each other to efficiently monitor and control the power distribution network over a larger geographical area. A 'Community Energy Storage (CES)' management application is developed which co-ordinates and controls the CES devices in real-time in order to allow high level of renewable integration to the distribution feeder. The application takes advantage of time-of-use (TOU) rate policy to reduce the energy cost for the community while smoothing intermittent solar power output to eliminate flicker. It can provide ancillary service to utility by limiting the reverse power flow towards grid when renewable generation is high but residential load is low in order to avoid any utility equipment malfunction. A CES application can collaborate with the CES applications running on other DGI nodes in order to collectively meet the objectives. The DGI platform and application functionalities are demonstrated at the 'Green energy hub' testbed at FREEDM systems center, NCSU.

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Poster Number: 83

Architectural Issues in Virtualizing Intrusion Detection System as a Network Function

Networking Services Providers face many challenges to introducing a new network service since traditionally such services are offered through custom hardware appliances, which are difficult to deploy, have a limited life cycle, and are tied to a particular service. Virtualization of Network Functions promises many of the advantages that Cloud Computing has offered to traditional computing: efficient resource utilization, economies of scale, use of commodity hardware, elastic resource scaling, speedy deployment of new services, etc. We look at security features as network functions (NFs) that can be virtualized and offered as a service. In particular, we propose different "security-as-a-service" architecture scenarios for intrusion detection/prevention system (IDS/IPS), and analyze the security and cost implications of the architecture choice. We create a framework to study the impact of architecture choices. We validate several of these architectures in a realistic deployment and also study their impact on network performance.

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Poster Number: 84

MRI-based Correction for PET Photon Attenuation in Neurological Imaging

Positron emission tomography (PET) is a functional imaging modality used in the diagnosis of numerous neurological disorders, such as epilepsy and Alzheimer's disease. Recently, this modality has been combined with magnetic resonance imaging (MRI), incorporating the advantages of each modality. However, PET/MRI cannot be fully utilized unless an accurate correction for PET photon attenuation can be performed. In order to perform a correction, the likelihood of attenuation (measured by the linear attenuation coefficient, or LAC) in the patient's body must be discerned. The primary obstacle in using MRI for this purpose is that MRI does not provide a measure of LAC. Bone tissue is particularly challenging because bone exhibits high LACs but cannot be visualized using conventional MRI due to rapid signal decay. However, specialized ultra-short echo time (UTE) sequences have been proposed to overcome this challenge. In this study, UTE- and Dixon-MRI images were utilized to distinguish the four most prominent tissue classes in the head: air, bone, soft tissue, and adipose tissue. The intra-tissue variation of LACs is small for three of these, allowing for the assignment of constant LACs for each. For bone tissue, UTE-MRI was used to estimate the LAC at any given location by deriving a relationship between LAC values and an MRI decay parameter. The method was tested using a dataset of patients from an Alzheimer's disease study. The results show that the four tissues prominently present in the head were accurately identified by our method. Furthermore, the distribution of LACs in bone tissue was accurately estimated. Finally, the PET images generated with this correction exhibited a high level of accuracy compared to a gold standard. Thus, we believe the use of this method will provide accurate quantitation of neurological PET data and may allow for more accurate diagnoses of neurological disease.

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Poster Number: 93

Impact of Frequency Selective Matching on the Capacity of Compact MIMO Systems

Multiple-input-multiple-output (MIMO) technique has become an essential element of the present generation communication standards like IEEE802.11n (Wi-Fi), WiMAX (4G), HSPA+, LTE etc. Research on MIMO systems has shown that employing antenna arrays at the transmitter and receiver can dramatically increase the capacity (i.e. data rate) of wireless multipath channels provided the antennas are spaced sufficiently far apart. Mobile transceivers are usually limited in size, however, so employing MIMO within a mobile often requires placing the antennas close together. This leads to mutual coupling between the antenna elements which can profoundly degrade the capacity performance. Prior works have indicated that this capacity loss due to coupling can be mitigated by using sophisticated multi-port antenna matching networks at the receiver. Nevertheless, the circuit design of these networks is too complicated. Moreover, the existing studies have focused primarily on frequency-non-selective (or narrowband) matching and relied on assumptions that are valid only for small bandwidths. In practice, however, all emerging communication systems are inherently broadband and the so-called optimum frequency non- selective multi-port matching ceases to offer optimal capacity over wide bandwidth. In this context, we have revisited the capacity performance of a coupled MIMO system over a non-negligible bandwidth using matching networks that incorporate frequency-selectivity. Exploiting the circulant symmetry of antenna impedance matrix, we have demonstrated a simple way of decoupling circular antenna array so that multi-port matching reduces to single-port matching which has simpler circuit configuration. In particular, we have presented upper and lower bounds on the best possible MIMO capacity that can be achieved by a simple class of physically-realizable, frequency-selective matching networks for MIMO systems with dimensions 2x2 and 4x4. Our results suggest that the proposed matching technique can significantly increase capacity compared to the conventional frequency non-selective matching (under strong coupling) and this relative merit scales up with array dimension.

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Advisor: David Ricketts
Poster Number: 96

A 40GS/s Track and Hold Amplifier in SiGe BiCMOS Technology

At the heart of communication systems is an interface between the digital and the analog world, which is provided by Analog to Digital Converters (ADCs). ADCs are widely used in satellite and wireless communication, instrumentation (wideband sampling oscilloscopes), radar and optical systems. These applications generally require a wide- bandwidth operation at high sampling rates, high resolution and large linearity. One limitation in achieving these performance metrics is the design of the front-end of an ADC called the Track and Hold Amplifier (THA). THAs are used to track the input voltage signal, and hold it constant during the period required by an ADC to perform an analog to digital conversion.

This paper presents the post-layout simulation results for the design of a THA in 90nm SiGe BiCMOS technology. The THA samples at 40GS/s while achieving 46dB of Spurious Free Dynamic Range (SFDR) for a 1Vpp input signal at 5GHz. For a small signal input power of -12dBm, the SFDR is simulated to be better than 70dB, which corresponds to >11 bits of resolution. The sampling stage is based on a switched emitter follower architecture, and is decoupled from the input signal source and output capacitance through buffer stages. The design is optimized for low harmonic distortion and large bandwidth by using a small hold capacitor (80fF), feedforward capacitances to compensate for hold-mode feedthrough, and dummy transistors to counteract charge injection from clock. The design is kept fully differential in order to minimize even-order harmonic contents. Small signal 3-dB bandwidth is simulated to be >20 GHz using S-parameter analysis in track-only mode. The design consumes 700mW of power while operating from a 4V supply with a die-area of 0.5mm2 including pads.

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Poster Number: 109

Laboratory Evaluation of Warm Mix Asphalt Concrete Mixtures with Recycled Asphalt Pavement Material

In this current world there is a need to use cleaner and more sustainable technologies. In pavement industry, one such technology is Warm Mix Asphalt Technology (WMA), which helps reduce production temperatures, leading to lower fuel consumption and emissions. Various laboratory and field studies have shown improved workability at lower temperatures when WMA technologies are used. However, use of WMA technologies has led to major concerns of moisture susceptibility especially with water-based technologies. Use of recycled material to construct pavements is also a popular way to move towards sustainability. The RAP material gives extra stiffness to the mixture, which is beneficial to prevent rutting but in turn decreases the workability and long term durability. However, this increased stiffness and high source- dependency of RAP has discouraged its general use.

It is believed that the use of WMA technologies can eliminate the workability problems associated with the use of RAP material. To study the compatibility between these two technologies, there is a need to study the workability and moisture susceptibility of WMA – RAP mixtures.

This research study focuses on using two WMA technologies – Evotherm 3G and The PTI Foamer with three different RAP percentages – 0%, 20% and 40%. NCDOT 9.5 B mixtures were prepared with a combination of these WMA technologies and RAP contents. These mixtures were evaluated for workability and moisture susceptibility, and compared to the workability and moisture susceptibility of the corresponding HMA mixtures. Tensile Strength Ratio test was used to evaluate the moisture susceptibility, while the workability was evaluated by %Gmm evolution curves. TSR ratio was observed to decrease with increase in RAP content for HMA as well as the two WMA technologies. Foamer mixtures showed better workability than Evotherm and HMA mixtures. The workability decreased with increase in RAP content for all three types of mixtures.

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Poster Number: 121

Where is Nitrate Going in Restored Wetlands? A 15N Tracer Evaluation on Nitrogen Cycling in Restored Wetlands

Denitrification and plant uptake have been identified as the primary pathways for nitrogen (N) removal within wetlands. However, only denitrification provides complete removal of N. Understanding the biogeochemical factors that affect N reduction in these systems could increase the potential for wetlands to be designed for more efficient pollutant removal services. Therefore, the overall objective of this project was to improve our understanding of the fate of applied nitrate-N in two distinct wetland systems at varying nitrate-N loads using 15N isotope tracer studies. A mesocosm experiment was designed using two soil types from future coastal North Carolina wetland restorations. Two 15N isotope enrichment tracer studies were completed at the end of the growing season with nitrate-N concentrations of 2.5 and 10 mg L-1. Sediment, biomass, water, and gas 15N samples were taken prior to and throughout the 7 to 10 day experiments to determine N transformation pathways. Nitrate – N removal during the 2.5 mg L-1 tracer study was 91-92% within 7 days. Based on preliminary tracer results, estimates of nitrate-N removal through plant uptake and presumed denitrification ranged from 25-34% and 35-49% within the wetland mesocosms, respectively. Likewise, during the 10 mg L-1 tracer study, significant reductions in nitrate-N were observed, with 90-99% removal within 10 days. Plant uptake and presumed denitrification during this second study ranged from 21-26% and 37-52%, respectively. Results quantified plant uptake and denitrification within these wetland systems during the end of the growing season and showed significant differences in total and temporary nitrate-N removal depending on loading rate and soil type. Findings such as these will provide wetland designers better information about the N dynamics with respect to nitrate-N loads and soil type, which could improve current design methods and increase permanent N removal within future systems.

Kenneth Mineart
Graduate Program: Chemical and Biomolecular Engineering
Advisor: Richard J. Spontak
Poster Number: 122

Novel Phase Behavior and Application of Superstrongly-segregated Block Copolymers

Block copolymers constitute a versatile class of soft materials composed of different polymer chains that are covalently bonded together to form a single macromolecule. The dissimilar chains repel one another, but are unable to fully separate due to their covalent linkages. In this case, the molecules self-organize and microphase-separate into a rich variety of nanostructural elements. The equilibrium morphology of a block copolymer typically depends on its composition (i.e., the relative size of its blocks) and the thermodynamic incompatibility between its blocks, with the degree of block segregation normally ranging from weak to strong.

Fluorinated and ionic blocks, however, undergo superstrong segregation, and such nanostructured polymers show tremendous promise in applications such as fuel cells, desalination membranes and organic photovoltaics. In this study, we examine the morphologies of several superstrongly-segregated block copolymers. First, through the use of molecular simulations, we provide evidence that a relatively simple, nonpolar block copolymer can exhibit two distinctly different types of coexisting morphologies when the chains possess highly asymmetric molecular architectures. Next, experimental examination of an ionic block copolymer reveals that its morphological characteristics, as discerned from electron microscopy and tomography, depend sensitively on preparation conditions and dictate photovoltaic efficiency. Finally, since ionic copolymers are often sensitive to thermal processing, we demonstrate that the morphologies of these materials can be controllably altered with vapor annealing. Taken together, these results provide groundbreaking insight into superstrongly-segregated block copolymers and help promote their further development for use in energy- and water-related technologies.

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Graduate Programs: Chemical and Biomolecular Engineering
Advisors: Michael D. Dickey, Orlin D. Velev
Poster Number: 127

Fundamentals and Applications of Hydrogel Actuation by Electric Fields

Hydrogel network s are part of a class of "smart" material systems that can sense and adjust their shape in response to the external environment. The ability to program and modulate hydrogel shape change has great potential for novel biomaterials and soft robotics applications. In order to control the hydrogel shape change, the gel network can be functionalized to respond asymmetrically to an external stimulus. We demonstrate how electric fields can be used to control polyelectrolyte hydrogel actuation through both binding and non- binding ion interactions. Additionally, electric field induced dipole-dipole interactions can be used to assemble and confine colloidal assemblies within hydrogels to impart unique material properties. In the case of non-binding ions, we present a novel class of "walking" gel actuators comprised of cationic and anionic gel legs which bend in response to the redistribution of mobile ions in the external field. The sign of the fixed charges on the polyelectrolyte network determines the direction of bending, which we harness to control the motion of the gel legs in opposing directions. Utilizing binding ions, we introduce an 'ionoprinting' technique with the capability to topographically structure and actuate hydrated gels in two and three dimensions by locally patterning ions via their directed injection and complexation, assisted by electric fields. The mechanically patterned hydrogels exhibit programmable temporal and spatial shape transitions and serve as a basis for a new class of soft actuators that can gently manipulate objects both in air and in liquid. Lastly, we have characterized the bending response of spatially controlled colloidal assemblies confined within a thermo responsive hydrogel. The bending behavior is dictated by the degree of chaining during dielectrophoresis. We have developed simple soft matter actuator devices and robotic components utilizing conventional polymers and external stimuli, which may serve as active components where conventional, stiff materials are inadequate.

Punith Naik, Joel Ducoste
Graduate Program: Civil Construction and Environmental Engineering
Advisor: Joel Ducoste
Poster Number: 131

A Systems Biology Approach to Assess the Role of Protein Complex on the Monolignol Biosynthetic Pathway

Biological networks consist of a variety of intermolecular interactions including protein-protein interactions, protein-DNA interactions, and RNA interactions that lead to complex traits. Complex traits are phenotypic features that emerge from the interplay of multiple genetic components. One important property of biological systems is robustness, which enables them to maintain cellular function in the presence of external and/or internal perturbations. The presence of multilevel interactions has been hypothesized as the main reason for robustness. Recent advancements in high throughput technology have vastly facilitated the understanding of how the individual components in the pathway interact to achieve a desired function. Understanding the way in which individual components interact in a biological network is a major goal of systems biology. The prediction of a system's response to internal or external perturbations, as well as the identification of components that play a major role in this response, requires mathematical modeling. In this work, we analyzed the Predictive Kinetic Metabolic Flux (PKMF) model that was previously developed to simulate the lignin biosynthetic pathway. An interesting phenomenon that was observed in the lignin biosynthetic pathway was the protein-protein interaction to form a protein complex for Ptr4CL. The reaction rate resulting from the enzyme complex is not only a function of individual enzymes, but also the complex. A detailed mechanistic model was developed to quantify the reaction rate in the presence of a complex. By incorporating this mechanistic model into the PKMF model, we posed several questions to assess the role of the complex on the lignin biosynthetic pathway. (1) What is the role of protein complex on the steady state flux distribution? (2) How does the steady state metabolic flux and concentration change with the change in enzyme concentrations of the complex? (4) How does the presence of protein complex affect the robustness of the pathway?

Thomas Price
Graduate Program: Computer Science
Advisor: Tiffany Barnes
Poster Number: 146

Comparing Textual and Block Interfaces in a Novice Programming Environment

Visual, block-based programming environments present an alternative way of teaching programming to novices and have proven successful in classrooms and informal learning settings. However, few studies have been able to attribute this success to specific features of the environment. In this study, we isolate the most fundamental feature of these environments, the block interface, and compare it directly to its textual counterpart. We collected data from two groups of novice programmers, one assigned to each interface, as they completed a simple programming activity. We analyzed results from a pre- and post-survey, as well as log data from the programming environment. We found that while the interface did not seem to affect users' attitudes or their perceived difficulty of the activity, students using the block interface spent more time on task and completed more of the activity's goals in less time.

Michelle Schmidt
Graduate Program: Environmental Engineering
Advisor: Emily Berglund
Poster Number: 159

Diversifying your Water Supply Portfolio: Simulating Municipal Water Decisions in a Seniority-based Water Rights Program

Municipalities in a shared water basin invest in water supply sources that are both reliable and cost effective. Municipalities may build a portfolio of water supply sources that includes permitted surface water, purchased water, groundwater, and recycled wastewater. In several western states, water is allocated to municipal, agricultural, and industrial users using a priority- based water permit program, which prioritizes surface water withdrawals for permit-holders with seniority. Priority-based permit programs may create water shortages in a shared river basin as climate change and urbanization stress water resources, and municipalities with more recently awarded permits may not receive water as expected.

A shared river basin has characteristics of a complex adaptive system, as autonomous municipal actors interact through a shared water resource and adapt water management practices in response to the environment and behaviors of other actors. This research simulates a shared river basin as a complex adaptive system using an agent-based modeling approach.

Heterogeneous municipal agents select a portfolio of water supply sources using a linear programming model to identify a least-cost water supply strategy. Agents meet demands using a combination of surface water, groundwater, purchased water supplies, and conservation measures. The agent-based model is coupled with the Water Rights Analysis Package, which simulates the priority-based water permit system and in-stream flows. The modeling framework is demonstrated to simulate a priority-based permitting program for the Guadalupe River, TX. Ten municipalities and other users hold permits that, in total, exceed the mean annual stream flow. Future scenarios of climate change and population growth are simulated to explore water management decision-making strategies that improve reliability of water delivery for municipal demands. Tipping points are explored in municipal water shortages based on the permit year and mean annual streamflow.

Chen Shen
Graduate Program: Mechanical Engineering
Advisor: Yun Jing
Poster Number: 163

Acoustic Meta-material For Cancelling Out Aberrating Layers

In many medical ultrasound or nondestructive evaluation (NDE) applications, ultrasound needs to be transmitted through an aberrating layer, where either the transmission is desired to be maximized or the reflection needs to be minimized. One of the most representative examples is transcranial ultrasound beam focusing, which could find usage in both brain imaging and treatment. However, transcranial beam focusing is extremely challenging because of the presence of the skull. In this research we investigate a type of anisotropic, acoustic complementary metamaterial (CMM) and its application in restoring acoustic fields distorted by aberrating layers. The proposed quasi two-dimensional (2D), nonresonant CMM consists of unit cells formed by membranes and side branches with open ends. Simultaneously, anisotropic and negative density is achieved by assigning membranes facing each direction (x and y directions) different thicknesses, while the compressibility is tuned by the side branches. Numerical examples demonstrate that the CMM, when placed adjacent to a strongly aberrating layer, could acoustically cancel out that aberrating layer. This leads to dramatically reduced acoustic field distortion and enhanced sound transmission, therefore virtually removing the layer in a noninvasive manner. In the example where a focused beam is studied, using the CMM, the acoustic intensity at the focus is increased from 28% to 88% of the intensity in the control case (in the absence of the aberrating layer and the CMM). The proposed acoustic CMM has a wide realm of potential applications, such as cloaking, all-angle antireflection layers, ultrasound imaging, detection, and treatment through aberrating layers.

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Graduate Programs: Biomedical Engineering, North Carolina State University/University of North Carolina, Chapel Hill[1]; Clinical Sciences, North Carolina State University[2]; Industrial and Systems Engineering, North Carolina State University[3]; Statistics, North Carolina State University[4]
Advisors: Ola L. A. Harrysson and Denis J. Marcellin-Little
Poster Number: 167

Geometry of the Canine Humerus

Radiographs have been used in several studies to measure canine or feline long bones and some information is available regarding the shape of canine humeri. Assessing geometry and variability of the canine humerus will provide information supporting the planning of limb sparing including prosthetic humeral stems for canine shoulder arthroplasty. The purpose of this study is to assess the geometry of the canine humerus using radiography. We hypothesized that canine humeral curvature of the head and shaft is greater in dogs from chondrodystrophic breeds compared to dogs from non- chondrodystrophic breeds. To test these hypotheses, we completed geometric measurements of humeri from chondrodystrophic and non-chondrodystrophic skeletally mature dogs from our referral population at North Carolina State University's Veterinary Hospital. Sixty-two patients were included with a mean±SD age of 8.5±3.5years and weight of 28.2±13.9kg. Twenty-eight patients were spayed females, twenty-seven were castrated males, and the remaining seven patients were unaltered males. Eleven patients were chondrodystrophic. Mean humeral lengths in the mediolateral view were 184±37mm and 143±46mm in non-chondro-

dysplastic and chondrodysplastic dogs, respectively. In non-chondrodystrophic dogs, mean mechanical lateral distal humeral angle was 90.7±7.1°, mechanical caudal proximal humeral angle was 49.4±4.6°, and mechanical cranial distal humeral angle was 70.3±5.7°. In chondrodystrophic dogs, these angles were 89.1±5.1°, 48.1±4.7°, and 71.7±7.0°. In non-chondrodystrophic dogs, the radii of curvature of the humeral head and glenoid cavity (normalized to humeral length x 100) were 9.43±0.80 and 9.68±1.02. In chondrodystrophic dogs, these radii were 9.72±1.40 and 10.73±0.94. Statistical comparisons between chondrodystrophic and non-chondrodystrophic dogs are in progress.

Harshad Srinivasan, Carter Keough, Ola Harrysson, Richard Wysk
Graduate Program: Industrial and Systems Engineering
Advisor: Ola Harrysson
Poster Number: 169

From Prototype to Production – Automating the Finish Machining of Additively Manufactured Parts

Additive Manufacturing (AM) is a new paradigm in manufacturing in which parts are produced by the incremental addition of material, in contrast to traditional manufacturing methods where material is removed or reshaped. This approach enables the production of parts with novel geometries and using novel materials while dramatically minimizing the need for process planning. These attributes make AM methods ideally suited for the production of high performance, customized parts for the Biomedical, high-performance Automotive and Aerospace industries – potentially allowing for significant gains in performance and function. However, current AM technologies for metals are incapable of delivering the required geometrical accuracies and surface qualities. Traditional methods for achieving these requirements involve long lead times and high costs, negating several of the advantages of AM. In order to overcome these challenges, this project involves the development of a system for the automatic finishing of Additively Manufactured parts in a CNC machine. In our approach, based upon a previously developed system for the production of parts by CNC machining of bar stock, CNC-RP, sacrificial fixturing features are automatically added to the part before additive manufacture. These features allow the part to be easily mounted in a CNC machine and are positioned to maximize the machinability of the part in the mounted position. A 3D scanning system that can measure the workpiece as-built and as-mounted in the CNC machine has been developed. These measurements are used to localize the final part within the available workpiece material - minimizing material wastage while ensuring producibility and final part quality. Algorithms for automatically assigning machining allowances to critical features and automated process planning systems for more specialized toolpath generation are being developed to augment this system. Finally, in order to underpin and drive these systems, an extension to the AMF format, and ISO/ASTM standard for AM part data exchange has been developed.

D. M. Van Den Broeck[1], D. Bharrat[2], A. M. Hosalli[1], N. A. El-Masry[2], S. M. Bedair[1]
Graduate Programs: Electrical and Computer Engineering[1], Materials Science and Engineering[2]
Advisor: Salah M. Bedair
Poster Number: 183

Strain-balanced InGaN/GaN Multiple Quantum Wells

InGaN/GaN multiple quantum well (MQW) structures suffer from a high amount of compressive strain in the InGaN wells and the accompanied piezoelectric field resulting in both a blue shift in emission and a reduction of emission intensity. We report the growth of InxGa1-xN/GaN "strain-balanced" multiple quantum wells (SBMQWs) grown on thick InyGa1-yN templates for x > y by metal organic chemical vapor deposition. SBMQWs consist of alternating layers of InxGa1-xN wells and GaN barriers under compressive and tensile stress, respectively, which have been lattice matched to a thick InyGa1-yN template. Growth of the InyGa1-yN template is also detailed in order to achieve thick, relaxed InyGa1-yN grown on GaN without the presence of V-pits. When compared to conventional InxGa1-xN/GaN MQWs grown on GaN, the SBMQW structures exhibit longer wavelength emission and higher emission intensity for the same InN mole fraction due to a reduction in the well strain and piezoelectric field. By matching the average lattice constant of the MQW active region to the lattice constant of the InyGa1-yN template, essentially and infinite number of periods can be grown using the SBMQW growth method without relaxation-related effects. SBMQWs can be utilized to achieve longer wavelength emission in light-emitting diodes without the use of excess indium and can be advantageous in addressing the "green gap."

Yuriy Veytskin
Graduate Program: Civil, Construction, and Environmental Engineering
Advisor: Christopher P. Bobko
Poster Number: 187

Nanoindentation Investigation of Unaged, Aged, and Polymer-modified Asphalt Binder and Mastic Linear Viscoelasticity and Cohesion

A need exists to develop accepted measurement techniques for characterizing the cohesive and linear viscoelastic properties of asphalt binder and mastic that can motivate, inform, and enable multiscale and macroscale modeling approaches. Efforts to develop better analytical models for asphalt binder and mastic behavior are challenged by various aspects of the multiscale nature of asphalt concrete, including small length scales, nonlinear material behavior, high cohesion, high heterogeneity at multiple length scales, and complexity in experimental methods to measure properties at the smaller length scales. Nanoindentation, a widely used experimental technique for obtaining quantitative data on the mechanical properties of heteroge-

neous materials, addresses this need. With the innovations that have brought force and displacement scales down in size, this flexible probe-based technique is particularly well-suited for characterizing material properties of individual phases within complex composite materials. While most nanoindentation testing and analysis are focused on hard materials with the aim of determining the elastic modulus and hardness, this research considers the behaviors of more complicated materials and combines traditional linear viscoelastic analysis with a nanoindentation-based approach for materials micro-characterization. Exploratory nanoindentation techniques for determining the cohesive and creep properties of asphalt binders and mastics, with mineral and manufactured fillers and varying filler volumetric concentrations, are developed, tested, and verified. New ways to calculate and interpret important cohesive and viscoelastic properties from nanoindentation data through low-load sphero-conical (blunt) nanoindentation are described. Both unaged and aged asphalt binders and mastics are investigated, with the inclusion of polymer-modified binders and mastics for the aged materials. Ultimately, improved characterization and modeling of asphalt binder and mastic as related to the bulk performance of asphalt concrete will enable improved material selection and engineering for longer infrastructure lifecycles.

Amanda S. Walter, Stacy Decrane, Eric Franson, Jonathan Taylor, Jeffrey Clegg and Sarthak Subudhi
Graduate Program: Biomanufacturing - PSM
Advisor: Michael C. Flickinger
Poster Number: 189

BTEXIMAB™: A Cost-reduced Infliximab Biosimilar for TNF-alpha Mediated Inflammatory Diseases, Utilizing High Capacity Cation-exchange Chromatography Capture.

With healthcare care costs continuing to rise within the U.S., there remains a demand for more affordable patient care. One area of opportunity poised for success is the prospect of biosimilars. As demonstrated internationally, biosimilars offer significant cost reduction in biological therapies while providing the same safety and efficacy as their reference biologic. In 2013, the highest grossing biological therapies in the U.S. were monoclonal antibodies targeting tumor necrosis factor alpha (TNF--). It is the goal of this case study to evaluate the development of a biosimilar monoclonal antibody that would supply 20% of the TNF-mediated inflammatory disease market in the U.S at a reduced cost per dose. The proposed biosimilar, BTEXIMAB™, is a chimeric immunoglobulin (IgG1) antibody, similar to Remicade® (infliximab), expressed in the Chinese Hamster Ovary (CHO) platform. As there are currently several competing biosimilars in development that target TNF--, reduced development time is needed to make a strong entrance into the marketplace. Contracting Lonza as a long-term business partner provides access to a well-established upstream platform and allows for expedited development of both the pre-clinical material and high titer commercial cell line, while also allowing for the concurrent renovation and validation of the Biomanufacturing Training and Education Center (BTEC) facility. As a large majority of the manufacturing costs occur in downstream operations, high affinity protein-A resin was replaced with high capacity cation exchange chromatography to reduce protein capture costs by 89%. Utilization of high performance tangential flow filtration allows for additional purification, eliminating time and money required for a third chromatography step. Additional cost savings will come from clinical trial extrapolation, outsourcing of final fill, and equipment re-use in the BTEC facility. By offering an estimated 30% percent in cost savings per dose, BTEXIMAB™ has the potential to be a strong competitor in providing affordable medications.

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Advisor: Shu-Cherng Fang
Poster Number: 190

Two Newsvendors with Inventory Transshipment under Limited Supply

Inventory transshipment between two newsvendors may generate a higher profit and has been shown to influence the newsvendors' strategic inventory decisions. We study a supply chain with inventory transshipment where two newsvendors place orders to a common supplier whose capacity is limited. If the newsvendors' total order quantity exceeds the capacity, all available supply will be allocated to them according to a pre-announced rule. After the demand is realized, the surplus inventory of one newsvendor may be transshipped, at an exogenous and fixed price, to the other newsvendor who has excess demand. In this newsvendor game, a Nash equilibrium of ordering decisions does not always exist. We investigate conditions for the existence and uniqueness of the Nash equilibrium. Subsequently, we show that the total newsvendor profit at the Nash equilibrium is non-decreasing in the supply capacity. Moreover, in some special cases, we identify the appropriate allocation rules such that the first-best inventory stocks under unlimited supply may lead to first-best inventory allocation under limited supply. An interesting effect of the supply constraint is that, inventory transshipment may not always benefit both newsvendors in terms of equilibrium profit, compared to the game under the same supply constraint but without inventory transshipment. Nevertheless, we show that at least one newsvendor can still benefit from inventory transshipment. Accordingly, we construct a coordinating contract that allows the newsvendors to negotiate the transshipment prices before placing orders to maximize the total profit such that both newsvendors can benefit from inventory transshipment.

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Advisor: Maria E. Mayorga
Poster Number: 201

A Predictive Model of Smoking Prevalence Based on Individual Dynamics

Individuals' smoking behavior change over time and their dynamics are complex and variable. Understanding these patterns will better enable us to recommend targeted policies, aid smoking cessation, prevent smoking initiation, etc. In this paper, we constructed a first-order Markov chain model for smokers' transitions among five smoking states, defined as: everyday heavy, everyday light, someday, former and non-smoker, using longitudinal data from the Tobacco Use Supplement to the Current Population Survey (TUS_CPS) 2002 and 2003. We confined our study to people aged 18 to 80 and modeled younger (18-34) and older (35+) adults separately. Two transition matrices were developed for the two age groups, respectively. From the two matrices, meaningful comparisons were made between age groups and smoking states. This gave us insights into the smoking behavior of different groups. Based on the Markov model, we constructed a discrete event simulation model in Arena to forecast adult smoking prevalence in the US through 2020. Then, we showed how the simulation model can be applied to gain insights into smoking trajectories and other applications. To our knowledge, this is the first paper to describe an adult individual's transition between smoking states using a nationally representative sample.

Liwen Zhang[1], Xin Wang[1], Weizong Xu[1], Yongyi Zhang[2]
Graduate Programs: Materials Science and Engineering, North Carolina State University[1]; Suzhou Institute of Nano-Science and Nano-Biotics, Chinese Academy of Sciences[2]
Advisors: Yuntian Zhu[1], Qingwen Li[2]
Poster Number: 204

High-strength and Multi-functional CNT Films/Composites by Micro-combing

Carbon nanotubes (CNTs), with superior mechanical properties, high thermal and electrical conductivities, have been the focus of extensive research for structural composites, thermal interface materials, and electrical conductors. CNT films and buckypapers have drawn increasing interest due to their outstanding two- or three- dimensional (2D or 3D) properties, easy fabrication, and amenability for scaled-up production. However, the potential of individual CNTs is limited by their short lengths, random alignment, and wavy structures. In order to maximize the CNT buckypaper properties, it is critical to improve their alignment and reduce their waviness. In this paper, we report a novel approach, micro-combing, to fabricate aligned CNT films with a uniform structure. High level of nanotube alignment and straightness was achieved using sharp surgical blades with micro-sized features at the blade edges to comb single layers of CNT sheet. These micro-combs also reduced structural defects within the film and enhanced the nanotube packing density. Following the mico-combing approach, the as-produced dry CNT films demonstrated a tensile strength of up to 3.2 GPa, Young's modulus of up to 171.8 GPa, and electrical conductivity of up to 1.8×10^5 S/m, which are much superior to previously reported CNT films or buckypapers. The as-produced CNT/PVA composite films also exhibit the best mechanical and electrical properties that have been reported. More importantly, this novel technique requires less rigorous process control and can construct CNT films with reproducible properties.

College of Humanities and Social Sciences

Matt Abele
Graduate Program: Communication
Advisor: William Kinsella
Poster Number: 1

Environmental Advocacy in the Wake of an Environmental Crisis: The Dan River Coal Ash Spill

North Carolina, while being the home to the largest utility provider in the United States, is also host to numerous open-air coal ash ponds associated with the coal burning process at coal-fired power plants. These ash ponds became the focus of the North Carolina political sphere in 2014 when a pipe burst at the Eden, NC facility releasing over 30,000 tons of this material into the nearby Dan River. This resulted in an immediate push by state agencies, constituents, and environmental organizations for strong coal ash management policies. This political situation provides a strong case study demonstrating the advocacy methods utilized by environmental non-profits in the creation of environmental legislation. Specifically, this research focuses on the interactions that took place between environmental organizations across the state and their relationships with state legislators. In-depth interviews were conducted to better understand the viewpoints and strategies utilized by these environmental advocacy groups. Participants were selected through a network sampling strategy. Interviewees recommended other participants based upon involvement in the drafting of the Coal Ash Management Act of 2014. This research found that in the process of advocating for this bill, the environmental community articulated a single powerful goal through the construction of

a strong network of organizations. This network relied on the varying fields of expertise brought to the table by many groups with numerous strategies and missions. Even further, these advocacy organizations utilized expertise and counterexpertise to present a powerful case against previous methods of coal ash management.

Jennifer A. Bellingtier and Shevaun D. Neupert
Graduate Program: Psychology
Advisor: Shevaun D. Neupert
Poster Number: 15

Daily Variations in Subjective Age: The Role of Stress and Negative Affect

A stressful day can make individuals feel older than their years. Although many have experienced the feeling, little research has been devoted to understanding the relationship between stress and subjective age. This study sought to build on earlier research which identified two psychosocial resources that mediated the impact of stress on subjective age over a ten year period: positive affect and control. The current study measured older adults' (60-96 years old) stressors and subjective ages each day over an eight day period. Our goals were twofold. First we sought to demonstrate that daily fluctuations in stressors affect perceptions of subjective age, a new contribution to the field. Second, we sought to replicate the mediators found in a ten year longitudinal study using data from the study of Midlife in the United States (MIDUS), within our daily diary study. Our results confirmed that daily increases in stress in general, as well as health stress in particular, raised individuals' judgments of subjective age. On average, participants felt 1.02 years older for each stressor they experienced during the day, and 3.96 years older for each daily health stressor. However, our results failed to replicate the mediating role of positive affect and control. For our adults, daily increases in stress were linked to rises in negative affect which fully mediated the impact of stress on subjective age. Instead of depleting psychosocial resources, daily stress promoted increases in negative mood and feelings of subjective older age. Mediators may be time-sensitive, indicating the need for future explorations at the daily level.

Monica Sue Bixby
Graduate Program: Sociology
Advisor: Toby Parcel
Poster Number: 17

The Victim-offender Overlap: Childhood Bullying, School Safety, and Violence

Considerable research has found a connection between being the victim of a crime and later engaging in crime oneself. Yet it is unclear how forms of victimization, including childhood bullying, are affected by mechanisms of informal social control, such as the school. I use the life course perspective and social control theory to examine the influence of school-based victimization, childhood bullying, violent victimization, school safety, and capital at home and at school to predict the likelihood of violent behaviors. I use data from *National Longitudinal Survey of Youth* (1997) for analysis. The dependent variable, violent behavior, includes data from 1997, 1999, 2000, 2002, and 2003, measuring if respondents had violently attacked someone. The findings suggest that school-based victimization increased the likelihood of subsequent violent offending. Bully victimization during childhood and violent victimization during adolescence also increased the likelihood of violent behaviors. Additionally, family social capital had a statistically significant negative effect on predicting the likelihood of violent behaviors. Finally, I tested interaction effects with school safety and childhood bullying victimization. Findings suggest that school safety moderates the effect of bully victimization on the likelihood to engage in violence. This finding suggests that individuals who perceived their schools as safe that were victimized by bullying had an increased likelihood to engage in violence compared to individuals who did not perceive their schools as safe but were victimized by childhood bullying. Individuals in safe schools may have felt individually targeted and victimized by bullying, resulting in a greater likelihood that they would act out in violence. This also suggests that the school environment may be limited as an agent of informal social control for individuals who experienced bully victimization during childhood. That is, even in a safe school environment, the negative effects of childhood bullying may persist throughout adolescence and young adulthood.

Caroline E. Borer
Graduate Program: Foreign Languages and Literatures
Advisor: Scott Despain
Poster Number: 19

The Effects of the "Genius Hour" on Written Presentational Communication in the Middle Grades Spanish Foreign Language Classroom

In the 21st century foreign language classroom, technology is an integral, yet rapidly changing part of language learning that deserves the constant attention and continual research of today's foreign language educators. This study investigates how inquiry- based learning and technology affect the written fluency, accuracy, and student self- perceptions in the Spanish language classroom. "Genius Hour" first appeared in the Google business model, but has since made its way to other *Fortune 500* companies. The premise of the "Genius Hour" is that 20% of Google employees' time at work is spent on a special project that the employee is passionate about (Maiers, 2011). When put in the context of a classroom, the "Genius Hour" takes on the same form as inquiry- based learning in that learners must work through an inquiry process (Ask, Investigate, Create, Discuss, and

Reflect) while utilizing technology to complete their passion projects (Escalante, 2013). The purpose of this study is to examine the effects of a "Genius Hour" passion project on the foreign language classroom, specifically on the written presentational communication and self-perceptions of middle school Spanish language learners.

In this study, two groups (Inquiry-Based Learning and Traditional Instruction) of 32 middle school Spanish language learners participated in weekly online, asynchronous discussion boards for 12 weeks in conjunction with a cumulative project. The participants used tablet computer technology for all aspects of the study. Writing samples from the discussion boards and the cumulative project were coded for accuracy and fluency errors (Ellis, 2008). Participants also completed a pre- and post-survey about their self- perceptions of the Spanish language, learning, and technology. Final results will include comparative statistical analyses of accuracy errors, fluency errors, total errors, error percentage, and participation rate between the two participant groups. A paired t-test will also be used to compare the pre- and post-survey results. Additional observations such as time on task, place of participation, use of tablet technology and student reflections will also be addressed in the presentation of the final results.

Stephen Carradini
Graduate Program: Communication, Rhetoric, and Digital Media
Advisor: Jason Swarts
Poster Number: 28

The Regularization and Regulation of Kickstarter Writing

Crowdfunding is a fundraising method that leverages the power of digitally networked communication to present a multimedia-enhanced alphanumeric proposal to a distributed audience. Writing studies scholars have conducted little investigation on the writing practices of authors in this type of proposal. In this study, I use grounded theory to analyze the formal features in a sample of eight proposals from crowdfunding platform Kickstarter to determine if there are temporarily stabilized similarities between the proposals. I conclude that the consistent features present in the texts are due to both the regulating aspects of Kickstarter's official format and the regularizing effects of a community of practice engaging in recurrent social action. Given these results, I make a limited claim for Kickstarter's stabilized-for-now status as a genre that writing scholars should investigate and that teachers of business writing should include in their pedagogy.

Tiffany Deans
Graduate Program: Social Work
Advisor: Alan Ellis
Poster Number: 37

Needs and Perceptions About Weight Management Among UNC Wake County Assertive Community Treatment Team Clients: An Evaluation Plan

Mental illness can have a devastating impact on the people experiencing it, their loved ones, and society as a whole. People who have a severe and persistent mental illness (SPMI) often face difficulties seeking employment, maintaining housing, and living independently. As a result, they are at an increased risk of suffering from low self- esteem, being hospitalized, becoming homeless, and relying on social services for survival. Because of these difficulties and risks, treatment is crucial for individuals with SPMI. Psychotropic medications have become an important part of treatment. However, these medications often cause significant side effects, such as tremors, fatigue, and sleep disturbances. One of the most problematic side effects is excessive weight gain. Some psychotropic medications have the potential to cause over 40 pounds of weight gain with long-term use. Very little research has been conducted on intervention methods aimed at reducing this weight gain. This study seeks to understand the needs and perceptions of those who have SPMI and are served by the UNC Center for Excellence's Wake County Assertive Community Treatment Team. The study focuses on these consumers' perceptions of weight management services and of access to affordable, healthy food in Wake County. Data were gathered through semi-structured interviews and paper-and-pencil questionnaires. This study will identify better ways for the mental health system to serve those with SPMI and possibly identify ways to prevent weight gain induced by psychotropic medications.

Andy E. DeRoin
Graduate Program: Social Work
Advisor: Jocelyn D. Taliaferro and David C. Fitzpatrick
Poster Number: 38

Living and Learning While Trans: Perceptions Versus Lived-experience of the Impact and Effectiveness of Policies and Practices on Transgender, Genderqueer, and Gender Non-conforming Students Attending North Carolina State University

The Consortium of Higher Education LGBT Resource Professionals (n.d.) seeks to create "higher education environments in which [LGBTQ] students, faculty, staff, administrators, and alumni have equity in every respect" (para. 1). To ensure adherence to these goals, it is necessary to examine the impact of each institution's policies and practices on transgender, genderqueer, and gender non-conforming students. Without a phenomenological investigation into the lived-experience of these students, policy makers may not have the perspective necessary to adequately and appropriately serve them. This evaluative research capstone investigated the impact and effectiveness of current North Carolina State University policies and practices. There were three research questions guiding this investigation: 1) What do university administrators perceive to be the impact of cur-

rent NCSU policies and practices on the lived- experiences of transgender, genderqueer, and gender non-conforming students? 2) What do transgender, genderqueer, and gender non-conforming students report to be the impact of current NCSU policies and practices on their lived-experience? 3) Are these policies and practices meeting the needs of transgender, genderqueer, and gender non-conforming students as demonstrated by reported lived-experiences? The researcher compared the content of semi-structured interviews conducted with five transgender-identified students and five university administrators and policy makers. General themes common among and between participant groups were analyzed, and results demonstrated a disparity between the perceived impact and lived-experience of transgender students. This research can help inform recommendations for North Carolina State University and other institutions of higher education as they work to create more positive, empowering campus communities.

Sarah Evans, Elizabeth Craig, and Nick Taylor
Graduate Programs: Communication, Rhetoric, and Digital Media
Advisor: Adriana de Souza e Silva
Poster Number: 46

Couples Who Slay Together, Stay Together: Examining the Relational Processes of Romantic Couples Who Game

Research suggests that engaging in joint activities as a romantic couple contributes to relational health (Canary & Stafford, 1992). Specifically, relational maintenance literature indicates that spending time together engaging in joint activities, especially leisure activities, is positively related to relational satisfaction (Canary, Stafford, Hause, & Wallace, 1993). Existing research on couples' play in online gaming is largely based on a single gaming genre, namely massively multiplayer online games (MMOGs), yet relies primarily on qualitative accounts of couples' play. Emerging gameplay genres such as the increasingly popular multiplayer online battle arenas (MOBAs) have been studied less often overall, and especially in terms of relational behaviors among gaming couples. In an effort to contribute to this significant body of literature, the current study incorporates a quantitative approach to the research, examining couples' play in *League of Legends*, relational maintenance, relational quality, and communication aggression.

Desmond A. Frierson
Graduate Program: Social Work
Advisor: Alan R. Ellis
Poster Number: 50

Homelessness Prevention and Intervention

Homelessness is a social epidemic in the United States. Although homeless populations have existed in society throughout history, this social issue came to a head only a few decades ago in the early 1980's. The definition of homelessness varies from source-to-source, however, a concise definition that arises from the McKinney-Vento Act (2001), specifies that a homeless individual is one who lacks a fixed, regular, and adequate night-time residence. Due to the complex nature of homelessness, with its countless causes and widespread effects, homelessness prevention and intervention programs can take on many forms and have a range of different goals. The current evaluation project examines an addiction recovery program at one of the largest service agencies for the homeless in Durham, North Carolina--Urban Ministries of Durham (UMD). This qualitative, cross-sectional evaluation employs focus groups to collect data from clients of UMD's Recovery Track, an intensive substance addiction recovery program. The purpose of this evaluation study is to provide UMD with information about the strengths and challenges clients identify regarding the Journey Recovery Track, the outcomes clients expect from the program, and whether those expected outcomes occur. This type of program evaluation can increase the efficiency and cost-effectiveness of service methods to improve lives and reduce unnecessary cost.

Vladimir Gritsenko
Graduate Program: Communication
Advisor: Melissa Johnson
Poster Number: 67

Effective Nonprofit Marketing and PR Practices: A Case Study of a Russian Political NGO

The Anti-Corruption Foundation (ACF), a Russian political nongovernmental organization (NGO) headed by a popular public activist, investigated financial fraud in the actions of government officials and got both moral and financial support from large groups of citizens. The nonprofit sector in Russia is comparatively young and underdeveloped, and political NGOs are seldom trusted by the public. Hence the fact that the ACF was successful in securing people's trust is particularly notable. This case study research project explored what made the organization's communication with its publics effective. Qualitative content analysis was used to analyze data on the organization's public relations activities. Specifically, the study focused on how the organization, its staff, and its leader were marketed to the public, how fundraising campaigns were run, and what persuasion methods were used to change the public opinion on political matters. Data from Russian and international mass media, social networks, and ACF's official materials were used for analysis. The findings suggest that the organization implemented a symmetric two-way PR approach. Despite the obstacles that Russian political and social climate posed, the synergy of effective communication, perceived importance of the organization's mission, and charismatic leadership generated public support that was unprecedented for a Russian political NGO. ACF's PR was also found to be untraditional, as the organization's communi-

cations were almost solely run by its leader, and all of its activities appeared to pursue a single political goal of discrediting those in power. Despite this, the ACF pioneered effective communication approaches that can be implemented by other NGOs in Russia.

Abigail Heller and Mary Schmidt
Graduate Program: Anthropology
Advisor: John Millhauser
Poster Number: 70

Combating the Curation Crisis in North Carolina

Archaeologists have an obligation to ensure the long-term survival and accessibility of collections that embody the tangible remains of community heritage and collective history. This study presents two examples of collaboration between state- and university- based archaeologists that address the current curation crisis and provides much needed training for future professionals. The North Carolina Office of State Archaeology Research Center (OSARC) is the state's repository and steward for archaeological materials that are owned or maintained by the state. OSARC faces funding and staffing challenges due to increasing demands of curatorship and recent economic downturns.

OSARC and North Carolina State University Anthropology graduate students are collaborating in efforts to mitigate the statewide curation crisis by working with two collections from historic sites that were lost to time for nearly 40 years. The study demonstrates how student involvement in solving the curation crisis also helps future archaeologists develop a sense of responsibility for the collections they produce. These cases exhibit how collaborative work can give emerging professionals an understanding of how to evaluate and prioritize collection restoration/conservation needs, technical skills in collections management, curation and conservation techniques, research potential assessment, and familiarity with the state and federal standards that collections must meet.

Casey Helms
Graduate Program: Foreign Languages and Literatures
Advisor: Jim Michnowicz
Poster Number: 71

L2 Spanish Subject Personal Pronouns: A Study of Twelve Undergraduate Students

The expression and omission of subject personal pronouns (henceforth SPPs) is a highly documented field of study in Spanish (Cameron, 1993; Flores-Ferrán, 2004, 2007, 2010; Orozco & Guy, 2008; Otheguy & Zentella, 2012), examining the social and linguistic constraints governing null versus overt SPPs. Many studies have confirmed that certain variables favor the use of overt or null SPPs. There is also extensive research on students of Spanish. In general, findings have supported the claim that L2 Spanish students use and interpret SPPs in a way similar to that of native Spanish speakers (Marqués-Pascual, 2011; Quesada & Blackwell, 2007; Rothman & Iverson, 2007). This study will have three questions of interest: first, do L2 students express SPPs at a similar rate as native speakers; second, do the same linguistic factors favor expression and omission of SPPs in students as natives; and third, do social factors such as time abroad and gender have an effect on SPP use. The data comes from semi-spontaneous speech of twelve students in fourth year Spanish classes at the university level. Preliminary findings are based on a subset of the participants. Averaged, the SPP expression rate of six participants (20.29%) is similar to that of Spaniards (20.9%) (Cameron, 1993). Four linguistic variables have been found to be significant predictors of SPP expression, the person and number of the verb, time, aspect and mood of the verb, coreferentiality and clause type. Individual constraint hierarchies are similar for those students who favor higher rates of overt SPPs but differ from speakers who favor lower rates, suggesting that the different rates of overt SPP expression are indicative of different underlying grammars for these students. Overall, these preliminary findings support the ongoing research of SPP rates of second language Spanish students and shed light on the need for continued research.

Kim Holland
Graduate Program: Sociology
Advisor: Kim Ebert
Poster Number: 73

Comparing U.S.-born Asian and U.S.-born White Men's Perceptions of Traditional Gender Roles

In this article I assess the influence of ethnicity on men's views of traditional gender roles in the U.S. As a privileged gender but marginalized racial group, Asian American men provide a unique perspective into understanding ideals of masculinity in our society. Gender scholars have established hegemonic masculinity as the culturally dominant form of masculinity. Hegemonic masculinity is what men attempt to achieve or what they measure themselves against. Some characteristics may include: physically strong, tall, aggressive, patriotic, primary breadwinner of the family, emotionless, heterosexual, and protective. It has been suggested that Asian men do not fit the White hegemonic masculinity ideals, so they may compromise to exhibit a more flexible conception of masculinity. Problematic cultural ideals of masculinity promote an unequal power system, forcing women into subordinate positions, viewing women as weak, emotional, and caregivers. This study compares U.S.-born Asian men's and U.S.-born White men's support of traditional gender roles. I used the World Values Survey from 2014 to compare U.S.-born Asian men's and White men's views. I hypothesized that 1) Ethnicity has an influence on views of traditional gender

roles, and 2) U.S.-born White men would be more likely to support traditional gender views than U.S.-born Asian men. Chi-squared was used to test my hypotheses. My first hypothesis was supported. The data suggested that there is a relationship between ethnicity and views towards gender roles. However, my second hypothesis was not confirmed. On the contrary, the data suggested that U.S.-born Asian men were more likely to support traditional gender roles. It is likely that there are various other factors, apart from ethnicity, that can contribute to men's views of traditional gender roles. For future research I suggest to incorporate control variables and utilize more complex statistical analysis.

Gavin P. Johnson
Graduate Program: English
Advisor: Carolyn R. Miller
Poster Number: 81

Bitches, Witches, and Genre Switches: Using *American Horror Story: Coven* to Explore Meta-genre and Meme Culture

When the third installment of the *American Horror Story* franchise premiered in the fall of 2013, it was an instant success. This television show, subtitled *Coven*, represents the culmination of what has become the horror genre. Through a number of horror tropes, e.g. supernatural activities, bloody murders, sexual themes, and campy acting, that are performed as a kind of cultural critique, it becomes appropriate to classify television horror as reaching Metz's final stage of genre evolution: critique. The "critique" classification allows the author to take greater risks when negotiating content of the text, and also signals a shift in our understanding of horror from genre to meta-genre. Additionally, because of the large, digital community that has been built around *AHS: Coven*, we can analyze this text through the lens of different media: Internet memes, which are authored in response to the televised text. Through these acts of digital authorship, fan communities use genre switching as a form of social action to create and categorize personalized, cultural meaning

In summary, this project, using *AHS: Coven* animated GIF memes as a case study, focuses specifically on how meta-genres, like horror, can easily be manipulated by digital, emergent media to, in essence, switch genres. Through digital authorship and genre switching, fans not only create new meaning for the text but also complicate the text's intended genre. Therefore, this project is two pronged: first, I will discuss how *AHS: Coven* operates as a horror text through performance and critique of established genre tropes. Second, I will use digital, animated GIF memes to explore how fan communities on the web use genre switching to author alternate meaning(s) for the original horror text, in this case *AHS: Coven.*

Riku Kawaguchi
Graduate Program: Sociology
Advisor: Kim Ebert
Poster Number: 86

The Effect of the Legalization of Same-sex Marriage on Anti-gay Hate Crime: A Preliminary Analysis

I present a preliminary analysis of the effect of the legalization of same-sex marriage (SSM) on anti-gay hate crime at the state-level. Hate crimes pose threats to individuals and communities because of their brutal nature that victims tend to sustain severe physical and psychological injuries, and because they spread fear among the targeted community, potentially damaging the community relations. While previous literature has examined racially-motivated hate crimes, anti-gay hate crimes have been neglected, resulting in a lack of theoretical and empirical explanations. Some have argued that hate crimes are retaliatory in nature so that certain antecedent events will trigger violent responses. This framework suggests that the recent policy shifts toward legalizing SSM in the U.S. increase anti-gay hate crimes. This is contrary to the recent polls showing increased public supports toward gay rights, which would predict a decline in anti-gay hate crimes as people are becoming more gay-friendly. To examine whether legalization of SSM and public opinion toward gays influence anti-gay hate crimes, I conducted two different analyses at the state-level, using data from FBI's Hate Crime Statistics, American Community Survey, and public opinion polls. First, I analyzed the patterns of anti-gay hate crimes between 2006 and 2012 in states with legal SSM. The patterns in general suggested that anti-gay hate crimes increased temporarily after SSM was legalized. Second, I used regression analyses, estimating models that accounted for legal status of SSM and public opinion in 33 states in 2011. While the bivariate model showed a statistically significant effect of SSM legal status, the effect was subsumed when public opinion was incorporated into the model. This suggest that public opinion was a better predictor. Finally, I discuss the future research agenda for studying anti-gay hate crime.

Sheron N. King, Melanie Riester, Teshanee Williams
Graduate Program: Public Administration
Advisor: RaJade M. Berry-James
Poster Number: 89

Genetically Modified Foods: The Good, the Bad, and the Trustworthy?

A review of the scientific literature depicts continued skepticism regarding genetically modified organisms (GMO) and food safety using this biotechnology. Investigating persistent consumer skepticism regarding the risks and benefits of genetically modified foods in underrepresented communities, is the focus of this study. Consumer research on GMO food skepticism confirms that safety concerns are widespread. Most of the consumer research on GMO food safety lacks the cultural viewpoint of underrepresented groups. In the debate regarding consumer safety, we believe that cultural attitudes toward genetic engi-

neering affect persistent food skepticism and also contribute to scientific mistrust of genetically modified food production and safety (Ludlow & Smith, 2011; Banati and Szabos, 2006; Goyal & Gurtoo, 2011). Essentially, consumer awareness and attitudes influence consumer behavior toward GM food supply and as a result, have led to strong consumer preferences for non-GM products (Baker and Burnham, 2001; Hallman et al, 2003; Li, et al 2004; Pew Research, 2006). Researchers continue to question how cultural norms influence consumer behavior and mistrust of scientific evidence, especially where GMO food is concerned (Evans & Ballen, 2013; Han, 2006). Specifically in the African American community, the church serves as a mediating factor having historically been the bedrock of preventive healthcare and consumer awareness. In this study, we conducted ethnographic research in the African American community to gain a deeper understanding of cultural perceptions of genetically modified foods. These focus groups consisted of 65 participants representing seven African American churches in Wake County (NC). Participants were asked to respond to questions regarding awareness, food safety, and trust. Using content analysis, results (trust) indicate that most participants trust researchers, doctors and pastors to tell them the truth about the risks and benefits of genetically modified food. Participants trust independent researchers the most to tell them the truth about GMO food safety.

Katherine Koffman
Graduate Program: Anthropology
Advisors: Sasha Newell, Nora Haenn and John Millhauser
Poster Number: 91

Climate of Doubt: Media and Elite Framing in North Carolina's Passage of HB819

In 2012, North Carolina passed House Bill 819 (HB819), which put in place a four-year moratorium on the calculation of future sea level change, as well as related policy implementation. The bill was a response to a 2010 report published by the state's Coastal Resource Commission's Science Panel (CRC), which stated that the coast of North Carolina is highly likely to experience a one meter sea level rise by 2100. The bill led to media frenzy, especially in Raleigh, North Carolina, where the political debate was centered. The NC legislature's action highlights the doubt that persists surrounding climate and sea level change nationally. A key aspect of this debate is how does the media frame climate change? This leads to the central question of this research project: how did the Raleigh media frame climate change, sea level rise (SLR) and the arguments of various actors involved in the bill's debate? We answered this question by examining climate change coverage in the city's newspaper, The Raleigh News and Observer, and publications of the NC-based conservative think tank, the John Locke Foundation. Our analysis found that due to their different audiences and political stances, the two sources addressed the bill and environmental conditions in very different ways, reflecting a political polarization in the media.

Johanne Laboy
Graduate Program: Communication, Rhetoric, and Digital Media
Advisor: Kama Kosenko
Poster Number: 94

IHBs, Diabetes Knowledge and Media Sources: Exploring the Connections in Young Adults

Diabetes mellitus is a serious public health threat worldwide. During the past decade, the incidence of type 2 diabetes mellitus has been rising among young adults in the United States. Irrational health beliefs (IHBs) and myths that young adults hold about the disease may influence their ability to look for information, seek medical care, or adhere to medical treatments. As a consequence, primary and secondary disease outcomes related to diabetes may become more prominent for that particular segment of the population. This study aimed to investigate the beliefs, myths and misconceptions young adults hold about diabetes, the media sources used to get information about health, and the relationship between these sources and beliefs. A survey instrument was administered at a campus in a large southern university and information was gathered regarding the participants' knowledge of diabetes causes, diagnosis, treatment, and care, as well as the participants' media use. Findings indicate that young adults hold a variety of irrational health beliefs. A one-way ANOVA indicated a relationship between diabetes status and young adults' beliefs about the diagnosis of diabetes. In addition, a two-tailed, bivariate, Spearman's rho Pearson Coefficient correlation for the data revealed that there is a relationship between media sources and the participants' knowledge about the causes of diabetes. Type 2 diabetes is a significant public health threat affecting many people in the U.S., and the incidence of the disease is increasing among young adults. This study on IHBs and media sources provides significant insight into young adults' knowledge and awareness of diabetes and the relationship between this knowledge and media sources. Findings may help health care professionals and health communicators develop messages to better communicate information about the disease and identify the media sources that would be most effective when delivering those messages to young adults.

Kaimeng Lei
Graduate Program: Social Work
Advisor: Alan Ellis
Poster Number: 98

The Effectiveness of the BASICS Program at NCSU in Reducing Alcohol Use among College Students

Alcohol misuse among college students is one of the most important public health problems in the United States. It causes a series of negative health and safety consequences, including, but not limited to, increased risk of alcohol use disorders, academic impairment, campus security problems, suicide attempts, unprotected sex, and assault and injuries. To protect students

from those consequences, Brief Alcohol Screening and Intervention for College Students (BASICS) program has been implemented at North Carolina State University (NCSU) for years. Yet, the effectiveness of this program at NCSU has not been formally evaluated. The influence of related factors also remains unknown. This evaluation is designed to examine the change in participants' alcohol use patterns several months after program completion, relative to alcohol use at intake. The questions that this study intends to answer are (a) how effective is the BASICS program at NCSU in reducing students' alcohol use between baseline and 3-10 month follow-up, and (b) to what extent is the program's effectiveness influenced by related factors such as sex, baseline pattern of use, adoption of protective strategies, readiness to change, and duration of intervention. This study follows a one- group pretest-posttest design. Data is collected from all students (n=112) who completed the BASICS program from April 1 to October 31, 2014. Pretest data is drawn from existing intake survey as well as the counselors' case notes and students' eCheckup To Go results. Posttest data is collected via an online survey. With evaluation results, social workers will be able to use evidence-based practice to help young clients make informed decisions about their alcohol use, and also to identify those with high risk so that further intervention can be provided. Besides, formal evaluation results will provide persuasive evidence for social workers to advocate for more alcohol education services from university stakeholders.

Melinda Leonardo
Graduate Program: Communication, Rhetoric, and Digital Media
Advisor: Jessica Jameson
Poster Number: 99

Lost in Transfer: How Training Participant Narratives Reveal Training Transfer Experiences

Organizational training transfer refers to the ability of training participants to transfer skills learned in training back into the workplace. Previous research has come primarily from the fields of human resources and organizational development, and has relied heavily on post-training evaluations and survey instruments. This qualitative study expands our understanding of the training transfer experience in two ways. Framing training as a social innovation, Rogers (1983) theory of diffusion of innovation is used to determine how aspects of the training itself and participants' attitudes toward the training material facilitate the transfer process as DOI would predict, The study specifically investigates two exploratory research questions 1) How do trainee narratives describe the experience of skill transfer? and 2) In what ways are participant experiences of transfer compatible or incompatible with the major themes of the training program? These questions were investigated through interviews of training participants before, during, and three months after mediation training as well as observation of the week-long training and an analysis of the training materials. Thematic analysis of participant interviews highlighted important perspectives of what happens in the transfer process. Three dominant themes included participants' expression of the need for communication skills, their motivation for transfer, and the training-to-practice gap. These were highly (although not completely) compatible with the training themes, which included the importance of skills practice, emotion is not bad, and the voice of both parties. The study has implications for theoretical development of training transfer and practical implications for training design and evaluation.

Kendall B. McCollough, D. Troy Case, and Ann H. Ross
Graduate Program: Sociology and Anthropology
Advisor: D. Troy Case
Poster Number: 113

Nutrient Foramen Variation in Human Long Bones

The nutrient foramen is a key landmark used in several long bone measurements; however, while it is documented as originating at the point of ossification, its overall stability in position and occurrence has not been fully explored in a stressed population. The purpose of this project was to evaluate the occurrence and position of the nutrient foramen in a documented skeletal collection. The sample consists of 52 adult European American males and 48 females from the Terry Collection. Standard metric measurements were taken for the humerus, radius, femur, tibia, first, second and fourth metacarpals. In addition, newly developed measurement to register the position of the nutrient foramen and number of foramina present (0 – 3) were recorded. Childhood stress was assessed via the presence of LEH (Linear Enamel Hypoplasias) and the relative lengths of the long bones. Positional information of the nutrient foramen was cross referenced with the approximated stress level of the individual to examine how position and occurrence were affected. Results suggest that elements are differentially affected by stress and so are the nutrient foramina. However, all long bones were not affected in the same manner. For example the foramen was found to be relatively stable in its location relative to bone length and in number in the tibia, while there was greater variation in the other elements.

Sonia L. Oakley, Christopher M. Allred, and Richard D. Yentes
Graduate Program: Psychology
Advisors: Samuel B. Pond; Adam W. Meade; Lori Foster Thompson
Poster Number: 135

Functioning of the Utrecht Work Engagement Scale among Men and Women from the United States: An IRT Approach

Given the link between employee well-being and desirable individual and organizational outcomes, researchers have become increasingly interested in measuring employee work engagement – a positive state of well-being characterized by cognitive, physical, and emotional investment in work activities. Although the Utrecht Work Engagement Scale (UWES) is one of the

most widely used measures of work engagement, little is known about the functioning of the scale items among U.S. samples. Furthermore, although research has established the psychometric properties of the scale across employees from different countries, no studies have examined whether this scale functions equivalently across gender groups. To address these gaps, the current study used item response theory (IRT) to identify UWES items that function effectively in full-time employees from the United States (N = 494), and function equivalently for men and women. Results indicated that while the UWES items functioned well in our U.S. employee sample (i.e., high discrimination parameters and item information functions), not all items functioned equally well for men and women. Differential item functioning (DIF) analyses indicated that approximately one third of the UWES items exhibited DIF across gender, suggesting that the scale may not function effectively for certain groups. Problematic items, which largely referenced the push and pull of work versus non-work identities, were less discriminating for women than for men. Our results are interpretable given traditional gender differences in work and family commitments. For individuals whose work choices are guided more heavily by commitments to non-work domains such as family, these items may not be particularly reflective of work engagement. To make accurate comparisons of work engagement across gender, and to effectively capture true work engagement levels for both men and women, recommendations concerning a modified UWES are provided.

Alexander J. Preiss
Graduate Program: International Studies
Advisor: Mark T. Nance
Poster Number: 145

Tourism Value Chains, Development, and Poverty

Tourism has long been identified as a promising tool for economic development and poverty alleviation. However, tourism comes in many forms, and scholars disagree on which has the greatest net benefit. In my research, I use a mixed-methods approach to investigate how variables in the tourism value chain affect lives and livelihoods in host communities. First, I use regression analysis of macroeconomic indicators to test whether alternative tourism (such as ecotourism and adventure tourism) differs from mainstream tourism in its economic impact. Using the prevalence of package tourism as a proxy for mainstream tourism, I run regressions with several variables that capture various aspects of economic development. Most of the regressions do not produce statistically significant results, suggesting that mainstream and alternative tourism do not differ significantly in their developmental potential. On the other hand, high proportions of package tourism correlate significantly with the importance of international tourism to the national economy. This suggests that countries that are more economically dependent on tourism tend to rely more on mainstream tourism. Second, I use a case study of a locally owned tourism operator in Ecuador to explore whether local ownership of tourism firms leads to a supply chain that has greater livelihood benefits for locals, particularly those in poverty. I obtain data via semi-structured interviews with the firm's owner and a key contractor, as well as financial and payroll data. I am still conducting this element of the research, but preliminary results indicate that this firm has a remarkably local supply chain, leading to a higher multiplier effect for the tourist dollar. This suggests that developing countries may benefit more from promoting the growth of local tourism firms than encouraging foreign direct investment in tourism.

Katy Rosenbaum
Graduate Program: International Studies
Advisor: Mark Nance
Poster Number: 155

Empowering Universities as Change Agents: Constructing Globalization through Campus Internationalization Plans

International education literature describes campus internationalization as a response or reaction to the forces of globalization. This research project uses a constructivist approach to examine how universities contribute to the understanding of globalization through strategic internationalization plans, specifically looking at whether they construct a neoliberal understanding of globalization or an alternative approach. A case study methodology was employed using strategic internationalization plans from several recipients of the prestigious Paul Simon Award for Comprehensive Internationalization. Using discourse analysis, this research looked specifically at rationales for internationalization, including action steps or programs along with desired outcomes. The discourse was then analyzed to determine how it contributed to the construction or understanding of globalization. Findings demonstrate strong bias towards internationalization plans constructing a largely neoliberal understanding of globalization, including the seemingly inevitable and unstoppable nature of globalization; an acceptance of the commodification of students and higher education; a focus on university rankings, prestige, and the need to compete on the free market; a quantitative bias in how plans measure desired outcomes; and the recognition of globalization as a westernizing or neocolonial force. In the plans examined, both discourse and actions are embedded in a neoliberal understanding of globalization, and these plans further contribute to and reinforce this construction.

Chaniqua Simpson
Graduate Program: Sociology
Advisor: Maxine S. Thompson
Poster Number: 164

Colorism across Families: Skin Tone and Children's Perceived Relationship Closeness with Parents

Scholars suggest that skin tone plays a major role in the lives of people of color, and many note that skin tone is especially important for personal interactions, dating, and mate selection. Despite this, little research is known about the relationship between skin color and other interpersonal interactions, especially as it relates to families and familial relationships. Drawing from literature on colorism/pigmentocracy and Latin Americanization, this research investigates the relationship between child's skin color and her/his perceived relationship dissatisfaction with their parents. Particularly, this research looks at the relationship between skin color and relationship closeness across racial categories and brings attention to gender, class, and immigration status as mediating mechanisms. Using the *National Longitudinal Study of Adolescent and Adult Health* (*Add Health)*, a relationship dissatisfaction scale was created and OLS regression techniques were used. Results suggest that gender and skin color are related to relationship dissatisfaction with darker skinned girls reporting higher levels of dissatisfaction than boys and lighter skinned girls. Additionally, boys report lower levels of relationship dissatisfaction than girls, with darker skinned boys reporting the least amount of relationship dissatisfaction. The results of this study highlight the importance of skin color and skin color ideologies and their roles in family relationships and socialization. Results also suggest and confirm that skin color may operate differently for females and males.

Mary Sloan
Graduate Program: International Studies
Advisor: Mark Nance
Poster Number: 166

Mapping Progress in International Aid: Threats and Responses in Morocco

Evaluating the impact of aid has been a decades-long exercise from which trends in the aid movement have emerged. First, a shift occurred in the goals of aid. Rather than focusing on increasing economic growth, aid programs became more targeted towards advancing human development and addressing human security threats. Additionally, aid organizations have sought to decentralize projects. As aid projects become more localized, beneficiaries, are able to provide input regarding their actual needs. If aid projects are more targeted to the real needs of individuals within developing countries and more inclusive in terms of input, one would expect this to be reflected in aid expenditure and the locations of projects. In my project I pose the following question to understand aid effectiveness in Morocco: Are aid organizations spatially and monetarily targeting existing human security threats? Measuring aid effectiveness through a spatial and monetary analysis will highlight the degree to which international trends in aid research have actually impacted the implementation of projects. Based on the results of the spatial analysis, I seek to determine how aid has impacted social unrest in Morocco. In answering my research question, I employ a case study of aid effectiveness in Morocco.

Effectiveness is measured both spatially and monetarily. The degree to which aid projects are located in human security hot spots serves as a spatial measurement. The amount of aid that is spent in each sector measures monetary effectiveness. In my analysis I utilize ArcGIS to map and analyze aid data and human security threats, as well as qualitative and quantitative methods to further examine aid effectiveness. My results are mixed, showing some aid projects in areas most vulnerable to human security threats.

J.J. Sylvia IV
Graduate Program: Communication, Rhetoric, and Digital Media
Advisor: Stephen Wiley
Poster Number: 174

The MOOC Dropout: Analysis of Course Completion Obstacles

The question of the merit and future potential of Massively Open Online Courses (MOOCs) has been widely debated in higher education, especially in light of recent research at San Jose State University that has shown that successful completion rates for MOOCs are much lower than the traditional classroom. MOOC completion rates ranged between 23 and 51 percent. This research, at least on the surface, tends to contradict the popular praise MOOCs originally received in media coverage, which often heralded it as a tool that would democratize higher education and open it up to those who traditionally did not have equal access to the classroom. However, these perspectives have not adequately addressed the reasons students are failing to successfully complete MOOCs. My poster addresses these reasons for failure by using a cultural historical activity theory analysis based on the comments made on three recent and popular articles reporting on studies that show low completion rates for MOOCs. Based on this analysis, I argue that the time allowed for completion of MOOCs and the background knowledge of student participants creates the contradictions that most often prevent successful completion. In conclusion, this project, by closely examining the reasons students are not completing MOOCs, sheds new light on the role MOOCs might play in the future activity of higher education.

Sheila Tampos
Graduate Program: Anthropology
Advisor: Shea McManus
Poster Number: 175

Community, Pain, and Respect: Understanding *Pangajow* Killings from the Agusan Manobo Perspective

The academic attention on acts of violence perpetrated by marginalized groups such as suicide bombing and mob lynching has led to various theoretical approaches. Instead of framing these practices within a single analytical category such as 'culture' or 'function', a productive framework considers the dynamics of culture and processes at the historical, socio-economic, and political level. Employing this integrative framework, the study examines a practice among the Agusan Manobo of southern Philippines called *pangajow,* a term understood as revenge killing, slave raiding, prestige killing, and armed revolt. Drawing on ethnographic interviews and participant-observation in two Manobo communities, the inquiry aims to provide an understanding of the practice based on the salient cultural concepts used in articulating the practice among members of the concerned communities. A semantic network based on the coded key terms reflects three overarching cultural concepts: *banua* or "community", *ginhawa* in relation to "emotion", and *bantug* in relation to "respect". It is argued that the Agusan Manobo make sense of *pangajow* killings using these concepts in light of historical, socio-political, and economic processes to which their communities are subjected. Most forcible of these processes are the issues on native-migrant dynamics, economic poverty, and the land laws from the colonial period to the creation of the modern state. This means that the concepts underlying the killings are dynamic as the Agusan Manobo continue to adapt to varying conditions. The Agusan Manobo, therefore, make sense of these killings through the dynamics of cultural concepts and structural processes. This emphasis on the complex interconnections between culture and large-scale processes hopes to be of theoretical significance to the understanding of violence especially among marginalized groups and of pragmatic relevance in informing effective initiatives to address these practices which continue to yield devastating consequences.

Lucia Lancellotti Titus
Graduate Program: International Studies
Advisor: William Boettcher
Poster Number: 178

Success and Failure of Revolutionary Action: Case Studies from the Arab Spring Algeria versus Egypt

Scholarly literature has debated on the subject of political revolutions for decades. Tilly (1978, 1993), Skocpol (1979), Goldstone (1991), and Katz (2004), among others, have forwarded several variables to explain the success of revolutionary action during the French, Russian, Chinese, and Iranian Revolutions. However, after the mass uprisings throughout the Middle East and North Africa in 2011, the question remains whether these same variables are just as likely to explain the success or failure of revolutionary action for the participants of the Arab Spring. In particular, by employing a qualitative case study approach, this research aims to explain the different outcomes of two participants who possessed similar revolutionary seeds: the success of revolutionary action in Egypt versus the failure of revolutionary action Algeria. Three previously forwarded variables were applied to the mass uprisings in each country: the role of the opposition movement, the role of the military or security forces, and the role of the state's response to the opposition. I hypothesized that a strong opposition movement, an ineffective or non-existent military or security force, and the inability of the state to respond effectively to the opposition movement were each likely to increase the success of revolutionary action, and vice versa. After a careful analysis of the empirical evidence, the findings of the research fully support the hypothesis. As such, these findings suggest that the variables forwarded by prior literature to explain some of the most significant revolutions of our modern history, continue to be highly relevant when attempting to explain the vastly different outcomes of the particular Arab Spring case studies.

Angela Tramontelli
Graduate Program: English
Advisor: Jeffrey Reaser
Poster Number: 180

The Inclusion of Linguistic Diversity in Foreign Language Curricula

The way we use language indexes our social roles and identities (c.f. Agha, 2003; Silverstein, 2003; Wolfram & Schilling-Estes, 2006). An accent or dialect simultaneously signals various social meanings including ethnicity, social class, or other demographic information. An awareness of language diversity therefore equates to an awareness of other forms of diversity in society. The North Carolina Language and Life Project at NC State is renowned for its innovative outreach programs which demonstrate that teaching students about language variation leads to greater social awareness and appreciation of multiculturalism (Dunstan, 2013). Proponents of foreign language education advocate that, among other benefits, one importance of learning a second language lies in using that language to connect with speakers of other cultural backgrounds. However, language diversity curricula such as that pioneered by NCSU (e.g. Reaser & Wolfram, 2007) have not yet been applied to foreign language classrooms.

This project extends the reach of existing sociolinguistic educational materials to demonstrate that teaching an awareness of the social functions of language can increase students' ability to use foreign languages to interact with speakers of other cultural backgrounds. I synthesize sociolinguistic research with theories of communicative language teaching and intercultural com-

petence development to demonstrate that language diversity education programs can supplement foreign language teaching. Second language acquisition theories and teaching pedagogies shape the curriculum so that it best integrates sociolinguistic content with existing educational frameworks.

The outcome of this project is the development of sociolinguistic educational materials created specifically for use in foreign language classrooms. By explicitly linking language learning with the cultural contexts of that language, students will be equipped with a better understanding of how their foreign language skills translate into the existing societal frameworks of the target culture, and will ultimately become more interculturally competent speakers.

Anne-Lise K. Velez, Mary Clare Hano, Jayce Sudweeks, Kate Albrecht
Graduate Programs: Public Administration
Advisor: Branda L. Nowell
Poster Number: 185

Investigating Network Boundaries in Complex Problem Domains

A network perspective offers rich theoretical and methodological approaches to investigating complex problem domains and the related efforts of interdependent actors seeking to intervene in these problem domains. Network scholarship is divided, with one camp favored by public management and organizational scholars viewing networks as purposefully created governance and coordination supra-structures with clearly delineated boundaries, and another perspective favored by sociologists and policy scholars viewing networks as social constructions with fluid boundaries based on viewer perspective. To date, these competing perspectives have largely avoided interaction. Here, we explore the intersection of these two perspectives based on case studies of three complex problem and policy domains: 1) a policy network concerning genetically modified organisms; 2) a wildfire disaster response network, and 3) a community health and wellness-focused service delivery network.

Tara Connolly Watterson
Graduate Program: Communication
Advisor: Deanna Dannels
Poster Number: 191

University Health Provider Perspectives on the Communicative Aspects of Brief Alcohol Interventions

Given the pervasiveness of binge drinking among the patient population of university students, university health service providers are often faced with opportunities to conduct brief alcohol interventions during appointments with patients. These interventions can be crucial to patient health outcomes such as decreasing alcohol consumption. However, the general population of medical providers has demonstrated discomfort and inconsistency in conducting screening and intervention regarding patient alcohol use. This study investigates provider perspectives on the communicative aspects of brief alcohol interventions with patients in the unique context of university health services. Providers self-reported communicative strategies that they used and communicative challenges they faced during alcohol-related conversations with patients. Fourteen university health medical service providers, including nurse practitioners, physician assistants, and physicians, participated in the study. Providers were employed at four medium to large universities in one region of the Southeast United States. Sampling was conducted according to a maximum variety heterogeneous sampling technique. Providers participated in in depth interviews, yielding self-report retrospective insights. Data were coded and analyzed according to the constant comparative method. Providers reported enacting the following communicative strategies during brief alcohol interventions: gathering more information, creating a nonthreatening environment, providing education about consequences, eliciting patient ownership, providing tips for harm reduction, and continuing the conversation. Additionally, providers reported the following communicative challenges to conducting brief alcohol interventions: choosing how and when to start the conversation, diagnosing a resistant population, establishing necessary rapport for a sensitive conversation, and maintaining credibility despite uncertainty about efficacy of interventions.

Allaire K. Welk, James H. Creager, Douglas J. Gillan
Graduate Program: Psychology
Advisor: Douglas J. Gillan
Poster Number: 192

A Novel In-sight: Inattentional Blindness is Not Blindness

The term "inattentional blindness," which researchers have applied to a number of empirical phenomena such as "the invisible gorilla," presupposes a mechanism in which an observer does not process (i.e., is blind to) unexpected events due to focused attention on a primary task. However, features of unexpected events may be processed, thereby receiving attention, based on the characteristics of the features. The current research investigates task relevance as one of those characteristics. To address this research question experimentally, inattentional blindness was treated as a dual task; participants received instructions to focus on a primary task, but were not explicitly informed about a secondary task. Specifically, participants played a visual video game in which multiple white and black pucks moved randomly within the display. One black puck contained a colored target (e.g., a green dot). Likewise, one white puck contained a dot of a different color (e.g., red). When pucks of the same color made contact, the target dot could transfer between pucks; the primary task was to track these transfers. On some trials, an unexpected event occurred: the unattended target's color changed. The unattended target could change to the color of the target the

individual was tracking (task relevant) or a color unrelated to the primary task (non-task relevant). In addition to counting the target transfers, participants recorded if they noticed anything unexpected. Participants' correctly identified unexpected events more frequently in conditions of task relevance than in conditions of non-task relevance. These results suggest that inattentional blindness is a poor name for this phenomenon. Rather than blindness to unexpected events, these results indicate that people who are focused on a primary task may process unexpected events as they more closely resemble the surface features of the primary task. Applications include driving, flying, and interactions with computers and video games.

Sarah E. Wenner and Pamela K. Koulianos
Graduate Programs: History
Adviser: S. Thomas Parker
Poster Number: 193

Secrets of Arabian Nights Revealed: An Analysis of Unique Ceramic Finds from Petra's North Ridge

Petra's North Ridge—north of the Colonnaded Street—has been excavated by multiple prominent archaeologists throughout the past century. A new team, under the direction of Drs. S. Thomas Parker and Megan Perry, have begun to explore the often neglected various shaft tombs and non-elite domestic structures within the archaeological park. Using material from the 2014 season, this poster will examine both local and imported unique ceramic finds from the Nabataean and Early Byzantine periods in order to place the inhabitants of the North Ridge within their larger historical and economic contexts. This also contributes to a greater understanding of Petra overall.

Eric Wilbanks
Graduate Program: English
Advisor: ErikThomas
Poster Number: 197

The Role of Social Information in Cognitive Processing: Sex and Sexuality

Exemplar models of cognitive linguistic processing hold that humans' robust memory faculty allows for the construction of "exemplars" or prototypes gained through statistical procedures applied to experiential memories of variation. Hybrid models such as that proposed by Pierrehumbert (2006) call for increased awareness of the mental encoding of social information during the construction of exemplars. Since they are based upon experiential memories, exemplar clouds are sensitive to social information, especially that which is memorable or unique. As Mendoza-Denton et al. (2003) note, congruence between the variant and the center of the exemplar cloud often facilitates cognitive processing. Walker and Hay (2011) find that congruence between "word age" and speaker age facilitate processing in a lexical decision task. Similarly, Sumner and King (2013) note that "masculine" or "feminine" words show stronger semantic priming effects when there is congruence between word and speaker gender.

Expanding upon these investigations of speaker age and gender on linguistic processing, the current study examines a new social variable, sexuality. First, a lexical association task was carried out to construct a corpus of word-pairs whose semantic links differed for straight female, straight male, and gay male speakers. Then, the effect of congruence between speaker sexuality and gender and the semantic pair was investigated in a lexical decision task. Statistical analyses of reaction times illustrate significant increases in reaction time when congruence between speaker and associated pair is negative. Additionally, the effect of congruence or incongruence on semantic priming was greatest for the gay male speaker. These data demonstrate the saliency of speaker sexuality information in lexical processing and cognitive semantic linking and argue for an expansion of the social categories relevant for Exemplar models of linguistic processing.

Olga Zielinska
Graduate Program: Psychology
Advisor: Christopher B. Mayhorn
Poster Number: 207

What are the Chances? Examining the Effect of Displaying Probability Rates on Web Health Searches

The internet offers many benefits to people seeking health information, such as the convenience of accessing information at any time, and the protection of viewing information anonymously; however, such information is unregulated and can be misinterpreted. Escalation, the observed increase in medical severity of search terms within a single search session, could occur. For example, escalation occurs when an initial search for "headache" leads to a later search for "brain tumor". Researchers have recommended including incidence rates to reduce escalation; however, this phenomenon has yet to be tested empirically. One-hundred-and-forty-seven undergraduates were randomly assigned to one of three presentation groups (control, pictorial, and numeric) where they evaluated four search results pages. Incidence rates were not displayed in the control whereas participants in the pictorial condition saw incidence rates displayed as bar graphs and those in the numeric condition saw incidence rates displayed as percentages. Escalation was evaluated using the susceptibility measure from the Risk Behavior Diagnosis Scale. Four symptoms were evaluated and each symptom was paired with four conditions: two benign and two serious. Benign susceptibility was highest when shown numerically, followed by pictorially, and lowest in the control. The numeric group was significantly higher than the control group (p=.009); however, there were no differences between the numeric and pictorial group, and between the control and pictorial group (p<.10). Similarly in the serious condition, the highest ratings were in the

numeric group, followed by pictorial and the lowest susceptibility in the control. Numeric was significantly higher than the control (p=.028), but there was no difference between the numeric group and the pictorial group, or between the pictorial group and the control (p<.10). Although susceptibility was higher when incidence rates were present for both benign and serious conditions, rates were higher for benign conditions than the serious conditions suggesting that people are not escalating. The findings from this study could be helpful in understanding how patients comprehend healthcare information and could conceivably provide direction for how health care professionals distribute information to their patients.

College of Natural Resources

Scott M. Beck
Graduate Program: Forestry & Environmental Resources
Advisor: Melissa R. McHale
Poster Number: 14

Beyond Impervious: Urban Land-cover Pattern Variation and Implications for Water Quality

Linking urbanization patterns to ecosystem functionality is a primary goal of urban ecological science. The recent refinement of urban land cover classification frameworks has given urban ecologists a powerful tool for assessing land cover patterns at high spatial resolutions. As a function of differing patterns of development, urban water quality is affected by the percentages of impervious and vegetation surfaces within catchments, although water quality variability remains unexplained. Variation in land-cover patterns could explain a significant proportion of water quality variation, however, little is known about if or how land cover patterns vary among urban catchments with similar development levels. This study was conducted to determine if and how land-cover patterns vary among small-scale (~1 -5km2) urban catchments sampled from within the degraded range of impervious cover (20-30%).

High-resolution (1m2) land-cover data were used to quantify 23 land-cover pattern and stormwater infrastructure metrics within 32 catchments across the Triangle Region of North Carolina. Hierarchical clustering organized the catchments into four watershed-level groups, each with a distinct landscape pattern. Among these groups, the connectivity of combined land-cover patches account for 40%, and the size and shape of lawns and buildings account for 20%, of the overall variation in land-cover patterns among catchments. Stormwater infrastructure metrics account for 8% of the remaining variation. Land-cover patterns do vary among urban catchments, which is supportive of findings that suggest patterns are important predictors of water quality variability. However, our study is inclusive of stormwater infrastructure and distinguishes between vegetation types. It demonstrates that trees and grass (lawns) are divergent cover types in urban systems – where grass cover actually increases with urbanization (pavement and building cover)—and suggests that the alternative land-cover patterns feeding stormwater networks could further explain water quality variability.

Troy Carlton
Graduate Program: Parks, Recreation & Tourism Management
Advisor: Michael A. Kanters
Poster Number: 27

Is 'Shared Use' Really Enough? Examining the Interrelationships of Policy and Built Environments on Leisure Time Physical Activity

Having access to recreational spaces and facilities has been positively associated with higher physical activity rates. Agencies have identified shared use agreements (SUAs) as a potential combatant for the physical inactivity epidemic. Although the sharing of public school facilities can provide opportunities for physical activity, we have limited information on how active people are when given access to these facilities. A statewide project examined the prevalence of shared use within N.C. public school facilities to measure the effect of access policies and facility quality on physical activity behavior. A mixed methodology approach using surveys and systematic observation was delivered. Observational data were collected by observers for various target areas at each school coding individuals' gender, age, and physical activity level. SPAS survey was administered quarterly to athletic directors inventorying the context of both school-based programs and outside/community shared use. The S-PARA audit rated the quality of facilities. Descriptive statistics for physical activity measurements were calculated for each target area. Approximately 9,000 observations were recorded within 123 target areas.

Tennis courts and outdoor tracks were the most used during after school hours by non-school individuals and community groups. Findings suggest that higher levels of physical activity were observed in schools who have extensive SUAs in place. Facilities that were lower in quality were more likely to be completely vacant than those of higher quality. SUAs allowing community access to facilities during non-school hours increases physical activity but not significantly. Despite having open access policies for public use, very little physical activity occurred in schools during after school hours and on weekends. Barriers such as the quality of resources, were found to be more influential in encouraging physical activity than establishing a formal SUA. High schools had a greater variety of and higher quality facilities and hence, were observed having more physically active people.

Bryan Dick
Graduate Program: Forest Biomaterials
Advisor: Ilona Peszlen
Poster Number: 41

Erosion Rates Derived From Exposed Tree Roots — New Tools in Water Resources Management

An accurate estimation of riverbank erosion rates is critical for the evaluation of the past, present, and future sediment regime of river systems. Understanding these relationships allows watershed managers and regulators to prioritize river restoration and contaminated site remediation projects. Exposed tree roots offer a means of determining erosion rates for specific sites of concern. Dendrogeomorphology is a well-established field, yet little has been done in the continental U.S. using this tool and no current literature exists on the use of this tool for many species found in the Eastern U.S. This research uses the changes in the anatomy of tree roots exposed by erosion processes to estimate the average annual erosion rates of riverbank sediments. The first study of this kind in the U.S., our research evaluates the applicability of 12 eastern hardwood species and one softwood species for this method. Exposed root samples from diffuse and ring-porous hardwoods, together with buried ones as controls, were analyzed.

Differences in the arrangement, size and frequency of vessels, fiber diameter, cell wall thickness, growth ring width, and scarring between the exposed and the buried samples were used to identify the first year of root exposure. Multiple river/stream sites have been evaluated with the novel method that relates erosion rates to the bank erodibility ranking system (Bank Erosion Hazard Index -BEHI) that is currently used by the US EPA.

Finding of this study, including macroscopic and microscopic indicators of the date or root exposure and regression analyses relating BEHI to erosion on 3 rivers are presented. Methods for lateral erosion rate determination and potential uses for water quality modeling, remediation site prioritization and risk assessment are presented.

Michael Drake
Graduate Program: Fisheries, Wildlife and Conservation Biology
Advisor: Nils Peterson
Poster Number: 42

Cultural Perceptions and the Poaching of Pangolins (*Manis temminckii*) in Namibia

Pangolins (Order *Pholidota*), also known as scaly anteaters, are simultaneously one of the world's rarest clades of mammals and also the most trafficked animal group. While the driving forces of the international pangolin trade are well understood- high value as a medicine and a food stuff in East Asia- little is known about the nature of illegal pangolin hunting in Southern Africa. We began addressing this need with an in person survey of rural Namibians (n = 1,146). Most (77.7%) respondents knew what a pangolin was, of which 66.3% reported having seen a pangolin. Of the total respondents, 67.8% identified pangolins as a valuable animal to capture, 68.6% were aware that pangolins were protected in Namibia, and 12.0% had previously captured a wild pangolin. Survey responses suggest that pangolins are widely valued throughout Namibia for both their ceremonial uses as well as for their perceived monetary value. Despite strict wildlife regulations and a strong national conservation ethic, pangolin poaching is prevalent in Namibia. Further study is needed to determine whether pangolins captured in Namibia are being consumed domestically or are traded on the international level.

Alexander C. Fish
Graduate Program: Fisheries, Wildlife and Conservation Biology
Advisors: Christopher E. Moorman and Christopher S. DePerno
Poster Number: 47

Effects of Military Training on Bachman's Sparrow Reproductive Success and Occupancy

The historic loss of longleaf pine (*Pinus palustris*) forests across the southeastern United States led to declines in many plant and animals species associated with the community. Military bases in the region are mandated to restore longleaf pine forest for these rare and endangered flora and fauna, but associated training exercises result in frequent ground disturbances that impact the vegetation structure and habitat of ground-dwelling wildlife like the Bachman's sparrow (*Peucaea aestivalis*). Bachman's sparrows nest and forage almost exclusively on the ground, making them an ideal species to investigate the effects of military training. We compared Bachman's sparrow nest survival between high and low intensity training areas and used point counts to estimate sparrow occupancy rates. Our preliminary results show similar nest success and occupancy rates between the two training areas and indicate that military training does not affect Bachman's Sparrow nest success or occurrence.

Judith Gisip and Richard L. Lemaster
Graduate Program: Forest Biomaterials
Advisor: Richard L. Lemaster
Poster Number: 63

Application of Feedback Control Technique for Extending Tool Life in Wood-based Machining Operations

An improvement in wood-based machining operations provides economic benefits in the form of increased productivity, and product quality, which are crucial to the industry. The objective of this study was to improve the performance of a computer numerical control (CNC) router when machining melamine-coated particleboard by extending the life of the cutting tools. A feedback control technique was used to extend tool life where the spindle speed of the CNC router machine was increased based on the tool spindle vibration level. This increased spindle speed, reduced chipping caused by tool wear, but at a cost of increased tool wear rate. The technique was applied in the cutting of a 4 × 8 ft. melamine-coated particleboard on a CNC router with a 10% cobalt grade tungsten carbide insert at 500 ipm of feed speed in a climb cutting direction. The process was repeated for three other spindle speed settings: 12,000 rpm, 18,000 rpm, and a step function cutting where the spindle speed was increased at regular intervals. Tool wear as a measure of tool life was measured on the tool cutting edge, and also the degree of panel chipping of the melamine layer to determine the quality of cut. Results showed that, at a constantly low spindle speed of 12,000 rpm, tool life was increased, but adversely affected the panel chipping due to a larger chip load. A constantly high spindle speed of 18,000 rpm produced lower panel chipping; however, it resulted in a higher rate of tool wear. Increasing the spindle speed at regular intervals showed a lower tool wear, and panel chipping; however, it provided no clue about when to systematically increase the spindle speed. The feedback control technique utilized the tool spindle vibration to regulate the spindle speed that greatly extended the useful life of the cutting tool.

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Graduate Programs: Forest Biomaterials[1]; Food, Bioprocessing, and Nutrition Sciences[2]
Advisors: Richard A Venditti, Sunkyu Park
Poster Number: 82

Fundamental Understanding of Enzyme Adsorption In Mechanically Refined Lignocellulosic Biomass: A Multidisciplinary Approach

Fundamental understanding of the enzymatic hydrolysis of lignocellulosic biomass is critical to the economic viability and commercialization of second generation biorefineries. More insight into the phenomena that control the enzyme adsorption will allow more efficient biorefinery operation and more effective enzyme cocktail design. It has been shown in many cases that mechanical refining after the traditional pretreatment can improve the overall carbohydrate conversion efficiency which positively impacts the process yields (Jones et al., 2014). However, little to no research has been done to fundamentally understand what factors are responsible for this phenomenon. A multi-disciplinary approach involving recombinant protein production from the NCSU Biomaufacturing Training and Education Center (BTEC), biorefinery unit operations of pretreatment, mechanical refining, enzymatic hydrolysis and biomass characterization from the NCSU Forest Biomaterials Department, and laser scanning confocal microscopy from the NCSU Cellular and Molecular Imaging Facility (CMIF) has been applied to fundamentally understand the substrate enzyme interactions and how they change during enzymatic hydrolysis of lignocellulosic biomass.

Non-hydrolytic fusion proteins that can selectively bind to amorphous and/or crystalline cellulose that have been tagged with fluorescent active proteins have been developed. These proteins that are similar in size and carbohydrate-binding mechanism to traditional cellobiohydrolases can be used to quantitatively understand the cellulose accessibility using their fluorescence and UV-vis spectroscopy, and they can be used in combination with confocal laser scanning microscopy (CLSM) to build a three-dimensional model of the lignocellulosic biomass and enzyme protein matrix. If successful, the techniques described herein can be applied to many different biomass feedstocks and pretreatment systems to fine tune and optimize biorefinery conditions and also elucidate which factors are most significant for improving the carbohydrate conversion efficiency.

Rosemary B. Keane, Jordan W. Smith
Graduate Program: Parks, Recreation and Tourism Management
Advisor: Jordan W. Smith
Poster Number: 87

Online Information Sources and Social Media Usage by Visitors to Crater Lake National Park

Emerging communication and sharing technologies such as social media could serve as a valuable tool for federal, state and local natural resource and recreation management agencies. Research into visitor demographics, planning preferences, information seeking and sharing preferences, and technology usage while at these managed recreation areas is vital to identify and develop effective communication and outreach strategies. Data collected through on site surveys was used to examine the use of social media by visitors to Crater Lake National Park, USA. Visitors were asked about their pre-trip social media usage as well as their preferences for distinct types of preferred park-related content delivered through specific social media platforms. Visitors were also asked about what information sources (both online and offline) they would trust most for trip related information. Results indicate clear preferences for certain types of information visitors' desire from specific social media platforms. There was notable demand for information about recreational opportunities and the park's cultural resources from image- based platforms (Instagram and YouTube). Platforms that included both text and images (such as Facebook and Twitter) were preferred for information regarding directions to the park, weather conditions, and scheduled activities. Visitors indicated

a strong desire for onsite Wi-Fi access. The National Park Service was the most trusted source of information, followed by close family and friends. Future research could examine whether these trends are characteristic of visitors to other parks, and what kinds of communication best practices the NPS can employ in the future.

Wen Lin[1], Asko Noormets[1], JC Domec[1,3], John King[1], Ge Sun[2], Steve McNulty[2]
Graduate Programs: Forestry and Environmental Resources[1]; USDA Forest Service[2]; Bordeaux Science Agro[3]
Advisors: Asko Noormets and JC Domec
Poster Number: 105

A Novel High-throughput α-cellulose Extraction Method for δ13C and δ18O Stable Isotope Ratio Analysis for Softwood

Wood stable isotope ratios (δ13C and δ18O) offer insights about plant water source, water availability and water use efficiency (WUE), which are informative for predicting the sensitivity of plants to projected future precipitation patterns. Though α-cellulose is broadly seen as the best indicator of plant water status, the time- and labor-intensive extraction process is the rate- limiting step in such an endeavor. Wieloch et al. (2011) designed a multiport extraction system (MSISS) with a 4-5-fold higher throughput than traditional methods. However, it does not include an extractive removal step which is necessary for many coniferous species. The objective of this study is to implement MSISS with a pretreatment step while remaining its high throughput. We thus introduced a simple chemical based extractive removal method from wood science and designed a multiport device which is compatible with MSISS. The performance of the device and the method was evaluated with wood of loblolly pine from 5 geographic locations in southeastern USA and of 5 other wide-spread coniferous species (black spruce, Fraser fir, Douglas-fir, Norway spruce, and ponderosa pine) with contrasting extractive profiles. The results indicate that the difference between the new and traditional α-cellulose extraction method are within the precision of the isotope ratio mass spectrometry (IRMS) method used: ±0.2‰ for carbon and ±0.3‰ for oxygen. The new combined method allows throughputs of up to several hundred samples in two weeks, while minimizing labor requirements to 2-3 days per batch of samples.

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Graduate Program: Fisheries, Wildlife, and Conservation Biology
Advisors: Chris E. Moorman, Chris S. DePerno
Poster Number: 112

A Comparison of Methods to Estimate Resident Canada Goose Abundance in North Carolina

Since the early 1980s, the resident Canada goose (*Branta canadensis*) population in North Carolina has increased. The expansion of the population provides valuable wildlife viewing and hunting opportunities, but increased goose abundance leads to human-wildlife conflict and greater risk of zoonotic diseases. To help drive adaptive management of burgeoning goose populations, including assessment of specific management practices, an efficient method to accurately estimate goose abundance across North Carolina is needed. Our objective is to compare precision and efficiency between two common methods to estimate goose abundance. The first method (i.e., Lincoln-Peterson estimation) uses hunter band returns and the second (i.e., plot survey) uses surveys of 1-km2 plots randomly located across potential Canada goose habitat. To quantify efficiency, we will record all expenses and time dedicated to goose banding and plot surveys. In June 2014, we banded 2396 geese at 43 sites across the state. To date, 141 band returns have been submitted, which will allow us to calculate harvest rate, the only unknown variable in the Lincoln-Peterson formula. This study will provide the first estimate of resident Canada goose abundance in North Carolina, and the comparison of methods will guide future state and regional efforts to monitor Canada goose abundance.

Andrew Moore[1], Héctor Grandon[2], Niels Muller[2], Cristina Segura[2], Sunkyu Park[1], Marion Carrier[2]
Graduate Programs: Department of Forest Biomaterials[1]; Centre for Technological Development-UDT[2]
Advisor: Sunkyu Park
Poster Number: 126

Conventional Fast Pyrolysis of Coated Biomass as an Alternative to the Valorization of Natural Thermoset Polymers

The valorization of secondary streams such as extracted tannins and Acetosolv lignin from Pine radiata, known as natural thermoset polymers, is a key issue in the development of lignocellulosic biorefineries. Fast pyrolysis, a thermochemical process that converts biomass into a valuable liquid product, is currently of particular interest for chemical production. However, conventional fast pyrolysis of thermoset biopolymers presents feeding problems due to their low fusion point, bed agglomeration, and low yield of highly oxygenated liquids (Nowakowski, 2010; Case, 2014). To overcome these technical barriers, the co-feeding with alkaline catalyst and/or the use of catalytic bed materials were applied and slightly improved the performance of the fluidized bed reactor. Preliminary 13C NMR and GC-MS analyses of liquids indicated promising results for the selective depolymerization of both polyaromatic polymers (Case, 2014; Carrier 2014).

Because of recurrent feeding issues, a new coating preparative method of the Pine radiata feedstock was used to process a mixture of Acetosolv lignin and sawdust prepared at different mass ratios of lignin to sawdust, 1:14 (LI20) and 2:30 (LI40). Total liquid and organics yields were measured for their significance in chemical production. Total liquid yields for Pine radiata, LI20 and LI40 were respectively found equal to 55, 46 and 32 wt.% using the 0.1 kg/h fast pyrolysis plant scale, while organics yields corresponded to 24.25, 29.02, and 32.24 wt.%.

Experimental conditions (temperature, mixture ratio) that are currently being optimized at a small scale (using a 2 L glass beaker and a 0.1 kg/h fast pyrolysis set-up) will be subsequently applied to an industrial scale (using a tank volume of 100 L and a 10 kg/h fast pyrolysis plant (Wilkomirsky, 2014)).

This new preparation technique of the feedstock overcomes the technical barriers associated with the feeding of thermoset polymers, without modifying the initial design of the fast pyrolysis reactor; but also enhances the production of the phenolic rich fraction.

Gary B. Perlmutter[1], Gary B. Blank[1], Viney P. Aneja[2], Thomas R. Wentworth[3], Howard S. Neufeld[4] and Margaret D. Lowman[5]
Graduate Programs: Natural Resources, North Carolina State University[1]; Air Quality Research, North Carolina State University[2]; Plant Biology, North Carolina State University[3]; Biology, Appalachian State University[4]; Science & Sustainability, California Academy of Sciences[5]
Advisor: Gary B. Blank
Poster Number: 142

Highway Effects on Forest Lichen Communities in Wake County, North Carolina: An Example of Secondary Impact Assessment

Nitrogen pollution in forests can cause serious ecological harm, ultimately resulting in reduced biodiversity dominated by weedy, pollution-tolerant species. Elevated NOx levels from vehicle emissions have been shown to penetrate roadside forests with the potential to impact the biotic communities within. Among the more sensitive ecosystem components are lichens, fungal-algal symbiotic organisms that receive nutrients by direct exposure to the atmosphere via wet and dry deposition. Lichen communities were studied along forest edge-to-interior gradients on either side of highway I-40 and a remote lake (control) in Wake County, North Carolina to investigate road impacts on this sensitive ecosystem component. Annual 2014 average NOx concentration representing the highway forest edge is 21.7 ppb from measurements by the EPA roadside monitoring station 3.4 km NW from the sample sites. At all sites lichens were sampled on trees at 10 m intervals along each of five parallel transects laid at selected distances from the forest edge, at trunk base (0-0.5 m) and bole (0.5-1.5 m) heights. The highway-exposed sites had 45 and 58 lichen species total, while a total of 84 species were found at the control site. Species richness increased from 4-5 spp at the edge to 21-32 spp at 150 m distant at the highway- exposed sites while in the control site lichen diversity of 40 spp at the edge decreased to 25 spp at 150 m. Regression analyses found significant evidence for relationships between lichen species number and distance in both highway-exposed sites at the whole trunk and at both base and bole levels; however, results for the control site were not completely significant. The lichen diversity patterns observed here suggest an impact from highway sources. Further research is needed to determine if the patterns are related to ambient air NOx concentrations.

W. Andrew Whittier
Graduate Program: Forestry
Advisor: Gary Hodge
Poster Number: 196

Teak (*Tectona grandis*) Seedling Nutrient Deficiency Symptoms in a Hydroponic System Correlated with Near-infrared Spectroscopy (NIR) Models

Growers working with teak seedlings in nursery settings often encounter issues related to incorrect nutrition. In order to help individuals accurately diagnose nutrition issues a study was initiated looking at the symptoms of twelve macro and micro nutrient deficiencies and toxicities on hydroponically grown teak seedlings. Preliminary studies were conducted to determine ideal nutrient solution strength, pH level, and buffer solution for hydroponically growing teak seedlings. This research was done in preparation for the nutrition study. In the larger symptomology experiment seedlings were grown in greenhouses in both a conventional liquid hydroponic setup and in sand culture hydroponics in order to investigate the efficacy of each system. In the sand culture hydroponic experiment different treatments resulted in significant differences in seedling height at eight weeks. The most dramatic differences in height occurred between control seedlings and those grown without one of the macronutrients. Plants grown in absence of Copper also exhibited reduced growth in conjunction with more rapid and dramatic symptoms than expected. In a second study additional teak seedlings were grown in sand under varying levels of Nitrogen, Phosphorus, and Potassium in order to investigate whether Near Infrared Spectroscopy (NIRS) models could be developed that accurately depict levels of these nutrients in seedling foliage. Near Infrared models will be developed using both a handheld Microphazir NIR scanner on fresh leaves and with dried ground leaves in a laboratory grade Foss NIR 6500 machine. Both systems are being investigated in order to compare the accuracy of the less expensive and more efficient handheld machine to that of the more intensive laboratory module. Results from all sections of this study will be incorporated into a guide that provides growers with a suite of tools to accurately diagnose issues with their seedlings.

Casey Bray[1], William Battye[1], and Viney Aneja[1], Daniel Tong[2], Pius Lee[2], Youhua Tang[2]
Graduate Program/Institution: Marine, Earth and Atmospheric Sciences, North Carolina State University[1], NOAA[2]
Advisor: Viney Aneja
Poster Number: 21

Evaluation of Ammonia Prediction by the NOAA National Air Quality Forecast Capability System using DISCOVER-AQ and CalNex Field Campaign Data

Fine particulate matter (PM2.5) is important in cloud formation and radiative transfer in the atmosphere, and is associated with adverse health effects. Ammonium sulfates (NH4HSO4 and (NH4)2SO4) and ammonium nitrate (NH4NO3) typically contribute about half of PM2.5 mass in the United States. Therefore, the computation of atmospheric ammonia (NH3) is critical to the prediction of (PM2.5) formation and PM2.5 mass concentrations. In this study, CMAQ model predictions of gaseous NH3 concentrations are compared with airborne measurements taken during NASA DISCOVER-AQ Colorado field campaign (2014) and California CalNex (2010) field campaigns in order to understand the accuracy of NH3 predictions within NOAA's National Air Quality Forecast Capability (NAQFC) system. Model error is analyzed with respect to altitude, time-of-day, and the proximity of emission sources. Measured NH3 values are found to be higher than model predictions. For the Colorado flights, measured NH3 averaged 3.2 ppbv, with a standard deviation of 5.4 ppbv and a maximum measurement of 90 ppbv (1-minute average). Modeled values for the Colorado flight paths averaged 1.2 ppbv, with a standard deviation of 1.5 ppbv and maximum prediction of 15 ppbv. For the California flights, measured NH3 averaged 3.9 ppbv, with a standard deviation of 14.5 ppbv and a maximum measurement of 380 ppbv. Modeled values corresponding to these flight California paths averaged 1.7 ppbv, with a standard deviation of 2.1 ppbv and a maximum prediction of 16.5 ppbv. The largest differences between measured values and model predictions occurred in regions of high NH3 emissions. Model errors also tend to decline with increasing altitude.

Allison A. Camp and David B. Buchwalter
Graduate Program: Toxicology
Advisor: David B. Buchwalter
Poster Number: 26

Comparison of Developmental Measures in Normal and Split Cohorts of the Mayfly *Cloeon dipterum*

Aquatic insects are ecologically important and widely used to assess ecological conditions in freshwater ecosystems. Abiotic factors such as temperature and light are known to play important roles in insect development, but remain poorly understood. In this study, we explored cohort splitting – a phenomenon where a given cohort of larvae "split" and follow radically different developmental regimes in response to seasonal change. Some individuals in the cohort complete their larval development normally and emerge as adults, while other individuals delay their development and over-winter as larvae. We stimulated cohort splitting in the mayfly *Cloeon dipterum* by manipulating (shortening) photoperiod. Offspring from a single mother were used in this experiment. We compared metabolic rates (via measures of oxygen consumption), growth rates and development time in individuals following different developmental trajectories.

Individuals following a normal developmental program had a growth rate of 0.69 ± 0.08 mg wet weight per day whereas the individuals that delayed their development grew at a rate of 0.087 ± 0.01 mg wet weight per day while light remained winter-like ($p < 0.0001$). Mass specific metabolic rates across development were not significantly different for between the groups. We could "release" larvae from their delayed development program by increasing photoperiod, thus artificially controlling development time. Cohort splitting appears to be a "bet-hedging" strategy used to maintain population persistence in a given area. Here we showed that cohort splitting could be stimulated by light alone and does not require a concomitant reduction in temperature.

Kate Coyle, Natalie Roberts, and Reade Roberts
Graduate Program: Genetics
Advisor: Reade Roberts
Poster Number: 33

Impact of Dietary Adaptation on Gastrointestinal Biology Across Trophic Levels in East African Cichlid Fishes

Response to diet is a complex interaction between nutrient intake, genetic factors impacting physiology and metabolism, and gut bacterial content. Because of the massive impact of diet on development and health, there has been significant effort to characterize the contributions of these elements in traditional models; however, the genetic underpinnings of dietary adaptation remain poorly understood, as is their contributions to evolution and speciation. East African cichlids are an excellent model system for studying evolution due to a recent adaptive radiation that has resulted in extreme phenotypic divergence in many traits, including those involved in adaptation to diet. I am using cichlid species from three different trophic levels (herbivore, omnivore, and carnivore) to investigate the effect of different diets on two traits involved in dietary adaptation: gut length and gut bacterial microbiome. Individuals of each species are raised on animal, vegetable, and mixed diets. Fish from each species by diet cohort are collected at multiple developmental time points for characterization of gut morphology and bacterial profile. Preliminary results show notable differences in the gut lengths of individuals from different trophic levels as well as

plasticity in gut length early in development. We also see differences in bacterial profiles across cohorts of different species just ten days after feeding begins and enrichment for particular bacterial taxa in certain cohorts. These preliminary results show species-specific differences and suggest that future comparative genomics and mapping of interspecific crosses will allow for identification of genetic factors underlying divergence across trophic levels.

Sofia Garakyaraghi, Evgeny O. Danilov, Catherine E. McCusker, Felix N. Castellano
Graduate Program: Chemistry
Advisor: Felix N. Castellano
Poster Number: 58

Ultrafast Dynamics of Sterically Congested Cu(I) MLCT Excited States

The metal-to-ligand charge transfer (MLCT) excited states of copper(I) diimine complexes are candidates for use as photosensitizers as they have strong absorption in the visible spectrum promoting both excited state electron and energy transfer reactions. Upon absorption of visible light, an electron is promoted from the Cu^{I} (d^{10}) to one of its diimine ligands resulting in a d^{9} electronic configuration at the metal center. While this state maintains its original pseudo-tetrahedral geometry, the change in electronic configuration results in the MLCT excited state undergoing substantial Jahn-Teller distortion. The addition of sterically bulky substituents in the 2- and 9- positions of the phenanthroline ligands has shown to be effective in increasing the excited state lifetime by hindering the extent of these distortions. Furthermore, an additional steric hindrance effect is observed with methyl groups in the 3- and 8- positions of the phenanthroline ligands, further locking the complex into its ground state tetrahedral geometry. Ultrafast transient absorption studies of $[Cu(dmp)2]^{+}$ (dmp = 2,9-dimethyl-1,10-phenanthroline), $[Cu(dsbp)2]^{+}$ (dsbp = 2,9-di(*sec*-butyl)-1,10-phenanthroline), and $[Cu(dsbtmp)2]^{+}$ (dsbtmp = 2,9- di(*sec*-butyl-3,4,7,8-tetramethyl)-1,10-phenanthroline) in dichloromethane and tetrahydrofuran were performed. Four different excitation wavelengths (418 nm, 470 nm, 500 nm, and 530 nm) were used to elucidate dynamics on ultrafast times scales spanning probe wavelengths ranging from the UV to the near-IR (350 nm to 1450 nm). With a time resolution of ~150 femtoseconds, excited state decay in all three compounds was found to be independent of excitation wavelength. There was no observed influence of solvent in the initial stages of excited state decay in any of these molecules including $[Cu(dmp)2]^{+}$. The combined experimental data revealed two ranges of time constants in these chromophores and were found to lengthen as a function of structure; $[Cu(dsbtmp)2]^{+}$, the molecule most resistant to flattening distortions, had the fastest initial dynamics, whereas $[Cu(dmp)2]^{+}$, the complex most susceptible to distorting, the slowest, with $[Cu(dsbp)2]^{+}$ lying in between.

Tiffany A. Garbutt[1], David L. Aylor[1], and David W. Threadgill[2]
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Advisor: David W. Threadgill
Poster Number: 59

Genetic Determinants of Cell State in Mouse Induced Pluripotent Stem Cells

Induced pluripotent stem cells (iPSCs) are derived by somatic reprogramming and have become a likely alternative to embryonic stem cells (ESCs) because of their potential for patient specific medicine and the insights they can provide on pluripotency regulation and cell fate determination. We generated iPSCs from the eight parental strains of the Collaborative Cross (CC) mouse genetic reference population, an enetically defined model system for investigating complex traits. Six of eight strains yielded ESC-like iPSCs. The NOD/ShLtJ (NOD) strain, a common model for Human Type I Diabetes, and the WSB/EiJ (WSB) strain were found to be non-permissive. Non-permissive mouse strains cannot form ESCs or iPSCs under standard conditions and instead form developmentally primed epiblast stem cell (EpiSC)-like colonies with limited differentiation potential. We generated fibroblast-derived ESC-like iPSCs from an F1 cross between NOD and the permissive 129S1/SvImJ strain, indicating that the EpiSC- like state is recessive to the ESC-like state. A complementation test revealed that the NOD and WSB EpiSC-like phenotypes do not complement. Using a glycogen synthase kinase 3β inhibitor, a mitogen-activated protein kinase inhibitor, and varying treatment length, we derived ESC-like iPSCs from both the NOD and WSB strains. Immunofluorescence staining for the ESC marker PECAM1 and the EpiSC marker CD40 reveal that EpiSC-like iPSC colonies contain both ESC-like cells and EpiSC-like cells. Studies are underway using single cell analysis and RNA sequencing to characterize genomic differences between strains, cell states, and treatments to provide better insight into pluripotency and cell state regulation.

Susan P. Gardner and Jonathan W. Olson
Graduate Program: Microbiology
Advisor: Jonathan W. Olson
Poster Number: 60

Defective Copper Homeostasis Affects Oxidative Stress Resistance and Host Colonization of *Campylobacter jejuni*

Campylobacter jejuni is an important human pathogen, but is considered a commensal in poultry. *C. jejuni* encodes genes implicated in copper homeostasis, however their role in stress resistance and host colonization is unknown. We have isolated strains with mutations in two of these genes: a multicopper oxidase (*cueO*:CM), and a Cu(I) translocating P-type ATPase (*copA*:CM). In vitro, these mutants were more susceptible to both the addition of copper in the growth media and to induced

oxidative stress. When these strains were inoculated into one-week-old chickens, their cecal contents contained fewer *C. jejuni* when assayed three weeks post inoculation. The deficiency was exacerbated by the addition of copper to the feed. Further studies will focus on disrupting copper homeostasis as a potential strategy to reducing pathogen load in domestic poultry.

Matthew S Gilmer
Graduate Program: Physics
Advisor: Carla Frohlich
Poster Number: 62

Pair-instability Supernovae of Massive Rotating Population I Stars

Pair-Instability Supernova (PISNe) are highly energetic thermonuclear explosion that can completely disrupt the material from an entire massive star (~140-260 Msol). These events have been studied in the context of the first generation of stars (Population III) since they were first proposed in 1967. It was thought that PISNe could only occur in the metal deficient early Universe, but recent results in stellar modeling suggest the possibility of PISN progenitors much closer to home. Here, we present simulations of the PISNe from rapidly rotating massive stars at sub-solar metallicities (Z=0.2, Z=0.6). We model both hydrodynamics and nucelosynthesis using the FLASH code and discuss how metallicity affects the explosion properties and nucleosynthetic yields. Finally, we speculate on the rate at which PISNe might occur in the local universe, and their detectability.

Carl Giuffre
Graduate Program: Biomathematics
Advisors: David R. Tarpy, Sharon R. Lubkin, Uduak Z. George
Poster Number: 64

Evaluating Honey Bee Grooming Behavior Using Digital Image Processing

Grooming is a significant aspect of insect behavior which can determine important features of an individual's health, such as disease resistance. In eusocial insects, individual grooming also contributes to the overall health of the colony as it plays a role in social immunity. Grooming can be particularly effective in reducing mite loads, preventing fungal infections and in some cases can lead to social vaccination. Unfortunately, the quantification of insect grooming often is labor- intensive, and requires manual observation of insect behavior. We have designed a novel assay to quantify self-grooming of the honey bee (*Apis mellifera*) using automated digital image processing techniques. By coating honey bees in baking flour (or powder) and recording them in an arena, we are able to measure changes in pixel data as honey bees groom themselves with minimal behavioral observations. Data will be presented which validate this as a useful, high-throughput tool to assess grooming rates of individuals and colonies. Evidence from preliminary trials will also be presented that suggest colony-level differences in honey bee grooming based on the amount of genetic diversity within a colony.

Sarah Hale
Graduate Program: Statistics
Advisor: Arnab Maity
Poster Number: 69

Functional Mediation Analysis Using FPCR with an Application to Genetic CNV Data

Mediation analysis with all scalar variables is widely used to examine the various pathways among primary and intermediate variables and identify mediating variables *M* that affect the relationship between the main covariate *X* and the response *Y*. Often, *X* affects *M,* which in turn affects *Y*. This relationship between *X* and *Y* that is mediated by *M* is called the indirect effect and is quantified using the product of coefficients from two models. We consider performing mediation analysis with a scalar mediator, a scalar response and a functional covariate, meaning the covariate is a continuous curve rather than a single scalar measure. In functional data analysis, a common procedure used to quantify the relationship between a functional covariate and a scalar response is functional principal component regression (FPCR). FPCR is a dimension reduction technique that decomposes the observed covariate curve to highlight the most important variation in the curve. We incorporate FPCR to extend the structure of mediation analysis to include a functional covariate. We present simulation results to investigate the performance of our proposed method and find it properly estimates the indirect effect function. In addition, we compare three proposed tests: a Wald test, a bootstrap method and a test using simultaneous confidence intervals. Both the Wald test and simultaneous interval test have adequate, albeit sometimes conservative, Type 1 error and good power, while the bootstrap test occasionally has much too high Type 1 error. We extend our method to account for generalized responses using generalized functional linear models and report similar results. Finally, we apply our methodology on a genetics application regarding multiple myeloma (MM). Genomic abnormalities in the number of copies of DNA, known as copy number variations (CNVs), are associated with the development and progression of cancer. We investigate the effect of gene expression on the relationship between functional CNV data and level of β2-microglobulin, a known biomarker for MM.

Lisa L. Herzog
Graduate Program: Biological Sciences
Advisor: Lindsay Zanno
Poster Number: 72

Histological and Computed Tomographic Analysis of Paleopathological Limb Bones

Osseous diseases and injuries that impact the vertebrate skeleton can persist in fossil specimens through diagenesis and biomineralization. Historically, paleopathologies (ancient diseases) or other skeletal abnormalities were studied by gross anatomical description and compared with analogous disease processes/injuries in extant organisms. Recent advances in visualization technologies permit more rigorous and comprehensive assessments of paleopathological etiology, including detailed reconstructions of internal structure. Here we examine the microstructure of abnormal bony calluses on the limb bones of the Cretaceous theropod dinosaur *Falcarius utahensis* (~125 Ma) and the Triassic crocodylomorph *Dromicosuchus grallator* (226 Ma) using Computed Tomography (CT) and paleohistology (tissue thin sectioning). While CT has become a common practice for visualizing pathological structure in fossil specimens, we test the fidelity of a paleohistological approach as a complementary diagnostic tool.

Pathologies on the mid-shaft of a tibia and humerus of *F. utahensis* and the tibia of *D. grallator* are represented by an abnormal, raised, smooth mass, occupy ¼ to ½ of the circumference, and are superficially similar. Although secondary bone is visible in CT analysis, our paleohistological samples permit far greater microstructural detail. Both methods reveal pathololgical commonalities including secondary reactive bone superficial to the primary periosteal surface and concomitant endosteal remodeling.

However, histological samples detail variations in vascularization and fiber orientation indicative of physiological differences in disease response. The theropod dinosaur *F. utahensis* exhibits immediate, rapid secondary bone deposition characterized by radial vasculature, and a centralized cryptogenic nidus/mass embedded within the primary fibrolamellar bone. The crocodylomorph *D. grallator* callus exhibits several intervals of slower growing reactionary bone characterized by longitudinal canals within a parallel-fiber matrix. Future work will compare these samples to skeletal disease in living relatives of *F. utahensis* and *D. grallator*—birds and crocodilians, respectively—to shed more light on the enigmatic etiology of these ancient pathologies.

Runchao Jiang
Graduate Program: Statistics
Advisor: Wenbin Lu and Rui Song
Poster Number: 79

On Estimation of Optimal Treatment Regimes for Maximizing t-Year Survival Probability

A treatment regime is a deterministic function that dictates personalized treatment based on patients' individual prognostic information. There is increasing interest in finding optimal treatment regimes, which determine treatment at one or more treatment decision points so as to maximize expected long-term clinical outcome, where larger outcomes are preferred. For chronic diseases such as cancer or HIV infection, survival time is often the outcome of interest, and the goal is to select treatment to maximize survival probability. We propose two nonparametric estimators for the survival function of patients following a given treatment regime involving one or more decisions, i.e., the so-called value. Based on data from a clinical or observational study, we estimate an optimal regime by maximizing these estimators for the value over a pre-specified class of regimes. Because the value function is very jagged, we introduce kernel smoothing within the estimator to improve performance. Asymptotic properties of the proposed estimators of value functions are established under suitable regularity conditions, and simulations studies evaluate the finite-sample performance of the proposed regime estimators. The methods are illustrated by application to data from an AIDS clinical trial.

Christopher C. Ladner
Graduate Program: Chemistry
Advisor: Gavin J Williams
Poster Number: 95

Reprogramming Substrate Specificity of Polyketide Biosynthesis by Yeast Cell Surface Display

Polyketides are a class of diverse chemically complex therapeutic natural products. Because of this complexity, traditional synthetic routes to creating new analogs is extremely challenging. Biosynthetic approaches for introducing chemical diversity are an attractive alternative to producing analogs. High-throughput approaches aimed at engineering biosynthetic machinery are highly sought after. Herein, we describe our efforts to create a versatile directed evolution strategy to engineer biosynthetic machinery by yeast cell surface display. This system uses a dual display plasmid that expresses both the enzyme and protein substrate on the yeast cell surface. Upon transfer of a reactive handle and subsequent fluorescent labeling, activity is reported by fluorescent activated cell sorting. Our system improves on previous strategies for bond-forming enzymes by creating an ultra high-throughput platform for the evolution of both the enzyme and protein substrate.

Yifang Li, Sujit K. Ghosh
Graduate Programs: Statistics
Advisor: Sujit K. Ghosh
Poster Number: 102

Bayesian Nonparametric Methods for Testing Shape Constraint for Longitudinal Data

In various applications of longitudinal data analysis, we often have subject matter knowledge about the population that may suggest a specific shape of the unknown mean curve over a given time period of interest. However, due to the variability across subjects or sites or lack of experimental scientific evidence, it may not be obvious to detect a specific shape of the population level trend based on sparsely observed data. For example, it is widely believed and debated that global temperature might be on rise over the last century based on observations taken at various locations around the globe, but a definitive answer is still lacking. Mixed-effect model is a commonly used tool to account for variations across different subjects or sites in longitudinal analysis. This paper develops a nonparametric Bayesian method to test various shape constraint of the population level mean trend based on approximating a Gaussian process using a sequence of penalized splines whose coefficients are allowed with vary with subjects or sites.

Posterior consistency of the test procedure is established under a set of regularity conditions and numerical illustrations are presented based on simulated and real data sets.

Gregory C. Mader
Graduate Program: Biomathematics
Advisor: Mette S. Olufsen
Poster Number: 107

Modeling Cerebral Blood Flow Velocity during Orthostatic Stress

Cerebral autoregulation refers to the physiological process that maintains stable cerebral blood flow (CBF) during changes in arterial blood pressure (ABP). In this study, we propose a simple, nonlinear quantitative model with only four parameters that can predict CBF velocity as a function of ABP. The model was motivated by the viscoelastic-like behavior observed in the data collected during postural change from sitting to standing. Qualitative testing of the model involved analysis of dynamic responses to step-changes in pressure both within and outside the autoregulatory range, while quantitative testing was used to show that the model can fit dynamics observed in data measured from a healthy young and a healthy elderly subject. The latter involved analysis of structural and practical identifiability, sensitivity analysis, and parameter estimation. Results showed that the model is able to reproduce observed overshoot and adaptation and predict the different responses in the healthy young and the healthy elderly subject. For the healthy young subject, the overshoot was significantly more pronounced than for the elderly subject, but the recovery time was longer for the young subject. These differences resulted in different parameter values estimated using the two subgroups.

Doreen McVeigh[1], David B. Eggleston[1], Ruoying He[1], AustinTodd[1], Craig Young[2]
Graduate Programs: Marine, Earth, and Atmospheric Sciences, North Carolina State University[1]; University of Oregon, Oregon Institute of Marine Biology[2]
Advisor: David B. Eggleston
Poster Number: 115

Potential Larval Connectivity of Deep-sea, Methane Seep Invertebrates in the Intra-american Sea

Population connectivity via larval dispersal is a key process that maintains spatially separate biological populations and communities. Since their discovery, deep-sea chemosynthetic ecosystems have been novel systems within which to test the generality of paradigms developed for shallow-water species. Deep-sea, methane seep habitats are distributed throughout the world, yet we know relatively little about the life history of seep invertebrates, nor patterns and processes underlying population connectivity for these unique biological communities. The goal of this study is to assess the biological and hydrodynamic drivers of population connectivity of deep-sea invertebrates among methane seep sites in the Intra-American Sea. Here, we present the preliminary results of a coupled bio-physical model used to assess connectivity of the mussel, *"Bathymodiolus" childressi*, and snail, *Bathynerita naticoidea*, among eight methane seep sites throughout the Gulf of Mexico and U.S. East Coast. Virtual larvae were programmed with varying pelagic larval durations (PLDs) and behaviors that best matched empirical data. Initial results suggest larval connectivity among sites of varying depths and locations, such as Florida Escarpment (Gulf of Mexico) and Cape Fear Diaper (southeast Atlantic), among a variety of larval behaviors and PLDs. This study is advancing our general knowledge of population connectivity in the deep-sea.

Elizabeth K. Medlock
Graduate Program: Toxicology
Advisor: Gerald A. LeBlanc
Poster Number: 118

A Novel Approach for High-throughput Screening of Potential Crustacean Endocrine Disrupting Chemicals

As the number of environmental compounds in production increases, the high-throughput assay is emerging as an important contributor to chemical toxicity testing. I have developed an *in vitro* assay capable of screening potential chemicals for their ability to activate the Methyl farnesoate receptor (MfR) in crustaceans. The MfR regulates aspects of sex determination and sex differentiation in crustaceans. The assay utilizes a relatively new technology, Bioluminescence Resonance Energy Transfer (BRET) to quantify ligand-dependent dimerization of the proteins dapmagMet and dappuSRC to form the active MfR. Two fusion proteins, dappuSRC-Rluc2 (Rluc2: luciferase, photon donor) and dapmagMet-mAme (mAme: yellow fluorescent protein, photon acceptor) were constructed to measure energy transfer upon dimerization of these MfR subunits. Incorporated protein domains, fusion protein construct orientation, as well as molar ratio of photon donor: acceptor were optimized prior to the screening experiments. Maximal energy transfer was achieved with full *dappu*SRC and *dapmag*Met open reading frames, photon donor/acceptor proteins fused to the 5' terminus of the receptor proteins, and a molar ratio of 1:6, respectively. An extensive list of environmental chemicals were screened with the optimized assay; including insect growth regulating (IGR) compounds and the Environmental Protection Agency's list of "high production volume (HPV)" chemicals. While the none of the 19 HPV chemicals tested initiated dimerization (≤ 100μM), several IGRs activated MfR dimerization with variable potency (EC50) *e.g.,* fenoxycarb (0.003μM) > pyriproxyfen (1 μM) > methyl Farnesoate = methoprene (2.5μM) > Kinoprene (30μM). Upon comparison of the novel MfR BRET assay and the standard *in vivo* ten-day chronic toxicity tests for *Daphnia magna*, MfR dimerization seems to be a suitable indicator of endocrine disruption, as the relative chemical potencies were similar between the two assays.

Yasamin Moazami
Graduate Program: Chemistry
Advisor: Joshua G. Pierce
Poster Number: 124

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 guanidine alkaloid, monanchocidin A, isolated from a Far Eastern marine sponge. The intricacy and novelty observed in the structure of the pentacyclic guanidine 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 guanidine core of the monanchocidins that relies on the utilization of a disubstituted *trans* –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.

Katherine Knudsen Myers
Graduate Program: Genetics
Advisor: Max Scott
Poster Number: 129

Genetic Background Influences Efficacy of tTa Overexpression Conditional Lethal System

Drosophila suzukii is a species of Asian fruit fly that has recently invaded the coastal United States, posing a threat to soft-bodied fruit crops. Unlike other fruit fly species that lay eggs in rotting fruit, D. suzukii females use a specialized serrated ovipositor to pierce the outer skin of the fruit to deposit their eggs in the fruit flesh. The Sterile Insect Technique (SIT) is a successful method of pest management that implements the release of modified insects as a means for control or eradication of a pest population. Due to the damage caused by the D. suzukii female ovipositor, classical SIT cannot be employed as a method for suppression of the pest population since sterile female D. suzukii would harm fruit crops. Therefore, releases must be male-only. Using the tools of genetic manipulation, transgenic flies can be developed to express a conditional lethal system that causes female flies to die and only male flies to reach adulthood. This female-specific lethality would be passed on to further generations when released transgenic males breed with the wild females, resulting in decline and eventual eradication of the wild population. One such system has been developed using overexpression of the tetracycline transactivator (tTA) to induce lethality. In this system, lethality is suppressed for lab rearing purposes but active in releases. The Drosophila melanogaster Genetic Reference Panel (DGRP) can be utilized to examine how genetic background influences the effectiveness of this lethal

system. Investigating female lethality due to tTA overexpression in 205 inbred lines with different genetic backgrounds and performing a Genome Wide Association Study (GWAS) will identify candidate allelic variants that influence the efficacy of the lethal system. These candidate variants may give insight into the potential of development of resistance in wild populations.

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Advisor: Alun Lloyd
Poster Number: 134

Convergent Cross Mapping (CCM): Limits of Applicability

Convergent cross mapping (CCM), proposed by Sugihara et al. (2012), is a method of distinguishing causality from correlation in time-series data. Based on nonlinear state space reconstruction, the method helps identify causal networks, even in nonseparable weakly connected systems. The CCM method has already been used to answer controversial questions in real ecological systems, such as the sardine-anchovy- temperature problem. However, it is not clear how observational noise or process noise might affect the state space reconstruction process of CCM in future applications. Similarly, though Sugihara claims that the method is appropriate for time-series data of length greater than 35-40, such a lower limit of has not been rigorously demonstrated. Here we use simulation to demonstrate that state space reconstruction elements of the CCM method still function properly with different types of noisy data. We also explore Sugihara's proposed appropriate lower limit of applicability. Though time-series of approximately length ten appear to be inappropriate for CCM, we propose a suitable space-for-time substitution and demonstrate through simulation that such substitution can help fill in the state space reconstruction necessary for CCM and would therefore broaden the applicability of the method, particularly in ecology. Finally, we discuss an example where a space-for-time substitution allows CCM to provide new insight into a difficult ecological question.

Feng Pan, Christopher Roland and Celeste Sagui
Graduate Program: Physics
Advisor: Celeste Sagui, Christopher Roland
Poster Number: 138

Ion Distributions around Left- and Right-handed DNA and RNA Duplexes: A Comparative Study

The ion atmosphere around nucleic acids is an integral part of their solvated structure. However, detailed aspects of the ionic distribution are difficult to probe experimentally, and comparative studies for different structures of same sequence are almost non-existent. Here, we have used large-scale Molecular Dynamics simulations to perform a comparative study of the ion distribution around $(5'\text{-CGCGCGCGCGCG-}3')_2$ dodecamers in solution in B-DNA, A-RNA, Z-DNA and Z-RNA forms. The CG sequence is very sensitive to ionic strength and it allows the comparison with the rare but important left-handed forms. The ions investigated include Na^+, K^+, and Mg^{2+}, with various concentrations of their chloride salts. Our results quantitatively describe the characteristics of the ionic distributions for different structures at varying ionic strengths, tracing these differences to nucleic acid structure and ion type. Several binding pockets with rather long ion residence times are described, both for the monovalent ions and for the hexahydrated $Mg[(H_2O)_6]^{2+}$ ion. The conformations of these binding pockets include direct binding through desolvated ion bridges in the GpC steps in B-DNA and A-RNA; direct binding to backbone oxygens; binding of $Mg[(H_2O)_6]^{2+}$ to distant phosphates, resulting in acute bending of A-RNA; tight "ion traps" in Z-RNA between C-O2 and the C-O2' atoms in GpC steps; and others.

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Graduate Programs: Statistics, North Carolina State University[1]; Biostatistics, Johns Hopkins University[2]
Advisor: Ana-Maria Staicu
Poster Number: 139

Inference on Fixed Effects in Complex Functional Mixed Models

We propose simple inferential approaches for the fixed effects of complex functional mixed effects models. The basic idea is to estimate the fixed effects under the independence assumption and then bootstrap independent units (e.g. subjects) to obtain estimates of variability. Extensive simulation studies show that the average coverage probability of the resulting confidence intervals maintains their size. Methods are motivated by and applied to the Baltimore Longitudinal Study of Aging (BLSA), though they are widely applicable to other studies that collect correlated functional data.

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Programs: Atmospheric Sciences, Department of Marine, Earth, & Atmospheric Sciences, North Carolina State University[1] U.S. Environmental Protection Agency, Research Triangle Park, NC [2]
Advisors: Viney P. Aneja and John T. Walker
Poster Number: 143

Satellite Based Estimation of Shortwave Aerosol Radiative Forcing by Regional Nucleation Events at a Forest Site in the Southeast US

Nucleation is an important source of atmospheric aerosol particles. Through their roles in direct and indirect radiative forcing, anthropogenic aerosols account for one of the largest uncertainties associated with the response of the climate radiative forcing. This study is unique as it synergistically combines ground based particle size distribution measurements with the mutli-spectral and broadband satellite observations to calculate the top of the atmosphere (TOA) shortwave aerosol radiative forcing caused by particles formed during strong regional nucleation events. Continuous particle size distribution measurements were conducted during November 2005 to September 2007, using Scanning Mobility Particle Sizer (SMPS), at the Duke Forest Site, Chapel Hill, NC. Our analysis of the particle size distributions and particle growth characteristics shows new particle formation is frequent in the region of interest. The particle size distributions from 10nm to 250nm (aerodynamic diameter), total number concentrations of ultrafine mode (< 25nm) and fine mode (25 < Dp < 250 nm) particles, and the particle growth rate are analyzed to classify the nucleation as regional nucleation event. At this site, the regional nucleation events were observed on cloud free days and are strongly positively correlated with SO_2 concentrations and photosynthetically active radiations. Shortwave flux from the Clouds and Earth's Radiant Energy System (CERES) instrument onboard Earth Observing System (EOS) Terra satellite are used to estimate the TOA aerosol direct radiative forcing. Terra Moderate Resolution Imaging Spectroradiometer (MODIS) 550 nm aerosol optical thickness and cloud fraction data are used to set thresholds to eliminate cloud contaminated CERES pixels to derive the TOA clear sky shortwave flux. The aerosol optical thickness at 550 nm (τ550) was highest (0.38 ± 0.20) in summer corresponds to the period of highest particle growth rate and lowest in winter (0.06 ± 0.05) corresponds to the period of lowest particle growth rate. During summer the nucleation day instantaneous shortwave aerosol direct radiative forcing is -24 ± 11 Wm_{-2} and during spring the estimated forcing is -15 ± 19 Wm_{-2}. Even though, the average aerosol optical depth in spring was lower than that in the summer, a significant aerosol radiative forcing was estimated for spring. Our results show that the instantaneous shortwave aerosol direct radiative forcing efficiency of nucleation day aerosol is -73 Wm_{-2} $\tau 550_{-1}$.

Meghan E. Rebuli[1], Jinyan Cao1, Emily Sluzas[1], K. Barry Delclos[2], Luísa Camacho[2], Sherry M. Lewis[2], Michelle M. Vanlandingham[2], Heather B. Patisaul[1]
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Advisor: Heather B. Patisaul
Poster Number: 149

Hypothalamic Estrogen Receptor Expression Altered in Juvenile and Adult Animals from the NCTR Subchronic Toxicity Evaluation of Bisphenol A (BPA)

In February 2014, the NCTR published the initial findings of a toxicity study evaluating the effects of BPA administered by gavage across a wide range of doses on Sprague Dawley rats (Delclos et al 2014 Tox Sci). The experiments described herein were conducted on a subset of animals from that main study in order to provide information regarding neural effects. Prior work, also conducted in collaboration with NCTR, found significant BPA-related effects on estrogen receptor (ER) expression in subregions of the newborn (postnatal day (PND1)) hypothalamus and amygdala of both sexes (Cao et al 2013, Tox Sci) but did not establish if those effects persist across peripubertal development and into adulthood. The present studies assessed *Esr1* (ERα) and *Esr2* (ERβ) expression in juvenile (PND 21) and young adults (PND 90). Dams were gavaged daily from gestational day 6 until labor began with vehicle (0.3% carboxymethylcellulose), 2.5, 25, 260, or 2700 µg BPA/kg bw/day, or 0.5 or 5.0 µg ethinyl estradiol (EE)/kg bw/day. Pups were then gavaged from the day after birth (PND 1) until the day before scheduled sacrifice on PNDs 21 or 90. Brains were collected at NCTR, coded (so subsequent work could be done blind to exposure groups), and shipped to NCSU for ERα and ERβ expression analysis using in-situ hybridization. Compared to vehicle controls, *Esr1* expression in the juvenile female rat anteroventral periventricular nucleus (AVPV) of the hypothalamus was significantly decreased in the 25µg/kg BPA group while 2.5, 25, and 260 µg/kg bw BPA produced significant decreases in *Esr2* expression in the adult female rat AVPV and medial preoptic area (MPOA). These data demonstrate the potential for neural effects at doses below the current lowest observed adverse effect level (LOAEL). These studies were conducted as a prelude to ongoing studies in the CLARITY program (a multi-investigator effort coordinated by FDA, NCTR, NTP and NIEHS) which will more comprehensively evaluate neuroendocrine and behavioral impacts of BPA exposure.

Rachel L Spreng[1] and Dahlia M Nielsen[1,2]
Graduate Programs: Bioinformatics[1]; Genetics[2]
Advisor: Dahlia M. Nielsen
Poster Number: 168

Detecting Cryptic Subgroups of Individuals Using Gene Expression Data

From drug response to survival time, there exists variability within populations that is often unexplained. It would be useful to be able to detect cryptic subgroups that vary according to treatment response, disease progression, recurrence, etc., and indeed, various methods have been developed for this purpose. Our goal was to improve on these methods by integrating information gleaned from external studies to inform subgroup identification. First, it is desirable to reduce dimensionality of

the data by selecting only genes that are relevant to the groupings of interest: those that are differentially expressed across subgroups. *A priori* gene selection is a challenge, but the abundance of publicly available gene expression data can aid in this task. Our method is based on the expectation that if a gene is differentially expressed across subgroups within a sample of individuals, the variance of gene expression measurements in that sample will be increased compared with the variance in an unperturbed sample. Data from public repositories can be used to determine how much variance in expression is expected for any given gene in a presumably homogeneous sample of individuals. We propose a gene selection step in which the variance in expression for each gene within the sample of interest is compared to expression variances for that same gene within a number of external samples. Only the genes with the most extreme variance relative to the comparison studies are selected. Individuals are then clustered on the selected genes using a model-based clustering method, although any clustering method could be used in combination with the proposed gene selection method. The proposed method reproduced known group labels with reasonable discordance for most test cases (including several biological samples as well as simulated samples) and demonstrated improved results in comparison to hierarchical clustering and support vector machine (SVM) techniques.

Stephen L. Strickland[1], Michael Shearer[2], Karen E. Daniels[1]
Graduate Programs: Physics[1]; Mathematics[2]
Advisor: Karen E. Daniels
Poster Number: 172

Spatiotemporal Measurement of Surfactant Distribution on Gravity-capillary Waves

Materials adsorbed to the surface of a fluid — for instance, crude oil, biogenic slicks, or industrial/medical surfactants -- will move in response to surface waves. Due to the difficulty of non-invasive measurement of the spatial distribution of a molecular monolayer, little is known about the dynamics that couple the surface waves and the evolving density field. Here, we report measurements of the spatiotemporal dynamics of the density field of an insoluble surfactant driven by gravity-capillary waves in a shallow cylindrical container. Standing Faraday waves and traveling waves generated by the meniscus are superimposed to create a non-trivial surfactant density field. We measure both the height field of the surface using moiré-imaging, and the density field of the surfactant via the fluorescence of NBD-tagged phosphatidylcholine, a lipid. Through phase averaging of the density field, we determine that the surfactant accumulates on the leading edge of the traveling meniscus waves and in the troughs of the standing Faraday waves. Potential applications of this technique are new methods of measuring interfacial rheology, new tests of theoretical predictions about resonant energy transfer between transverse and longitudinal surface waves, and understanding the mechanical effects of oceanic contamination.

Xiangming Zeng and Ruoying He
Graduate Programs: Marine, Earth, and Atmospheric Sciences
Advisor: Dr. Ruoying He
Poster Number: 202

River-derived Sediment Transport in the Bohai, Yellow, and East China Seas: A Model Study

The transport of sediment derived from the Huanghe and Changjiang Rivers in the Bohai, Yellow, and East China Seas (BYECS) over the past 48 years (1958-2005) was simulated and analyzed using the Coupled Ocean-Atmosphere-Wave-Sediment Transport (COAWST) modeling system. Model skill assessments against in situ wave and hydrographical observations indicate the model simulation can generally reproduce the hydrodynamic environment of the BYECS. The simulated positions of fine sediment high- accumulation-rate regions well resemble the observed, which are also known as muddy patches in the BYECS. Bottom stress analysis further indicates that the formation of muddy patches near river mouths is largely related to their proximity to the sediment source. Muddy patches formed in regions further away from river mouths are due to their associated weak bottom stress. The simulated seabed sediment distribution reveals that most of the Huanghe derived sediment stays inside the Bohai Sea, whereas the Changjiang derived sediment can spread over into both the Yellow and East China Seas. There are strong seasonal variations in the two rivers-derived sediment transport. Stronger (weaker) offshore sediment transport occurs in the winter (summer).

Yuan Zhang
Graduate Program: Physics Department
Advisors: Celeste Sagui, Christopher Roland
Poster Number: 205

Structural Characterization of Intrinsically Disordered Peptides

Intrinsically disordered proteins (IDPS) comprise about 10% of all proteins, and at least 40% of eukaryotic proteins exhibit at least a long, disordered loop. IDPs are associated with a broad range of human diseases, such as cancers, neurodegenerative diseases (Alzheimer's disease, Parkinson's disease, Huntington disease), type-II diabetes, etc., that arise from protein misfolding, leading to aggregation, loss of normal function, and gain of toxic function. We present the results of extensive Molecular Dynamics (MD) simulations of three projects associated with such IDPs. (1) We present the results of extensive Molecular Dynamics (MD) simulations of the tridecapeptide corresponding to residues 659-671 of the envelope glycoprotein gp41 of HIV-1, which spans the 2F5 monoclonal antibody epitope ELDKWA. We found that gp41659-671 forms part of a flexible conformational ensemble, with various residual secondary structures, in agreement the experimental observations. Under uniaxial tension, the

disordered peptide first becomes fully helical before melting into turns, loops and 310-helices. (2) Although results from codes such as DSSP and STRIDE converge in well-ordered structures, the agreement between the secondary structure assignments is known to deteriorate as the conformations become more distorted. In this second work, we have carried out MD simulations of (relatively) disordered peptides, specifically gp41659-671, the homopeptide polyasparagine (N18), and polyasparagine dimers. We have analyzed the resulting conformations with the most popular secondary structure analysis assignment algorithms DSSP, STRIDE and KAKSI, and carefully characterized the differences in structural assignments. (3) Nine neurodegenerative diseases involve polyglutamine expansion and aggregation, and the aggregation is often manifested as amyloid-like fibrils. In this work, we have analyzed the stability of amyloid-like fibrils in a variety of steric zippers related to a segment from the yeast protein Sup35, with the purpose of elucidating the contrasting roles of glutamine and asparagine in the aggregation of prions.

Brandon Zoellner, Prangya P. Sahoo, Paul A. Maggard
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Advisor: Paul A. Maggard
Poster Number: 208

Compositional Studies and Band Engineering of p-type Cu(I)-Containing Oxide Semiconductors

New investigations of *p*-type Cu(I)-containing oxide semiconductors were performed to probe the fundamental relationship between the crystal structure, bandgap sizes, band energies, and photoelectrochemical properties. The solid solutions of $CuNb_{1-x}Ta_xO_3$ ($0 < x \leq 0.15$) and $Cu_5(Ta_{1-x}Nb_x)_{11}O_{30}$ ($0 < x \leq 0.5$), as well as Cu_3VO_4 were synthesized via high temperature solid-state methods. Powder X-ray diffraction confirmed the purity of each product and the lattice parameters were refined as the molar ratio between Nb(V), Ta(V), and Cu(I) were adjusted. The measured band gaps of both $CuNb_{1-x}Ta_xO_3$ and $Cu_5(Ta_{1-x}Nbx)_{11}O_{30}$ were altered depending on the ratio between Nb(V) and Ta(V). Minor blue shifts in the band gap from 1.89 eV to 1.97 eV were recorded for the $CuNb_{1-x}Ta_xO_3$ solid solution as the percent of Ta(V) was increased to 15%. However, large red shifts over a range of 2.60 eV to 1.95 eV were observed for $Cu_5(Ta_{1-x}Nb_x)_{11}O_{30}$ for $x = 0$ to $x = 0.5$. Photoelectrochemical experiments on polycrystalline films of $CuNb_{1-x}Ta_xO_3$, $Cu_5(Ta_{1-x}Nb_x)_{11}O_{30}$, and Cu_3VO_4 illustrated how the changes in composition can control the photocurrents produced under visible-light irradiation. Films composed of $CuNb_{1-x}Ta_xO_3$ exhibited an increased stability of the cathodic photocurrent with a larger Ta(V) content. However, films of $Cu_5(Ta_{1-x}Nb_x)_{11}O_{30}$ exhibited stronger photocurrents as Nb(V) was introduced into the structure. Additionally, the photocurrents of Cu3VO4 demonstrated the importance of the formation of Cu(II) oxides on the particle's surface. Mott-Schottky analyses of $CuNb_{1-x}Ta_xO_3$ and Cu_3VO_4 films determined the conduction band edges to be -1.82 V versus RHE at pH 12 and -0.63 V versus RHE at pH 5.8, respectively, which provide sufficient overpotentials to drive the reduction of water into hydrogen gas. Additional techniques such as, thermogravimetric analysis, X-ray photoelectron spectroscopy, and scanning electron microscopy were used to track the change in composition and the characteristics of the surfaces of the metal oxides.

College of Textiles

Halil I. Akyildiz
Graduate Program: Fiber and Polymer Science; Materials Science and Engineering
Advisors: Jesse S. Jur and Gregory N. Parsons
Poster Number: 2

Modification of Optical Properties of Polyethylene Terephthalate by Sequential Organometallic Vapor Infiltration

Polyethylene terephthalate (PET) is a recyclable thermoplastic polymer that has applications in textiles, packaging and insulating. PET shows weak photoluminescence by the excitation of the pi electrons on the backbone of the polymer upon UV absorption. This emission is identified by two adjacent band in the near UV region of the spectrum. Lower wavelength emission is attributed to the monomeric emission from the polymer and the other band is attributed to emission due to the interactions between the polymer chains. In this study the emission in the PET fibers are enhanced by infiltration of trimethylaluminum (TMA) precursors by sequential vapor infiltration (SVI) technique. TMA by reacting the ester groups in the polymer forms organic inorganic hybrid materials. In this study it is shown that SVI improves the higher wavelength emissions of the polymer is which is attributed to the enhanced interactions between the polymers. Furthermore the effect of the changes in the polymer structure on emission of the PET thin films is studied which showed SVI increases only certain emission bands. Emission bands improved by SVI is attributed to the amorphous regions of the polymer.

Ritika Burman
Graduate Program: Textile Technology Management
Advisors: Yingjiao Xu and Genessa Devine
Poster Number: 24

Sustainability in the Textile and Apparel Industry: Framework Development

The textile and apparel (T/A) industry plays a significant role in the society in terms of trade and employment. However, from production to consumption, the T/A supply chain is associated with a number of social, economic, and environmental issues: collectively called the sustainability issues. Companies are pressured by their key stakeholders to address sustainability related challenges. The challenges can be addressed if the companies are able to monitor their activities and report their progress by using measurement frameworks that help quantify the efficiency and effectiveness of a company's activities. Many such frameworks are available but Global Reporting Initiative (GRI) is one of the most widely adopted as it provides a comprehensive set of guidelines for sustainability reporting. These guidelines, however, are generic and do not reflect the specific nature of any industry. Given this limitation, various industry sectors and researchers have developed frameworks that are industry specific by adopting GRI guidelines (e.g., mining and minerals industry) (Azapagic, 2004). For the T/A industry, many companies use the Higg Index which is an internal assessment tool used for assessing company activities. It is however not used for reporting purposes. Hence, various companies use Higg Index for internal assessment, and the GRI for sustainability reporting. The purpose of this study is to develop a sustainability measurement framework for the T/A industry that can be used for both the purposes. The development of framework is based on a qualitative analysis of the complementarity of two most relevant frameworks, GRI and Higg Index, and a review of academic literature on sustainability. The resultant framework could be used internally, for monitoring activities and also externally, for sustainability reporting. Additionally, as the framework developed is compatible with GRI indicators, it can also help in standardization of the sustainability reports and enable cross-comparisons within the industry.

Yizhuo Chen
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Advisor: Yingjiao Xu
Poster Number: 30

The Role of Social CRM in Brand Marketing: A Perspective of Consumers' eWOM

Companies used to fully control the relationship between brands and their customers. Nowadays, the control of the relationship has shifted to customers who have the power to influence each other using Electronic Word of Mouth (eWOM). Therefore, incorporating customer relationship management via social media into existing brand marketing framework is of strategic importance. By integrating social media marketing, Customer Relationship Management (CRM) and Social CRM, this study aims to propose a strategic model that can leverage the voice of consumers to enhance brand marketing communications. Beyond the conceptual scope, the second objective for this study is to empirically test the role of Social CRM in the proposed model, in terms of 1) influence of the visible cues from online user profiles on other consumers' responses, 2) influence of brand names and product attributes in social media content on other consumers' responses, and 3) effectiveness of marketing communication on social media. Social media data from an online purchasing environment (Amazon.com) and a non-purchasing environment (Runnersworld.com) was collected using web scraping technique. The data was analyzed using linear regression models, text mining, principal component analysis, and sentiment analysis. The results show that profile of the author of a posting on social media significantly influenced other consumers' responses in both purchasing and non- purchasing social media settings. Moreover, in non-purchasing social media settings, consumers' replying behaviors depended more on social media content than their viewing behaviors did. The findings also suggest a positive influence of marketing communication on consumers' attitude toward the brand b. In summary, this research expands the scope of brand marketing by integrating social CRM into brand marketing research framework. Managerially, the findings of this study also provide great implications to the brand marketing managers in their effort of understanding and serving their target consumers at the age of social media.

Karis Ranae Foster
Graduate Programs: Textiles
Advisor: Cynthia Istook and Andre West
Poster Number: 49

A Design Application with Shima Seiki WholeGarment® Knitting

Within the knitwear industry, there are four main categories of knitting methods: cut & sew, knitted length or panel knitting, fully-fashioned, and integral knitting. The major downside to the cut & sew, panel knitting or fully-fashioned method is attributed to its requirement for human labor. These products created are subject to human error, which reduces the consistency of a collection of products (Isaacs, 2005).

WholeGarment® or complete garment knitting provides a solution to these inconsistencies by manufacturing an entire garment ready-to-wear on the machine without seams. This process requires minimal processing after knitting and has the potential for reducing production lead times. (Tait, 2008; Kanakaraj & Ramachandran, 2010)

As an early stage of this research, a production decision-making model has been developed specifically for WholeGarment® knitting that takes into account all variables that may influence a business owner to choose this style of knitting over others.

Taking this process model into account, several garments have been designed and executed with the Shima Seiki Apex 3 SDS-One knitting software and produced on a Shima Seiki MACH2X WholeGarment® machine. Several iterations of a specialized garment have been conducted and corrections are currently being made to increase knitting efficiency and reduce errors. First samples have been knit with 100% acrylic yarn, 2/29 size on an eight gauge machine. Final samples will be knit with mercerized cotton and cashmere, which are more appropriate for formal applications. Corrections to date consist of adjusting interacting cables and reducing fancy stitches near cables to prevent dropped stitches.

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Ashley Gabel
Graduate Program: Textile Technology
Advisor: Andre West
Poster Number: 53

Methodology for the Improvement of Athletic Wear

Athletic clothing has seen many improvements and changes in the last few decades. Most notably, athletic garments are now made of synthetic fibers and made to fit close to the body. Though these are positive improvements that assist the athlete both in training and in competition, the research being completed on athletic wear has increased significantly and the industry must keep up with these breakthroughs. This research covers how to implement many of these new technologies and demonstrates several preliminary studies that will help move the athletic clothing industry in that direction. To implement significant changes it is important to gather more data on the subjects that the industry is designing for. Because athletic garments fit close to the body, the garments made for this population have measurements that are comparable to their actual body measurements. Unfortunately, current athletic garments are not made to fit today's wide range of athlete body styles. Another issue is the actual design of the garments intended for athletes. Currently, most companies use the most cost-effective methods and not the ones that are best for the athlete, the environment, and the economy. This research introduces several ways to improve athletic garments from a design and production aspect. Perhaps the biggest issue with re-making a sizing system and creating one that is nationwide for athletes is the determination of what actually does and does not fit. This research proposes a way to quickly and efficiently determine whether or not something fits and by how much the garment does or does not fit. This very simple method will be able to tell the consumer before they purchase a garment (provided that they have body measurements available) whether or not this garment will fit, how it will fit, and where it will fit.

Chirag R. Gajjar, Bhavya Singhi, Melissa A. Pasquinelli and Martin W. King
Graduate Program: Fiber and Polymer Science
Advisors: Martin W. King and Melissa A. Pasquinelli
Poster Number: 54

Experimental and Computational Study of Process-property Relationships for Bioabsorbable Polymers

Bioabsorbable polymers like poly(lactic acid) (PLA) are attractive biomaterials for regenerative medicine and tissue engineering applications due to their inherent property of *in vivo* resorption over time. However, the same useful property of hydrolytic degradation is a major concern from a manufacturer's stand point. Melt-processing parameters such as higher processing temperatures, extrusion rate and the residence time in barrel, as well as material characteristics like residual moisture and monomer content influence the rate of degradation of the final product. Thus, the goal of our study is to determine the optimum processing conditions for bioabsorbable polymers in order to achieve the desired properties of extruded fibers while preventing excess degradation during processing. We propose the use of molecular dynamics (MD) simulations along with the experimental approach to understand the thermal degradation of PLA under the effect of various processing conditions (such as temperature and residence time) and the local environment (presence of oxygen, moisture and monomers). For the experimental study, we used different melt-spinning parameters to extrude PLA yarns, and characterized the changes in the physical and chemical properties as a result of processing conditions. MD simulations were performed on PLA chains using reaxFF force-field in LAMMPS. From the experimental study, it was seen that different temperatures and take-up speeds resulted in a difference in the orientation of the polymer chains and the crystalline content. The level of crystallinity also governs the tenacity, and a direct correlation was observed between them. MD simulation results showed that at slower rates for raising the temperature, the degradation started at relatively lower temperatures, whereas with prolonged exposure at higher temperatures, the extent of degradation increased. This combined approach provides a better understanding of process-induced degradation, which will help to design resorbable biomaterials, such as scaffolds, with better control of their *in vivo* performance.

Lauren A. Hunt
Graduate Program: Textile Engineering, Chemistry and Science
Advisors: Peter Hauser, Ahmed El-Shafei
Poster Number: 74

Ultra-violet Curable Process Chemistry for Biofilm Resistant Finish on Textiles

A biofilm is a group of microorganisms in which cells stick to each other on a surface. They can grow virtually anywhere there is moisture, nutrients and a surface; as a result, they affect many natural and industrial environments. One example of a biofilm is bacterial growth on apparel and footwear. These biofilms not only cause unpleasant odors, but they can also lead to serious medical issues. Preventing the formation of biofilms on textile fibers has the potential to significantly improve the performance of textile products.

New technologies are needed within the textile industry to reduce environmental impacts and improve efficiency and economic feasibility. This study aims to develop a UV-cure process chemistry for coatings that impart biofilm resistant properties to textiles. As compared to traditional textile finishing, ultra-violet curing technology provides a customizable, rapid commercial process, with reduced energy consumption, that imparts value-added functional finishes to textile substrates.

In previous research, a wide array of acrylate and methacrylate monomers was analyzed to determine their ability to support or hinder cell growth. This research examines five acrylate and methacrylate polymers previously identified to most efficiently inhibit cell propagation. Homopolymer/copolymer formulations and necessary curing parameters were optimized to achieve the most efficient UV induced polymerization and ideal biofilm resistant properties. Performance evaluation of each when applied to polyester fabric was conducted via FTIR analysis, contact angle testing, and antibacterial activity assessment using Streptoverticillium reticulum.

Jingyao Li
Graduate Program: Textile Chemistry
Advisor: Stephen Michielsen
Poster Number: 100

Comparison of Wicking Behavior of Artificial Blood and Porcine Blood on Textile Surfaces

Bloodstain pattern analysis (BPA) is an important tool to help investigators have a better understanding of what happened at the crime scene. Most studies of bloodstains have been performed on hard surfaces, only a few on textiles. Due to the structural variety and liquid absorbing properties, BPA on textiles is more complicated and the different wicking behaviors lead to various bloodstain patterns. In this study, the wicking behavior of artificial blood (AB) and porcine blood (PB) on different textile surfaces were investigated. The area, perimeter and circularity changing over time during the wicking process of AB and PB were measured. The weight decrease of the blood drops was recorded continuously during the drying process. Two types of common fabric were used in this study: plain woven bed sheet fabric (both balanced and unbalanced) and jersey knit T-shirt fabric. All the fabrics used were 100% cotton fabric. Area of AB stains are approximately twice as large as that of PB stains. The drying time of PB is much longer than AB. The pattern of bloodstain were also affected by yarn structure. No obvious difference of bloodstain pattern caused by varying fabric structure (balanced or unbalanced) were observed. When wicking on ring spun woven fabric, bloodstains have a more circular shape (high circularity), while on air jet and open end woven fabric the bloodstains have low circularity. The wicking behaviors are similar between AB and PB. The difference in area and drying time are observed because PB contains red blood cells which do not exist in AB. The fabrics made of yarns with a more uniform structure result in a more circular pattern because liquid wicks evenly. These studies should assist bloodstain pattern analysts interpret stains on textiles.

Xingyu Li
Graduate Program: Textile Engineering
Advisor: Stephen Michielsen
Poster Number: 101

Drip Bloodstain Patterns on Textile Surfaces

Bloodstain pattern analysis (BPA) is the examination of the shapes, and the categorization and distribution of bloodstain patterns in order to provide an interpretation of the physical events of a crime, which gave rise to their origin. These stains occur in a large proportion of homicide cases. They offer extensive information and are an important part of a functional, medically and scientifically based reconstruction of a crime. Many BPA studies have been published, however, most of them dealt with hard, non-absorbent surfaces. Although textiles are present in at most crime scenes, but BPA on textiles has not been developed to the same extent as on non-porous materials. This study focuses on the effect of yarn and fabric construction on drip bloodstains, and differences between porcine blood and artificial blood. Three types of yarn: ring spun, open end, and Murata vortex spun yarn, which are all from the same bale of cotton from Cotton, Inc., were converted into three types of fabric - 100x100, 130x70 woven and a similar jersey knit. In addition, a similar commercial woven and knit fabric were tested. Dripping single 30μL porcine and artificial blood drop from half meter high on these fabrics, which were placed 90° and 30° impact angle and videoed from top view and bottom view, resulted in stains that were analyzed for their area, perimeter, circularity, ellipticity,

and number of spines and satellite drops. Analysis showed that yarn and fabric construction both effect on dripped bloodstain. Fabric construction is a more obvious factor when impact angle is 30°. The areas of porcine bloodstains are smaller than artificial blood because of the blood cells in porcine blood.

Katelyn V. Patrick
Graduate Program: Textiles
Advisor: Yingjiao Xu
Poster Number: 140

Exploring Generation Y Consumers' Consumption of Fitness Clothing: A Means-end Chain Approach

Thanks to the growing health awareness and the trend of athleisure, the fitness clothing market has been substantially growing. Major sportswear brands, as well as retailers, are expanding their offerings to meet this increasing demand from the market. Generation Y consumers are one of the major segments for the sportswear industry in the U.S. Insight of Generation Y consumers' behavior toward fitness clothing will be of strategic importance for the industry to serve this growing segment. This study, using the widely adopted means-end chain (MEC) model, is designed to uncover the driving values behind Generation Y consumers' fitness clothing consumption. Data was collected from 35 subjects via laddering interviews and was analyzed following the means-end chain model. As a result, a product attribute-value hierarchy was generated to reflect the preferred product attributes, perceived consequences, driving values, and the connections among these variables. Physical comfort seemed to be the most salient attributes identified by the subjects, followed by aesthetics, price, functionality, fit and durability. Brand names, fiber content, and versatility were also mentioned. Examples of low level consequences were saving money, comfort, and avoiding embarrassment. High level consequences were slightly more abstract, including image, efficiency, and healthy habits. Seven values were revealed in this study, including self-esteem, security, social recognition, accomplishment, freedom, physical wellbeing and happiness. More importantly, unique paths were identified connecting the preferred attributes to the desired values, indicating the driving values for the specific attributes sought by the consumers. Such understanding of Generation Y consumers' consumption of fitness clothing, in terms of their desired product attributes, perceived consequences, and driving values, will provide great managerial implications to the practitioners in their product development, marketing, and customer relationship management. In summary, using MEC model this study uncovered the driving values for Generation Y consumers' consumption of fitness clothing.

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Poster Number: 148

Development of Degradable Scaffold for Tendon-bone Junction Regeneration and Evaluation of the Role of TgfbR2 Expressing Progenitor Cells on the Scaffold

Tendons play an important role in transferring stresses between muscles and bones and in maintaining the stability of joints. Tears in the joints have poor healing capacity and the lesions are associated with cartilage degeneration. Therefore, strategies are needed to promote repair and long-term regeneration of such joints. The ultimate goal of this study is to develop a biodegradable scaffold for tendon-bone junction regeneration. As a first step to achieve this, polylactic acid (PLA) yarns were braided into tubular scaffolds and cultured with unique TGF--Type II receptor-expressing joint progenitor cells under static conditions. The scaffolds were designed to mimic the natural mice tendon-bone junction in terms of its structure, mechanical and immunochemical properties. Two types of PLA yarns were used. Those with round fibers had a 25μm diameter, while those fibers with a 4 deep grooved (4DG) cross-section had a thickness of 45μm. Three different tubular scaffolds measuring about 2 mm in diameter were braided on a Steeger 16-spindle braiding machine (Model K80/16-2008-SE) to mimic the tendon-bone junction by using these different yarns. The three different scaffold structures were: 1) PLA hollow tube using round fibers, 2) PLA hollow tube using grooved and round fibers, and 3) PLA multicomponent tube containing round fibers in the sheath and grooved core fibers inserted within the lumen. The biological and mechanical performance of the three scaffolds were evaluated, including cell viability using an Alamar Blue assay, cell attachment and proliferation using a live/dead assay, laser scanning confocal microscopy (LSCM) and dynamic tensile strength and initial Young's modulus on an Instron mechanical tester. The results of this study showed that all three scaffolds exhibited good viability and cell attachment for the TGF--Type II receptor- expressing progenitor cells. In view of these promising results further work is continuing with animal *in vitro* trials.

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Poster Number: 150

Plasma Induced Thiol-ene Addition for Polymeric Film Coating Applications

Deposition of metal oxides on different substrates has been an attractive topic due to its ability to render unique optical and electrical properties. However, common drawbacks of these films are undesirable chemical and mechanical robustness, which necessitates an additional stable protective layer to guarantee long term application of the product. Polymeric coatings can be used for this purpose, since they offer chemical and mechanical toughness. Photopolymerization of acrylate monomers and acrylated resins (such as epoxies, polyesters, polyurethanes) has been employed in the coating industry for years, due to the very fast reaction rate and large chemical diversity. Yet recent concerns about the toxicological activity of acrylate based chemicals, as well as processing challenges such as sensitivity of the reaction to air (specifically, oxygen), low conversion before gelation, high network shrinkage stress and light instability due to presence of photo-active components, have discouraged this approach. Thiol-ene systems, as an alternative, offer a set of unique properties not the least of which are toxicologically safer chemistry, low network shrinkage, oxygen insensitivity, and high conversion before gelation. Our proposed methodology for achieving the objective of this study is based on thiol-ene polymerization via atmospheric pressure plasma (APP). Use of APP as a source of excited species for initiation allowed the avoidance of photoactive components. Particular application of plasma sources for surface modification has motivated us to show reliability of this technology for polymer industry applications. The target of this study is a multilayered film containing a layer of sputtered metal oxide on top, which functions as an electromagnetic mirror for infrared range radiation. We sought to fabricate a polymeric protective coating on top of this layer. Using APP, we were able to carry out the thiol-ene reaction. Additionally, we tailored coating (mechanical and chemical) properties by altering the chemical composition of coating precursors.

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Poster Number: 156

Durable, Halogen-free Flame Retardants for Nonwovens

Fire is a major cause of property damage and death each year. In the United States alone in 2013, the National Fire Protection Agency reported 11.5 billion dollars in property damage and 1.24 fire related deaths. Historical flame retardants use halogenated compounds to conduct the flame retardant chemistry, but these compounds have recently been shown to be toxic, bioaccumulative, endocrine disruptive and persistent. The purpose of this study is to develop new paradigm of novel halogen-free flame retardant finishes based on phosphorous-nitrogen synergistic chemistry that are durable and sustainable with no dripping and no smoking during testing. These finishes are capable of covalent bonding to nonwoven polypropylene via UV treatment. Novel halogen-free flame retardant monomers were developed, characterized and graft polymerized onto polypropylene and polyester. Several char-forming agents and crosslinkers were assessed for flame retardant ability, and pentaerythritol triacrylate was determined to be the most effective char forming crosslinker. UV treatment conditions were assessed to optimize coating yield. The monomer/crosslinker ratio was optimized for each condition, and the FR behavior was analyzed with TGA and a simple vertical flame test. The FR fabrics formed a char after being burned, and had as much as 20wt% remaining after TGA testing.

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Poster Number: 170

Consumer Preferences Among Plus-size Females: Fashion vs. Fit

This study aims to identify the significance of fashion and fit among the plus-size female population. With obesity rates among adults and children progressively rising, the plus-size population is expected to continue to increase in number. Studies have shown evidence of dissatisfaction in apparel offerings for plus-size women. Several retail stores have been established to provide apparel for this underserved market, however inconsistencies in clothing with shape variety still exist. These irregularities are evident in retail sizing charts, as well as the standard for plus-size apparel, ASTM Standard D6960, 2004. These sizing systems only provide dimensions for one body type although there are nine variations in body shape seen in the female population. This study analyzes variations in body shape, the level of satisfaction with current retail offerings, personal body cathexis and satisfaction, as well as consumer retail behaviors and preferences. These variables were examined via an online survey which allowed a convenience sample of 146 females to self-report answers to questions regarding these specified topics. Data was collected from average (size 12 and below) and plus-size (size 14 and above) females to compare responses for both groups. Results showed that most plus- sized females view themselves as oval or pear shaped while average sized females are more likely to view themselves as hourglass. Participants were comfortable overall with certain elements of their bodies except for the waist. Both average and plus-sized females preferred fit over fashion where fit is most often defined as comfortable and fashion is most often defined as a style. Results from this study will help designers and retailers identify and improve upon their plus-size offerings thereby providing better fitting fashionable clothing for plus-size women in the apparel industry.

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Poster Number: 173

A Systematic Investigation of How Antioxidants Prevent Thermal Degradation during the Processing of Industrially-relevant Polymers

During the formation of polymer products, thermal degradation has been an issue, which is also affected by the presence of oxygen and other impurities as well as the processing conditions. Thermal degradation not only impacts the physical and mechanical properties of the products, but also often leads to the failure of production lines. Antioxidants are often added to prevent thermal degradation during processing. An understanding of the molecular mechanisms that underlie thermal degradation can thus lead to the production of polymer materials with enhanced properties and can minimize waste during production. The goal of this work is to utilize both experiments and simulations to investigate how antioxidants reduce the loss of properties during thermal degradation. We studied two commercial antioxidants, Irganox 3114 (phenolic antioxidants) and Irgastab FS 042 (non-phenolic antioxidants), in polypropylene systems. From both simulations and experiments, antioxidants were observed to be most effective when the extrusion temperature is closer to melting temperatures but high enough to obtain effective melt flow. Both antioxidants were observed to have their own mechanisms and timescales to prevent thermal degradation. Chemical changes during melt extrusion and physical properties after extrusion will also be presented.

Yu Xie
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Poster Number: 199

Small Diameter Vascular Prostheses for Coronary Artery Bypass Surgery

Coronary arterial diseases (CAD) is often a life threatening condition for patients suffering from cardio-vascular disease accounting for more than 385,000 deaths each year in the United States. The gold standard material for replacement or bypass surgery is the patient's own autologous veins, which however may not be available due to aging, previous harvesting or the pre-existing arterial disease. Synthetic commercial ePTFE and polyester (PET) are not suitable for small diameter vessels (< 6 mm), mainly due to their poor circumferential compliance, thrombus formation and low endothelialization. In this study, we developed a bilayer tubular graft made of biodegradable polymers with the purpose of mimicking the multilayer structure of the native artery and provide adequate mechanical properties, reduced thrombogenicity and improved cell proliferation. Small diameter prototype vascular prostheses were fabricated by weft knitting polylactic acid (PLA) multifilament yarns into a tube and then electrospinning polylactide-co-caprolactone (PLCL) copolymer fibers onto the outer surface. The bilayer tube was then turned inside out so as to keep the knitted layer on the outside, followed by an impregnation of 0.5 wt% collagen/elastin (1:1 ratio) crosslinked with genipin. Both the mechanical and biological performances of the prototype scaffolds were determined, including circumferential tensile strength, suture retention, bursting strength, compliance, thrombogenicity and endothelial cells biocompatibility using an MTT assay and immunofluorescence. The results demonstrated that either adding an electrospun layer and/or impregnating with collagen/elastin improved the bursting strength, suture retention and circumferential tensile strength of the bilayer prosthesis. The graft with the electrospun layer inside has superior compliance compared to the graft with electrospun layer outside. We also found that the collagen/elastin impregnation reduced the level of thrombogenicity, and the electrospun layer promoted more uniform endothelial cell proliferation on the inner luminal surface. Work is continuing to evaluate the device using an in vivo animal study.

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Poster Number: 200

Imaging Modalities to Visualize Polyester Fabric in Implantable Textiles

The treatment of aortic aneurysms with the deployment of an endovascular stent-graft has become a routine clinical procedure. While short term results are encouraging, the long term in situ biostability for these devices is still in question, particularly with the trend to use thinner graft materials, and with clinicians using chimney and sandwich approaches to insert more than one stent-graft into the same aneurysm. These trends are known to lead to fabric distortion, abrasion against metallic stents, tearing, ravelling and in situ yarn failure. The aim of this research study was to evaluate alternative visualizing modalities to determine which technique could be used to observe the integrity of polyester graft fabrics either *in vivo* or during accelerated *in vitro* fatigue testing. Nano-silver coatings and silicon based ink coatings were applied to polyester fabrics taken from commercial stent grafts so as to make them radio- opaque to x-rays. After coating, x-ray images, clinical computed tomography (CT) and micro CT scans were performed to visualize the polyester graft material inside a polyurethane phantom. The nano-silver particles could not provide sufficient radio-opacity to permit the polyester fabrics to be observed under x-ray. However, the silicon-based radio-opaque ink coating was able to provide adequate radio-opacity with x-ray imaging and CT modalities so as to identify locations but not for measuring dimensions to within ± 1mm. Clinical CT and micro CT scanning were found to be not suitable modalities for imaging the polyester component of a stent graft either with a contrast agent or in air. This is because the artifacts in the CT image created by the metal stent interfere with the ability to accurately locate the fabric.

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Poster Number: 88

Organizing Chaos – A Study of the Molecular Genomics and Gene Expression of Canine Histiocytic Malignancies

Histiocytic malignancies (HM) are rare, highly aggressive tumors that respond poorly to current treatments in human and veterinary medicine. Data regarding recurrent copy number aberrations (CNAs) and gene-expression are limited. This study used molecular cytogenetics to identify recurrent CNAs and structural changes in canine HM. Based on these data, a custom NanoString gene expression assay was developed, and Immunohistochemistry (IHC) used to confirmed functionality and qualitative increase in proteins of interest. Initially, 70 cases of canine HMs 5 target breeds including Bernese mountain dogs and flat-coated retrievers were evaluated for genome-wide CNAs using array comparative genomic hybridization at 26kb resolution, while structural aberrations were assessed using fluorescence in-situ hybridization (FISH) with canine whole chromosome paint probes. All samples showed significant genomic disruption, with recurrent deletions of chromosomes 16 and 31, as well as previously reported genes such as PTEN and RB1. Structurally, canine HMs presented with a deranged karyotype, characterized by large, multi-centromeric chromosomes. Cases demonstrated a high degree of tumor heterogeneity, including a distinct lack of clonality. Expression studies showed severe de-regulation in the mitotic spindle assembly complex genes including the Aurora Kinases (p-value <0.0001) and MMP-9 (p-value <0.001). No significant differences were found between breeds, however MMP-9 gene expression was significantly higher in visceral and pleural tumors (p-value < 0.0002). IHC also confirmed increased MMP-9 in HMs compared to controls, histiocytomas and plasmacytomas (p- values 0.02, 0.0042 and 0.0002), while demonstrating a unique punctate staining pattern in tumor cells. Taken together, these data offer exciting opportunities for the development of novel treatments and diagnostics in the management of canine HMs.

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Poster Number: 117

Investigation of mPGES-1 as a Novel Anti-inflammatory Target in Equine Leukocytes

Prostaglandin E_2 (PGE_2) is a potent mediator of inflammation in many crippling equine orthopedic disorders. PGE_2 synthesis at sites of injury induces redness and swelling, as well as recruitment and activation of leukocytes, leading to exacerbated pain and tissue damage. While non-steroidal anti-inflammatory drugs (NSAIDs) effectively inhibit synthesis of PGE_2 and other eicosanoids by targeting cyclooxygenase (COX) enzymes, their non-selective inhibition can cause renal toxicity and gastrointestinal ulceration. Thus, safer anti-inflammatory therapeutic targets are needed in horses. Based on data from other species, one promising target is microsomal prostaglandin E synthase-1 (mPGES-1), the terminal enzyme downstream of COX in the inducible PGE_2 synthesis cascade. Our objective was to investigate mPGES-1 as an anti- inflammatory target in horses using an *in vitro* inflammatory model. We hypothesized that mPGES-1 expression is induced by lipopolysaccharide (LPS) in equine leukocytes, and that the mPGES-1 inhibitor MF-63 could selectively inhibit PGE_2 production when compared to non- selective or COX-2-selective inhibitors (indomethacin and NS-398, respectively). Primary equine leukocytes were primed with granulocyte-monocyte colony-stimulating factor (GM-CSF), followed by LPS stimulation in the presence or absence of MF-63, indomethacin, or NS-398. Stimulation of leukocytes resulted in increased mRNA expression of mPGES-1 and COX-2, while constitutive enzymes cytosolic PGES (cPGES) and COX-1 remained unchanged. Interestingly, mPGES-1 protein levels did not change significantly following stimulation, while COX-2 protein significantly increased within 6 hours. cPGES and COX-1 proteins were unchanged. PGE_2 secretion was significantly increased upon stimulation, and application of MF- 63, indomethacin, and NS-398 all significantly decreased PGE_2 secretion after 18 hours. MF- 63 selectively inhibited PGE_2 synthesis, while indomethacin and NS-398 were non-selective and led to decreased PGE2, TXA2 and PGI_2 levels. This data indicates that mPGES-1 inhibition is a viable PGE_2-selective anti-inflammatory target in equine leukocytes. This knowledge could lead to safer, novel methods of controlling painful inflammatory equine orthopedic diseases.

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Poster Number: 130

Hypoxia and Retromer as Potential Regulators of Polarized Amyloid Precursor Protein Expression and Secretion in RPE Cells

Amyloid precursor protein (APP) is a ubiquitously expressed protein that produces amyloid-beta (Aβ), a key component of Alzheimer's disease which is also found in drusen present in age-related macular degeneration (AMD). Retromer, an intracellular retrograde transport complex, shuttles APP away from key cleavage enzymes, limiting the production of Aβ. Retromer regulates the polarized movement of APP from the trans Golgi network to apical or basolateral surfaces for secretion. Polarized

secretion of APP by retinal pigmented epithelial (RPE) cells under normoxic and hypoxic conditions has not been previously studied. Our current studies have found that oxygen levels do indeed control polarized secretion of APP in RPE cells. Specifically, using our unique cell culture system of polarized, tight junctional RPE cells we determined that 4.5 times more APP was secreted basolaterally versus apically. Under hypoxic conditions (0.5% oxygen) APP secretion was decreased in both the apical (94%) and basolateral (72%) direction; while still maintaining a 4 fold higher level of APP secretion in the basolateral versus apical direction. An additional novel finding is hypoxia's effect on retromer levels. Hypoxia decreases retromer levels in polarized RPE cell lysates by 89%. Significantly, when retromer was knocked down with siRNA in non-polarized RPE cells, APP secretion is reduced an average of 38% in both normoxic and hypoxic conditions. We are currently determining if the effect of hypoxia on retromer causes alteration of the polarized secretion of APP. As hypoxia is a common pathology of the retina, understanding how this condition affects protein processing, polarized localization, and secretion is vital to our comprehension of RPE pathophysiology.

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Poster Number: 152

MAVS Abundance and Subcellular Localization Is a Determinant of Basal Expression of Interferon-β in Cardiac Myocytes

Viral myocarditis (cardiac damage and inflammation) is indicated as the second-leading cause of sudden death in young adults. Cardiac myocytes are not replenished yet are indispensable for cardiac function. Previously our laboratory reported that cardiac myocytes express higher basal levels of the protective cytokine interferon-β (IFN-β) compared to cardiac fibroblasts, providing a "pre-arming" mechanism that protects them against viral infection. Here we investigated the mechanism for cardiac myocyte expression of abundant basal IFN-β. In most cells, IFN-β is expressed at low levels. Upon viral infection, viral RNA is recognized by the cytoplasmic sensors RIG-I and MDA-5. These sensors are then translocated to the mitochondria and mitochondrial-associated endoplasmic reticulum membranes (MAM) where they interact with the adapter protein MAVS. MAVS then recruits TRAF3 to activate specific transcription factors resulting in induction of IFN-β. Using confocal microscopy, we found that cardiac myocytes, which are muscle cells profuse with mitochondria, have higher basal levels of MAVS and greater association of MAVS with the MAM than do cardiac fibroblasts. We next examined the MAVS target, TRAF3. TRAF3 localized diffusely in the cytoplasm in uninfected cardiac fibroblasts and skeletal myotubes but localized to punctate bodies upon viral infection or stimulation with synthetic double-stranded RNA. Remarkably, TRAF3 localized to punctate bodies even in uninfected cardiac myocytes consistent with spontaneous basal activation. Finally, confocal microscopy of primary cardiac cultures generated from gene-deleted mice demonstrated that MAVS, but not the upstream sensors RIG-I and MDA-5, is necessary for basal TRAF3 activation in cardiac myocytes. Together, our results suggest that greater MAVS abundance and association with the MAM in cardiac myocytes results in basal activation of TRAF3, triggering a signaling cascade that results in high basal levels of IFN-β in cardiac myocytes. This suggests a novel role for abundant mitochondria in the innate antiviral response of cardiac myocytes.

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Advisor: Jeffrey A. Yoder
Poster Number: 153

Investigating the Function of a Highly Conserved Gene, TMEM150a

Autophagy is an evolutionarily conserved cellular process that involves degradation and/or recycling of cell contents. This mechanism aids in maintaining cellular homeostasis during stressful physiologic conditions. In addition, it was recently discovered that autophagy aids in immune function in multiple ways. This includes degrading intracellular pathogens, as well as a role in response and control of cytokine release. Due to this multifaceted functionality, the role of autophagy is currently being investigated in numerous diseases, including cancer, neurodegenerative, cardiovascular, infectious, pulmonary and autoimmune diseases.

A family of human proteins—termed damage regulated autophagy modulators (DRAMs)—has been linked to the control of autophagy during periods of cellular stress. The DRAM family includes five significantly homologous proteins, one of which is TMEM150a (DRAM5a).

Yet, TMEM150a remains functionally undefined. Presently, our lab has determined that TMEM150a encodes a Type III transmembrane protein that possesses five transmembrane domains, is highly conserved across vertebrate species, and is transcriptionally responsive to immune stimuli. A relationship between TMEM150a and autophagy was investigated by coupling TMEM150a knockdown in zebrafish larvae with an assay to assess levels of acidic, autophagically active cells *in vivo* via acridine orange labeling. Disturbance of TMEM150a protein production generated increased levels of acridine orange fluorescence compared to negative controls, indicating a functional link between TMEM150a and autophagy.

However, the link between TMEM150a, autophagy and the innate immune system remains unknown.

To assess the connection between TMEM150a and the innate immune response, we utilized siRNA techniques to knock-down TMEM150a in mammalian cells, followed by challenge with a potent innate immune stimulant- lipopolysaccharide (LPS). Cy-

tokine levels in culture supernatants were evaluated. Interestingly, a dramatic increase in interleukin-8 (IL-8 aka CXCL8) protein levels were seen in cells lacking TMEM150a when compared to negative controls. This relative pattern was confirmed at the transcript level by quantitative PCR.

IL-8 is a very powerful neutrophil chemoattractant that aids in early innate immunity. Aberrant production of IL-8 has been implicated in both acute and chronic inflammatory diseases. It was recently reported that autophagy can induce IL-8 production in epithelial cells, suggesting a strong connection between these two pathways. Due to TMEM150a's role in both of these processes, we hypothesize that TMEM150a effects IL-8 production by negatively regulating autophagy.

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